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Mehmet Huseyin Bilgin
Hakan Danis
Ender Demir
Sofia Vale *Editors*

Eurasian Economic Perspectives

Proceedings of the 29th Eurasia Business and Economics Society Conference

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Mehmet Huseyin Bilgin • Hakan Danis •
Ender Demir • Sofia Vale
Editors

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Editors
Mehmet Huseyin Bilgin
Faculty of Political Sciences
Istanbul Medeniyet University
Istanbul, Turkey

Hakan Danis
MUFG Union Bank
San Francisco, CA, USA

Ender Demir
Faculty of Tourism
Istanbul Medeniyet University
Istanbul, Turkey

Sofia Vale
Department of Economics
ISCTE-IUL Iscte – Instituto Universitário de Lisboa
Lisbon, Portugal

The authors of individual papers are responsible for technical, content, and linguistic correctness.

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Preface

This is Volume 1—Eurasian Economic Perspectives of the 16th issue of the Springer's series **Eurasian Studies in Business and Economics**, which is the official book series of the Eurasia Business and Economics Society (EBES, www.ebesweb.org). This issue includes selected papers presented at the 29th EBES Conference—Lisbon that was held on October, 10–12, 2019, in Lisbon, Portugal. The conference is hosted by the *ISCTE-IUL Instituto Universitário de Lisboa.*

Amine Tarazi from the *University of Limoges,* France, **Robert William Vivian** from the *University of the Witwatersrand*, South Africa, and **Christo Auret** from the *University of the Witwatersrand*, South Africa, joined the 29th EBES Conference as keynote speakers. During the conference, participants had many productive discussions and exchanges that contributed to the success of the conference where 312 papers by 551 colleagues from 52 countries were presented. In addition to publication opportunities in EBES journals (*Eurasian Business Review* and *Eurasian Economic Review*, which are also published by Springer), conference participants were given the opportunity to submit their full papers for this issue. Theoretical and empirical papers in the series cover diverse areas of business, economics, and finance from many different countries, providing a valuable opportunity to researchers, professionals, and students to catch up with the most recent studies in a diverse set of fields across many countries and regions.

The aim of the EBES conferences is to bring together scientists from business, finance, and economics fields, attract original research papers, and provide them with publication opportunities. Each issue of *the Eurasian Studies in Business and Economics* covers a wide variety of topics from business and economics and provides empirical results from many different countries and regions that are less investigated in the existing literature. All accepted papers for the issue went through a peer review process and benefited from the comments made during the conference as well. The current issue covers fields such as accounting/audit, banking, economics of innovation, empirical studies on emerging economies, international trade, labor economics, public economics, and regional studies.

Although the papers in this issue may provide empirical results for a specific county or regions, we believe that the readers would have an opportunity to catch up with the most recent studies in a diverse set of fields across many countries and regions and empirical support for the existing literature. In addition, the findings from these papers could be valid for similar economies or regions.

On behalf of the series editors, volume editors, and EBES officers, I would like to thank all presenters, participants, board members, and the keynote speakers, and we are looking forward to seeing you at the upcoming EBES conferences.

Istanbul, Turkey Ender Demir

Eurasia Business and Economics Society (EBES)

EBES is a scholarly association for scholars involved in the practice and study of economics, finance, and business worldwide. EBES was founded in 2008 with the purpose of not only promoting academic research in the field of business and economics but also encouraging the intellectual development of scholars. In spite of the term "Eurasia," the scope should be understood in its broadest terms as having a global emphasis.

EBES aims to bring worldwide researchers and professionals together through organizing conferences and publishing academic journals and increase economics, finance, and business knowledge through academic discussions. Any scholar or professional interested in economics, finance, and business is welcome to attend EBES conferences. Since our first conference in 2009, around *12,459* colleagues from *99* countries have joined our conferences and *7091* academic papers have been presented. ***EBES has reached 2375 members from 87 countries.***

Since 2011, EBES has been publishing two journals. One of those journals, *Eurasian Business Review—EABR*, is in the fields of industrial organization, innovation, and management science, and the other one, *Eurasian Economic Review—EAER*, is in the fields of applied macroeconomics and finance. Both journals are published quarterly by *Springer* and indexed in *Scopus*. In addition, EAER is indexed in the *Emerging Sources Citation Index* (*Clarivate Analytics*), and EABR is indexed in the *Social Science Citation Index (SSCI)* with an impact factor of 2.222 as of 2019.

Furthermore, since 2014 Springer has started to publish a new conference proceedings series (**Eurasian Studies in Business and Economics**) which includes selected papers from the EBES conferences. The 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th (Vol. 2), and 24th EBES Conference Proceedings have already been accepted for inclusion in the *Conference Proceedings Citation Index—Social Science & Humanities (CPCI-SSH).* Subsequent conference proceedings are in progress.

We look forward to seeing you at our forthcoming conferences. We very much welcome your comments and suggestions in order to improve our future events. Our success is only possible with your valuable feedback and support!

With my very best wishes,

Klaus F. Zimmermann
President

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Contents

Contributors

Ayşe Özge Artekin Department of Finance, Banking and Insurance, Yunak Vocational School, Selçuk University, Konya, Turkey

Irep Bayat Labour Economics and Industrial Relations, Mersin University, Mersin, Turkey

Beril Baykal Labour Economics and Industrial Relations, Kocaeli University, Kocaeli, Turkey

Marija Bečić Department of Economics and Business Economics, University of Dubrovnik, Dubrovnik, Croatia

Seyran Gürsoy Çuhadar Labour Economics and Industrial Relations, Kocaeli University, Kocaeli, Turkey

Rasa Daugėlienė Faculty of Social Sciences, Arts and Humanities, Kaunas University of Technology, Kaunas, Lithuania

Paula Gomes dos Santos Accounting and Auditing Department, Lisbon Accounting and Business School – ISCAL/IPL, Lisbon, Portugal

Andreea Dumitrache Department of Cybernetics and Statistics, University of Economic Studies, Bucharest, Romania

Podimatas Eleftherios Department of Economics and Regional Development, Panteion University of Social and Political Sciences, Athens, Greece

Rozina Eustathiadou Computer Technology Institute and Press – "Diophantus", Patras, Greece

Michalaki Evanthia Department of Economics and Regional Development, Panteion University of Social and Political Sciences, Athens, Greece

A. Filipova-Slancheva Financial and Accounting Faculty, University of National and World Economy, Sofia, Bulgaria

Toshitaka Fukiharu School of Business Administration, Kansai University of International Studies, Amagasaki, Japan

Vania Ivanova Economics Department, UNWE-Sofia, Sofia, Bulgaria

Anna Jędrzychowska Department of Insurance, Wrocław University of Economics and Business, Wrocław, Poland

Algis Junevičius Faculty of Social Sciences, Arts and Humanities, Kaunas University of Technology, Kaunas, Lithuania

Zeynep Karaçor Department of Economics, Selçuk University, Konya, Turkey

Sevilay Konya Department of Management and Organization, Selçuk University, Konya, Turkey

Semra Köse Aydın Üniversitesi, İstanbul, Turkey

Sevda Köse Labour Economics and Industrial Relations, Kocaeli University, Kocaeli, Turkey

Ilmars Kreituss RISEBA University of Applied Sciences, Riga, Latvia

Mücahide Küçüksucu Department of Economics, Necmettin Erbakan University, Konya, Turkey

Florentina Kurniasari Technology Management Department, Universitas Multimedia Nusantara, Tangerang, Indonesia

Christos Manolopoulos Computer Technology Institute and Press – "Diophantus", Patras, Greece

Carla Martinho Accounting and Auditing Department, Lisbon Accounting and Business School – ISCAL/IPL, Lisbon, Portugal

Lucía Mellado Departamento Economía de la Empresa y Contabilidad, Facultad Ciencias Económicas y Empresariales, Universidad Nacional de Educación a Distancia (UNED), Madrid, Spain

Małgorzata Mikita Department of Capital Markets, Warsaw School of Economic, Warsaw, Poland

Monika Moraliyska International Economic Relations & Business Department, University of National and World Economy, Sofia, Bulgaria

Aleksandra Nocoń Department of Banking and Financial Markets, University of Economics in Katowice, Katowice, Poland

Wioletta Nowak Institute of Economic Sciences, University of Wroclaw,, Wroclaw, Poland

Oguzhan Ozcelebi Department of Economics, Istanbul University, Istanbul, Turkey

Laura Parte Departamento Economía de la Empresa y Contabilidad, Facultad Ciencias Económicas y Empresariales, Universidad Nacional de Educación a Distancia (UNED), Madrid, Spain

Ayse Akdam Peker College of Land and Registry, Department of Land and Registry, Ankara Haci Bayram Veli University, Ankara, Turkey

Irina Petersone RISEBA University of Applied Sciences, Riga, Latvia

Ewa Poprawska Department of Insurance, Wrocław University of Economics and Business, Wrocław, Poland

Anna Pyka Department of Banking and Financial Markets, University of Economics in Katowice, Katowice, Poland

Irena Pyka Department of Banking and Financial Markets, University of Economics in Katowice, Katowice, Poland

K. Rajamani Research Wing—State Bank Institute of Leadership, State Bank of India, Kolkata, India

A. G. Rekha Research Wing—SBIL, State Bank of India, Kolkata, India

A. G. Resmi Business Studies and Social Sciences, Christ (Deemed to be University), Bangalore, India

Sara Sousa Coimbra Business School/ISCAC and CERNAS, Polytechnic Institute of Coimbra, Coimbra, Portugal

Yannis C. Stamatiou University of Patras and Computer Technology and Press – "Diophantus", Patras, Greece

Stelian Stancu Department of Cybernetics and Statistics, University of Economic Studies, Bucharest, Romania

Madalina Stefanet Department of Cybernetics and Statistics, University of Economic Studies, Bucharest, Romania

Nikolay Sterev Industrial Business Department, UNWE-Sofia, Sofia, Bulgaria

Kaya Tokmakcioglu Department of Management Engineering, Istanbul Technical University, Istanbul, Turkey

Feyza Turgay Labour Economics and Industrial Relations, Kocaeli University, Kocaeli, Turkey

Delitheou Vasiliki Department of Economics and Regional Development, Panteion University of Social and Political Sciences, Athens, Greece

Perica Vojinić Department of Economics and Business Economics, University of Dubrovnik, Dubrovnik, Croatia

Lihua Wu School of Economic and Management, Southeast University, Nanjing, China

Qian Yuan School of Economic and Management, Southeast University, Nanjing, China

Ping Zhang School of Computer Science, Nanjing University of Posts and Telecommunications, Nanjing, China

Part I
Accounting/Audit

Insights from Lobbying Research on the Accounting Standard-Setting Process Through Comment Letter Submissions

Lucía Mellado and Laura Parte

Abstract The purpose of this paper is to provide an overview of lobbying research through comment letter submissions in the accounting standard-setting process. First, we review the theoretical framework that supports lobby behavior in accounting standard-setting process. Second, we examine the participation in lobby process and constituents' incentives to participate worldwide. Third, we analyze the studies that focus on the content of comment letters to understand the position and argument of participants, and finally, we examine the effectiveness of a lobbying strategy through the relationship between the inputs (comment letters) and output (final standard). This paper identifies fundamental questions that remain unanswered and offers avenues for future research.

Keywords Lobbying · Comment Letters · IASB · FASB

1 Introduction

The accounting normative process is a subject of interest to the accounting community. The determination of standards has been considered not only a technical process but also a political process, due to the observation of pressures on the standard-setting (Gipper et al. 2013). In this context, the literature has defined "lobbying" as all of the actions taken by stakeholders to influence the regulatory process to defend their own interests (Sutton 1984). The differences among national regulators, for example, whether they are public or private, and their formal procedures or participation systems are important to study issues such as legitimacy or technical quality. Traditionally, the Unites States national standard-setter has been a reference for accounting regulation. However, in recent decades, the International Accounting Standards Board (IASB) has captured most of the attention of academics

L. Mellado (✉) · L. Parte
Departamento Economía de la Empresa y Contabilidad, Facultad Ciencias Económicas y Empresariales, Universidad Nacional de Educación a Distancia (UNED), Madrid, Spain
e-mail: lmellado@cee.uned.es; lparte@cee.uned.es

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and practitioners because of its global scope, and mainly after the convergence project conducted jointly with the United States Financial Accounting Standards Board (FASB).

Hence, constituent participation in the international regulatory process has increased compared to previous national accounting projects (Jorissen et al. 2013). The FASB and the IASB follow a formal process in setting standards that encourages broad participation (Holder et al. 2013). Nevertheless, the methods used by interested parties to exert pressure on standard-setters can be numerous. Georgiou (2004) distinguishes between direct methods (e.g., participation in discussion panels) and indirect methods (e.g., using the media as a mediator to influence). Subsequently, Kwok and Sharp (2005) add the distinction between formal methods (participation in a standardized consultation process such as the submission of comment letters) and informal methods (e.g., private conversations with single members of the standard-setting institution). The submission of comment letters has been considered one of the most accessible methods and the most visible action for participating in the regulatory process. Comment letters contain a large amount of valuable information that researchers can infer from their analysis (e.g., information about the writers' characteristics, their incentives, their position relative to accounting rules, a strategy to persuade, and expectations).

The aim of this paper is to provide an overview of the lobbying literature in the accounting standard-setting process through comment letter submissions (particularly to the IASB and FASB). First, we explain the constituents' and regulators' behavior in the accounting standard-setting process from a theoretical perspective. Second, we classify the previous literature according to the following objectives: understanding participation in the process and inferring from text or content analysis. Finally, we examine the effectiveness of a lobbying strategy through the relationship between the inputs (comment letters) and output (final standard).

The paper contributes to the literature in lobbying research in different ways. First, it provides an overview of a theoretical framework to understand how political forces may influence the standard-setting process through comment letters. Early works consider self-interest and economic effects to be fundamental factors in a lobbying strategy (Watts and Zimmerman 1978; Sutton 1984). To gain a better understanding of the lobbying phenomenon, recent papers extend these arguments by providing a more robust framework to design future studies. For example, they integrate traditional accounting and economic theories with other strands in the social sciences, such as political science or psychology. The conjunction of different theories contributes to an enhancement of a more extended theoretical framework.

Second, this paper reviews the instrument, sample, and methodology used by researchers to achieve their objectives, focusing on both their weaknesses and their strengths. The main instrument is the analysis of comment letters to understand the decision to submit comment letters, the power of different groups, the characteristics of participants, the potential benefits of being involved in the regulatory process, and the letters' effectiveness (relationship between the inputs and the output). Although early research has used single accounting standards and small samples primarily due to the complexity of working with manually collected data, extended research has

overcome some of the weaknesses of preliminary papers, thereby increasing the scope of studies through multiple accounting standards and making it possible to maximize the sample and generalize the results. In fact, the combination of quantitative and qualitative data makes it possible to obtain a more complete view of the accounting standard-setting process with respect to early results.

Third, we identify fundamental questions that remain unanswered and that can be developed by future studies. We present some avenues at the end of each section, and we provide an agenda for future research in the conclusion section. Finally, we discuss the limitations of comment letters as a methodology for analyzing the accounting standard-setting process.

The structure of this paper is as follows. Section 2 provides an overview of the main theoretical aspects behind lobbying research. Sections 3 and 4 review the literature that explains the decision to submit comment letters (participation) and the literature that analyzes the substance of comment letters (content analysis), respectively. Section 5 examines the literature that investigates the usefulness of comment letters for constituents and regulators (the input-output relationship). Finally, Section 6 provides the conclusions, the future avenues, and the limitations of the paper.

2 Theoretical background

2.1 The role of theories in explaining regulators' behavior in the accounting standard-setting process

The IASB and the FASB seek to develop high-quality accounting standards to take decisions about the firms. They have also been involved in a convergence project to reduce accounting standards divergences between both regulatory bodies. Supranational government and domestic countries provide political legitimacy to the regulatory bodies. Consequently, the IASB and FASB work continuously to guarantee their technical expertise (substantial legitimacy) as well as to guarantee that the process is transparent, independent, considering the public interest (procedural legitimacy) (e.g., Burlaud and Colasse 2011). Legitimacy theory is being developed in the field of the standard-setting process (e.g., Botzem 2014).

The political and institutional environment surrounding the IASB and the FASB is complex but particularly in the case of the IASB because there are several formal and informal institutions and entities that can influence it at different levels: (1) authority level: national governments, supranational governments, or institutions such as the International Organization of Securities Commissions (IOSCO); (2) organizational level: national accounting standard-setters, advisory bodies, auditors and accounting associations, financial and industry associations; and (3) participation at the constituent level (business and investors) (Baudot and Walton 2014). In this paper, we focus on the third level to understand how standard-setters react to the

lobbying activities of constituents. Lobbying activities in the FASB standard-setting process have been studied for several decades (Gipper et al. 2013).

The decision-making process to review or adopt a new accounting standard is complex. According to Cortese and Irvine (2010), it is like a "black box." To better understand this "black box," economic theories of regulation are divided into three main approaches that explain the behavior of standard-setters: the public interest model, regulatory capture theory, and the ideology model. The public interest model (Posner 1974) holds that accounting rules are necessary public goods in unregulated markets and that standard-setters make socially efficient decisions because the interest payoff of regulators may be positively correlated to social welfare (Polk 2002). In Sunder 1988, Sunder already noted the necessity to have a structure that does not let the Boards to act unless they strongly consider the standard may be socially desirable. In contrast, the model proposed by regulatory capture theory (Stigler 1971) suggests that firms in the regulated industry "capture" the regulator, thereby opposing social efficiency. Watts (2006) explains that the accounting regulators have the responsibility to define the Agenda for reviewing, amending, or propose new accounting standards. During the process, it is important to guarantee the market equilibrium and prevent the potential lobby of special interest group or political forces that pursue their self-interest. Also, there is an intermediate theory, the ideology model, in which regulators are moved by their own beliefs and attempt to achieve public welfare but consider useful information concerning the effects of proposals provided by interested parties (Kothari et al. 2010).

The ideology theory is of particular interest for understanding the role of standard-setters in the accounting normative process. Allen and Ramanna (2013) argue that the background of board members is important for determining the accounting style. If they have a prior carrier in financial services, then they propose fair-value methods to increase the relevance instead of the reliability. The opposite results are found for members affiliated with the Democratic Party. The influence exerted by Big 4 members has also been studied (Botzem 2014), but the need for technical expertise is undeniable. Drawing on organizational theories, some studies do not consider the individualistic approach of the board, instead assuming the collective role of the boards as groups of interacting individuals with different ideologies. Morley (2016a) calls this approach internal lobbying, that is, the effects of the existing division into ideological groups but relaying in the IASB the final outcome.

Nonetheless, to determine the position of regulators and their attitude toward constituents, we consider essential to examine the entire due process. The steps of the IASB are as follows: (1) setting the agenda (mandatory); (2) planning the project (mandatory); (3) developing and publishing the Discussion Paper (DP), including public consultation (facultative); (4) developing and publishing the Exposure Draft (ED), including public consultation (mandatory); (5) developing and publishing the Standard (mandatory); and 6) procedures after a Standard is issued (mandatory). Comment letters are submitted during the public consultation period of the third and fourth steps. It is interesting to complement comment letters analysis with formal and informal mechanisms during the due process, such as information from consultative

groups, staff documents, and interviews with the key actors, to obtain a more complete view of the process and extend the conclusions of previous papers.

Studies on the accounting standard-setting process are changing their focus to also include the regulator's perspective. The theories that support these advances are based on organizational studies, political science, and psychology. Recent papers on the behavior of standard-setter are analyzing the background of board members and the presence of ideology groups. Additionally, studying the manner in which standard-setters perceive constituents' opinions in comment letters and how they are reflected in the final standard requires theoretical support that may be reinforced. To show a global perspective, studies can include the examination of the evolution of projects, the formation of the agenda, and the timing of due process, among others.

2.2 The role of theories in explaining constituents' behavior in the accounting standard-setting process

Most empirical studies consider the 1970s to be the beginning of lobbying research due to the "rise of economic consequences" (Zeff 1978). Preparers changed the objective from simply presenting reporting information to incorporating economic effects. Consequently, the previous literature builds models that link the participation of constituents in standard-setting to the economic effects of accounting rules (Watts and Zimmerman 1978) and the type of accounting issue under consideration (Sutton 1984). The general assumption of these theories is that participants are moved by their self-interest. The classification of Durocher et al. (2007) is very useful in regard to understanding the basis of constituents' behavior. They classify these theories into three streams: the Economic Theory of Democracy (ETD), Positive Accounting Theory (PAT), and the Coalition and Influence Group (CIG).

The decision to submit or not submit a comment letter is defined as a cost-benefit function, as Sutton (1984) proposes on the basis of the rational choice theory. Considering the ETD, Sutton (1984) argues that a rational entity allocates resources to lobbying only if the benefits compensate for the costs, which is compared with a political system and the decision to allocate a vote. Then, if the participants pursue its own benefit instead of the public interest with values such as honestly, loyalty, or morality, it can be considered an opportunist behavior.

Based on the ETD, lobbying research has focused on studying constituents' participation in the process to determinate the benefits from lobbying. Participation is expected to be more concentrated among those who are more economically affected by the standard (e.g., considering whether a proposal is controversial) (see, e.g., Tandy and Wilburn 1992; McLeay et al. 2000; Giner and Arce 2012; Chircop and Kiosse 2015).

The PAT is also a relevant theory, which is based on the works of Watts and Zimmerman (1978) and explains the preparers' incentives to participate in lobby. Some accounting regulatory proposals impact on financial figures involved in other

contracts, such as debt covenants or manager compensation. The proposals can lead to unintended consequences and the redistribution of wealth among different actors, which is in line with the postulates of agency theory. Empirical studies suggest that changes in accounting standards and both their expected and unintended consequences may influence the willingness of preparers to participate and their global position with respect to the proposals. Although PAT excludes the group of users as a potential objective, it seems logical to consider that this group is concerned by economic incentives.

Previous researches assumed a pluralistic conception of power (Jorissen et al. 2006; Giner and Arce 2012). They have primarily focused on answering the following questions: who is involved in lobbying actions and why. Questions such as how to exert pressure and the effectiveness of instruments in influencing in the standard-setter's decision are less explored in the empirical literature.

The third stream of research proposed by Durocher et al. (2007)—the CIG—is more focused on analyzing the effectiveness of groups and alliances in the standard-setting process. They argue that the potential alliances and cooperation between groups may exert pressure on the accounting standard-setting process, including groups with high power that face the process non-pluralistic. Hence, Metcalf Report (1976) points out that large audit firms exert a high influence on FASB. Puro (1984) explains that large audit firms can join their clients to create a strong coalition. However, MacArthur (1988) does not support the above arguments. Cortese and Irvine (2010) also note coalitions among powerful groups and their influence over regulators (Kwok and Sharp 2005; Yen et al. 2007).

The concept of power is a key feature in lobbying studies. Most previous studies assume that power is distributed through all constituents addressing a comment letter but that it can vary across constituents (Morley 2016b). We think that conduct a more in-depth analysis of theories that explain the behavior of a powerful accounting firms is a challenge for studies focusing on the IASB context. Also the empirical approach to test the influence of more (less) interested groups can help to understand the accounting standard-setting process through comment letter submissions. Futures challenges are related to finding a method to measure hidden lobbying activities or indirect lobbying, or to quantify the effect of other factors, e.g., media. Additionally, the combination of several methods to lobby may be a signal of how interested an entity is.

3 Literature on participation: the decision to submit a comment letter

3.1 Participants' profile in the process

Sutton (1984) divides the participants in the standards development process into preparers of financial reporting and users to explain the differences in decisions by

collectives of interest. Empirical studies show that preparers are the collective that participates the most in the accounting standard-setting process (e.g., Tandy and Wilburn 1992; Jorissen et al. 2006; Jorissen et al. 2012; Giner and Arce 2012; Kosi and Reither 2014; Mellado and Parte 2017a). The literature considers self-interest and the probability of influencing the outcome to be the key factors. Compared to users, preparers are richer and less diversified, and their economic interests are more homogeneous. These characteristics reduce the cost of submitting a comment letter and increase the possibility of success (Sutton 1984). Even in the case in which users are wealthier than preparers, they are less interested in any standard because of their diversified portfolios (Giner and Arce 2012). Additionally, the empirical research shows that preparers participate significantly more when proposals have a major impact on a firm's financial statements (e.g., Jorissen et al. 2012).

In contrast to preparers, the group formed by auditors has been less studied in the literature. Different theories seek to predict the behavior of auditors focusing on the firms' motivation to participate: (1) auditors are expected to lobby on behalf of their clients and to the transfer of wealth (Watts and Zimmerman 1982; Puro 1984); (2) auditors are expected to lobby to protect their own interest according to their inclination toward conservatism to preserve rule reliability and avoid litigation risk (Hilton-Meier et al. 1993, and Mora et al. 2015); (3) auditors are expected to lobby to protect public interest or users financial statements.

The groups formed by users, academics, or national standard-setters are also scarcely explored by the literature. Giner and Arce (2014) focus on the participation of national standard-setters, providing an interesting contribution to the field. The evidence suggests that the participation of national standard-setters is not continuous during all the process, being higher at the end of the projects, which is consistent with institutional theory. It is also noted that national standard-setters search a convergence process with the IASB in order to gain legitimacy with the participation. Findings also reveal that the participation of other collectives (i.e., academics) is low.

In summary, extended research on lobbying behavior through comment letters has primarily focused on the behavior of preparers, with the following as the main issues being examined: the lobbyist profile, the incentives to participate, the period of time, the methods of performing lobbying, and the effectiveness of lobbying actions. However, with respect to preparers, the research may be extended in several ways. For example, the evidence on financial firms is still preliminary. The role of financial firms as preparers and users is also an interesting question. Auditors are also an interesting collective in the accounting standard-setting process, and little evidence on this group exists.

3.2 Corporate characteristics associated with participation

Watts and Zimmerman (1978) introduce the assumption that comment letters reflect the position of managers using PAT. This theory identifies three factors that explain

the manager's incentive to incur in several accounting practices: the political cost hypothesis, contractual arrangements associated to debt covenants, or associated costs to manager remuneration and compensation. Based on this framework, Kelly (1985) and Francis (1987) examine the decision of firms to participate in the FASB standard-setting process through comment letters versus firms that do not. Kelly (1985) finds that size is the main corporate characteristic in the decision to lobby. Although the empirical model includes interesting variables such as management ownership, the evidence is limited due to the small sample. To overcome this problem, Francis (1987) uses a large sample and shows that size and adverse financial statement effects are key factors that explain lobbying behavior.

There is a consensus in the literature that larger firms submit more comment letters than smaller firms across all industries around the world (e.g., Sutton 1984; Kelly 1985; Francis 1987; Georgiou 2005; Jorissen et al. 2012; Kosi and Reither 2014; Santos and Santos 2014; Mellado and Parte 2017a). Smaller firms have less discretion (and power) to engage in lobbying behavior; they often participate through trade associations.

Empirical research on preparers' incentives driven by compensation management contracts and the debt covenant hypothesis from the positive accounting perspective are still scarce, and the results do not show a clear direction. Using the accounting regulation of the oil industry, Santos and Santos (2014) find an association between lobbying strategies and firm size but a weak association with compensation management contracts. Georgiou (2005) and Koh (2011) show that debt covenant effects influence corporate lobbying behavior, but for example, Kelly (1985) does not find any association. The proxy used in empirical research to measure debt covenants can explain the results. Although most empirical studies use the debt-to-equity ratio, some authors argue that the debt covenant is a better proxy (see, e.g., Georgiou 2005). The literature also argues that profitability is a good proxy of the decision to participate in the accounting standard-setting process (Jorissen et al. 2012; Kosi and Reither 2014; Santos and Santos 2014).

Empirical studies also show differences by industry when examining lobbying participation. The industries most affected by accounting standard projects are more likely to participate compared to industries that show less exposure to accounting figures. For example, in the leasing accounting project, companies from sectors that use operating leases more intensively, such as transport services, retail, restaurants, hotels, and utilities, tend to lobby more than companies in other industries (Mellado and Parte 2017a).

Kosi and Reither (2014) state that firms lobbying in the past may have experienced economies of scale. It could be reasonable to make more effort in an early stage of the project and decrease the effort in subsequent periods, due to marginal cost. However, it could be also logical to continue with lobby strategy (instead to decrease in subsequent periods) when the participant achieved success the first time (Kosi and Reither 2014). More recently, Mellado and Parte (2017a) show that the decision to submit a comment letter in a lease accounting project is associated with firm age or experience.

Another stream of research focuses on the association between the lobbying strategy and variables such as management ownership and internal and external corporate governance. Koh (2011) analyses lobbying during the "stock option" standard-setting process conducted by the FASB in 2004. He concludes that small firms are more likely to participate in the process when similar firms in the industry have also lobbied and when they have higher board independence. Kosi and Reither (2014) find that variables such as size, profitability, past lobbying experience, and financial constraints are positively related to lobbying decision. Furthermore, less concentrated ownership's firms tend to lobby more. Chircop and Kiosse (2015) show that the likelihood of firms to submit a comment letter is positively associated with pension fund size and that the number of shares available for trading is a positive influence. It is also interesting to extend the proxies used in these studies to better understand the lobbying strategy. For example, political connections, enforcement control, and more firm variables can improve the results and implications.

In terms of methodology, prior papers use univariate test to examine lobbyist participation (e.g., Georgiou 2005; Giner and Arce 2012; Kosi and Reither 2014; Mellado and Parte 2017a; Mellado and Parte 2017b), discrete choice model (such as probit or logit) to examine the probability of submitting a comment letter and the variables that explain the decision to participate o submit a comment letter (e.g., Francis 1987; Koh 2011; Jorissen et al. 2012), or multinomial regression to examine the probability of submitting one, two or more comment letters (Kosi and Reither 2014; Santos and Santos 2014; Mellado and Parte 2017a).

Regarding empirical design, de Figueiredo and Richter (2014) find two main challenges for lobbying studies: omitted variables (hidden lobbying activities) and endogenous selection into the lobbying process. Both are related and pervasive. In the first case, there are some unobserved variables not included in the model that can be correlated with the error term in a regression, resulting in an incorrect causal inference. The decision to lobby by an interest group is not a random event. Therefore, not permitting random selection (in which some interest groups will be assigned to lobby and others not) can lead to biased results because of a possible correlation between the group assignment process and outcomes. Consequently, researchers may pay attention to these challenges in future research by finding techniques to measure unobservable relevant variables for lobbying and applying methods to reduce the risk of endogenous selection to increase the robustness of statistical analysis.

In this sense, the decision to submit a comment letter and their determinants, with a robust framework, is an area of special interest in this field. A fruitful avenue is to continue developing the theories and find additional explanation to understand the reasons for lobbying, including the sociological and psychological theories that can help to comprehend certain human behaviors. Also it is important to advance in small collectives, which are scarcely examined until the date.

3.3 Jurisdiction

A seminal study by La Porta et al. (1998) provides a comprehensive investigation of country-level attributes, setting the basis for future cross-country studies. Subsequent empirical studies show that international financial reporting and accounting practices are influenced by variables such as economic factors (capital market development, per capita Gross Domestic Product (GDP)), national legal systems (political systems, tax mechanisms, investor protection, enforcement systems, securities regulation disclosure requirements), cultural values, and social attitudes, among others.

The IASB is a global standard-setter that seeks to make financial information comparable worldwide; therefore, it needs to have international legitimacy. However, country participation is not homogeneous worldwide and the academia and authorities have paid special attention to this issue. Empirical researches find that factors such as legal factors, cultural variables, institutional factors, informational environments, etc., confirm a different behavior in geographical participation (e.g., Orens et al. 2011; Jorissen et al. 2013; Larson and Herz 2013; Dobler and Knospe 2016; Mellado and Parte 2017b).

Orens et al. (2011) explain that civil law countries participate more because they are less familiar with the accounting standard-setting process. Jorissen et al. (2006) confirm that geographical participation depends on the rule of law, enforcement controls, tax compliance, and earnings management. Jorissen et al. (2014) also find that the participation is high in developed countries compared to less developed countries. Considering individual countries, constituent from countries such as the United Kingdom, the United States, Australia, Hong Kong, and Switzerland participates more compared to constituent from countries such as Japan, India, Brazil, or Africa (Jorissen et al. 2013; Dobler and Knospe 2016).

Hofstede (2001) introduces cultural variables (individualism, power distance, uncertainty avoidance, or masculinity) creating an index for every country in the sample. Previously, Gray (1988) provides accounting classifications between countries (such as professionalism vs statutory control, uniformity vs flexibility, conservatism vs optimism, and transparency vs secrecy) which some relationship with Hofstede's country division. Empirical studies have used both as determinants of the decision to participate or participation intensity at the country level (Jorissen et al. 2013; Larson and Herz 2013; Dobler and Knospe 2016; Mellado and Parte 2017b). As a part of the culture of a country, language barriers can influence the decision to lobby.

Regarding the use of IFRS by jurisdiction and the influence of IFRS differences in the lobbying decision, the evidence is mixed. Larson and Herz (2013) suggest that higher differences with IFRS in historical accounting practices lead to a higher submission of comment letters. In contrast, Holder et al. (2013) find that countries exposed to IFRS present more comment letters with an unfavorable opinion. Some studies explore the relationship between non-compliance with standards caused by corruption and lobbying. The majority of studies suggest that they are substitutes,

assuming that they are negatively associated with one another (Jorissen et al. 2006; Harstad and Svensson 2011). Under a regulatory constraint, firms have the option to bribing bureaucrats to avoid rules or lobbying through the accounting standards process. The first is positively associated with the poverty trap due to restrain lobbing strategies (Harstad and Svensson 2011). The second seems to be effective for political influence. It implies a greater investment but guarantees a better quality of reporting and credibility of the market in the long term.

Prior research uses the number of comments letters submitted by a country as a proxy to lobbying intensity (Larson and Herz 2013). To measure the variables is common to use absolute values (Jorissen et al. 2012; Dobler and Knospe 2016) or relative values such as deflated variables by listed firms (Jorissen et al. 2006) or economics variables such as capital market development and per capita GDP (Jorissen et al. 2013). The methodology used in this area is very similar to that of empirical papers that focus on investigating the corporate determinants of lobbying. Generally, they use a univariate methodology to test significant differences among country variables and linear regression models (OLS regressions) to test the association between dependent and independent variables (e.g., Jorissen et al. 2012; Jorissen et al. 2013; Larson and Herz 2013; Dobler and Knospe 2016).

Summing up, to examine the lobby is common to use large samples with several accounting standards projects (since the early stage to the final publication), including a wide set of variables and factors associated to firm levels and country factors. As a result, the evidence contributes toward our lobby understanding worldwide. Accounting regulators could benefit from these results not only to understand lobby motivations and incentives for different collectives (including auditors and firms) and country factors but also to anticipate several behaviors in the accounting standard-setting projects. Considering the objective to gain legitimately worldwide, the participation to certain countries (Western countries) and emerging countries should be an objective for accounting setters. Hence, researchers should be focused on understand such low participation of certain countries, including appropriate countries variables—microeconomic and macroeconomic factors.

Several limitations have been detected. The country representation though databases is not representative; large amounts of data exist for developed countries, but limited data are available for small and emerging countries. This situation makes it difficult to fully compare the results. A deeper analysis of country-level variables is also required to identify possible correlations and interrelations between variables. Recent studies include a large set of variables to find differences between countries without appropriate controls. Researchers may also pay attention to the index included in the database that allows countries around the world to be classified because they typically assume that the classification holds constant during various periods.

4 Literature on the content of comment letters: positions and arguments

The content of comment letters is valuable to know the agreement or disagreement with the proposal and also the specific arguments and comments for constituents. However, researchers should analyze the content of comment letters by categorizing and codifying the text. Content analysis could be oriented to: (i) explore the structure of the text (number of words, number of questions answered, number of complex words, number of specific words, and expressions associated to the research objective, etc.); (ii) understand the meaning of words (what they are saying and why). This approach is more accurate to understand the reasons to lobby.

Previous work that uses the content analysis methodology has focused on the single-issue accounting standard due to the necessity to process the letters, which contains large amount of text (Yen et al. 2007; Holder et al. 2013). Examining a single-issue standard is easier to codify the arguments of interest, the lobbying position (Georgiou 2005), the meaning of the comments (Giner and Arce 2012), and accuracy in the content of the letter. Puro (1984), Giner and Arce (2012), Holder et al. (2013), and Anantharaman (2015) identify the global position of respondents through three categories: agreement, opposition or, occasionally, neutrality. Also, they emphasized the relationships between the characteristics of respondents and their position in the letter (e.g., Koh 2011).

Yen et al. (2007) identify five types of arguments in comment letters: definitions, scope, due process, outcome-oriented, and others. Later, Mora et al. (2015) classify the arguments in comment letters submitted to lease DP issued by IASB in 2009 in more categories: conceptual framework arguments (concepts, subjectivity, cost/benefit, anti-abuse, business model. . .) and economic consequences arguments.

Other studies focus on understand the arguments by groups of respondents. Regarding the concept of control, Stenka and Taylor (2010) consider two groups: corporate versus non-corporate. They analyze arguments and find that corporate respondents are more concerned about specific subjects. Giner and Arce (2012), using comment letters on ED for IFRS 2 issued by IASB, identify arguments related to recognition, valuation, and allocation. The evidence suggests that constituents provide arguments when they do not agree with the proposal. Hence, preparers and consultants use more arguments related to the economics effects than conceptual arguments are used less frequent than economics. In contrast, regulator uses mainly conceptual arguments. Mora et al. (2015) suggest that preparers know that conceptual arguments are the best strategy to influence regulators. Interesting, Stenka (2013) provides a rhetorical analysis through comment letters. The categories and dimension selected are as follows: (i) lexical choice, (ii) sound patterning, (iii) figurative language, and (iv) schematic language.

As noted above, content analysis is a methodology that is mainly used to draw conclusions through comment letters. The process of codification can be human-coded or computer-aided. Early studies have used the former to draw conclusions on the position and arguments driven by constituents. However, the commercialization

of specific software to treat qualitative text has permitted an extension of the content analysis technique to conduct an in-depth investigation of the style, tone, readability, and linguistic complexity, among other aspects. This field of research is extensive and may be applied to the process of setting accounting standards, particularly in the context of comment letters.

However, this approach has several limitations. The large amount of work and time to ensure the outcome makes the process difficult and complex. To ensure valid inferences, it is necessary an appropriate, and sufficiently developed, coding system to guarantee reliability, i.e., so that research can replicate and reproduce the study under different conditions (see Yen et al. 2007). Then, the methodology for processing the text is a key factor due to the importance of providing consistent results that are to be used in future works. If researchers use a different method to code the text, the results and implications cannot be extrapolated to other studies.

5 The effectiveness of lobbying efforts

This section examines several relevant issues: (i) whether the comment letters submitted in the accounting standard-setting project are an effective tool to influence the final standards, and (ii) whether the lobbyists use specific strategies (i.e., what type of arguments) to effectively pursue regulators and guarantee lobbying success in the accounting standard-setting project; (iii) whether there are some collectives that influence more regulators (power of constituents).

The focus is to determine how much lobbying efforts impact the outcome (degree of lobbying success), i.e., whether lobbyists achieve their objectives. But first, lobbying success should thus be defined. Mcleay et al. (2000) and Giner and Arce (2012) consider that the acceptation of the proposals by the regulators makes a lobbyist more successful than the rejection of the proposals. Therefore, lobbying success may be defined as the capacity to convince regulators to adopt a similar position regarding final standard. Bamber and McMeeking (2016) extend the definition of success to the fact of "having your voice heard"; that is, they consider persuasion as a multi-stage process in which the discussion of the constituents' proposal is already a signal of lobbying effectiveness.

The researchers have the challenge to identify the expectations of accounting standard-setters and lobbyists to empirically test the successful of lobby behavior. Considering that regulators comply with social welfare (Polk 2002), their decisions will be oriented to maximize the public benefit. In this context, the strategies are divergent. Lobbyists pursue to influence the accounting standard process in order to achieve their objectives or self-interest, and regulators are mainly focused on guaranty the quality of accounting standards to maximize social welfare; then, lobbying success is located at the point at which both interests converge. Hansen (2011) explains that lobbying success is positively associated with the ability of respondents to transfer valuable information to regulators. Therefore, the ability to

anticipate the objectives of accounting setters should be a fruitful barometer of lobbying success.

The evidence in this stream is mixed. Yen et al. (2007) find an association between the specific arguments included in the comment letters and the most significant changes included in an early stage of the project (the EDs) compared to the final standard. They explain that the FASB attempts to understand the positions of participants and that the content of the comment letters persuades the regulators. Other authors suggest that constituent coalitions can capture the standard-setting process to secure favorable regulation (Cortese et al. 2010).

The studies also show that preparers persuade regulators (Kwok and Sharp 2005); auditors persuade regulators in contrast to business preferences (McLeay et al. 2000) and support the objectives pursue by preparers, conditioned to the help of auditors or academics; users are able to persuade regulators (Seamann 1999); there is no influence by interested groups, at least significant (Buckmaster et al. 1994). Anantharaman (2015) focuses on the impact of comment letters on changes between EDs and final standards concluding that the participation of opposing parties was ineffective.

To the best of our knowledge, there are few studies focusing on lobbying effectiveness, particularly on the IASB. Hansen (2011) finds that lobbying success depends on two factors: the ability of constituents to communicate high-quality information to the IASB and the credibility of the comment letters submitters. This is a fruitful avenue for future research in the field.

Regarding power among interested groups, the evidence is mixed. Kwok and Sharp (2005) show that preparers were the most influential group. Conversely, Giner and Arce (2012) suggest that every interested party has the same power in the process in the comment letters submitted to all consultation periods of the share-based payment project. These authors also conclude that conceptual arguments are more useful for regulators than economic arguments; therefore, they may be determinants for lobbying effectiveness.

Bamber and McMeeking (2016) introduce innovation into the study of pervasiveness from a theoretical and a practical perspective. Drawing on legitimacy theory, they analyze comment letters on ED 7, separating comments that request amendments (named outcome-oriented under Yen et al. 2007) from other comments and introducing a weighting system to prevent the comments from being treated equally, designating them minor, moderate or major. Subsequently, they reconcile the ED with the Standard (IFRS 7) on a word-by-word basis to identify changes and to observe whether they coincide with those proposed. Then, reviewing IASB documentation, they study what the discussed issues are and whether they impact on the outcome, given that the discussion is the first step. The results are related to the respondent and to the jurisdiction: accounting firms are significantly less influential; US comments are found to be more useful to the process than UK comments.

The methodology used to analyze lobbying effectiveness—that is, the relation between the input and the output—is a combination of qualitative and quantitative methods. Qualitative or content analysis methods focus on the identification of the strategy and position through the content of the comment letters (since an early stage

until the last stage) and also to identify the final position adopted by the regulators. The comparison between what the constituents want and what the standard-setters adopt in the final accounting standard could be conducted through models that allow to test the positive association between groups of arguments, considering the predictor variable and the outcome.

Studies that analyze narratives and predict the impact on standard-setters are interesting to the academia because they provide recommendations to regulators and constituents. This field will provide valuable opportunities for advances in this area. It could be also interesting to combine content analysis to quantitative models to detect lobbyist strategies from different groups.

6 Conclusion

This paper presents a review of the lobbying literature through comment letters in the accounting due process. This study is motivated by a growing interest of different collectives in the international accounting standard-setting process. Empirical research has provided important insights into the lobbying phenomenon; however, the review of the literature shows some gaps that could be covered in future research. In addition, the study includes a critical perspective that can help for future researches.

Comment letters have been considered a useful instrument to measure participation because of the fact that they are easily available due to their public and formal character and that they are supposed to reflect invisible lobbying methods. Empirical research on the accounting standard-setting process through comment letters has mainly focused on the following: i) identifying the interested subjects or groups that submit comment letters, understanding the reasons for participation, ii) understanding positions and arguments, and iii) examining the success of comment letters to persuade regulators.

Some opportunities for future researches are as follows:

- Regarding theoretical framework of lobbying studies, the mapping from theory to the empirics is occasionally quite fragile (Gipper et al. 2013). Future studies may reconsider and criticize the general assumptions driving by previous papers to better analyze and understand the lobbying behavior. The majority of the studies uses a restricted approach based on classical economic rationality. A complex body of theories stems from the main accounting research, but some theories also draw from political science, sociology, and psychology. The primary challenge is the integration of theories with a logical and accurate interpretation of the explanatory factors of participation, the analysis of strategy, and the prediction of effectiveness.
- Although comment letters sent by preparers have been extensively analyzed from a technical perspective, little evidence exists about other collectives such as professional and non-professional investors, academics, trade associations, and

the accounting profession, among others. One of the main reasons is that the number of comment letters from these collectives is lower than the number of comment letters sent by preparers. More attention is required by the accounting profession community to be sufficiently involved in every project. For example, we consider to be interesting the following questions: Do accounting firms focus on their clients' position? Do they favor the complexity of rules to increase their income from fees? Or do they tend to avoid the risk of litigation? Do the Big 4 have special influence over standard-setters due to their knowledge, expertise, experience, resources, and connections, or is the opposite true?

- Lobbying in accounting standards requires a deeper analysis of the influence of all constituent groups. Most of the empirical works have assumed that each constituent has a similar power and ability to influence the standard-setting process through the attendance of comment letters and vote-counting systems, but it is possible that formal institutions such as European Financial Reporting Advisory Group (EFRAG) and European Securities and Markets Authority (EASM) influence more than other groups such as trade associations (see, e.g., Morley 2016b). Political theories about the typology and distribution of power are crucial in these studies. Furthermore, collective influence (CIG) may be differentiated from individual power. Drawing on the discussion of the proposals of specific constituents by accounting standard-setters, interviews with key actors of the accounting standard-setting process, staff documents, and working papers that contain responses to the comment letters, among others, can help to better analyze the differences in constituents' influence on the standard-setting process. However, the challenge is to weigh the degree of difference. To measure the powerful of constituents could be interesting to include variables such as "connections" or "expertise."
- Comment letter research is currently limited to one or two steps of the entire standard-setting process. Some researchers (see, e.g., Gipper et al. 2013) accentuate the importance of investigating political forces in previous and subsequent stages, for example, by investigating the manner in which potential topics are included (or excluded) in the agenda, considering that the IASB's discussions of potential projects occur in public meetings. Studying political forces throughout the due process, considering each step separately, may allow a better understanding of the lobbying phenomenon. One challenge is to study the political forces in these other steps that are unobservable except for some established formal mechanisms such as public IASB meetings for discussing the inclusion of potential projects or the existence of a consulting group during project planning.
- Special attention is required to the role of cross-country factors and firm specific variables in explaining lobbying in the accounting standard-setting process. Understanding the potential effects of cross-country factors, for example, the impact of the global economy on the fundamental activities of a firm, could be valuable for future work. Researchers require a complete understanding of the national settings to correctly identify the variables to revisit and extend the evidence of prior papers. That is, based on seminal studies in the field, researches

should consider the specific setting (local standards and local issues that can affect the output).

- Moreover, it is also interesting to find accurate factors to understand why lobbying is undertaken. For example, the most controversial projects, conceptual critical issues, the potential economic consequences of the proposals, and the main industries affected. Some authors have remarked on the differences between projects that affect disclosures and projects that affect income statements. Every proposal attracts the attention of different collectives with different characteristics. For example, constituents can be involved in the process consistently over time or in other case, can react only to specific proposals: What are the reasons? This approach may provide an avenue for further research.
- Regarding methodological issues, previous analyses of comment letters have used a quantitative approach. Combining the former with qualitative methodology allows to extend the conclusions of previous work and to obtain a better understanding of the entire phenomenon. Qualitative analysis is less commonly because the identification of variables inferred from text analysis presents two main challenges: the objectivity when the text is processed and the identification of key drivers and variables to make inferences and to minimize the considerable amount of time involved when the research is based on hand-collected data. Currently, advances in software for processing large amounts of text in a sophisticated manner can help researchers to obtain more robust conclusions. Empirical research based on content analysis (meaning-oriented or form-oriented) can also benefit from psychological theories to extend the results. From a practical perspective, analyzing the real intention, tone, or linguistic persuasive strategies of comment letters allows more robust conclusions.
- Other challenges for future studies are to find the relation between observable lobbying methods and invisible lobbying methods, to study indirect lobbying, and to include new models and techniques such as in-depth interviews, quasi-experiments, or structural equations.

Comment letters have been the most used proxy for lobbying activities in the accounting literature. However, the analysis of lobbying in the accounting standard due process through comment letters has some caveats. In general, prior empirical analysis circumscribed their studies to those that send a comment letter. However, the new accounting standard will affect to other many constituent that they did not participate through comment letters. It is also interesting to understand whether comment letters reflect hidden lobbying actions or hidden actors could be considered. Some studies base on a vote rather than seeing the complexity of the comments. We believe fundamental to use alternative methods to fully understand the lobbying phenomenon in accounting standard-setting (e.g., informational and financial strategies, and internal and external pressure). A more holistic approach is an avenue for moving forward.

Considering that the international standard-setting process is attracting attention from institutions, practitioners, and researchers, this systematic overview of seminal

point out some avenues for future research. We believe that there is still room to make progress in this line of research.

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The Bulgarian Life Insurance Sector: Review and Analysis of Investments

A. Filipova-Slancheva

Abstract The aim of the study is to review and analyze the investment portfolios of life insurance companies in Bulgaria in view of the new regulatory requirements, actual business model trends, and current financial market environment. Investments are an integral part of the life insurance business model. In the study, Bulgarian life insurance sector is examined—regulations on investments, investment policy, and type of investments. Along with this, the accounting approach, accounting treatment, applicable accounting standards, and specific characteristics of all the financial instruments included in the portfolios of Bulgarian life insurance are examined. Last but not least, the paper also investigates whether asset allocation trends for Bulgarian life insurance companies are similar to the trends for European insurance sector.

Data for life insurance companies' investments are obtained from publicly available sources and include five-year period 2014–2018. Respective literature related to life insurance, financial instruments, investments, and accounting standards is reviewed. It is worth mentioning that life insurers are among the largest institutional investors in Bulgaria. Findings show that there have been new specific trends for Bulgarian life insurance companies, in terms of their investment portfolios, list of involved financial instruments throughout recent years. General conclusion is that investments of life insurance companies are changing and rebalancing is experienced with major factors strict regulatory investment limits, low yield environment, change of business model, and conservative risk management approach.

Keywords Life Insurance · Financial Statements · Investments · Accounting · Bulgaria

A. Filipova-Slancheva (✉)
Financial and Accounting Faculty, University of National and World Economy, Sofia, Bulgaria
e-mail: afilipova@unwe.bg

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1 Introduction

The insurance business is a business, where insurance companies receive premiums and invest these premiums until claims or benefits become due. In terms of life insurance, it provides an extensive selection of savings and retirement products, through which individuals and businesses can invest for the future. Investments are an integral part of the insurance business model and life insurance business model in particular. Based on the operating strategies of life insurers (claims toward life insurers are generally better estimated) enables life insurers to invest in less liquid assets and long-term assets, while following a buy-and-hold investing strategy. Accumulating long-term funds, in order to match assets and liabilities life insurance companies can provide long-term financing. It is worth mentioning that by long-term financing, they fulfill an important role in the real economy. For example, European institutional investors (pension funds, insurance companies) hold almost 30% of the outstanding European corporate bonds. Hence, their investment behavior could impact market price stability and funding for governments and companies. Academics and policy makers (Borio et al. (2001); Joint FSF-CGFS working group 2009; Papaioannou et al. 2013; Claessens and Kose 2013 and Houben and van Voorden 2014) confirm that procyclical investment behavior (sell assets as prices fall and buy as prices rise) by institutional investors (pension funds, insurance companies) hurts the stability of the overall financial system.

In terms of Bulgaria, the life insurance sector, being a part of insurance sector, is a crucial component of the financial system. This stems from the amount of premiums it collects, the scale of its investment, long-term investments along with the essential social and economic role it plays in covering individual and business risks. Bulgarian life insurance business comprises of life insurance companies, which are registered as a joint stock companies and are regulated by Financial Supervision Commission (FSC). Branches of foreign life insurance companies also operate on the Bulgarian life insurance market, which are not the subject of this study, as they are not supervised by local regulators and they are not included in the statistical forms. At the end of 2018, 16 life insurance companies were operating (11 are regulated and 5 are branches), with total assets EUR 844 mln. From this figure, total investments of life insurance companies are EUR 639.4 mln. (75% of total assets of life insurers), slight decrease compared to December 31, 2017—EUR 644 mln. and 79% of total assets.

In order to measure the development of the insurance market, a gross premium income (GWP) figure is calculated. For 2018, GWP of life insurance companies is EUR 229 mln. vs. EUR 219 mln. in 2017 and EUR 218.9 mln. in 2016. Unlike GWP, which quantifies the amount of premiums written as absolute value, insurance penetration takes into account the change in the role of the insurance sector for economic development. It can be summarized that the insurance penetration in Bulgaria and for life insurance sector in particular is 0.41%—much lower than the average EU insurance penetration of 7%. In Table 1, GWP and Life Insurance

Table 1 GWP and Life Insurance Penetration in Bulgaria

	Gross Written Premium (in EUR mln.)	Life Insurance Penetration	Gross Domestic Product (in EUR billion)
2014	174.1	0.40%	42.75
2015	200.1	0.40%	44.16
2016	218.9	0.40%	47.36
2017	219.0	0.40%	50.43
2018	229.0	0.41%	55.20

Source: Financial Supervision Commission 2018; National Statistical Institute 2019

Penetration in Bulgaria, historical date with these figures is shown for the period 2014–2018 (FSC 2018; NSI 2019).

Life insurers are among the largest institutional investors in Bulgaria. Apart from their importance for the financial system, there is a limited number of articles and research papers on the Bulgarian life insurance market, investments of Bulgarian life insurance companies, investment policy, type of investments, and accounting standards prepared by Bulgarian researchers. Let alone the accounting approach, treatment, and specific characteristics of financial instruments included in the portfolios of Bulgarian life insurance companies. Along with this, from academic perspective, comparison of the Bulgarian case with other EU member state investment trends case is interesting to be explored. Hence, this paper is enriching the existing Bulgarian literature in the field of life insurance, financial instruments, and their accounting treatment, as also shedding light on the comparison of Bulgarian life insurers sector with EU one.

This paper is contributing to the literature with its in-depth review and investigation of the investment portfolios of Bulgarian life insurance sector within certain five-year time frame, where external factors along with new regulations are affecting their investment portfolio composition, while extensively reviewing accounting treatment of the financial instruments included in their investment portfolios. The paper also investigates whether asset allocation trends for Bulgarian life insurance companies are similar to the trends for European insurance sector.

Main findings show that there have been new specific trends for Bulgarian life insurance companies, in terms of their investment portfolios, list of involved financial instruments throughout recent years. Investments of life insurance companies are changing and rebalancing, with bonds and shares having highest share—81% out of total investments as of 31/12/2018. Due to strict regulatory investment limits, low yield environment, change of business model and conservative risk management approach, debt securities and other fixed-income securities (bonds) at the end of 2018 are 70% of total investments vs. 58% 3 years ago. On the contrary, bank deposits have experienced significant decrease throughout the last 3 years—from EUR 50 mln. as of 31/12/2015 to EUR 11.7 mln. as of 31/12/2018 (from 8% to 2% of total investments). Based on the list of financial instruments in their portfolios, life insurers applied the following accounting standards for investments, as issued by

International Accounting Standard Board (IASB)—IFRS 4 Insurance Contracts, which automatically defines IAS 40 Investment Property, IAS 28 Investments in Associates and Joint Ventures, IFRS 11 Joint Ventures, IFRS 10 Consolidated Financial Statements (for control), IAS 32 Financial Instruments: Presentation, IAS 39 Financial Instruments: Recognition and Measurement (respectively IFRS 9 Financial Instruments as of 2022, as IFRS 17 Insurance Contracts Allows Its Later Application), IFRS 7 Financial Instruments: Disclosures and IFRS 13 Fair Value Measurements.

The paper is structured in six parts. First two parts are introduction in Bulgarian life insurance—historic review, actual financial standing of the sector from investment perspective, regulatory and legal framework, and applicable local requirements. The third part is on characteristics of the investments of life insurance companies from accounting perspective. The fourth part is on selected methodology, stemming from the research objectives. In the study, the following objectives are set—review of the relevant literature related to investments of life insurers and more specifically investments which cover technical reserves, investment policy, and type of investments. Along with this investments in major assets that cover technical reserves of life insurers in Bulgaria (shares, bonds, deposits, etc) are reviewed from the accounting approach perpspective, their characteristics, and applicable accounting standards perspective. Research objective is to compare and outline differences and changes in investment policy of Bulgarian life insurers before and after implementation of Solvency II, as well as investment trends for Bulgarian life insurance companies compared to EU ones. The fifth part is on findings and results, and the last part is conclusion. The paper is solely related to Bulgarian life insurance sector, its investment policy and type of investments, applicable regulatory framework, accounting approach, and accounting standards.

2 Investments and Investment Policy of the Bulgarian Life Insurers: Legal Framework and Type of Assets

Investments of the insurance companies are crucial business activity because consider management of technical and non-technical reserves of insurance companies. The regulation of the investment activity of the insurers in Bulgaria is based on the Insurance Code 2019, which governs the investment risk management system, competences, functional relationships, and risk management responsibilities, in accordance with the applicable regulatory requirements, including Council Directive 2009/138/EC (2009) or Solvency II Directive and Commission Delegated Regulation (EU) 2015/35 (2015) (hereinafter referred to as Directive 2009/138/EC and Regulation (EU) 2015/35).

The Solvency II Directive introduces a major change in the way insurance companies operate. It should be clear that directive and regulation require greater focus on the investments (assets) part of insurers' portfolios, as well as the risks they

entail. Key principles in Solvency II are the introduction of risk-based capital requirements and the mark-to-market approach for balance sheet items. Also in this context, Solvency II is a completely new risk-oriented approach for measurement and evaluation of the financial position and strength of the EU insurance companies (Chobanova 2015). It is considered that the practical application of Solvency II will impose significantly higher capital to insurance companies. These requirements are expected to prevent the entities from the effective allocation of their own funds.

2.1 Solvency II and Local Legal Framework for Investments of Life Insurers

All investments held by insurers should be managed in accordance with the "prudence principle." The insurer should have at its disposal an adequate structure of liquid assets (investments/resources) at all times in its activity against commitments under insurance contracts. European directives require a direct link between insurance liabilities and assets. In summary, "prudent investor" principle is required from each insurer in its investing decision, i.e., to invest the allocated insurance reserves (technical reserves) and own funds from the position of the prudent investor.

Conservative regulation predetermines the insurer's investment policy by obliging it to cover the gross amount of technical provisions and the reserve fund so that the relative share of investments by type of insurance and its insurance portfolio structure ensures security, profitability, and appropriate liquidity for the specific insurance. In addition, the assets in which the insurer invests its technical reserves, and as such an investment they serve to cover them, should be diversified and allocated so that "no category of assets, investment market, or individual investment has a significant share."

Bulgarian Life Insurance Code strictly defines which assets are allowed to cover the technical reserves of life insurance companies, along with specific limits per asset class. These assets, apart from its broad legal definition and restrictions, basically include as follows: government bonds; other type of bonds—corporate, municipal; shares or equities, units of collective schemes, property; cash; deposits; receivables; other assets. For every asset class, there is strictly specified limit.

3 Characteristics of the Investments of Life Insurers from the Accounting Perspective

The economics of insurance transactions is completely different from other enterprises. A major problem in insurance contracts accounting is to appropriately determine a way of reflecting the risk of insurance activities in published financial

statements. In this respect, as outlined by Klumpes and Morgan (2008) accounting standard setters should ensure that these treatments are broadly consistent with both their conceptual frameworks and similar non-insurance transactions that are entered into by these same enterprises.

Bulgaria as a European Union (EU) member state applies the International Financial Reporting Standards (IFRS) as the basis for presenting their consolidated financial statements for fiscal years beginning on or after January 1, 2005. In terms of insurance and insurance contracts, the International Accounting Standard Board (IASB) established a two-phase project. In 2004, the IASB issued IFRS 4 Insurance contract as the result of phase I of the project on insurance contracts. For Meyer (2005), the aim of the standard is to achieve high comparability and assist the decision-making process on capital markets. On May 18, 2017, the IASB published IFRS 17 Insurance Contracts. Apart from the predecessor standard—IFRS 4 Insurance Contracts, which set out a limited number of high-level guidelines and disclosure requirements for the accounting of insurance contracts, IFRS 17 introduces a significant change to insurers' and reinsurers' accounting and consequently their financial statements. IFRS 17 is expected to provide greater consistency.

The structure of the insurers' investments includes mainly shares, bonds and to a lesser extent investment property, investments in subsidiaries, associates, and joint ventures and deposits. The issues of insurer investments are not dealt directly in IFRS 4 Insurance Contracts, which automatically defines IAS 40 Investment Property, IAS 28 Investments in Associates and Joint Ventures, IFRS 11 Joint Ventures, IFRS 10 Consolidated Financial Statements (for control), IAS 32 Financial Instruments: Presentation, IAS 39 Financial Instruments: Recognition and Measurement (respectively IFRS 9 Financial Instruments as of 2022, as IFRS 17 Insurance Contracts Allows Its Later Application), IFRS 7 Financial Instruments: Disclosures and IFRS 13 Fair Value Measurements, as determining in respect of accounting of the investments of the insurers. IFRS 17 Insurance Contracts—together with IFRS 9 Financial instruments—are anticipated to bring further consistency and transparency to European insurers (EIOPA 2018).

3.1 Characteristics and Accounting of the Investment Property of Life Insurers

The reporting of investment property by insurers is carried out in accordance with the provisions of IAS 40 Investment Property. By their nature, purpose, and affiliation to the investment policy of the insurers, the investment property is a long-term investment in land and/or building or parts thereof (or both), which are held rather for long-term rental income and/or to increase the equity of the insurer, or both, than to be used in the principal business of the insurer or for administrative purposes. One of the major differences between an investment property and property for own

purposes is the ability of the investment property to generate cash flows relatively independently of other assets.

Paragraph 8 of IAS 40 Investment Property lists the following as examples of investment property: Land owned for the purpose of raising capital over the long term, and not for the purpose of short-selling in the ordinary course of business; land held for indefinite future use (if the entity has not determined that it will use the land either as owner-occupied property or for short-term sale in the ordinary course of business, the land is considered to be held for capital appreciation.); a building owned by the entity (or a usable asset related to a building held by the entity) and leased under one or more operating leases; a building that is not used but owned to be leased out under one or more operating leases; property under construction or construction for future use as an investment property.

In order to recognize an investment property in the balance sheet of an insurer as an asset, the following two conditions must be fulfilled cumulatively: it is probable that the reporting entity will receive future economic benefits from the investment property, and the cost of acquiring this investment property can be fairly estimated.

3.2 Characteristics and Accounting of Investments in Subsidiary, Joint, and Associated Undertakings and Other Undertakings in which the Life Insurer has a Stake

Upon initial recognition, an investment by the insurers in shares/units of an entity is classified according to the relevant class—an investment in a subsidiary, associate, joint venture, or financial asset. The requirements of the relevant accounting standard should apply—IFRS 10 Consolidated Financial Statements (for control), IAS 28 Investments in Associates and Joint Ventures (for Significant Impact), IFRS 11 Joint Ventures (for Joint Venture), IFRS 12 Disclosure of Interests in Other Entities. If an investment does not provide control, significant influence, or joint control, it is treated as a financial asset in accordance with IAS 39 Financial Instruments: Recognition and Measurement (IFRS 9 Financial Instruments, respectively).

Depending on the size of the investment, the insurer acquires a holding in which it obtains control, significant influence, or joint control over the entity in which it invests. This is one of the most important characteristics of investments. The influence of which or involvement is also determined by the relationships between the two entities.

Disclosure of information about interests in subsidiaries, associates, and joint ventures is carried out in accordance with the requirements of IFRS 12 Disclosures of Interests in Other Entities. The purpose of the standard is to provide greater transparency, comprehensibility, and the ability to make informed decisions by users of summarized financial information regarding: the interests of insurers in other

enterprises, the nature of those interests, the risk profile, and parameters of the return on each participating interest, as well as their impact on the financial position, results achieved, and changes in the cash flows of the insurers.

3.3 Characteristics and Accounting of the Financial Assets of the Life Insurers

Investments in financial assets are comprised of two large groups: investments in securities (stocks and bonds) and investments in deposits. Investments in shares/units that do not provide control, joint control, or significant influence of the investor, generally with a holding of less than 20% of the voting rights, are accounted for in accordance with IAS 39 Financial Instruments (respectively the new IFRS 9 Financial Instruments). IAS 32 Financial Instruments: Presentation clarifies the nature of financial assets. In their composition, financial assets include initial instruments—equity securities (stocks), debt securities (bonds), receivables, and derivatives and complex instruments allowing insurers to manage and reduce their economic and financial risks associated with his activity.

The insurer is entitled to invest in various securities subject to certain conditions. There are two major types of securities—stocks and bonds. These securities may be traded on the stock exchange or may not be traded on an active market. Typically, the market price of these financial instruments depends on their liquidation value and the income they incur (the amount of stock dividends, interest, and/or discount on bond denomination).

IAS 39 Financial Instruments: Recognition and Measurement overlaps on the following two characteristics: identifying the category to which an asset is assigned and determining its initial valuation. According to the standard, financial assets are classified in four categories: financial assets at a fair value through profit or loss, held-to-maturity investments, available-for-sale financial assets, and loans and receivables.

3.4 Characteristics and Accounting of the Investments in Deposits

Insurers accumulate enormous liquidity, where its management requires diversification. This diversification involves three major financial assets: cash invested in deposits, cash invested in equity securities, and cash invested in debt securities. Bank deposits are presented in the statement of financial position of the insurers at cost, including accrued interest.

With respect to deposits, whether denominated in BGN or in foreign currency, yields originate mainly from interest rates, and if they are denominated in foreign

currency, yields may flow from exchange rates. Foreign currency deposits in accordance with IAS 21 Exchange Rate Effects are monetary items and as such, any change in the exchange rate of the currency in which the deposit is denominated against the functional currency (or presentation currency) is recognized for the period to which it relates.

4 Research Method

In first part of the study, literature related to life insurance business models, investments of life insurance companies, EU initiatives Solvency II, legal framework and the Bulgarian perspective, investment policy, financial instruments, and type of investments, along with the accounting approach and accounting standards are examined.

There is a limited number of articles and research papers on the Bulgarian life insurance market, investments of Bulgarian life insurance companies, investment policy, type of investments, and accounting standards prepared by Bulgarian researchers. Hence, this paper tries to shed light in respect of investment policy of life insurance companies from an accounting perspective.

Data for life insurance companies' investments are obtained from publicly available sources (website of the respective company, Bulgarian National Bank - BNB and Financial Supervision Commission—FSC) and financial publications by FSC and BNB. Data concern 5 (five)-year period—2014 to 2018.

5 Results and Findings

Findings show that there are specific and new trends for Bulgarian life insurance companies, in terms of their investment portfolios, and the list of involved financial instruments over recent years. Investments of life insurance companies are changing and there is rebalancing in asset allocation, with other financial investments having highest share—62% of Total assets and 83% out of Total investments as of 31/12/2018. Due to strict regulatory investment limits, low yield environment, change of business model, and conservative risk management approach, debt securities and other fixed-income securities at the end of 2018 are 52% of Total Assets vs. 58% 3 years ago and 70% of Total Investments, respectively, vs. 58% 3 years ago. On the contrary, bank deposits have experienced significant decrease throughout the last 3 years—from EUR 50 mln. as of 31/12/2015 to EUR 11.7 mln. as of 31/12/2018 (from 7% of Total Assets to 1% and from 8% to 2% of Total Investments, respectively). In Tables 2 and 3, Total Investments of Bulgarian Life Insurance Companies 2014-2018Y and Structure of Total Investments of Bulgarian Life Insurance Companies 2014–2018Y are presented, respectively. Date is extracted from official statistic forms published by Financial Supervision Commission (FSC 2014, 2015,

Table 2 Total Investments of Bulgarian Life Insurance Companies 2014-2018Y

Amount (in 000 EUR)	31.12.2014	31.12.2015	31.12.2016	31.12.2017	31.12.2018
1. Total Investments	575,220	611,205	679,564	643,975	639,403
2. Investment property	18,440	19,163	17,460	18,926	17,742
3. Investments in subs., joint, and assoc. undertakings and other undertakings in which the insurer has a stake	54,165	54,213	62,038	84,390	84,390
4. Shares and other variable-income securities and stakes in investment funds	55,736	62,408	59,450	68,087	72,351
5. Debt securities and other fixed-income securities,	340,194	356,658	418,661	457,512	445,959
5.1. including securities issued and guaranteed by the government	252,736	274,928	358,088	387,428	372,579
6. Bank deposits	54,511	49,626	45,460	31,274	11,658
7. Other loans	51,576	67,830	75,790	2317	2483

Source: Financial Supervision Commission 2014, 2015, 2016, 2017, 2018

Table 3 Structure of Total Investments of Bulgarian Life Insurance Companies 2014-2018Y in %

	31.12.2014	31.12.2015	31.12.2016	31.12.2017	31.12.2018
1. Investment property	3%	3%	3%	3%	3%
2. Investments in subs., joint and assoc. undertakings and other undertakings in which the insurer has a stake	9%	9%	9%	13%	14%
3. Shares and other variable-income securities and stakes in investment funds	10%	10%	9%	11%	11%
4. Debt securities and other fixed-income securities,	59%	59%	62%	71%	70%
4.1. including securities issued and guaranteed by the government	44%	45%	53%	60%	58%
5. Bank deposits	9%	8%	6%	5%	2%
6. Other loans	9%	11%	11%	0%	0%

Source: Financial Supervision Commission 2014, 2015, 2016, 2017, 2018

Table 4 Investment of Bulgarian Life Insurers under Solvency I (2015) and Solvency II (2016 and 2018) in %

	2015	2016	2018
Investment property	3%	3%	3%
Investment in subsidiaries	9%	9%	14%
Shares	10%	9%	11%
Bonds	59%	62%	70%
Incl. Government bonds	45%	53%	58%
Bank deposits	8%	6%	2%
Other loans	11%	11%	0%

Source: Financial Supervision Commission 2015, 2016, 2018

2016, 2017, 2018) in order figures to be analyzed and respective developments outlined.

In order to compare the portfolio structure of Bulgarian life insurance sector, the author reviews also the structure before and after implementation of the new regulation Solvency II in 2016. In Table 4, Investment of Bulgarian Life Insurers under Solvency I (2015) and Solvency II (2016 and 2018) in %, concerns 3 years period- 2015, 2016, and 2018. The main reason for this comparison is to outline the changes of investments of Bulgarian life insurers before and after implementation of Solvency II (FSC 2015, 2016, 2018), reviewing data for investments from accounting perspective. Major changes are in the increased share of bonds, incl. Government bonds, and the plunge of the share of bank deposits.

EIOPA published an *Investment Behaviour Report* (EIOPA 2017) (for 2018, no new report was published), which analyses the investment behaviour of European insurers over the past 5 years (supervisory data from 87 large insurance groups and four solo undertakings across 16 EU Member States). The report identifies several trends in European insurance sector as the major ones are as follows: a trend toward lower credit rating quality fixed-income bonds; a trend toward more illiquid investments, including non-listed equity and loans and a decrease in property investments; average maturity of the bond portfolio is extended; the weight of new asset classes is increased—infrastructure, mortgages, loans, real estate; a small decrease in the debt portfolio and a small increase in "other investments" between 2015 and 2016; and the volume of non-unit linked and non-index linked assets has significantly increased in the last years.

Traditionally, in EU the largest part of total investments of insurance companies is in fixed-income securities. The bond portfolio comprises of government and corporate bonds, collateralized securities, and structured notes where government and corporate bonds are approximately 95% of the total size of the portfolio. Total bonds as a % to Total Investments are 83.5% in 2016 vs. 84% in 2015. The share of equity investments as a percentage of total investments is 8.9% in 2016 with same percentage—8.9% in 2015. For the period 2011–2016, this share stays almost the same.

As one of the objectives of the research is to investigate whether asset allocation trends in Bulgaria are similar to the ones in Europe and having outlined the trends summarized by EIOPA, the following is valid for Bulgarian life insurance sector: no

increase in lower credit rating quality fixed-income bonds; a slight trend toward more illiquid investments such as non-listed equity and loans and a decrease in property investments; an extension of the average maturity of the bond portfolio; no increase of the weight of new asset classes—infrastructure, mortgages, loans, real estate; a significant increase in the bond portfolio and an increase in government bond portfolio between 2015 and 2016, 2018; and the volume of non-unit linked and non-index linked assets has significantly increased in the last years. In summary, Bulgarian life insurance sector, being part of EU insurance sector and complying with the same regulatory EU requirements, has some investment specifics and not all investment trends relevant for the other major EU countries are valid in Bulgaria as at the date of this research.

6 Conclusion

The life insurance sector is a crucial component of the financial system in Bulgaria. This stems from the amount of premiums collected, the scale of investment, as well as the essential social and economic role it plays in covering individual and business risks. The Bulgarian life insurance business comprises of life insurance companies, which are registered as joint stock companies and are regulated by the Financial Supervision Commission (FSC). At the end of 2018, Total Assets of Bulgarian life insurance companies are EUR 844 mln. From this figure, total investments of life insurance companies are EUR 639.4 mln. (75% of total assets of life insurers), slight decrease compared to December 31, 2017—EUR 644 mln. and 79% of total assets.

Findings from the research show that there have been specific and new trends for Bulgarian life insurance companies, in terms of their investment portfolios, list of involved financial instruments throughout the last years. General conclusion is that investments of life insurance companies are changing and rebalancing in asset allocation took place, with other financial investments having highest share—62% of total assets and 83% out of total investments as of 31/12/2018. Due to strict regulatory investment limits, low yield environment, change of business model, and conservative risk management approach, debt securities and other fixed-income securities at the end of 2018 are 70% of total investments vs. 58% 3 years ago. The economics of life insurance transactions is completely different from other enterprises. A major problem for life insurance accounting is to determine an appropriate way of reflecting the riskiness of insurance activities in published financial statements.

This paper reviews applicable accounting standards for investments of life insurers, as issued by IASB—IFRS 4 Insurance Contracts, which automatically defines IAS 40 Investment Property, IAS 28 Investments in Associates and Joint Ventures, IFRS 11 Joint Ventures, IFRS 10 Consolidated Financial Statements (for control), IAS 32 Financial Instruments: Presentation, IAS 39 Financial Instruments: Recognition and Measurement (respectively IFRS 9 Financial Instruments as of 2022, as IFRS 17 Insurance Contracts Allows Its Later Application), IFRS

7 Financial Instruments: Disclosures and IFRS 13 Fair Value Measurements. However, Solvency II is targeted at assessing insurer solvency and so focuses on a firm's balance sheet, where International Financial Reporting Standards (IFRS) is also interested in reported profits.

Further research is needed to evaluate new standards IFRS 9 and IFRS 17 and their implications on Bulgarian life insurance sector and positive effects in bringing further consistency and transparency.

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Measures to Assess the Payment Behavior of the Portuguese Subnational Governments

Paula Gomes dos Santos and Carla Martinho

Abstract This study aims to assess the outcomes of the Late Payments Directive (LPD), in the Portuguese subnational governments, which is essential for the sustainability of their commercial debt. It proposes that the control measure of the payment behavior is permeable to creative accounting practices. The investigation is based on a quantitative study of the 308 Portuguese subnational governments, from 2011 to 2017. The data were obtained from the official releases of the Directorate-General of Local Authorities (DGAL). The paper provides empirical insights about the actual outcomes of LPD. It suggests that the official data reported by Portuguese subnational governments is not reliable and does not enable the accurate evaluation of the LPD outcomes, not setting a common methodology for measuring the payment behavior of public authorities neither in Portugal, nor when compared with other Member States. Although all the data was obtained from DGAL, its lack of reliability is highlighted. Researchers are encouraged to study the control measures of the payment's behavior adopted by other Member States.

The paper contributes to the knowledge of the Portuguese actual outcomes of LPD implementation at subnational governments and proposes new control measures.

Keywords Payment behavior measure · LPD outcomes · Financial sustainability · Subnational public governance · Nonreliable Reports

1 Introduction

Financial sustainability has a relevant role on the economic recovery of the last international crisis. Measuring, managing, and controlling it has become a challenge for governments (Montesinos et al. 2019). International organizations have advised

P. G. dos Santos (✉) · C. Martinho
Accounting and Auditing Department, Lisbon Accounting and Business School – ISCAL/IPL, Lisbon, Portugal
e-mail: pasantos@iscal.ipl.pt; cmartinho@iscal.ipl.pt

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governments to implement policies aiming for financial sustainability (International Monetary Fund [IMF] 2014; European Parliament [EP] 2009; European Commission [EC] 2012). According to Cabaleiro et al. (2013), these policies are essential for ensure financial health and intergenerational equity. Financial sustainability is the basis for the structural functioning of the public sector and is key to the economic growth and social welfare, contributing to build confidence in the public governance. It includes not only the government's debt control but also the commercial debt control.

The Late Payments Directive (LPD) (Council Directive 2011/7/EC 2011) was issued in response to the negative impact of the late payments in commercial transactions on business' sustainability. The Fiscal Sustainability Report (EC 2012) stated that some Member States such as Portugal, Italy, and Greece had a sustainability gap higher than the average of the European Union (EU). Recurring debt and deficit situations in public sector have been recognized by the literature and international agencies as a risk for sustainability, which need to be controlled (Bolívar et al. 2016; Checherita-Westphal et al. 2014; IMF 2014; Pérez-López et al. 2013; Estevez and Janowski 2013; United States Agency for International Development [USAID] 2011; Pina et al. 2010).

The financial sustainability of the Portuguese subnational governments has a particular relevance, as they experienced financial difficulties in the past decade (as an excessive and chronic indebtedness) (João 2014; Ferreira 2011; Lobo and Ramos 2009; Cabral 2003; Carvalho 1996), giving an extreme importance to subnational governance. A good public governance should not only be effective and efficient, but also transparent (OECD 2013). According to Heald (2003), Grimmelikhuijsen (2012), and Cucciniello and Nasi (2014), to be able to evaluate the LPD it is essential to have information about the "policy outcome transparency." Thus, the challenge of controlling commercial debt and eradicating late payments from public administrations requires the creation of an instrument, automatic and easy to apply, so that its monitoring allows a generalized and effective control, understandable both for the public sector and for citizens.

Therefore, transparent control measures are essential for understanding the public sector payment behavior and to assess the LPD real effects and outcomes. LPD establishes late payments; however, it does not establish how to measure them. Therefore, this investigation contributes (i) to the knowledge of the control measure of the payment behavior of subnational governments and (ii) to the assessment of the actual LPD outcomes.

Being LPD relevant for the Portuguese subnational governments' financial sustainability, and to fully understand payment behavior, this investigation aims to assess the LPD outcomes in subnational governments, during the period of 2011–2017, while studying:

- The Portuguese control measure of late payments, and.
- If it allows an effective control and a common measure to assess the payment behavior of public authorities in Portugal, namely in the subnational governments**,** as well as in comparison with other Member States.

This paper has five sections. Starts with the investigation purpose and importance, and then details the theoretical framework about the impact of late payments on the European financial sustainability, the control measures of late payments and their transparency. Also, the late payments control measures in Spain and in Portugal are presented. Section 3 explains the data and the methodology used, and Sect. 4 presents the findings. The last section provides the main conclusions and suggests future investigations.

2 Theoretical Framework

2.1 Financial sustainability and Late Payments

Financial sustainability is the capacity to fulfil all commitments (IFAC 2013; IPSASB 2013; EC 2012; Budgetary Framework Law 2015; Financial Regime of Local Authorities and Intercity Entities Act 2013; CICA 2009). Debt sustainability analysis is usually focused on "government debt" (namely debt securities and loans), although government liabilities are wider including additional debt instruments (EC 2019). IMF (2013) considers all debt liabilities as debt.

Financial sustainability has been considered as the government's "solvency." However, it should also include the government's liquidity, as the international crises have proven (EC 2019). Concerned with the late payments consequences on the European economy, the European Parliament issued Council Directive 2011/7/EC (2011), the Late Payment Directive (LPD), imposing the need to pay for the acquisitions within 30 days or, exceptionally, within 60 days. According to Bilotta (2013), one in four bankruptcies in the EU was due to late payments, which lead to the loss of approximately 450,000 jobs per year. EC (2015) estimates that, in 2012, the financial costs associated with public authorities' late payments went from 0.005% of GDP in Finland, to 0.19% of GDP in Greece.

2.2 Late Payments Control Measures Assessment

2.2.1 Control Measures Transparency and Accounting Practices

The LPD impact assessment concluded that, in 2015, the average payment duration (of 58 days) did not meet the Directive terms (EC 2015). LPD implementation was also assessed in 2018 (shown in Fig. 1).

Although the situation has improved, namely in the southern countries (as Spain), the average payment duration in some countries overdues the 30-day payment term (as in Italy with over 100 days, Portugal with over 80 days, and in Greece with over 70 days).

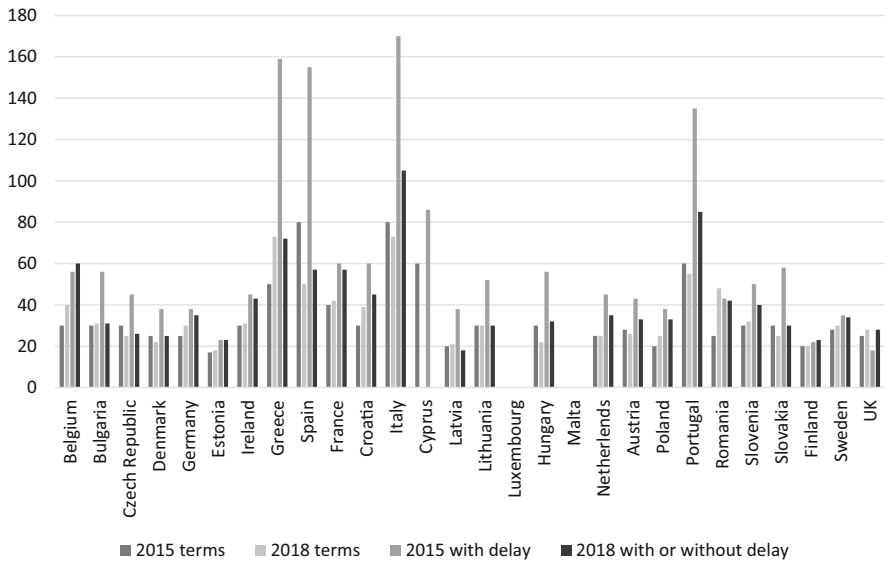

Fig. 1 Terms and delays of public authorities' payments (2015 and 2018). Source: EP (2018, p. 16) (Cyprus, Luxembourg, and Malta were not assessed at 2018)

Despite the need to control late payments, LPD does not establish how to measure them. EC (2015) highlighted that a harmonized measurement would enable the cross-country comparability. EP (2018) has pointed out that it is necessary to establish a common methodology for reporting the payment behavior in Europe, to limit the risk of having noncomparable data.

According to Berry and Berry (2007), the adoption of a given measure by a Government depends, namely, on "other policies" and on the "external environment." So, other government diplomas/policies that have already been implemented that may influence (positively or negatively) the adoption of the new public policy should be examined.

Member States were urged to assure the Late Payment Directive proper implementation by removing national laws that conflict with the Directive aims (EP 2018). LPD was set by law and involves accounting practices and the organization behavior in complying or not with the legal framework. For Dillard et al. (2004), it is necessary to understand how accounting affects and is affected by public policies, namely under the institutional theory. Hopwood (1988) also argues that there is a strong relation between accounting and institutional theory.

Institutional theory studies the relation between the formal organizational structures and their social processes (Dillard et al. 2004). DiMaggio and Powell (1983) argue that isomorphism is what best expresses the homogenization process. For Aldemir and Uysal (2017), isomorphism may be discussed in terms of public sector accounting. DiMaggio and Powell (1983) defend that the institutional isomorphism

may be a coercive isomorphism, which emerges from political influences (arising from, for example, legal requirements).

According to Carpenter and Feroz (2001), institutional theory and economic resource dependency theory, being complementary, contribute to better understand public sector accounting decisions. For Pfeffer (1981) and Pfeffer and Salancik (1978), the resource dependency perspective focuses on financial resources problems to explain the individual's behavior within an organization. Hence, in fiscal stress years, government actors focus on ensuring the necessary financial resources (Carpenter and Feroz 2001).

Oliver (1991) focuses on political self-interest to understand organizational strategic responses to institutional pressures for change. The author identified different strategic responses to that pressure, concluding that organizations do not always conform to their institutional environment expectations (Oliver 1991).

According to Carpenter and Feroz (2001), resource dependence may influence the government's accounting practices, resulting in coercive isomorphic pressure for change. DiMaggio and Powell (1983) have noticed that the resistance of individual organizations to institutional pressures for change results of the professional elite's in challenging the norms. As Miller (1992) defended about accounting and objectivity, an organization accounting practices may not always follow the original designs.

To be able to effectively assess the LPD implementation, European Parliament should concern the outcome's transparency. According to Heald (2003), Grimmelikhuijsen (2012), and Cucciniello and Nasi (2014), public policy transparency can be divided into three sequential components, "decision-making transparency" (the process that led up to a particular policy), "policy transparency" (how a policy addresses a particular social issue), and "policy outcome transparency" (data about the actual effects of a particular policy). Thus, to fully understand the LPD outcomes, it is essential to assess its control measures. Without such information, it will not be possible to accurately evaluate LPD.

2.2.2 LPD Control Measures in Spain and in Portugal

Given the similarities between Portugal and Spain, both the slowest European southern countries payers in 2015 (EC 2015), and in order to study if there is a common measure to assess the payment behavior of public authorities in EU, this section presents the LPD control measures in those countries.

In Spain, Budgetary Stability and Financial Sustainability Act 2012 establishes the principle of the commercial debt sustainability. The Calculation Method of the Average Payment Period Act 2014 established the average payment period (APP) formula applicable to the public sector. Table 1 shows the APP formula for each entity.

The number of days of the paid transactions and of the pending payment transactions was understood as the calendar days since the 30 days after the invoice entry date or from the approval date, as appropriate. Given the APP methodology, some

Table 1 Average payment formula in Spain

Average payment (APP) formula	Legend
$APP_{entity} = \frac{[(PTR \times \sum PTA) + (PPTR \times \sum PPTA)]}{[(\sum PTA) + (\sum PPTA)]}$	PTR - paid transactions ratio PTA - paid transactions amount PPTR - pending payment transactions ratio PPTA - pending payment transactions amount

Source: Adapted from Calculation Method of the Average Payment Period Act 2014

Table 2 Average payment formula in Portugal

Average payment (APP) formula	Legend
$APP_t = \frac{\sum_{i=t-3}^{t} \frac{DF_i}{4}}{\sum_{i=t-3}^{t} A_i} \times 365$	DF = short-term suppliers' debt at the quarter end A = acquisitions

Source: Adapted from Pay on Time Program Act 2008

public administrations presented a negative APP (because 30 days were subtracted from the number of days until payment). The European Commission considered that this methodology was not compatible with the article 4 of Council Directive 2011/7/EC and, in February 2017, sent a letter of formal notice to the Spanish authorities for having approved a regulation that systematically granted the public authorities an additional period of 30 days regarding the payment period.

The Calculation Method of the Average Payment Period Act 2017 modified the Calculation Method of the Average Payment Period Act 2014, in order to comply with the EC requirement, modifying the APP calculation methodology. The formula is the same but what is understood as the number of days of the paid transactions and of the pending payment transactions are the calendar days since the invoice entry date or from the approval date, as appropriate. The new methodology is being used since April 2018.

In 2011, Portugal requested international financial assistance, which led Portuguese governments to give a special attention on combating the culture of late payments of the public authorities. Measures Against Late Payments in Commercial Transactions Act 2013 transposed the LPD into Portuguese law, establishing the same rules, i.e., the need to pay within 30 days or, exceptionally, within a maximum of 60 days.

Directorate-General of Local Authorities (DGAL) is responsible for releasing quarterly data on the average payment terms of subnational governments (it should be noted that, in Spain, that release is monthly). As LPD has no guidance in how to measure payment terms, the formula established in Pay on Time Program Act 2008 is used, with the changes made by Average Payment Period Formula Act 2009, to measure the Portuguese public authorities average payment duration (presented in Table 2).

Pay on Time Program Act 2008 establishes the concepts of "short-term suppliers' debt" and "acquisitions." It should be noted that the data does not have the same accounting basis in all of the public sector, being gathered in a cash basis and in an

Table 3 Short-term suppliers' debt and acquisitions

Sector	Short-term suppliers' debt (DF)	Acquisitions (A)
Subnational governments	Accounts payable excluding other debts	Fixed asset Inventories Payable expenses
Health units	Accounts payable	Fixed asset Inventories Payable expenses

Source: Adapted from Pay on Time Program Act 2008

Table 4 APP formula weakness

APP formula	Factors
The formula considers the total quarter acquisitions and the debts at the end of the quarter.	An entity that buys on the beginning of the quarter and pays on the end have an APP of zero, when it paid in 90 days.
Fixed assets acquisitions.	These acquisitions are the fixed assets increases. However, these increases may be an exchange transaction or a non-exchange one.
The debts value.	Some entities only recognize the invoices close to or at the payment date.

Source: Adapted from Carvalho et al. (2018)

accrual one, which leads to the coexistence of different control measures depending on the public subsector. Table 3 summarizes the scope of these concepts for subnational governments and health units, for which data is accrual based.

In subnational governments, "short-term suppliers' debts" (DF) does not consider "other debts," unlike what happens in the health units. According to the Local Governments Accounting Standards 1999, "other debts" are "transactions nonclassified in the previous payables accounts," so they should be residual.

Martinho and Santos (2019) and Baleiras et al. (2018) defend that subnational governments average payments period (APPs) may be underestimated by not considering "other debts" as "short-term suppliers' debts," particularly when they are material.

For Carvalho et al. (2018), an APP of 0 or 1 day, as reported by some subnational governments, indicates the data low reliability, although obtained from DGAL. The authors conclude that these small APPs "may result from good payment practices, from noncomplying with accounting rules (recognizing the debt only at the payment date) or from the formula" (Carvalho et al. 2018, p. 291). Table 4 shows the formula weakness exposed by the authors.

Ausloos et al. (2017) argue that, in Italy, data reliability concerns (related to poor auditing procedures) have become more relevant since the bankruptcy of several subnational government entities under the last financial crisis. The Portuguese Audit Authority (IGF) defend the need to review the APP methodology, adopting a common measure for all subsectors to achieve comparability (IGF 2012). The Portuguese APP methodology does not allow to obtain negative APPs (as it did in

Spain), but it may give entities until 90 days to make payments and still have an APP of zero, provided that they paid until the end of the quarter.

3 Data and Methodology

Having a sustainable commercial debt is of most relevance for the government's financial sustainability, namely for Portugal that had to request international assistance. To achieve this challenge, it is essential to comply with LDP, paying to suppliers within 30 days. To actually understand the effects of the LPD, it is essential to have transparent information about the control measures and its outcomes.

Following the literature (Heald 2003; Grimmelikhuijsen 2012; Cucciniello and Nasi 2014), to be able to evaluate the LPD it is essential to have information about the "policy outcome transparency," i.e., access to information that details the actual effects of LPD.

This investigation aims to assess the LPD outcomes in subnational governments, for the period of 2011–2017, studying:

- The Portuguese control measure of late payments, and.
- If it allows an effective control and a common measure to assess the payment behavior of public authorities in Portugal, namely in the subnational governments**,** as well as in comparison with other Member States.

The investigation focuses on the 308 Portuguese subnational governments and it was based on the APPs data and on the Statements of Financial Position released by DGAL for the years 2011–2017 (last year for which data was available). Following Pay on Time Program Act 2008, "short-term suppliers' debt" is the payables accounts excluding "other debts." It was considered the last quarter APPs of each year, except in Oeiras in 2017 where the third quarter APP was used (the last quarter was not available). The subnational governments have been classified into three categories according to the number of inhabitants, following the criteria of Carvalho et al. (2018):

- Small: up to 20,000 inhabitants.
- Medium: between 20,000 and 100,000 inhabitants.
- Large: more than 100,000 inhabitants.

The number of subnational governments in each category, small, medium, and large, from 2011 to 2017, is shown in Table 5 (inhabitants' data are from "Pordata" site).

Most of the Portuguese subnational governments are of small size, and only about 8% are large ones (being the same ones in the period). In that period, the number of inhabitants had some variations, leading to a residual difference in the number of the medium and small municipalities over the years.

Table 5 Subnational governments by category (2011–2017)

	2011	2012	2013	2014	2015	2016	2017
Large	24	24	24	24	24	24	24
Medium	103	101	100	100	99	99	98
Small	181	183	184	184	185	185	186
Total	308	308	308	308	308	308	308

Source: Own source

Table 6 Percentage of subnational governments with APPs up to 5 days (2011–2017)

	2011	2012	2013	2014	2015	2016	2017
Large	0%	0%	4%	4%	13%	13%	13%
Medium	1%	4%	5%	7%	8%	9%	13%
Small	2%	5%	7%	9%	12%	14%	17%
Total	2%	5%	6%	8%	11%	12%	15%

Source: Own source

4 Findings

The average payments period (APP) measures the capacity to fulfil the obligations in commercial transactions. Carvalho et al. (2018) question the reliability of the available data, namely in what concerns to the "strange" small reported APPs. Table 6 presents the percentage of subnational governments, by category, with an APP less or equal to 5 days (according to the Ministry of Finance, after 5 days since the invoices entry date they are considered as payables).

The percentage of subnational governments with APPs up to 5 days is getting higher in all categories, being 13% of the large and medium ones, and 17% of the small ones in 2017. Given the expenses of legal procedures, in a bureaucratic public administration (Carvalho et al. 2018), it is not plausible that so many Portuguese subnational governments have these APPs. Remember that the APPs consider the quarterly debts, so it systematically grants an additional period until 90 days regarding the payment period.

According to Baleiras et al. (2018) and Martinho and Santos (2019), the APP measure is limited by not considering the "other debts." Thus, the APP was adjusted in order to consider those debts as "short-term suppliers' debt." The adjusted APPs (called "overall APP") were obtained from a proportional ratio between the payable's accounts considered by Pay on Time Program Act 2008 and those added to the "other debts." When subnational governments had a "short-term suppliers' debt" of 0 and value in the APP, it was considered an overall APP of 0 (the nonreliable data would distort the new measure). When those debts (under Pay on Time Program Act 2008 framework) were less than € 10,000, relevant "other debts" would also distort the overall APPs, so the same solution was followed. The annual averages evolution of the official APPs and of the overall APPs (in days) of the Portuguese subnational governments during the period is shown in Fig. 2.

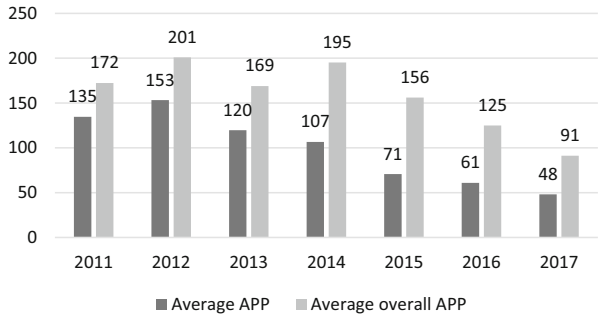

Fig. 2 Annual averages, in days, of APPs and overall APPs of Portuguese subnational governments (2011–2017). Source: Own source

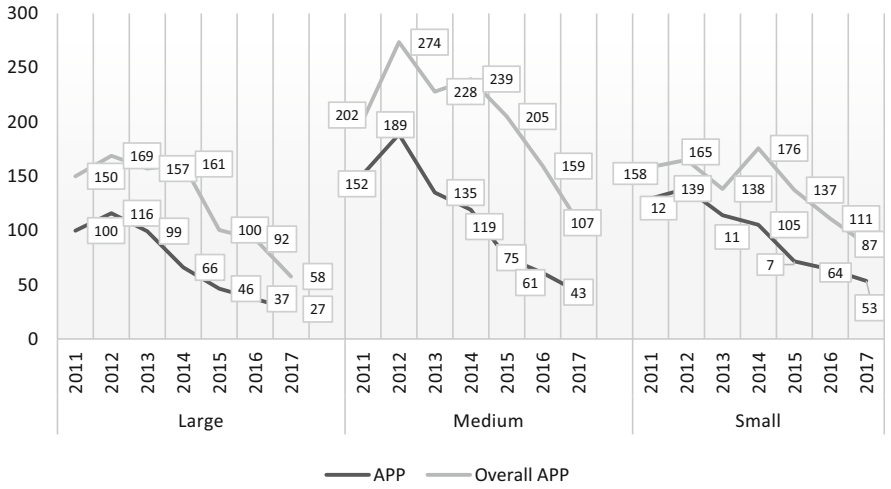

Fig. 3 Annual averages, in days, of APPs and overall APPs of Portuguese subnational governments, by category (2011–2017). Source: Own source

The official APPs of the subnational governments show a tendency of reduction since 2012 (where the longest term of 153 days can be observed), achieving an APP of 48 days in 2017. Although they have improved, they do not, however, comply with the LPD 30 days. The overall APPs allow to confirm the downward trend, although not in 2012, but since 2014. The payment practices showed by this measure are further away of the LPD objective. At the end of 2017, the average payment period of 91 days is more than three times higher than the 30-day limit.

The "other debts" impact in the control measure became clear by comparing the overall and the official APPs. The overall APPs greatly exceed the official ones in all the years, being more than the double in 2015 and 2016. This is ~~a~~ strong evidence that the average payment period has a relevant increase when the control measure considers the "other debts" (although they should be residual, they recognize very material amounts). Figure 3 allows to understand the payment behavior of the

Table 7 Portuguese Subnational Governments, by category, with APP and overall APP >30 days (2011–2017)

	2011	2012	2013	2014	2015	2016	2017
APP > 30							
Large	83%	75%	54%	42%	38%	38%	21%
Medium	85%	84%	74%	57%	43%	40%	36%
Small	76%	70%	65%	53%	38%	38%	40%
% of Total	**80%**	**75%**	**67%**	**54%**	**40%**	**39%**	**37%**
Ov. APP > 30							
Large	96%	96%	92%	75%	71%	75%	63%
Medium	93%	92%	86%	86%	84%	79%	77%
Small	84%	80%	78%	75%	83%	75%	70%
% of Total	**88%**	**85%**	**81%**	**79%**	**82%**	**76%**	**71%**

Source: Own source

subnational governments, by size, under the APPs and the overall APPs methodology.

2012 recorded the highest official APPs of the period in all the categories. The highest term of 189 days was observed in medium-sized municipalities. Despite the downward tendency, only the large subnational governments, and in 2017, met the 30 days term (with 27 days). The average payment period of the medium and of the small municipalities in all the years does not comply with LPD (even in 2017, where there is an average of 43 and 53 days, respectively).

The overall APP by category allows to understand that subnational governments have payment terms that stray too far from the LPD objective. Although the positive evolution of the payment practices since 2014, it is possible to observe that there is no category where they have average APPs within 30 days. Even the large ones have, in 2017, an overall APP of 58 days which is more than the double of the official APP. Table 7 shows the percentage of subnational governments, by size, that have APPs and overall APPs over 30 days, enabling the LPD assessment.

If we consider the official APPs, the number of subnational governments that have payments terms of more than 30 days has been reducing since 2011, in all categories. However, in 2017 there are still 37% of them that have APPs higher than 30 days, being the large ones the most compliant (with only 21% having APPs over 30 days).

Under the overall APPs methodology, although there is a positive trend, it can be observed that there are more subnational governments with a payment period of more than 30 days. This is the situation of 71% of them in 2017 (against the 37% when using the official APPs), and happens in all categories (for example, the large ones are the triple when compared to the officials APPs).

The assessment of the payment practices following the overall APP method leads to a substantial different outcome than the one that is currently achieved by official method. The difference between the percentage of subnational governments with an overall APP over 30 days and the ones with an official APP over 30 days, calculated

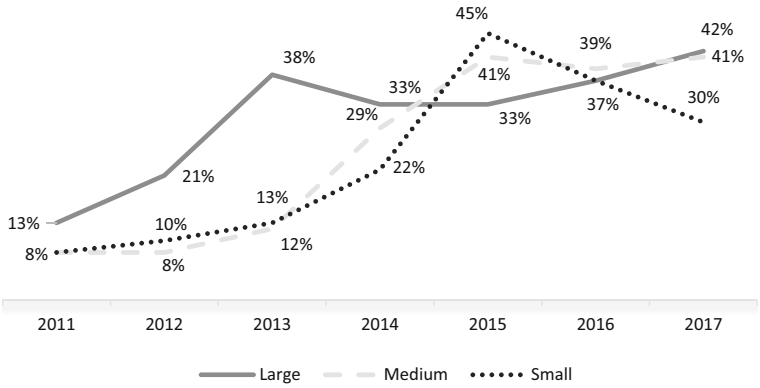

Fig. 4 Percentage of subnational governments, by category, with "overall APP >30" higher than "APP >30" (2011–2017). Source: Own source

Table 8 Ratio of 'other debts' and 'short-term suppliers' debt' (2011–2017)

	2011	2012	2013	2014	2015	2016	2017
APP > 30							
Large	1.8	6.4	6.0	6.2	9.5	11.2	4.4
Medium	5.4	4.1	10.5	8.2	20.9	11.6	12.3
Small	1.6	1.3	1.6	2.5	4.3	3.8	3.3
Total	**2.5**	**2.3**	**4.3**	**4.6**	**9.7**	**6.9**	**6.3**
Ov. APP > 30							
Large	0.8	0.5	0.6	0.3	0.4	2.2	0.4
Medium	0.4	0.4	0.7	1.5	1.0	2.2	1.0
Small	0.3	0.3	0.3	1.4	1.0	0.6	0.5
Total	**0.4**	**0.4**	**0.5**	**1.3**	**0.9**	**1.3**	**0.7**

Source: Own source

by the difference of the data presented in the previous table, can be observed in Fig. 4.

As can be seen in Fig. 4, in the last 3 years, the percentage of municipalities with an overall APP higher than the official APP is, for all categories, greater than 30%. If it is considered that the commercial debt is sustainable when the average payment period to suppliers does not exceed 30 days, it can be concluded that Portuguese subnational governments still have a sustainability problem (namely if the overall APP methodology is followed, i.e., the same methodology followed by other Portuguese public subsectors). Given the relevance that "other debts" have in the payment behavior control measure, Table 8 allows to see the ratio of "other debts" and "short-term suppliers' debt" in the subnational governments with an APP up to and over 30 days.

Observe that "other debts" are more relevant, in all categories, in the subnational governments that comply with LPD ("other debts" are much higher than the "short-

term suppliers' debt," when they should be residual). In the medium ones, that ratio is of 20.9 in 2015 and of 12.3 in 2017.

It can be observed that this ratio tends to increase in the subnational governments that have the smallest official APPs and report payment practices that comply with LPD. Thus, subnational governments are recognizing as "other debts," material debts that should probably be considered as "short-term suppliers' debt" (obtaining small official APPs).

5 Conclusions

The last international crisis has brought the challenge to governments of adopting policies aiming for financial sustainability, namely regarding the need to reduce late payments which have been recognized as having a negative impact on businesses sustainability. Having a sustainable commercial debt (for which it is essential to pay suppliers within 30 days, complying with LDP) it is of most relevance for the Portuguese financial sustainability.

Given its importance to actually assess the effects of the LPD, the Portuguese control measure of late payments was studied. Following Berry and Berry (2007), the Pay on Time Program Act 2008 was examined, diploma that establishes the APP formula. This study confirms the conclusions of Carvalho et al. (2018), Baleiras et al. (2018), and Martinho and Santos (2019) concerning the APP measure weaknesses. Being quarterly, the measure considers the quarter end debts, granting an additional period until 90 days regarding the payment term.

Subnational governments APPs disregard "other debts" as "short-term suppliers' debts," contrary to other sectors of Government, which limits the comparability within the public sector. Being LPD a coercive isomorphism, the actor's behavior (Berry and Berry 2007) should be considered as well as the individual organizations resistance to institutional pressures for change (DiMaggio and Powell 1983). Thus, it was studied the relevance of the "other debts" when compared with the "short-term suppliers' debts" to see if it could influence the control measure.

The number of subnational governments reporting an APP until 30 days is getting higher since 2011, but the same ones are reporting "other debts" much higher than "short-term suppliers' debts." In 2017, these are 4.4 times more than "short-term suppliers' debts" in the large municipalities, 12.3 times more in the medium and 3.3 times more in the small ones. Therefore, the trend to increase the value recognized in "other debts" is followed by the trend to reduce the official APPs. It can be concluded that subnational governments are reporting smaller official APPs than the ones they would have if the APP measure did not except those debts.

As showed by the literature (Carpenter and Feroz 2001; Miller 1992; Oliver 1991; DiMaggio and Powell 1983), there may occur resistance to institutional pressures for change (even being coercive). By not considering "other debts," the APP formula is permeable to accounting practices that are discrepant of their "original designs." The investigation allows to conclude that the Portuguese APP formula does not set a

common methodology for measuring the payment behavior of public authorities neither in Portugal, neither when compared with other Member States, as Spain. Also, it has many weaknesses, it is permeable to unethical behavior and practices and does not allow a generalized and effective control of the commercial debt. Therefore, the available data led to the conclusion that the information reported about the payment behavior of subnational governments is not reliable, not allowing an effective control of the LPD implementation and not contributing for the Portuguese financial sustainability.

The revision of the Pay on Time Program Act 2008 is recommended, in what concerns the "short-term suppliers' debt," harmonizing the control measure in the public sector in order to obtain comparable statistical elements. Also, a monthly report instead of a quarterly should be considered, in order to be able to compare with other Member States. The diploma analysis led to the conclusion that it may negatively influence the real adoption of the LPD, not enabling the assessment of the actual outcomes. Remember that the Member States should remove any domestic laws that conflict with the aims of the Directive, ensuring the proper LPD implementation (EP 2018).

The lack of reliability of the data is a study limitation, although it was obtained from DGAL. Also, the consideration of an overall APP of zero in some subnational governments, as explained in Sect. 4, could be a limitation, although it is considered as having no significant effect on the conclusions which only would be reinforced with the inclusion of those entities. The paper contributes to the knowledge of the control measures of the payment behavior of subnational governments and to the assessment of the actual LPD outcomes. As future research, the study about LPD outcomes and their transparency in all of Government sectors is proposed. Also, the study of the control measures of late payments adopted by other Member States is proposed.

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Part II
Banking

Interactions Between Effectiveness and Consolidation of Commercial Banks in the Polish Banking Sector

Irena Pyka, Aleksandra Nocoń, and Anna Pyka

Abstract Bank consolidation is a process that has been observed in the world economy since the early 1980s. Until the global financial crisis formation of bank capital groups and financial conglomerates was considered as banks' response to the globalization of financial system. After the global financial crisis, a "consolidation window" opened up in the global economy, which did not bypass the Polish banking sector. At the same time, it coincided with the support of the Polish government interested in its repolonization, which in a consequence resulted in an increase of the concentration level of bank capital. The main aim of the paper is the analysis of consolidation processes after the global financial crisis, as well as interactions between concentration of commercial banks in Poland (as a quantitative approach to the consolidation process) and their operational efficiency. The research indicates that concentration of the Polish banking sector affects effectiveness of the sector and individual commercial banks. However, scale and strength of these dependencies varies between the analyzed cases.

Keywords Banking sector · Commercial bank · Consolidation process · Effectiveness

1 Introduction

Bank consolidation is a process that has been observed in the world economy since the early 1980s. Banks are eager to merge and form larger organizational structures, operating on a global scale, due to the following causes: shareholders' striving to maximize profit, managers' striving to increase the privilege of their market position, and the use of all the privileges resulting from consolidation in the banking business

I. Pyka · A. Nocoń (✉) · A. Pyka
Department of Banking and Financial Markets, University of Economics in Katowice, Katowice, Poland
e-mail: irena.pyka@ue.katowice.pl; aleksandra.nocon@ue.katowice.pl; anna.pyka@ue.katowice.pl

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(Chrabonszczewska 2016). Until the global financial crisis formation of bank capital groups and financial conglomerates, treated as the effect of increasing mergers and/or acquisitions, was considered as banks' response to the globalization of financial system. However, intensification of bank capital concentration processes has increasingly given rise to numerous controversies. The growing number of global banks based on the benefits of cross-border loans—the so-called *cross-border financing*, raised concerns about the disappearance of competition on bank services market and weakening position of a bank client. A new dimension of global banking, called as the financialization, was particularly criticized (Marcinkowska 2015; Szunke 2014). However, strong criticism of large banks' activities followed after the global financial crisis, when they were burdened with the responsibility for escalation of systemic risk in the international economy, and many of them received serious public financial support. The subject of controversy has become not only scale of this support, but also its legitimacy, impact on public budget balance as well as their use by the financial institutions. Based on these circumstances, there is a question what do consolidation processes look like after the global financial crisis? Due to the nature of the study, it was carried out in Poland at a level of the whole banking sector and selected commercial banks setting out the task of multilayered recognition of the undertaken problem.

The main aim of the paper is the analysis of interactions between effectiveness and concentration of commercial banks in Poland. In the postcrisis period, there is observed intensification of capital ownership changes. In 2012, due to the need to return received public aid, the Belgian KBC bank has signed the agreement with Santander bank regarding the merger of Kredyt Bank with BZ WBK bank. The merger was completed in January 2013. This was also the case of the Greek EGF group which was looking for opportunities to improve its financial results. At that time, it was decided to sell the branch in Poland. However, these changes occur constantly. After the global financial crisis, a "consolidation window" opened up in the global economy, which did not bypass the Polish banking sector. At the same time, it coincided with the support of the Polish government interested in its repolonization (Pyka et al. 2018), which in a consequence should result in an increase of the concentration level of bank capital.

The structure of the article includes critical literature studies which present the current state of knowledge about the undertaken problem, methodology with the main indicators used during the research, and the main empirical part of the paper—analysis of the interactions between consolidation and effectiveness in the whole banking sector as well as individual banks. The article ends with a summary which provides the main conclusions from the research.

2 Literature Review

The consolidation process of banking sector is widely studied in the literature (Seo and Hill 2005; Frąckowiak 2009; Antoniadis et al. 2014; Kumar 2013; Ayadi and Pujals 2005; Mikołajczyk 2014; Joash and Njangiru 2015; Tsaurai 2017; Juszczyk et al. 2013). These studies generally focus on the motives and course of consolidation processes, measures of bank concentration level, and mutual effects of an increase or decrease in the banks' capital concentration on selected economic variables.

The research highlights intensification of consolidation processes, which is mainly due to the constantly changing legislative framework and competitiveness environment. According to Ayadi and Pujals (2005), changes in the legal framework, including changing regulations, put pressure on using consolidation processes to remain competitive and fully benefit from the dynamic nature of financial market. However, there is no compliance regarding its positive impact on competitiveness. World Bank (2013) indicated that consolidation may lead to increase in competitiveness, but appropriate supervision and adequate regulations are a necessary condition. On the other hand, Laeven and Claessens (2003) showed almost no relations between an increase in concentration and a level of competition. In turn, Flejterski and Wahl (2010) adopted an increase in competitiveness as a part of set of goals conducive to the progressive banking sectors' consolidation. Among the motives of consolidation process, they also included the possibility of improving operational efficiency through increasing the scale of operations or organizing/changing organizational structures. Kotowicz (2015) believed that in the Polish economy the consolidation process after the global financial crisis was also favored by an increase in the scale of operations of large banks, exceeding the growth in scale of the sector.

In the literature, there is no unanimity on how to examine a level of consolidation processes. When it comes to the measures of concentration, Pawłowska (2014) and Klepacki (1984) refer to the most commonly used consolidation measures. These are concentration ratios (CR) and Herfindahl-Hirschman Index (HHI). While the opponents believe that they only take into account values of the market structure, but no other features, such as regulations, barriers to entry or exit are included. Hence, they propose to use *a new empirical industrial organization* theory, which uses more advanced measurement methods such as the Lerner index, H-statistics or Boon measures (Ramotowski 2013; Mikołajczyk 2014). Tushaj (2010) additionally—in assessing a level of concentration of the sector and selected banks—uses the Hall-Tideman Index (HTI), Rosenbluth Index (RI), Hannah-Kay Index (HKI), Multiplicative Haus Index (Hm), additional Haus index (ha), and entropy measures (E).

Furthermore, in the literature there is also no explicit position regarding an impact of changes in the banking sector concentration on its stability. Kurgan-Van Hentenryk (2001) argued that consolidation contributes to stabilization of banking system. He showed that many of the governments of European countries, including Austria, Belgium, and Germany, promoted bank consolidations when the financial system was exposed to banking crises in the 1920s and 1930s. On the other hand, it

is suggested that bank consolidations do not significantly improve the performance or efficiency of the participating banks (Berger et al. 1999; Financial Service Agency 2002; Shih 2003).

The other authors look for a link between a level of consolidation and effectiveness of banking system supervision. Beck et al. (2003) argued that supervision of a highly concentrated sector is more effective. Formation of large banking structures is justified by economies of scale, arising due to mergers and acquisitions, as well as by the belief that larger banks better diversify their operations, which allows them to better adapt to market conditions and at the same time increases their resistance to a potential banking crisis. On the other hand, Mikołajczyk (2014) and Iwanicz-Drozdowska (2002) indicate that excessive concentration may lead to the creation of huge financial institutions and also increase on complexity of capital group's structure.

The subject of research, concerning the ongoing banking sector consolidation, are also changes in financial indicators and the ownership structure of a banking sector. Research conducted by the Polish Financial Supervision Authority (Polish Financial Supervision Authority 2013) indicated that, across the whole European Union, there is no statistically significant relation between concentration in a banking sector and financial indicators. While Weber (2000) studied an effect of bank mergers in the aspect of reduction of operating costs, obtained mainly by limiting employment and noticed the existence of a relation between a consolidation process and size of employment as well as a level of labor costs. He showed that, like Kozak (2015), consolidation contributes to reduction of employment in a banking sector.

The conducted research also concerns links between capital concentration and banking efficiency. Considering consolidation in terms of its impact on efficiency, it should be assessed whether, and if so, how an increase in the concentration of bank assets in the sector will translate into basic effectiveness measures. If a sector's concentration is a result of M&A, the fundamental question is whether this process improves operational effectiveness of an acquiring bank. The relationship between bank market concentration and bank efficiency is complex and sometimes ambiguous: depending on the banking market-specific characteristics, this relationship may be either positive or negative. Roger and Ferguson (2009) studied the potential impact of financial consolidation on financial institutions' effectiveness. Their research concluded with an extensive evaluation of the potential effects of financial consolidation on the efficiency of financial institutions, competition among such firms, and credit flows to households and small businesses. According to Goddard et al. (2008), banks' consolidation in the USA often only slightly improved the efficiency of the combined institution. The study also suggested that the hubris and agency motives for merger may be relevant, or that synergy derived more from enhanced market power than from cost savings. De Young (1993) studied 348 merged banks, of which 43% were intercompany ones. The study estimated pre- and post-merger cost efficiency by applying a thick frontier approach. Prior to merger, the acquiring banks were more cost efficient than the target. However, in the 3 years period after the merger, cost efficiency improved in about 64% of the cases. It is generally confirmed that bank market consolidation and efficiency relationships

are of particular relevance in Europe, but they remain controversial (Goddard et al. 2007; Molyneux 2009; Basílio et al. 2016).

Consolidation processes in Poland in the period after the economic transformation and until 2009, which were banks' reaction to the globalization of the financial system, did not take into account intensification of bank capital concentration processes after the financial crisis of 2008–2012. During this period (i.e., in the years of 2009–2017), the global banking dimension was particularly criticized, in which commercial banks were burdened with the responsibility for escalation of systemic risk in the international economy, and many of them received serious public financial support.[1] The adopted time horizon covering the years of 2005–2018 complements and broadens the research already carried out by others.

3 Controversy Around the Essence and Measurement of Bank's Effectiveness

Effectiveness is an economic concept, which did not find the final scientific consensus for many years. Effectiveness concerns various areas of human activity, including economic activity (Nawrocki 2015). It is widely accepted that economic effectiveness is a quantitative category that describes a degree of achievement of economic objectives (Czyżewski and Smędzik 2010). Therefore, research on economic effectiveness is primarily associated with optimization of resource allocation. This point of view also accompanies the identification of the concept of bank effectiveness. Nowadays, commercial banking sector is constantly undergoing major changes, which cause that banks, in order to meet market and customer requirements, steady monitor effectiveness of their operations (Szelągowska and Posacka 2006; Jonek-Kowalska and Zieliński 2017; Stoła 2011).

Empirical studies presented in the chapter concentrate on the financial effectiveness of a bank. It is well reflected in the set of goals that a bank pursues. It shows an amount of profit, while on the other hand, it allows to assess growth dynamics of bank's market value (increase of added value, increase of benefits for owners). The following indicators for measuring bank's financial effectiveness were adopted in the research:

- Return on assets (ROA)—an indicator reflecting the quotient of net profit and total assets.
- Return on equity (ROE)—an indicator reflecting the quotient of net profit and equity.
- Profit per person (bank net income per full-time equivalents)—reflecting the amount of profit earned by one full-time employee.

[1]The subject of controversy has become not only scale of this support, but also its legitimacy, impact on public budget balance as well as their use by the financial institutions.

- Cost/income ratio (C/I ratio)—an indicator reflecting the quotient of the total costs and revenues of a bank (or a sector).

ROE, ROA, and C/I ratios can be presented as percentages or numerical values, while profit per person ratio is expressed in a currency unit. All the above-mentioned indicators are used in assessing effectiveness of banking sector, a single bank or a bank's capital group. In the first three measures of effectiveness the higher their value against the background of a sector, competition, the better. On the other hand, the lower C/I ratio, the higher operational effectiveness of a bank (sector). The calculated ratios may show a positive proportional relation, when ROA, ROE, and profit per person increase along with a concentration ratio (as a measure of ongoing consolidation) and then this situation will indicate that consolidation has a positive effect on bank's/sector's effectiveness. In such a situation, the C/I ratio should present a downward trend over time. If the ROA, ROE, and profit per person show an inversely proportional relation to a concentration ratio, this may indicate a negative impact of bank consolidation on effectiveness of banks' and/or sector's activity (then the C/I ratio will also increase over time). There is also possible a situation that effectiveness indicators will not show changes in relation to an increase of the CR5/CR10 ratio, which means no interaction between banks' (sector's) concentration and effectiveness.

4 Consolidation of the Banking Sector in Poland in 2005–2018

The processes of bank consolidation in Poland can basically be analyzed since 1990, when a period of the transformation of the Polish market economy begins. They ran in different ways. Initially, it was a result of the privatization program of the centralized economy, then a targeted consolidation program, and in the end it turned out to be the result of mergers and acquisitions taking place in the developing European Union (Pyka et al. 2018). Research carried out in this study covers the years of 2005–2018. Moreover, after a certain stagnation of ownership transformation in Poland, at the turn of the twentieth and twenty-first centuries, under the strong influence of the negative consequences of the global financial crisis, their next stage begins. It justifies to undertake research, indicating the direction and effects of consolidation processes in the Polish banking sector.

A scale of banking sector consolidation has been adopted to measure a level of its concentration. Concentration, by its nature, means focusing and, unlike consolidation, is a measurable phenomenon. There are many indicators for measuring the concentration of banks. Among them, there are the concentration ratio (CR) and the Herfindahl-Hirschman Index (HHI). The basic concentration indicators CR3, CR5, and CR10 determine a share of, respectively, three, five, and ten largest banks in the selected financial variable, e.g., net assets, gross loans, or banking sector deposits. In turn, the Herfindahl-Hirshman Index (HHI) determines the estimated level of density

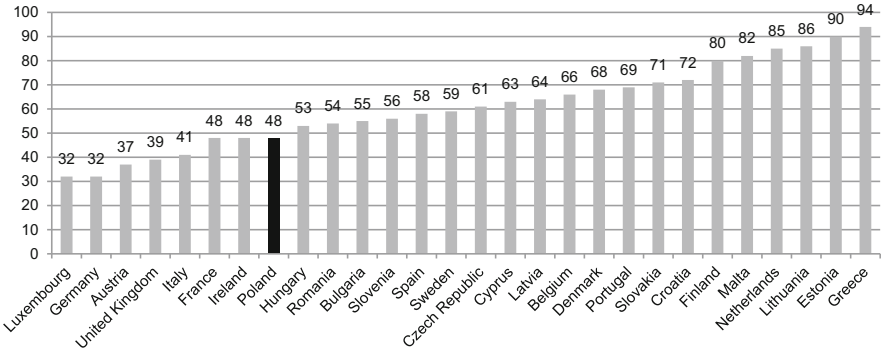

Fig. 1 CR5 concentration ratios in the European Union in 2015 [%]. Source: Based on Kotowicz (2015)

in a given industry and the level of competition in a given market. This index takes values higher than 0 and at most equal to 1 (or 10,000 if percentage instead of fractional values has been used in its calculation). Higher index values correspond to higher market concentration (Olszak 2014; Kil 2015).[2]

The study uses sectoral data and indicators illustrating the share of 5 and 10 banks in the sector's assets (CR5, CR10). Due to the fact that commercial banks are a subject of the analysis, the HHI was rejected. The resignation from the HHI results from the fact that cooperative banks, which were not included in the research, strongly influence on a level of this indicator. The level of concentration of the Polish banking sector compared to EU Member States is low (see Fig. 1). The values of CR5 ratios place the Polish banking sector in the 21st position among EU countries and are clearly lower than the EU average (62%).

The distant position of the CR5 ratio of the Polish sector, compared to other EU countries, indicates that in other EU countries assets are even more concentrated among the top five banks. In six European countries (Finland, Malta, the Netherlands, Lithuania, Estonia, Greece) the five largest banks gather over 80% of the sector's assets (Pyka and Nocoń 2019). In Greece, the CR5 ratio in 2005 was at a level of 65%, while since 2013 it has been amounted to 94%. This means that five credit institutions control almost the whole Greek banking sector (Cichy and Puszer 2016). The similar situation is when it comes to the CR10 ratio—its value is lower than the average of the Central European region countries, which amounts to 76%. It is interesting that in CEE countries concentration is higher than in developed countries of Western Europe.[3] It should be noted that the values for Poland are closer to those for Western Europe.

[2]In the case of the HHI in Poland, its value should be considered as low compared to the European countries. Only the most developed financial markets, such as Germany, Luxembourg, Italy, and the United Kingdom, were characterized by a lower value.

[3]This may be due to the fact that in the aftermath of the global financial crisis, the quality of banks' loan portfolios has significantly deteriorated in most CEE countries. This forced a need to take over

While analyzing a level of concentration in the Polish banking sector, it is noted that in 2005 a share of the five largest banks in Poland (PKO BP, Pekao SA, Santander Bank Polska, mBank, and ING Bank Śląski) accounted for almost 49% of the total assets of the whole sector. In 2008 and 2009 it was over 44%, in 2014—49%, while in 2018 the total balance sheet in the five largest banks exceeded 100 bln PLN, and their share in the sector's total assets fluctuated around 48%. In turn, the 10 largest banks (CR10) in Poland managed over 74% of the assets of the whole sector in 2018, while 8 years ago it was just over 63% (see Table 1).

The indicators of the banking sector concentration in Poland show constant, though small changes (the CR10 ratio is much more susceptible to changes), although their level is still quite low compared to other European Union countries. Situation is different in large European economies (Germany, the UK, France, Italy), where a share in the total assets of a sector of the five largest banks does not exceed 50%, and even ranges from 30 to 40%. Countries with the smallest concentration of the sector (in terms of assets) are Luxembourg and Germany, where the five largest banks account for about 30% of the assets of the whole banking sector (Pyka and Nocoń 2019).

5 Analysis of Relations Between Concentration and Effectiveness of the Polish Banking Sector

The conducted analysis of interactions of the main effectiveness indicators and bank concentration in the Polish banking sector, representing a macroeconomic approach to the analyzed problem, was based on the CR5 and CR10 ratios. The left ordinate axis of Fig. 2 presents the percentage values of ROA, ROE, and C/I ratios in relation to changes in the CR5 and CR10 ratios. The right ordinate axis illustrates how the net income to one full-time equivalent, quantified for the whole banking sector in Poland, has changed in relation to the same concentration indicators (CR5, CR10).

Analyzing the interactions of the banking sector concentration in Poland and a set of analyzed effectiveness indicators, it should be emphasized that:

- CR5 ratio within analyzed 14 years is relatively stable, larger changes are observed in the CR10 ratio.
- Greater correlations of the concentration level and efficiency of the banking sector are noticeable in relation to changes in the CR10 ratio rather than CR5 ratio.
- Until 2015 (with the exception of 2009—time of financial crisis escalation) it is observed a relation (proportional relation) between the change in CR10 and ROE

smaller and weaker institutions on the banking market and thus contributed to an increase of the banking sector concentration ratio.

Table 1 Share of the largest 5 (CR5) and 10 (CR10) banks in the total assets of the whole sector in 2005–2018

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CR5	49%	47%	47%	49%	47%	47%	49%	47%	47%	49%	47%	47%	49%	48%
CR10	69%	66%	64%	62%	64%	63%	63%	65%	67%	70%	71%	71%	70%	74%

Source: Polish Financial Supervision Authority (2016, 2017, 2018)

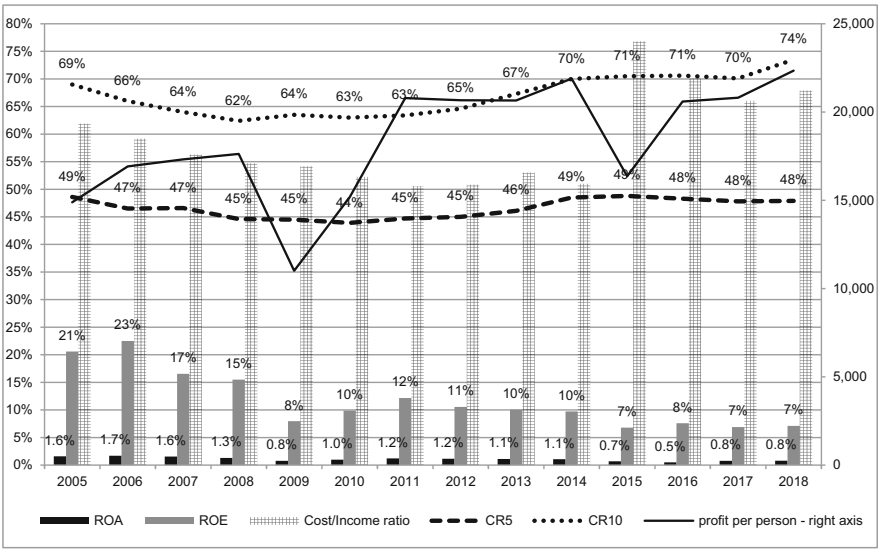

Fig. 2 ROA, ROE, C/I, and profit per person versus concentration of the banking sector in Poland (CR5 and CR10 ratios) in 2005–2018. Source: Own work based on the National Bank of Poland and the Polish Financial Supervision Authority data. * NOTE: currency conversions were made assuming that 1 EUR = 4 PLN

as well as ROA; however after 2016—after the banking tax implementation and other charges for banks, such relations are difficult to determine.[4]

- Correlation of profit per person ratio versus concentration level is similar to correlations with ROA and ROE, but with a less clear trend; similar to ROA and ROE in 2009 (financial crisis), the indicator deteriorates and in the following years it increases again to values not recorded historically; another very significant deterioration of the indicator occurs in 2015 and is not related to the consolidation process but to the macroeconomic and fiscal circumstances.
- In 2005–2008 with a decrease in the CR10 ratio, there is a decrease in the C/I ratio, while in the years of 2009–2014, along with an increase of the CR10 ratio, the C/I ratio decreased, between 2015 and 2018 again as the concentration level

[4]The deterioration of main effectiveness indicators in 2015 and 2016, including an increase of cost/income ratio, lowering ROA and ROE indicators resulted from an increase of operating costs, which were related, among others, from the implemented tax on certain financial institutions (the so-called *banking tax*). This tax included commercial banks. In addition to the banking tax, the financial results of the banking sector in Poland were also affected by liabilities to the Bank Guarantee Fund and contributions to the Borrowers Support Fund (FWK), which value was determined by the amount of unsupported housing loans in a bank's portfolio (capital from the Fund is used as repayable aid for people having problems with mortgage loans). FWK contributions were paid in February 2016; however, most banks recorded the related expenses in December 2015. The one-off event, which was the sale of Visa Europe shares, had a positive impact on the financial result of the banking sector in 2016, when Polish banks earned about 2 bln PLN (Pyka 2017).

increases, the C/I ratio increases; therefore, it can be observed that the C/I ratio in the analyzed period (except the years of 2005–2008) indicates an inverse relation as compared to CR10 ratio; thus, it can be assumed that an increase of concentration is conducive to the improvement of the C/I ratio.

6 Analysis of Relations Between Concentration and Effectiveness of the Selected Commercial Banks in Poland

The interactions between concentration and effectiveness of a given bank in the Polish banking sector are difficult to examine, based on the concentration ratios for the whole banking sector. In order to objectively assess whether (and if so how) service of a major part of the banking market by a given bank affects effectiveness of its operations, in the research a share of assets of the analyzed bank in the total assets of the whole sector was adopted as the concentration indicator. The research covered banks included in the CR5 ratio, i.e., PKO BP SA 2005-2017, PeKaO, Santander, mBank, and ING SA 2005-2017 Śląski in the period of 2005–2017.[5]

Analyzing the above-mentioned effectiveness and concentration indicators for PKO BP, the largest commercial bank in Poland, the following conclusions can be drawn (see Fig. 3):

- Since 2008 a share of assets of the biggest commercial bank in Poland (PKO BP SA) has been systematically increasing, while the largest increase was recorded after 2013 as a result of the Nordea Bank Polska SA acquisition.[6]
- ROA and concentration ratio show inverse relations, which means that ROA indicators deteriorate with an increase of the concentration ratio in the analyzed period; this may confirm the thesis that an increase of concentration affects complexity of banking group structures and favors a decrease of effectiveness indicators (at least in the first years after M&A—after the acquisition of Nordea Bank Polska, a share in the sector was growing, but did not impact on an increase of asset profitability).
- In 2005–2008, ROE increased while a share of bank assets in the sector decreased; in subsequent years, ROE decreased despite an increase in the concentration ratio; this indicates an inverse relation between ROE and a level of concentration of PKO BP bank in the sector; however, it should be noted that this may also result from macroeconomic conditions (financial crisis, the banking tax) and the merger process with Nordea Bank Polska.

[5] At the moment of the research, there is no access to the commercial banks' results for 2018, as it was possible in the sectoral analysis.

[6] PKO BP assets increased from 199.2 bln PLN in 2013 to 248.7 bln PLN in 2014.

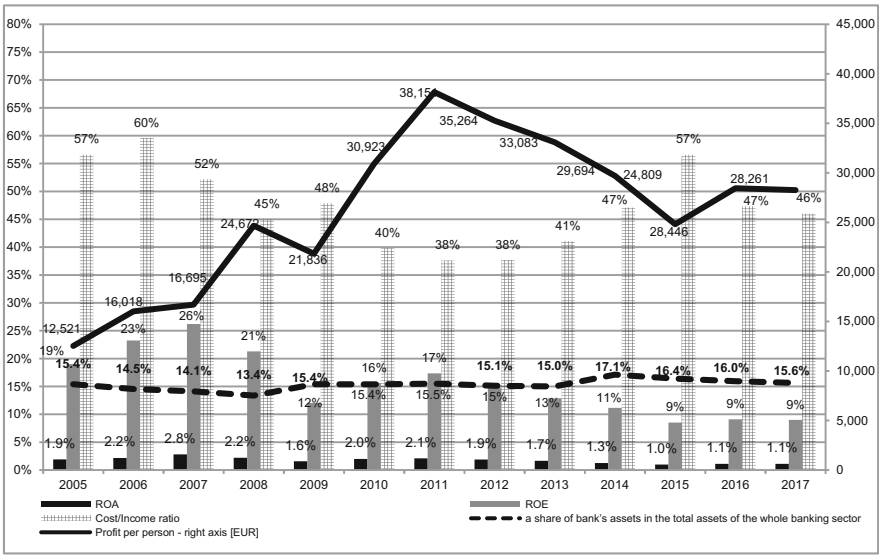

Fig. 3 ROA, ROE, C/I, and profit per person of PKO BP SA bank versus a share of bank's assets in the total assets of the whole banking sector in Poland in 2005–2017. Source: Own work based on the annual unconsolidated reports of PKO BP SA in the years of 2005–2017. * NOTE: currency conversions were made assuming that 1 EUR = 4 PLN

- An increase of the share of PKO BP assets in the sector's total assets is conducive to an improvement in the C/I ratio as well as an increase of net income related to the scale of employment (except for the years 2009 and 2015—respectively the period of the financial crisis and fiscal changes in banking industry).

Analyzing interactions between effectiveness and changes in the share of PeKaO bank (the second largest commercial bank in Poland) in total assets of the whole banking sector in 2005–2017, presented in Fig. 4, it can be noticed that a share of the bank's assets has been increasing since 2008. ROE and ROA ratios were inversely proportional to an increase of the concentration of bank's assets in the sector's assets. There are no interactions of changes in concentration ratio of bank's assets in sector's assets and changes in net income per employee. An increase in the share of PeKaO assets in the sector's assets has a positive impact on the C/I ratio.

Furthermore, in the next stage of the research, there was conducted the analysis of interactions between effectiveness and changes in the share of mBank in the total assets of the banking sector in 2005–2017 (Fig. 5). Throughout the whole analyzed period, there is no spectacular changes in a share of mBank's assets in the sector's assets (no new acquisitions of the analyzed bank), accompanied by a simultaneous decline of ROE since the financial crisis, i.e., since 2008. ROA ratio was stable in the whole analyzed period (just like the concentration ratio) except a period of the financial crisis (2008–2012) when the rate of return on bank assets decreased. Despite a stable share of the assets of the analyzed bank in sector's assets, there is

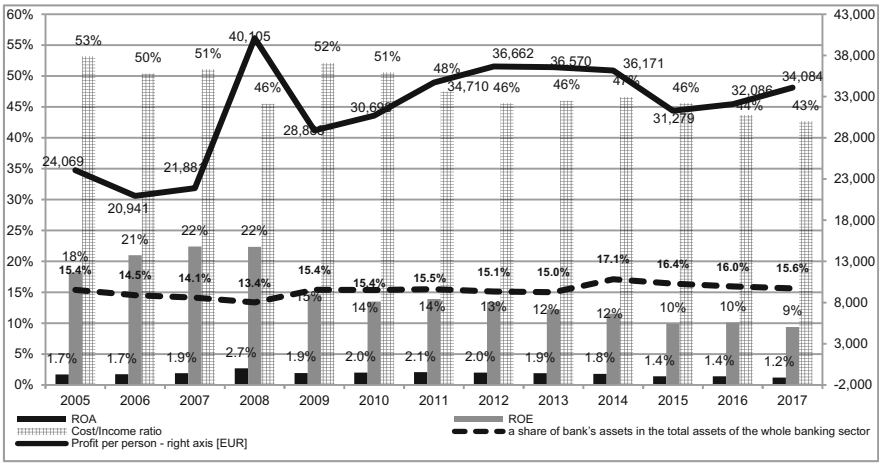

Fig. 4 ROA, ROE, C/I, and profit per person of PeKaO SA bank versus a share of bank's assets in the total assets of the whole banking sector in Poland in 2005–2017. Source: Own work based on the annual unconsolidated reports of PeKaO SA in the years of 2005–2017. * NOTE: currency conversions were made assuming that 1 EUR = 4 PLN

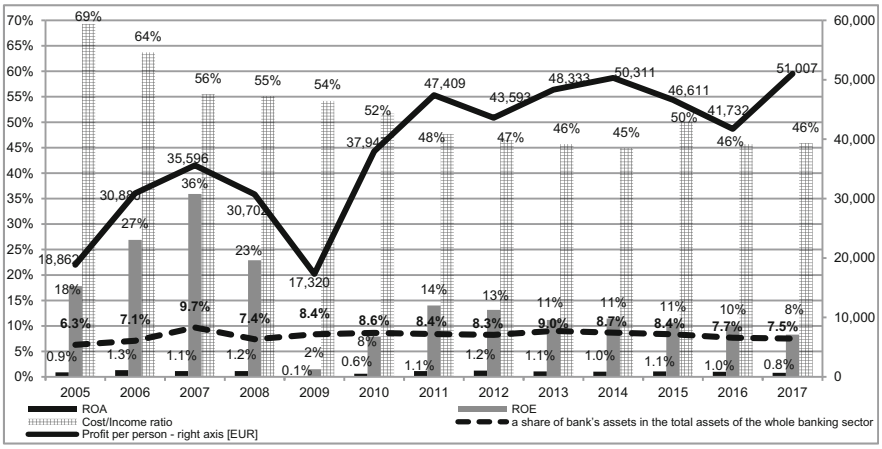

Fig. 5 ROA, ROE, C/I, and profit per person of mBank bank versus a share of bank's assets in the total assets of the whole banking sector in Poland in 2005–2017. Source: Own work based on the annual unconsolidated reports of mBank in the years of 2005–2017. * NOTE: currency conversions were made assuming that 1 EUR = 4 PLN

observed a systematic decline in the C/I ratio. In 2008–2009 there was a drastic drop of profit per person ratio, and its increase later on; there is no visible interaction of the net income/full-time equivalents in relation to changes in concentration ratio.

Figure 6 illustrates mutual dependencies between Santander Bank's effectiveness and its assets share in the whole banking sector's assets in the years of 2005–2017.

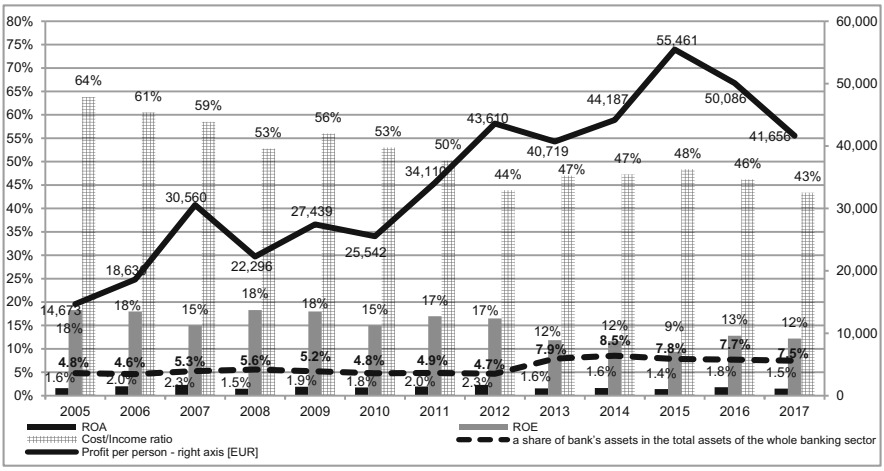

Fig. 6 ROA, ROE, C/I, and profit per person of Santander Bank SA bank versus a share of bank's assets in the total assets of the whole banking sector in Poland in 2005–2017. Source: Own work based on the annual unconsolidated reports of Santander Bank SA in the years of 2005–2017

Since 2013, a share of the bank's assets has increased disproportionately more than in the years of 2005–2012. Since 2013, along with an increase of the concentration of bank's assets in relation to the sector's assets, ROA and ROE ratios have decreased slightly. Regardless of the degree of concentration, there was a decline in the C/I ratio in the analyzed period, which indicates good bank's effectiveness. Along with an increase in concentration of bank's assets in the sector's assets in the years of 2013–2015, the profit per person ratio also increased; however, in 2016–2017 the indicator deteriorated significantly.

Figure 7 shows the mutual dependencies between ING's effectiveness and its asset share in the banking sector's assets in the years of 2005–2017. Since the beginning of the financial crisis (i.e., since 2008), there was a significant increase in a share of ING's assets in the sector's assets (organic growth, no M&A), while there was also observed stable level of ROA ratio and deterioration of ROE ratio in this period. The bank recorded a decrease (and then its maintenance) of the C/I ratio, along with an increase of a share of the bank's assets in 2008 and later maintaining this share at a similar level. Since 2008, there has been a gradual improvement in profit per person ratio with no significant changes in a level of concentration of bank's assets in the sector's assets.

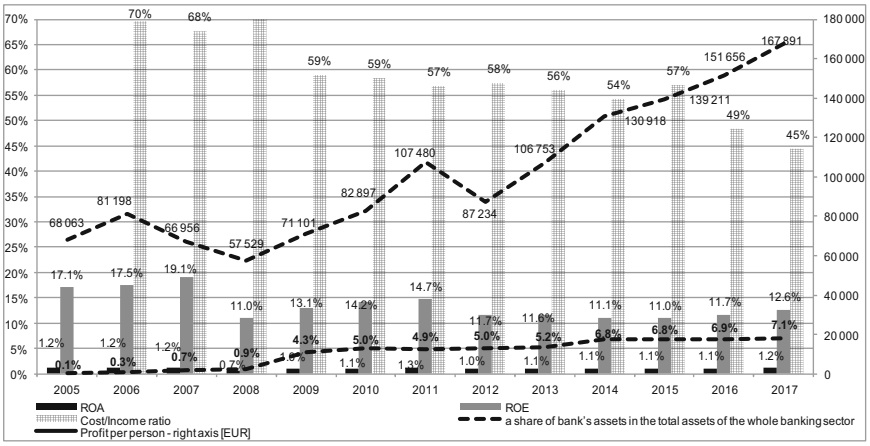

Fig. 7 ROA, ROE, C/I, and profit per person of ING Bank Śląski SA bank versus a share of bank's assets in the total assets of the whole banking sector in Poland in 2005–2017. Source: Own work based on the annual unconsolidated reports of ING Bank Śląski SA in the years of 2005–2017

7 Conclusion

The conducted research concerning interactions between a concentration level and selected effectiveness indicators of commercial banks and the banking sector in Poland in the years of 2005–2018 indicates that concentration of the Polish banking sector affects effectiveness of the sector and individual commercial banks. Concentration of the sector, measured by the CR10 ratio, indicates greater interactions with effectiveness indicators of the banking sector than concentration, measured by the CR5 ratio.

The interactions between concentration and effectiveness of banks allow to draw the conclusion that in the years of 2005–2018 four subperiods can be distinguished, covering the years of:

- 2005–2007—a period before the global financial crisis, where there is observed an increase in banking sector's assets along with high operational effectiveness and decreasing concentration of the sector
- 2008–2011—identified as a period of escalation of the crisis, when there was observed a slowdown in the growth of banking sector's assets, lowering its profitability and stabilizing a level of concentration
- 2012–2014—characterized by an increase of the sector, expressed in the size of assets and combined with a decrease of its profitability due to increased operating costs of commercial banks and an increase in a level of concentration in the banking sector
- 2015–2018—when there was a further gradual increase of assets and an increase of concentration ratios of the banking sector combined with "rebuilding" of its profitability.

These periods have different characteristics, which cause big problems with drawing coherent and unambiguous conclusions from the conducted research and often not corresponding to the theories, described in the literature. This encourages the authors to conduct further in-depth research, in particular those based on modeling interactions between concentration in the banking sector and effectiveness of individual banks. Moreover, the authors are aware of a further research gap, concerning an impact of banking sector's concentration on its stability, which might be a subject of their next studies.

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An Empirical Study of Blockchain Technology, Innovation, Service Quality and Firm Performance in the Banking Industry

A. G. Rekha and A. G. Resmi

Abstract Despite the potential promises that blockchain technology (BT) offers to the financial services sector, its large-scale implementations are still in a nascent stage. There is no consensus on what benefits BT may bring, and there is always a possibility of difference between expected benefits and experienced real-world impact. Since the actual impact can be assessed only after large-scale implementations by financial institutions, there is little empirical evidence available in the literature. In this context, this research seeks to explore the potential impact of BT by developing and empirically testing a model. For this purpose, we have identified four dimensions of BT, namely, Decentralization, Transparency, Trustlessness, and Security. The impact of BT on innovation, service quality, and firm performance is assessed based on the extent to which these dimensions are present in the organization. The linkages of the latent constructs are estimated by analyzing the primary data collected from senior managers of various banks in India. The findings of this study provide several important considerations regarding the implementation of BT.

Keywords Blockchain · Bank · Financial service · Innovation · Service quality · Performance

1 Introduction

Blockchain technology (BT) is identified as a disruptive innovation of the Internet era. This technology promises to bring revolutionary transformations in the way we transact over the internet, with prospective applications in various domains (Swan 2015; Huckle et al. 2016; Tapscott and Tapscott 2016; Beck et al. 2017). A

A. G. Rekha (✉)
Research wing- SBIL, State Bank of India, Kolkata, India

A. G. Resmi
Business Studies and Social Sciences, Christ (Deemed to be University), Bangalore, India

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blockchain is a distributed, decentralized, and immutable database, consisting of a growing sequence of blocks containing timestamped transactions, which is shared among a peer-to-peer network by a consensus mechanism. BT has got promising application prospects in the banking and financial services industry, especially in payment clearing and settlement systems, bank credit information systems, trade finance, etc. (Guo and Liang 2016; Peters and Panayi 2016; Treleaven et al. 2017). By way of decreasing transaction costs and by improving operating efficiency, BT offers the potential to be the core, underlying technology of the future financial services sector.

Despite the potential promises that this technology offers, large-scale BT implementations in the banking sector are still in the nascent stage. There is always a possibility of difference between expectations and experienced real-world impact of BT since the actual impact can only be assessed after large-scale implementations by financial institutions. While there are several initiatives offering blockchain solutions, especially by financial service providers and FinTechs, so far, no application has achieved large-scale recognition. It is necessary to be aware of the potential impacts resulting from the use of blockchain technology to real-world applications to foster the adoption of this technology at a larger scale. But there is no consensus on what benefits BT may really bring (Halaburda 2018).

Numerous conceptual studies are published focusing on BT. However, only a limited number of studies are available in literature, which is analytical and empirical in nature. Further, the focus of most of the research available on BT deals with technical, computational, and engineering aspects of blockchain. BT has not yet been thoroughly investigated from a strategic and managerial perspective by both academicians and practitioners. This gap has created exciting research avenues, especially from the perspective of managerial challenges and implications. A set of characteristics of BT are identified for this study, considering the above into account. Further, these characteristics are grouped into four dimensions of BT. Using these dimensions, we explore blockchain and related technologies from different perspectives, including strategic as well as managerial. A theoretical model is developed and empirically tested to explain the potential impact of BT on innovation, service quality, and firm performance in the context of the banking industry.

The rest of the paper is organized as follows: The research model and hypotheses are presented in sect. 2. This is followed by a discussion on the data and methodology in sect. 3. Section 4 presents the analysis and findings. Finally, the concluding remarks are given in sect. 5.

2 Research Model and Hypotheses

In order to understand the underlying concept of BT and to derive a distinct set of characteristics, a rigorous literature review is performed. One of the significant reasons for the interest in BT is its characteristics that provide security, anonymity,

and data integrity without the need for any third party in control of the transactions (Yli-Huumo et al. 2016). BT can be leveraged to overcome the drawbacks that are associated with trusting a central authority by enabling reliable transactions on the blockchain without knowing or trusting the peer dealt with. Some authors have pointed out that BT enables a secure trust-free transaction system (Beck et al. 2016). Shared and distributed storage of information is mentioned as another characteristic of BT which enhances the transparency of the blockchain system (Garman et al. 2014; Cai and Zhu 2016). Seebacher and Schüritz (2017), in their work, identified trust and decentralization as the key characteristics of BT. Transaction security and immutability in the blockchain network achieved through public-key cryptography and peer verification process are also discussed in the literature (Cucurull and Puiggalí 2016; Weber et al. 2016; Zhao et al. 2016). An in-depth review and synthesis of these literature have revealed a set of characteristics that facilitate implementation of BT in an organization. From these four principal characteristics are identified for BT, namely, Decentralization, Transparency, Trustlessness, and Security. Using these dimensions, we explore BT from a strategic as well as managerial perspective. Further, we examine the potential impact of BT on innovation, service quality, and firm performance in the context of banking industry.

Innovation is generally considered as an essential component for organizations to obtain competitive advantage and superior performance (Cooper and Kleinschmidt 1987; Mone et al. 1998; Gunday et al. 2011). As per the definition given in the OECD Oslo manual 2005, product innovation can be viewed as the introduction of a new or significantly improved good or service. Process innovation is the implementation of a new or significantly improved production or delivery method. Organizational innovation is the implementation of a new organizational method in the firm's business practices, and it is strongly related to administrative efforts (OECD 2005). Product and process innovations are closely related to technological developments (Gunday et al. 2011). Further, considerable research has been conducted on the relationship between innovation and service quality (Verhees and Meulenberg 2004; Parasuraman 2010) and also on service quality and firm performance (Roth and Jackson III 1995; Kaynak 2003; Yee et al. 2010).

While there are many conceptual studies that suggest that BT will have a positive impact on the firm's performance, there is no empirical evidence published so far. Similarly, there are only a limited number of studies focusing on BT and service quality, and again there is no empirical evidence in the literature. In the context of the banking industry, BT is expected to decrease transaction costs and improve operating efficiency. In this study, we aim to explore the impact of the dimensions of BT on firm performance through innovation by examining the product, process, and administrative innovations, as well as through service quality in the context of the banking industry. Figure 1 represents the conceptual framework of the study.

A structural model is developed for testing the following hypothesis:

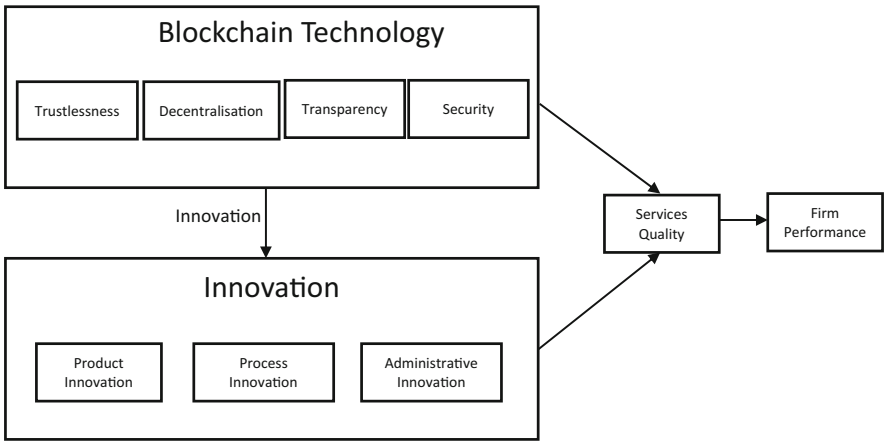

Fig. 1 Conceptual framework of the study. Source: author's own study

H1: *The four dimensions of blockchain technology (i) trustlessness, (ii) decentralization, (iii) transparency, and (iv) security are positively related with the three dimensions of innovation, (a) product innovation, (b) process innovation, and (c) administrative innovation*

H2: *The four dimensions of blockchain technology (i) trustlessness, (ii) decentralization, (iii) transparency, and (iv) security are positively related with service quality*

H3: *The three dimensions of innovation (a) product innovation, (b) process innovation, and (c) administrative innovation are positively related with service quality*

H4: *Service quality is positively related with firm performance*

3 Data and Methodology

The linkages of the latent constructs are estimated by analyzing the primary data collected from senior managers of various banks in India by applying Structural Equation Modeling (SEM). A scale for BT is developed for this study with Trustlessness, Decentralization, Transparency, and Security as multidimensional constructs. Measures of innovation (Jiménez-Jiménez and Sanz-Valle 2011), service quality (Parasuraman et al. 1988), and firm performance (Jiménez-Jiménez and Sanz-Valle 2011) are adapted from previous literature. All these constructs are measured using a five-point Likert scale, measured from strongly disagree to strongly agree. A draft questionnaire is pre-tested to check the content validity and hence modified accordingly. Questionnaires containing items measuring BT, innovation, service quality, and firm performance were distributed to 200 senior managers of various banks in India. A total of 167 responses were obtained, out of which

Table 1 Descriptive statistics of latent constructs

Variable	Items	Item Code	Mean	Std. Dev
Trustlessness	Level of anonymity of transactions in the organization is high	TRL1	3.12	1.246
	Degree of Automation in my organization is high	TRL2	3.15	1.269
	Need for a central authority for exchange of information within my organization is low	TRL3	3.12	1.320
	Need for a central authority (like RBI) for exchange of information within the industry among peer network comprising competitors, vendors, etc. is low	TRL4	3.15	1.279
Decentralization	Extent of collaborative storage of information within my organization by various functional areas is high	DEC1	3.17	1.319
	Extent of collaborative storage of information within my industry by peer network comprising competitors, vendors, etc. is high	DEC2	3.13	1.258
	Extent of distributed sharing of information within my organization by various functional areas is high	DEC3	3.18	1.332
	Extent of information updating within my organization by various functional areas is high	DEC4	3.12	1.275
	Extent of information updating within the industry by peer network comprising competitors, vendors, etc. is high	DEC5	3.10	1.187
Transparency	Extent of consensus needed for modifying shared information by various functional areas within the organization is less	TRN1	2.90	1.170
	Extent of consensus needed for modifying shared information by peer network comprising competitors, vendors, etc. is less	TRN2	2.87	1.175
	Degree of auditability in the organization is high	TRN3	2.85	1.259
	Degree of traceability of transactions in the organization is high	TRN4	2.92	1.200
Security	In my organization updating of shared information is possible only with authorization	SEC1	3.08	1.210
	Risk of tampering of history of transactions is very low in my organization	SEC2	3.08	1.210
	Information access is possible with authorization in my organization	SEC3	3.08	1.210
	There is a high level of accountability about transactions in my organization	SEC4	3.08	1.210
Product Innovation	The frequency of new products/services introduced in my organization is high	PDI1	3.28	1.274
	My organization has pioneer disposition to introduce new products/services	PDI2	3.30	1.252
	My organization invests high efforts to develop new products/services in terms of hours/person, teams, and training	PDI3	3.27	1.322

(continued)

Table 1 (continued)

Variable	Items	Item Code	Mean	Std. Dev
Process Innovation	The frequency of introduction of changes in processes is high in my organization	PCI1	3.06	1.195
	My organization has pioneer disposition to introduce new processes	PCI2	3.10	1.224
	My organization provides clever response to new processes introduced by other companies in the same sector	PCI3	3.10	1.179
Administrative Innovation	My organization has high novelty of administrative systems	ADI1	3.10	1.413
	There is a high degree of search for new administrative systems by managers in my organization	ADI2	3.10	1.296
	My organization has pioneer disposition to introduce new administrative systems	ADI3	3.10	1.383
Service Quality	My organization is able to provide services as promised	SQL1	3.19	1.255
	My organization is prompt in providing services to the customers	SQL2	3.18	1.332
	My organization can instill confidence in the customers	SQL3	3.12	1.297
	My organization provides services that best suits to the customers	SQL4	3.15	1.325
	My organization is technologically up-to-date	SQL5	3.12	1.285
Firm Performance	Quality of product/services of my organization is high	FPR1	3.15	1.296
	There is high internal process coordination in my organization	FPR2	3.15	1.296
	The image of my organization and its products is high	FPR3	3.15	1.296

Source: Based on primary data

11 responses were with missing values and those were excluded from the final sample.

4 Analysis and findings

The data revealed that all the constructs are having high item communalities, hence the concern of sample size adequacy is satisfied. Descriptive statistics of indicators of all the latent constructs are shown in Table 1.

Individual confirmatory factor analysis (CFA) is performed by considering each latent construct one by one, and the results are explained in Table 2. All the nine constructs are having statistically significant ($p < 0.001$) factor loadings (≥ 0.5), and the value of Average Variance Extracted (AVE) exceeds the recommended

Table 2 Convergent validity of latent constructs

Variables	Item Code	Convergent Validity				
		Factor Loading	Convergent Validity	Internal Reliability	Construct Reliability	R^2
		Standardized Regression Weight (> 0.5)	Average Variance Extracted (≥ 0.5)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (≥ 0.7)	Squared Multiple Correlations (>0.5)
Trustlessness	TRL1	0.925	0.864	0.962	0.962	0.856
	TRL2	0.925				0.855
	TRL3	0.941				0.886
	TRL4	0.925				0.855
Decentralization	DEC1	0.927	0.846	0.965	0.965	0.859
	DEC2	0.905				0.819
	DEC3	0.947				0.897
	DEC4	0.930				0.866
	DEC5	0.895				0.801
Transparency	TRN1	0.927	0.842	0.955	0.955	0.860
	TRN2	0.920				0.847
	TRN3	0.922				0.850
	TRN4	0.902				0.813
Security	SEC1	0.927	0.859	0.961	0.961	0.860
	SEC2	0.927				0.860
	SEC3	0.929				0.862
	SEC4	0.926				0.858
Product Innovation	PDI1	0.934	0.852	0.945	0.945	0.872
	PDI2	0.923				0.852
	PDI3	0.914				0.835
Process Innovation	PCI1	0.913	0.828	0.935	0.935	0.833
	PCI2	0.905				0.818

(continued)

Table 2 (continued)

Variables	Item Code	Convergent Validity				
		Factor Loading	Convergent Validity	Internal Reliability	Construct Reliability	R^2
		Standardized Regression Weight (> 0.5)	Average Variance Extracted (≥ 0.5)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (≥ 0.7)	Squared Multiple Correlations (>0.5)
	PCI3	0.913				0.834
Administrative Innovation	ADI1	0.946	0.876	0.954	0.955	0.895
	ADI2	0.927				0.859
	ADI3	0.935				0.875
Service Quality	SQL1	0.930	0.859	0.968	0.968	0.864
	SQL2	0.946				0.894
	SQL3	0.907				0.822
	SQL4	0.917				0.841
	SQL5	0.921				0.848
Firm Performance	FPR1	0.936	0.878	0.955	0.956	0.877
	FPR2	0.937				0.879
	FPR3	0.937				0.878

Source: Based on primary data

Table 3 Intercorrelation, AVE, and Squared Intercorrelation values

Constructs	Intercorrelation				AVE	Square of Intercorrelation			
	Trustlessness	Decentralization	Transparency	Security		Trustlessness	Decentralization	Transparency	Security
Trustlessness	–				0.864	–			
Decentralization	0.527	–			0.846	0.278	–		
Transparency	−0.606	−0.671	–		0.842	0.367	0.450	–	
Security	0.582	0.576	−0.342	–	0.859	0.339	0.332	0.117	–

Source: Based on primary data

Table 4 Fitness indexes of latent constructs

Variable	CMIN/DF (< 5.0)	χ^2 ($p > 0.05$)	NFI (>0.9)	IFI (>0.9)	TLI (>0.9)	CFI (>0.9)
Trustlessness	0.590	1.180	0.998	1.001	1.003	1.000
Decentralization	0.788	3.941	0.996	1.001	1.002	1.000
Transparency	2.187	4.374	0.993	0.996	0.989	0.996
Security	0.000	0.000	1.000	1.003	1.008	1.000
Product Innovation	0.850	0.850	0.998	1.000	1.001	1.000
Process Innovation	0.111	0.111	1.000	1.002	1.007	1.000
Administrative Innovation	7.566	7.566	0.985	0.987	0.960	0.987
Service Quality	7.802	1.560	0.992	0.997	0.994	0.997
Firm Performance	0.000	0.000	1.000	1.002	1.006	1.000

Source: Primary data

minimum value of 0.50. Again, Cronbach's alpha and composite reliability of all the constructs are greater than the recommended threshold of 0.70 (Hair et al. 2011; Fornell and Larcker 1981), and R^2 values above 0.5 (Easterby-Smith, 1991), indicates evidence for convergent validity.

The results from Table 3 confirm that the intercorrelation values of the exogenous variables are well below 0.85 and AVE values are greater than squared intercorrelation values, and hence indication for discriminant validity (Hair et al. 2011; Fornell and Larcker 1981).

Table 4 shows that the values for NFI, IFI, TLI, and CFI are well above the recommended threshold of 0.90 (Hu and Bentler 1999; Hair et al. 2011; Hooper et al. 2008). Hence unidimensionality of all the latent constructs are verified. Therefore, it is evident that there are no cross loadings, or the indicators are reflecting only the corresponding construct.

The VIF values for all the four predictor variables are less than 5, with tolerance levels greater than 0.2, indicating the fact that there is no multicollinearity issue in the data set. Figure 2 represents the structural model used in this study. According to the results summarized in Table 5 the overall fit of the structural model is good, with a $\chi 2$ value of 1153.695 and CMIN/DF value of 2.303, which is well below 5.0 (Marsh and Hocevar 1985). NFI, IFI, TLI, and CFI are above 0.90 (Hair et al. 2011; Hu and Bentler 1999; Hooper et al. 2008). All these results suggest that the overall fit of the structural model is good.

Table 6 shows the results of hypothesis testing. The first hypothesis (H1) is developed for testing the relationship between four dimensions of BT and three dimensions of innovation. H2 tests the relationship between BT and service quality. Further, H3 tests the relationship between innovation and service quality. Finally, H4 tests the relationship between service quality and firm performance.

The results of the study generally support theoretical predictions, and some interesting findings also emerged. The results reveal that there is a significant positive relationship between trustlessness and process innovation, trustlessness and administrative innovation, decentralization and product innovation,

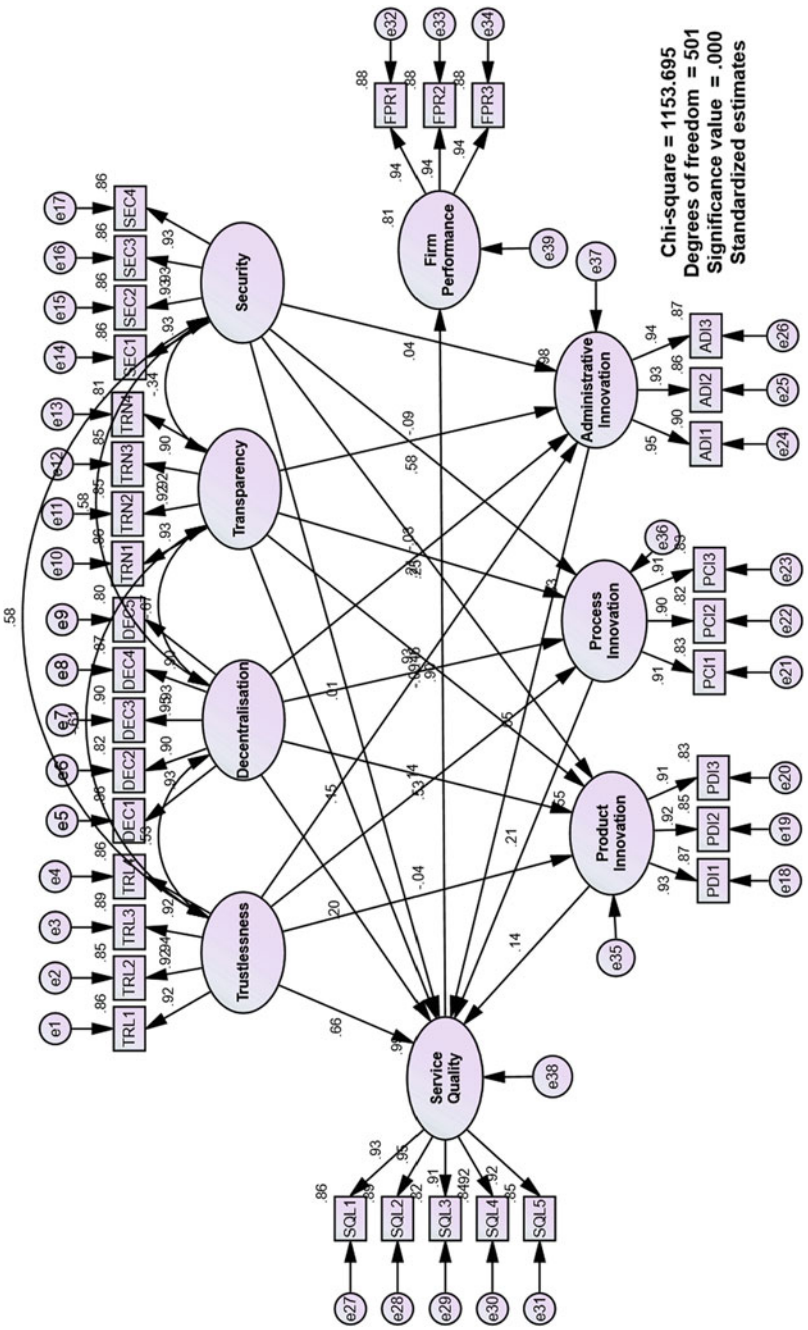

Fig. 2 Structural Model. Source: Primary data

Table 5 Model fit summary

CMIN/DF (< 5.0)	χ^2	NFI (> 0.9)	IFI (> 0.9)	TLI (> 0.9)	CFI (> 0.9)
2.303	1153.695	0.9	0.9	0.909	0.919

Source: Based on primary data

decentralization and process innovation, transparency and process innovation, security and product innovation, and security and process innovation. However, trustlessness was found to have an insignificant relationship with product innovation. Banking, being a service industry, this result has important implications. From the three dimensions of innovation, both product and process innovation are positively and significantly related to service quality. Further, consistent with the findings of existing literature, the relationship between service quality and firm performance was found to be positive.

Another significant finding and consequent implication of this study is that except security, all other dimensions of BT are positively and significantly related to service quality. Contrary to the proposed benefits on service quality aspects expected from BT's heavy reliance on cryptographic security mechanisms (Dubovitskaya et al. 2017; Schlegel et al. 2018), our results indicate that the security dimension is having an insignificant relationship with service quality. Since processing speed plays a significant role in achieving superior service quality and faster banking transactions is one of the key advantages expected from BT, this result should be read along with some of the previous studies investigating the security-speed trade-offs in blockchain protocols when it comes to tackling scalability (Kiayias and Panagiotakos 2015). Research on this area is still immature. Extensive research on different aspects of BT, primarily related to security, speed, and scalability in delivering financial services, is required to overcome the challenges hindering its large-scale adoption. Importantly, the significance of the results lies in the fact that it reveals that an in-depth understanding of security aspects of blockchain systems will be needed when considering large-scale implementations in the banking sector.

5 Conclusions

In this work, we have attempted to foster a general understanding of the impact of blockchain technology from a managerial perspective. A theoretical model is developed and empirically tested to explain the potential impact of BT on innovation, service quality, and firm performance in the context of banking industry. This study makes several significant contributions to theory and practice. It is the first of its kind to shed light on the various dimensions of blockchain technology and its impact on innovation, service quality, and firm performance. The findings of this study provide several important considerations to the decision makers regarding implementation of BT in their organizations. The results provide a better understanding of why banking

Table 6 Hypotheses testing

Hypothesis	Relationships			Standardized path coefficient	S.E.	t Value	Comments
	Structural Paths			Standardized Regression Weight		C.R.	
H1a	Product_Innovation	←	Trustlessness	−0.038	0.093	−0.428	Not Supported
H1b	Process_Innovation	←	Trustlessness	0.142	0.059	2.249*	Supported
H1c	Administrative_Innovation	←	Trustlessness	0.929	0.060	17.262***	Supported
H1d	Product_Innovation	←	Decentralization	0.529	0.098	5.355***	Supported
H1e	Process_Innovation	←	Decentralization	0.455	0.063	6.412***	Supported
H1f	Administrative_Innovation	←	Decentralization	−0.032	0.045	−0.768	Not Supported
H1g	Product_Innovation	←	Transparency	−0.090	0.106	−0.944	Not Supported
H1h	Process_Innovation	←	Transparency	0.210	0.068	3.070*	Supported
H1i	Administrative_Innovation	←	Transparency	−0.091	0.050	−2.146*	Supported
H1j	Product_Innovation	←	Security	0.253	0.092	2.950**	Supported
H1k	Process_Innovation	←	Security	0.582	0.063	8.903***	Supported
H1l	Administrative_Innovation	←	Security	0.037	0.043	0.978	Not Supported
H2a	Service_Quality	←	Trustlessness	0.662	0.330	2.063*	Supported
H2b	Service_Quality	←	Decentralization	0.203	0.047	4.234***	Supported
H2c	Service_Quality	←	Transparency	0.155	0.049	3.438***	Supported
H2d	Service_Quality	←	Security	0.015	0.050	0.312	Not Supported
H3a	Service_Quality	←	Product_Innovation	0.137	0.030	4.427***	Supported
H3b	Service_Quality	←	Process_Innovation	0.212	0.064	3.623***	Supported
H3c	Service_Quality	←	Administrative_Innovation	0.052	0.308	0.156	Not Supported
H4	Firm_Performance	←	Service_Quality	0.902	0.056	16.409***	Supported

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

industry might want to invest in using blockchain-based technologies. Further, this study corroborates prior research relating service quality and performance. Finally, given the little empirical research on blockchain technology, future research across various other industries would help determine if the findings are more generalizable.

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New Solutions in the European Financial Market and their Impact on the Polish Market

Małgorzata Mikita

Abstract The aim of the study is to analyze the impact of new European regulations, which include: Capital Requirements Package IV Directive, Capital Requirements Regulation, banking union and capital union on the market in Poland. Special attention was paid to the impact of the new regulations on the banking sector in Poland and the small- and medium-sized enterprises. Poland, as an EU member state, is obliged to implement the guidelines presented in the Capital Requirements Package IV Directive, Capital Requirements Regulation, while as far as banking union is concerned, it has the possibility to join it on the basis of close cooperation. The capital union has not been established so far; therefore, it is not possible to talk about its real impact on the market in Poland; however, it is possible to predict the potential effects of its establishment. The article consists of five main parts covering the following issues: characteristics of the European financial market, introduction of new European regulations concerning financial market, analysis of the impact of new regulations on the banking sector in Poland and analysis of the impact of new regulations on the sector of small- and medium-sized enterprises in Poland. The author argues that the new European regulations increase the stability of the banking sector in Poland and access of small- and medium-sized enterprises to capital.

Keywords EU · Poland · Banking Sector · SMEs · Capital Union · Banking Union · CRD/CRR package

1 Introduction

The global financial crisis of the twenty-first century that emerged in 2018 in the US mortgage market has exposed the weaknesses of the European financial market. It turned out that despite many years of European Union (EU) efforts to build a Single

M. Mikita (✉)
Department of Capital Markets, Warsaw School of Economics, Warsaw, Poland
e-mail: mmikit@sgh.waw.pl

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European Market, resilient to financial crises, the goal was not achieved. The EU financial market has responded very significantly to the negative impulses coming from the US market, also plunging into the crisis (Apergis et al. 2019). The dynamic spread of the crisis was made possible, on the one hand, by the globalization of the global economy, which has been ongoing for many years (reflected in increased interconnections between different countries of the world), and, on the other hand, by the lack of a properly structured global financial architecture in the EU (Center for Economic Policy Research 2018) that would reduce the likelihood of crises occurring and allow for effective crisis management if they occur (Gostomski 2017).

This situation has given impetus to EU financial market reforms (ECB 2019a). The main objective of the reforms was to increase the stability of the EU financial sector by strengthening its supervision, monitoring of systemic risk, increasing the efficiency of restructuring of banks at risk, enhancing investor protection, as well as tightening the requirements for financial institutions (Schemmel 2019). In addition, the integration of EU Member States' capital markets has become one of the priorities, so as to increase their efficiency. In order to achieve these objectives, a new legal framework for the creation and operation of credit institutions in the EU was introduced and the conditions for allowing banks to operate in the EU market were clarified. The above regulations were included in the CRD IV/CRR (Capital Requirements Package IV Directive/Capital Requirements Regulation) (European Parliament and the Council 2013a, b), which was adopted by the European Parliament on April 16, 2013. New rules on supervision of the EU financial market as well as new regulations on bank resolution were introduced with the establishment of the banking union (Schoenmaker and Siegmann 2013). Capital market integration is to be fostered by the establishment of a capital markets union.

The aim of the study is to analyze the impact of new EU regulations, which include: CRD IV/CRR package, banking union, and capital union on the market in Poland. Special attention was paid to the impact of the new regulations on the banking sector in Poland and the small- and medium-sized enterprises (SMEs) sector.

Poland, as an EU Member State, is obliged to implement the guidelines presented in the CRD IV/CRR package, while as far as banking union is concerned, it has the possibility to join it on the basis of close cooperation. The capital union has not been established so far (it is expected to be in 2020). Therefore, it is not possible to talk about its real impact on the market in Poland; however, it is possible to predict the potential effects of its establishment.

2 EU Financial Market

The EU financial market includes the financial markets of all member states. Despite many years of work to unify this market and introduce uniform rules for the functioning of financial institutions and markets across the EU, this has not yet been achieved. EU countries remain countries with different legal solutions for

financial markets. Some differences are also observed in relation to the type of financial institutions operating on particular markets and the products they offer, as well as the financial infrastructure solutions adopted and the degree of development of particular segments of the financial market. Moreover, the efficiency and stability of financial institutions and markets in different countries vary (Lazarides and Drimpetas 2016).

A strong EU drive to harmonize the rules of financial markets has been observed since 1999, when the EU indicated that one of its objectives is to create a market with free movement of capital between Member States and freedom to provide financial services, i.e., to build the so-called "single financial market." The idea began with the development of a document called FSAP (Financial Services Action Plan), which allowed for the creation of a legal basis for the single financial market (Ozkok 2017). Many documents (directives, regulations, recommendations, decisions, communications) were issued at that time, which set out the guidelines on which this market is to be based. The common guidelines concerned the rules of trading in financial instruments on the European market, standardization of information contained in prospectuses, rules of operation of investment funds on the EU market, and capital requirements for banks and insurance companies (Freixas et al. 2004). Listen to regulations addressed to credit rating agencies, common accounting standards, or rules concerning trading in derivatives. The process of implementation of EU regulations into the legislation of individual EU countries has been going on to date and is being carried out with different intensity in different countries. This makes some financial market segments more integrated than others. The best-integrated segments today are the interbank money market and the bond market. The segments with a low degree of integration are the retail banking market and the stock market. In the EU, bonds are mainly traded on a common trading platform managed within the MTS group (Mercado dei Titoli de Stato). In the case of government securities (bonds, treasury bills), the MTS controls the trading on 13 markets of the EU Member States—Austria, Belgium, Denmark, Spain, Poland, France, Germany, Greece, Ireland, Italy, Portugal, Finland, and the Netherlands. There is no stock market regulation at the EU level. Each country determines its own share market regulations, although these regulations are constructed taking into account certain guidelines contained in EU directives (for instance in: Markets in Financial Instruments Directive - Directive 2014/65/EU, Prospectus Directive - Directive 2010/73/EU, Transparency Directive - Directive 2013/50/EU).

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about its real impact on the market in Poland; however, it is possible to predict the potential effects of its establishment.

3 New EU Regulation—The Essence

New EU financial market regulations appeared after 2008 and were the EU's response to the global financial crisis. The most important regulations, introducing the most significant changes to the EU financial market, include the CRD IV/CRR package, the banking union, and the capital union.

3.1 The CRD/CRR Package

The detailed regulations of the CRD IV/CRR package relate to banks' own funds, capital buffers, banks' leverage, liquidity standards, credit risk assessment, and corporate governance. The banks' own funds are divided into two categories: Tier 1 capital and Tier 2 capital. Additionally, within the Tier 1 capital the Common Equity Tier 1 capital (CET I) was separated as the best quality capital and additional Tier 1 capital. The CRR Regulation identifies the component items of the above capital categories as well as possible deductions. It is assumed that the total capital ratio to be maintained by banks should be min. 8%. The minimum level of Common Equity Tier 1 capital ratio must not fall below 4.5% of risk-weighted assets and the minimum level of Common Equity Tier 2 capital ratio must not fall below 6% of risk-weighted assets (European Commission 2019c). In addition to the standard capital requirements, the CRD IV/CRR package has introduced a number of capital buffers, which further encumber the assets of some banks. These are the Global Systematically Important Financial Institution, countercyclical capital buffer, capital conservation buffer, and systemic risk buffer (Moudud-Ul-Huq 2019).

The buffer for global systemically important banks applies only to those banks that are on the list of so-called systemically important banks. Its purpose is to increase the safety of their operations. It is the responsibility of the national authorities to identify the systemically important banks, but the EU authorities may additionally identify those banks that are not on the list of banks reported by individual countries, and their importance is high from the point of view of the EU as a whole. This buffer was set at 3.5%. This buffer applies to banks from 2019 onward.

The Countercyclical Capital Buffer is a buffer aimed at mitigating financial market disturbances in times of economic downturn. It is set at 2.5% of risk-weighted assets. The funds accumulated in that buffer are to be used in crisis situations. Like the buffer for systemically important global banks, the full amount of the countercyclical capital buffer applies from 2019. The purpose of the Countercyclical Capital Buffer is to absorb bank losses in times of crisis. This buffer

determines the amount of core funds of CET-1 bank in relation to its total risk exposure. According to the guidelines of the CRD IV/CRR package, its amount is 2.5%. Effective from 2019.
The system risk buffer, ranging from 1% to 5% of risk-weighted assets, is a buffer that may be additionally introduced by national supervision if necessary. As regards the leverage ratio, a requirement has been introduced that, from 2018, banks will be required to maintain below 33.3%.

Under the CRD/CRR framework, banks are required to respect two liquidity buffers (Budnik and Bochmann 2017):

- LCR (Liquidity Coverage Ratio)—this is a short-term liquidity buffer,
- NSFR (Net Stable Funding Ratio)—it is a long-term liquidity buffer (BIS 2014).

The full guidelines for the LCR are valid from January 1, 2019. The desired value of the ratio is above 100%. A similar value is foreseen for the NSFR (Basel Committee on Banking Supervision 2014). As far as credit risk assessment is concerned, credit risk estimation methods (Standardized Approach and Internal Ratings Based Approach), rules for calculation of risk-weighted exposure amounts as well as risk weights for individual exposures have been defined. The CRD IV/CRR package introduced new corporate governance guidelines. These guidelines were addressed to the management authorities. They mainly concern the ways of managing banking risk and disclosing information on how the bank operates.

3.2 Banking Union

The banking union clarifies common rules for the supervision of banks in the EU (Single Supervisory Mechanism (SSM), their resolution (SRM), and the Single Deposit Guarantee Scheme (SDGS). A European System of Financial Supervision was established to carry out supervision. The European System of Financial Supervision is composed of:

-The European Systemic Risk Board (ESRB), which monitors systemic risk (Smuga 2013).

- The four European Supervisory Authorities (ESA), i.e.:

  The European Banking Authority (EBA),
  European Insurance and Occupational Pensions Authority (EIOPA),
  The European Securities and Markets Authority (ESMA),
  Joint Committee.

- competent or supervisory authorities of the Member States as defined in the relevant Union acts (Schemmel 2016).

In addition, the European Central Bank plays an important role in the SSM, which, as of November 2014, carries out prudential supervision of the largest euro area credit institutions (credit institutions with assets in excess of EUR 30 billion)

(European Council 2013). Resolution is handled by the Single Resolution Board (SRD). It monitors the implementation of the resolution scheme through national resolution authorities. The purpose of the Single Resolution Board is to ensure the effective resolution of insolvent financial institutions. The Single Resolution Fund (SRF)9 was created to provide financial support to the scheme. The Single Resolution Fund (SRF) is planned to harmonize the legal rules for deposit protection up to EUR 100000 (PWC 2014). So far (till XI/2020), no detailed solutions have been introduced in this respect (the solutions applied so far are local systems, i.e., developed and controlled by individual countries). The Single Resolution Fund is going to be gradually built up during the period until 2023 included.

3.3 Capital Union

The idea of creating a Capital Markets Union (CMU) appeared for the first time in the statement of European Commission (EC) President J.C. Juncker in 2014. In February 2015, the European Commission (EC) published a document (Green Paper) entitled "Building a Capital Markets Union" (European Commisssion 2015), which outlined the objective of creating a capital union, drawing attention to the challenges facing the European capital market and the necessary courses of action to meet them. In September 2015, the EC published a detailed action and construction plan for CMU (European Commission 2019d)—"Action plan on building a capital markets union" (European Commission 2015a). This document identified specific projects to be implemented in the period 2015–2019 (European Commission 2015b). Most projects have already been completed (European Commission 2015b). This means continuing work on the creation of the capital union also in 2020 (European Commission 2019g). The primary objective of the capital union is to create a single capital market for all 28 EU Member States. Today, the European capital market is not a single market. It is a market composed of 28 national capital markets, with different levels of development. These include markets characterized by a high level of development, such as the British market or the Swedish market (with share market capitalization above 100% of their GDP), as well as underdeveloped markets, such as the Slovak, Lithuanian, Latvian or Cypriot market (with share market capitalization below 10% of their GDP) (Veron and Wolff 2016). The capital markets of EU countries also differ in terms of regulatory requirements.

Despite the introduction of full liberalization of capital movements between Member States and between Member States and third countries in July 1990 (the free movement of capital is based on Articles 63–66 of the Treaty on the Functioning of the EU, supplemented by Articles 75 and 215, which refer to sanctions) (European Commission 2019e), full integration of the capital market within the EU has not been achieved. This is particularly evident in the stock market, which is one of the least integrated European markets, as well as in the corporate bonds market. No new authorities are planned to be established under the Capital Market Union. The work

is in the nature of harmonizing the rules and standards applicable to capital markets in individual EU Member States.

4 The Impact of New EU Regulations on the Banking Sector in Poland

The primary objective of the new EU regulations is to strengthen the financial system and reduce its vulnerability to crises. This goal is being implemented, which also applies to banks operating in Poland. Banks are obliged to take less risky actions, which is a result of new guidelines on capital requirements, liquidity, and leverage. The provisions on corporate governance, unification of rules on credit risk assessment, or creation of new capital buffers are also important for security. In addition, the CRD IV Directive's provisions on the prudential supervision of financial institutions, as well as the publication of information on prudential regulation, also serve to improve the safety of the banking system. Prudential supervision clarifies the responsibilities and powers of the home and host countries. The rules applicable to the exchange of information between countries, as well as the duties of persons responsible for the assessment of consolidated financial statements of financial institutions, are presented.

The introduction of new regulations by individual banks in Poland was obviously associated with costs. One can talk about costs related to the need to meet new capital requirements and new liquidity measures and regulations on the amount of leverage. However, the increase in costs incurred by banks did not translate into higher prices of loans granted by banks. There is therefore no question of reducing their attractiveness to potential borrowers.

Banks in Poland achieve good financial results. The net result for the whole banking sector in Poland at the end of 2018 amounted to over PLN 14.7 billion (KNF 2018a) (in 2017, the net result of this sector was PLN 13.6 billion) (KNF 2018b). They also meet the own funds requirements provided for in the CRD/CRR package. Additionally, it can be said that they have no liquidity problems. All commercial banks meet the EU standard for short-term liquidity (the so-called LCR—Liquidity Coverage Ratio) at the required level of 100% (KNF 2018a). However, the challenge for banks is to meet the EU standards for long-term liquidity (which is determined by the NSFR—Net Stable Funding Ratio). Currently, Polish banks are financed mainly with domestic deposits (their share in the financing of assets is 61%), while market capitals constitute a small share in their financing (only 19% of bank assets are financed in this way) (European Commission 2019f). In order to meet the requirements of the NSFR, banks should issue more securities (including, inter alia, mortgage bonds). Ultimately, the size of the NSFR indicator should be at least 100% and should be achieved by Polish banks by 2023 (Basel Committee on Banking Supervision 2014). The persistence of good situation of banks in Poland favors the environment, e.g., sustained economic revival, stable financial situation of

enterprises, or improvement of the situation on the labor market (European Commission 2019f).

The stability of banks in Poland is confirmed by stress tests conducted in 2018 by the European Banking Authority (EBA) (EBA 2018). The two largest Polish banks, i.e., PKO BP and Pekao SA, have undergone stress tests, which have achieved very good results, which prove high stability of their operations. Similar conclusions can be drawn from the stress tests conducted by the NBP in 2018. The impact of hypothetical shocks on banks in Poland in the period from Q3 2018 to the end of 2020 was examined. The results of the stress tests indicated that the probability of materialization of systemic risk (which would result in disruption of financial intermediation services provided by banks) is low (NBP 2018).

The establishment of the banking union has resulted in the creation of a single supervisory mechanism in the countries covered by the banking union. However, this mechanism does not apply in Poland, as Poland has not joined the banking union. The supervision of the Polish banking market is exercised by the Polish Financial Supervision Authority (KNF). This institution exercises supervision over the entire financial market in Poland. This supervision includes: banking supervision, pension supervision, insurance supervision, capital market supervision, supervision of cooperative savings and credit unions and the National Cooperative Savings and Credit Fund, supervision of payment institutions, payment service offices, electronic money institutions, as well as supervision of rating agencies. The purpose of this supervision, in accordance with Article 2 of the Act on the supervision of the financial market, is to ensure the proper functioning of the financial market, its stability, security and transparency, confidence in the financial market, as well as to ensure the protection of the interests of market participants (KNF 2006). The supervision over the activities of the PFSA is exercised by the Prime Minister. The Commission, apart from supervising the financial market, is also obliged to undertake actions aimed at the development of this market, as well as actions aimed at the proper functioning of the financial market in Poland.

The establishment of a capital union may result in a reduction of loans to the largest companies. It can be expected that large companies will to a greater extent than before raise capital directly from the capital market (e.g., by issuing shares or bonds). The regulatory changes may result in banks in Poland moving away from low-margin and riskier products. This may result in a worsening of access to credit for small- and medium-sized enterprises (SMEs), which are the driving force of any economy (Angelkort and Stuwe 2011). In order to counteract the reduction of bank financing for SMEs, the EU has introduced some additional provisions within the CRD IV/CRR package. One of these is reduced capital requirements for credit risk related to exposures to SMEs. It has been agreed that capital charges to banks for SME exposures will be reduced by applying a support factor of 0.7619 to encourage banks to lend to this group of companies.

5 The Impact of New EU Regulations on the SME Sector in Poland

The establishment of a capital union will have a particularly important impact on the SME sector in Poland. It can be expected that the capital union will provide SMEs in Poland with easier access to capital. On the one hand, it can be assumed that it will contribute to an increase in the inflow of foreign capital to Poland; on the other hand, a more dynamic development of the capital market in Poland and facilitated access to that market for SMEs can be expected. The increase in the inflow of foreign capital to Poland will be supported primarily by uniform rules for the assessment of companies (credit scoring), stimulating the development of the market of Venture Capital Funds (VC) through their financial support with EU funds, as well as unification in terms of taxes.

The development of uniform rules for the assessment of companies will facilitate a comprehensive assessment of investors' situation and enable comparisons to be made in terms of investment profitability. This will increase investors' interest in seeking effective capital allocations throughout the EU and not only in their own country. Therefore, small- and medium-sized enterprises operating on the market in Poland will also enjoy greater interest. It can be expected that many of them will receive additional capital support from foreign investors. Currently this support is at a very low level. Only 6.37% of SME investment outlays are funds from foreign sources (European Commission 2018a). The EU is considering the creation of central databases on SMEs of a similar nature to the central credit register—AnaCredit Project (Analytical Credit Datasets) created by the ECB and national central banks from the euro area and several from outside the euro area. The AnaCredit Project is a database of data and national credit registers. It provides, inter alia, detailed information on the availability of credit for companies, including SMEs (European Commission 2018a).

Stimulating the development of the market for VC funds operating in the EU is a crucial issue for SME financing. An important problem in the development of the VC market in all EU countries is the scarcity of capital that flows to these funds from investors (institutional and individual). Despite the introduction in 2013 of the European Venture Capital Fund Regulation—EuVECA (European Commission 2018b), which established a single rulebook for this type of funds (which was intended, inter alia, to encourage EU citizens to invest in EuVECA funds), the development of the market for venture capital funds is still insufficient to effectively meet the needs of SMEs. Only 12% of SMEs in the EU benefited from funding under VC funds in 2018 (a similar level was observed in previous years, i.e., in 2017 and 2016) (European Banking Federation 2019). In Poland, in the period 2015–2017, VC funds supported only 48 enterprises (the total value of support amounted to EUR 0.2 billion) (European Commission 2018a). On April 10, 2018 the EC and the European Investment Fund launched a pan-European venture capital funds-of-funds programme (VentureEU) to increase investment in innovative start-ups (pan--European venture capital funds-of-funds program) (European Commission 2018b).

The EU plans to allocate € 410 million to support VC funds. This is expected to double the amount of venture capital available in Europe (European Commission 2018b). Therefore, more interest of VC funds in Polish SMEs can be expected.

The introduction of tax unifications, including unified tax reliefs, will foster the realization of foreign investments, including the inflow of capital to Poland. Although issues related to the development and implementation of common tax regulations seem unrealistic, any unification in this respect would make it easier for investors to make decisions on investing in SMEs operating on foreign markets. On December 11, 2017, the EC published new tax guidelines to facilitate the operation of investors in foreign markets (European Commission 2019a), and on December 18, 2017 the EC launched a public consultation on building a proportionate regulatory environment to support SMEs (European Commission 2017). Among the proposed tax incentives are ideas to differentiate tax rates on profits from funds deposited in banks on deposits and profits generated by capital market investments.

It can be expected that the capital market union will encourage more dynamic development of the capital market in Poland, which will result in numerous facilitations for SMEs in accessing this market. First of all, it can be expected:

- reduction of costs connected with drawing up prospectuses,
- increase access to the private placement market for SMEs,
- to make the corporate bond market more accessible to SMEs,
- increase bank financing for SMEs due to the development of bank securitization transactions.

One of the significant barriers to SME access to the capital market is the obligation to draw up a prospectus in its current form. The costs of drawing up the prospectus are perceived by SMEs as too high. The EC proposed to limit the scope of information presented in the prospectus and to streamline the approval process, as well as to change the ceiling of exemptions from the obligation to publish the prospectus. The introduction of changes aimed at reducing costs related to the development and publication of the issue prospectus would contribute to increasing the interest of companies in raising capital directly from the capital market.

From the point of view of SMEs, it is very important to develop private placement markets, i.e., markets that enable raising capital by selling securities to one or a small group of investors (outside the public market) and a pan-European private placement system. Raising capital through private placement is a cheaper and quicker way to raise capital compared to raising capital on public markets. The EC envisages standardizing the private placement process itself as well as the documentation relating to the creditworthiness of issuers (European Commisssion 2015).

One of the capital market segments in Poland, which is characterized by a low level of development, is the corporate bonds market (from the point of view of SME financing, it is important only for mid-cap companies). The European corporate bond market is characterized by a low level of standardization and price transparency (European Commisssion 2015). The EU is considering harmonizing at EU level the rules for obtaining and enforcing enforcement titles related to claims in the event of late payment of benefits under corporate bonds (this would be the case for covered

bonds introduced into an organized trading system) (European Commission 2019b). This would also require the unification of regulations at national level, so as to allow for the segregation of bond collateral from the bankruptcy estate. The introduction of such guidelines in Poland would increase the effectiveness of the collateral enforcement system and thus increase investor interest in corporate bonds.

It is also important from the point of view of SME financing in Poland to create a sustainable securitization market that would be based on simple and transparent securitization instruments. Such a market would provide a bridge between banks and capital markets and would enable the transfer of risk from the banking sector to the capital market, which in turn would increase banks' ability to grant loans (European Commisssion 2015). The EC proposes to implement the so-called "simple, transparent and comparable" standard of securitization, called "high quality securitization" (previously this concept was developed by the European Central Bank) (ECB 2019a, 2019b).

6 Conclusion

The analysis of the impact of new EU regulations on the financial market in Poland allows us to conclude that this impact is positive. Banks take less risky actions, which increases their security. What is more, the need for banks in countries operating outside Poland to meet the new EU guidelines makes it possible to reduce the so-called risk of contagion, which additionally increases the stability of the financial market in Poland. The established banking union also contributes to reducing this risk. The costs of introducing new regulations did not significantly affect the profits of banks. The banking sector in Poland is one of the most profitable sectors. Banks have no problems with financial liquidity.

The capital union is a particularly important project for SMEs operating in Poland. It creates an opportunity to increase SMEs' access to capital. Additionally, increasing available sources of financing should result in lowering the costs of capital acquisition by SMEs. The implementation of the capital union creates an opportunity to increase the inflow of foreign capital to Poland (due to the introduction of uniform rules for the assessment of enterprises, as well as certain uniforms in terms of taxes and financial support for VC funds). In addition, the establishment of the capital union is an opportunity to stimulate the development of the capital market, especially its segments such as private placement or corporate bonds market. It can also be expected that access to bank loans will increase for SMEs as a result of the development of bank securitization transactions. Full benefits for SMEs in Poland resulting from the new EU regulations will be visible only in the long run. Full implementation of the banking and capital union, as well as full implementation of all regulations developed at the EU level, will take time.

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Part III
Economics of Innovation

Implementation of Productivity Apps to Increase Financial Inclusion in Peer-To-Peer Lending Platform

Florentina Kurniasari

Abstract Peer-to-peer lending (P2P lending) is growing rapidly in Indonesia in line with the advanced of digital technology. This new platform is expected to support the Indonesian government strategy in increasing financial inclusion. Although the new platform is easily accessible using the mobile phone, some Indonesians are still reluctant to use the apps by themselves. There is an urgent need of human touch to educate and give appropriate information about the system. The role of direct sales agents of the P2P lending platform is key to gaining the trust of the prospective borrower. The P2P lending platform must be able to develop and implement apps to monitor activities and increase productivity of its direct sales agent. The purpose of this research is to analyze the implementation of sales management activity apps to increase the productivity of the direct sales agent, simplify the application procedure, shorten the approval time, and finally increase the financial inclusion in Indonesia. The object of the research is MODALKU, one of the largest P2P lending platforms in South East Asia. The target user of the apps is all the direct sales agents who are approaching prospective borrowers from the ultra-micro segment market. The result of the research showed that the direct sales agents play an important role in educating the prospective borrower in using the technology and explaining the benefit of the loan application in supporting their businesses.

Keywords Productivity Apps · Direct Sales Agent · Ultra-Micro Segments · Peer-to-Peer Lending Platform · Indonesia

F. Kurniasari (✉)
Technology Management Department, Universitas Multimedia Nusantara, Tangerang, Indonesia
e-mail: florentina@umn.ac.id

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1 Introduction

The advance of information technology has encouraged the increase of innovation in many business and financial sectors (Lestari 2015). Financial technology is an innovative digital financial technology that offers financial services using information technology. Peer-to-peer lending (P2P lending) is a form of crowdfunding without involving any financial institution as the intermediaries (Cinca et al. 2015) using an online platform (Ritter et al. 2009). The P2P lending platform offers flexibility to both parties: lenders and borrowers (Meng 2016). The lenders, as investors, expect a higher return from their investment in a P2P lending platform (Egbunike et al. 2018). Meanwhile, the borrowers can take advantage of the low transaction cost.

The financial technology is expected to fill the gap of financing needs and increase financial inclusion for Indonesians who were un-bankable but had potential business. The financial technology could be seen as an alternative source of financing (Abd Hamid et al. 2018) especially for the ultra-micro segments to grow their business. The ultra-micro segments are characterized by their low daily income sales, doing business in densely populated housing areas, and having simple self-owned trading business. In the year 2018, the total financial technology market in Indonesia reached US$ 22 million, increasing at the rate of 16.3% yearly, in which lending occupied 31% of the total industry (Fintechnews 2018). Therefore, there is a huge potential market for P2P lending platforms in Indonesia. While the latest financial technologies are continually being introduced, the target number rate of the financial inclusion did not keep as the same pace as possible on such changes.

Indonesians still have reluctance in using mobile phones for doing financial transactions, including the lending and borrowing activities. Indonesians have always been communal, keeping close-knit communities, and the cultural values push forward principles of collectivism (Minkow 2013). Even in modern settings and modern communities, they will keep their inclusivity and friendliness (Dellner 2014).

The P2P lending platform relies on the direct sales agent to educate, to give appropriate information about the financial technology platform, and to sell the product itself. The role of direct sales agents of the P2P lending platform is key to gaining the trust of the prospective borrower. The P2P lending platform (Modalku) needs a system that can monitor activity and expedite the product ordering process. The existing work-flow process in Fig. 1 shows that no activity management tools or application to measure the direct sales productivity. The management team has difficulties in monitoring and controlling the direct sales agent in approaching new customers. There is some lack of data that can show the condition of prospective customers. Besides, the procedure to process the application takes a long time. There is an inefficient and process that can affect sales productivity performance.

Therefore, the P2P lending platform must be able to develop and implement apps to monitor activities and increase productivity of its direct sales agents. The purpose of this research is to analyze the implementation of sales management activity apps

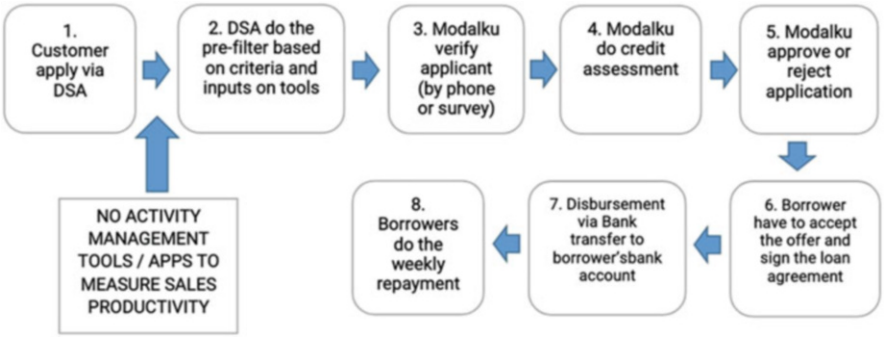

Fig. 1 Flow Process (Current)

to increase the productivity of the direct sales agent, simplify the application procedure, shorten the approval time, and increase the number of borrowers which will finally increase financial inclusion in Indonesia. The research is trying to analyze the importance of the direct sales agent's role in the P2P lending platform. The P2P lending platform is one of the financial technology platforms which highly uses the technology in doing the financial services. In Indonesia, the P2P lending platform's success must be supported by the direct sales agent who becomes an educator for the prospective customers in explaining the usage and benefit of the medium itself.

2 Literature Review

2.1 Peer-to-Peer Lending

Financial technology is defined as mobile-based technology to increase financial system efficiency (Kim et al. 2015). P2P lending is defined as all lending and borrowing activities among individuals using a technology platform without any intervention from a traditional financial institution (Ritter et al. 2009) and related to the internet-based financing platform (Stern et al. 2017).

2.2 Ultra-Micro Segment

Ultra-micro segment is the backbone of the Indonesia's economic growth. There are more than 50 million small- and medium-sized enterprises (SMEs), but many of them do not have adequate access to banks (OECD 2019). Most of SMEs are located in the urban areas of Java and Sumatra, where the Indonesian population is concentrated. SMEs find difficulties in growing their businesses since they usually manage the business in more conventional ways. The limited resources of the SMEs (especially in financial) are also one of the obstacles to make their business competitive.

When applying for loans they won't be able to provide collateral to formal financial institutions such as banks. Therefore, they have difficulties getting financing from the banks to make their business grow bigger in the future.

2.3 MODALKU

Taking advantage of the emergence of smartphone and mobile subscribers, peer-to peer lending platforms such as Modalku see an opportunity to capture this prospective market. The new Targeting the ultra-micro segment, Modalku focuses in serving and providing loan for the ultra-micro segment located in the big municipalities in Java provinces. To minimize the risk and reduce the default rate, the first applicant can only borrow a maximum of three million Rupiahs with a loan tenor of 13–26 weeks. The repayment system is setting-up weekly every Wednesday to their virtual account that can be paid through some appointed POS, such as: minimarket. There is a 3% interest rate per week and an additional 5% administration fee for any approved loan application. The borrower must provide the bank account since the loan disbursement will be transferred directly to their account.

2.4 Direct Sales Agent

An innovative strategy was developed by using the direct sales agents (DSA) system in approaching the new lead prospective customers. Even P2P lending system is highly emphasized with the technology application and platform, Modalku chose to combine the existing system with the direct selling strategy. Direct selling defined as a distribution method that can be used both for product or service industries through personnel contact (Yen et al. 2008). In his book *Marketing 4.0*, Phillip Kotler states that the marketing strategy should adapt to the changing nature of customer paths in the digital era and the role of marketers is to guide the customers throughout their journey from awareness and ultimately to advocacy (Kotler et al. 2017). The DSA of Modalku is expected to give adequate information about the product and the platform while influencing the prospective borrower to apply for the loan. The DSA act as an educator who will explain the benefit of the product to increase the borrower's business performance.

2.5 Mobile-Based Applications

A mobile-based application is defined as a type of application software designed to run on a mobile device. The mobile application itself can utilize data from the GPS to ensure the direct sales agent. The mobile application also has the facility to read the

item barcode using the camera to accelerate all necessary information and data input. By using this mobile application, Modalku management can easily monitor their sales agent's activities when meeting with the prospective customers in the exact location and at the same time having adequate knowledge about the business of prospect borrower. The mobile-based application provides real-time information accurately and shortens the application processing time. The apps make it easier to handle the whole application process, increase efficiency, improve customer service, and increase the approval rate. The mobile-based application system's benefits are easy coordination among the team members by sharing information and data accurately; keeping tracking of the application process; simplify the reporting system, and allocating the resources.

2.6 Global Positioning System (GPS)

As a global navigation satellite system (GNSS), GPS is able to provide the geolocation and time information to any GPS receiver in the earth (Abel and Chaffee 1991). A mobile-based application with the GPS feature enables the management to track in real time (live) all the movements of the sales agents directly from the computer or laptop. The GPS shows which streets or areas were covered by the sales agents and the suitability with the target performance for each sales agent.

3 System Design

Developing sales productivity application for Modalku needs some phases which should be performed. The application system should be able to cover the need to monitor the performance of the direct sales agents, including the attendance system, the work-plan, live tracking, and reporting. Figure 2 shows the system design used in the sales productivity apps, called The Worm.

Figure 2 shows the design of The Worm system. The string message sent by the user (direct sales agent) is transmitted to the back-end of the system through the Internet and some text pre-processing steps are performed. All form of database query will be delivered to the web server Modalku. The knowledge structure, which is shown in the Worm application, is obtained from interviews with the Modalku management team. The features of The Worm consist of four main subjects: check-in, planning, reporting, and live tracking.

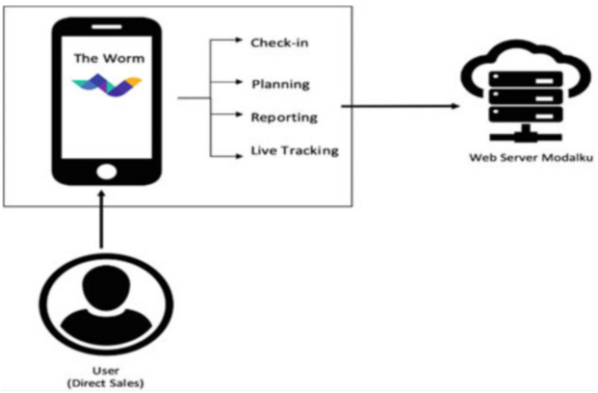

Fig. 2 System Design. Source: Kurniasari and Prihanto (2019)

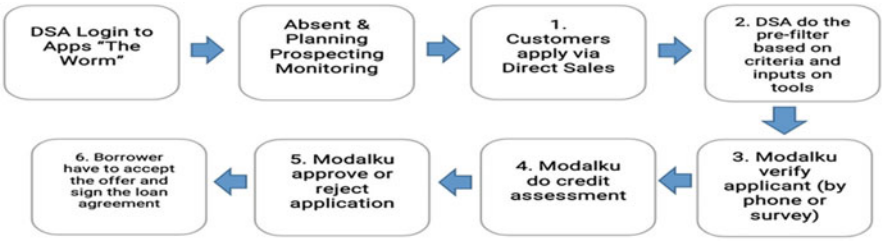

Fig. 3 Flow Process (New)

4 Implementation

The implementation of the new application "The Worm" is changing the flow and business process of Modalku in acquiring new customers (see Fig. 3). The new application shortens the business process in measuring the performance of the DSA. The DSA are able to download the Worm apps easily and log in through their smartphone. The Worm enables them to record their attendance directly. By recording their attendance via apps, the DSA do not need to go to Modalku office every day. DSA are also able to inform and give the reason to the office about their absence in the Worm apps. The new apps reduce the time needed for them to go to the office. They can start visiting the prospective customers as soon as possible during the office hours that start from 8 a.m. The apps system allows them to acquire more prospective borrowers and allocate their time to visit the existing borrowers. All the DSA activity will be recorded real time and the Modalku management have the opportunity to monitor directly. Managing the time efficiently, the DSA have the opportunity to fulfill the target of new borrowers. If the DSA find any difficulties in achieving the target, the Modalku management is able to respond and solve the problem in a speedy manner.

The Worm application is developed as an integrated system to monitor the productivity of the DSA as users. Shortly after users launch the application, The Worm logo in the splash screen will be displayed. Before logging in to The Worm system, all DSA have to complete and fill in their profile which consists of personal data, password, and the sales coverage area (Kurniasari and Prihanto 2019).

The menu provided in this application is the check-in menu for the DSA. As the first feature in The Worm, this feature describes the activity of DSA to check-in. After take a photo by the camera in their smartphone, the DSA must tag their location. Using GPS, the system will be able to live-track the exact position of each DSA. This feature records the position of the DSA and compares it to the prospective borrower's location. If the location of the prospective borrower is not in the sales coverage area, the system will automatically reject the check-in process. This system is expected to assist the Modalku management in supervising the DSA assigned to visit both the prospective and existing borrowers. The system will describe each DSA performance to fulfill the assigned daily target visit (Kurniasari and Prihanto 2019).

In the planning features, the Modalku management creates the target assigned for each DSA daily. Modalku will use the Worm application to ensure that all DSA has fulfilled the target to visit the borrower according to the Modalku team's schedule. The feature describes the prospective leads/borrower target, the prospective apply mark, and not the apply leads target. Each DSA has to explain if they fail to meet the target (Kurniasari & Prihanto, 2019).

The next feature of the application system is recording data from new leads (prospective borrowers). Each DSA must fill in the personal data of the new lead, including the personal and business name and also the address of the business. Using GPS, the system will show the live tracking of the exact location of the business. A new lead who is interested to apply for loan will proceed to the next process and apply online through the DSA sales application (Kurniasari and Prihanto 2019).

The final feature describes the reporting system of each DSA daily activities. The reporting system give detail information of each DSA in fulfilling the target number of borrowers. This feature gives benefit for both Modalku and the DSA themselves. For Modalku, the number of prospective leads who are finally able to apply for loan will show the ability to increase the company's performance. Each DSA must write down the visit's results and explain the reason in details why the prospective leads are not interested in applying for loan. If the DSA missed the target, Modalku is able to assist the DSA in solving the problem and initiates some strategies to improve their performance. The system is able to describe the data of all lead borrowers in real time and the live tracking will enable them to evaluate the business performance of the prospective borrowers. The system summarizes the data of DSA activities every day (Kurniasari and Prihanto 2019).

Meanwhile, the reporting system enables the DSA to evaluate their performances and their financial reward if they meet the target. It will also motivate them to work harder to fulfill the target. Since all data are automatically recorded, the DSA will re-approach the lead borrower who is not interested in applying for the loan in the future. A changing new approach can be developed to successfully acquire more lead borrowers (Kurniasari & Prihanto, 2019).

5 Conclusion and Future Works

The Worm application for the peer-to-peer lending industry in Indonesia has been successfully developed and implemented in Modalku. Users (DSA) are able to have the data and information which are divided into four categories: Check-In, Planning, Reporting, and Live Tracking. The system is expected to enhance the performances of both DSA and Modalku to achieve and support the mission in increasing financial inclusion in Indonesia. The application system simplifies the administration process by giving live tracking location of the DSA and the prospective lead businesses. The usage of technology would be free of effort and less time-consuming for the DSA in inputting the borrower data. GPS sensor that is available in the system enables the Modalku management team to monitor activities of DSA accurately and maintain the company's competitiveness (Utomo and Budiastuti 2019).

Even though the new system brings more benefits for Modalku and DSA, it still needs some development in the future. Future development should cover the integration of both the Worm and the application process. The new application's success should be evaluated by measuring the perceived usefulness and ease of use (Sunny, Patrick, and Rob, 2019) using the Technology Acceptance Model (TAM) approach.

The new system is expected to increase the number of new applicants from the ultra-micro segment interested in borrowing loans from Modalku as a Peer-to-Peer lending platform. The approval loan can be used to growing the business. The new system is also aligned with the Indonesian government's objective to increase the financial inclusion for the countries' ultra-micro segments. Furthermore, the new system can be replicated and used in other financial technology platforms to deal with the prospective borrowers that combine the human and technology approach simultaneously.

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Measuring the Importance of Churn Predictors in Romanian Telecommunication Industry

Andreea Dumitrache, Stelian Stancu, and Madalina Stefanet

Abstract Telecommunication sector is a saturated market, and each client's action affects the company profit. The most valuable asset of the telecommunication company represents its clients' database. The Telecom industry pays special attention to the migrant clients because from an economic perspective, the cost invested by the company in the acquisition of a new customer is higher than the cost of keeping an existing client. This paper aims to determine the most important factors that influence the decision of a client to migrate from a telecom provider to another through a graphical method. We apply the churn prediction model on a dataset from Romania that has not yet been studied before. We choose to use the Balanced Random Forest technique to build the churn prediction model and the AUC coefficient to evaluate it. Permutation importance makes a classification of the most important features in the model and measures their impact through a metric called the importance score. The result proves that the most significant three factors in the churn phenomenon (client migration) are the number of months since the last change in the account, the number of minutes off the network and the invoice cost, a significant difference in score, the first the indicator being ten times more important than the next one. Therefore, we can state that we can resolve the main action by resolving the churn problem on the current dataset solved by monitoring and evaluating these variables.

Keywords Churn Predictors · Permutation Importance · Telecommunications · Romania

A. Dumitrache (✉) · S. Stancu · M. Stefanet
Department of Cybernetics and Statistics, University of Economic Studies, Bucharest, Romania

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1 Introduction

An important problem that affects the business of telecommunication companies is represented by migrant customers. Due to the saturated markets, there is a fierce competition and its dynamic conditions and the continuous emergence of new and more competitive offers lead to the transformation of customers into something like chocolates for children according to Blattberg et al. (2010). Telecommunication is one of the most affected sectors by this consumer behavior. The telecommunication churn has grown with the emergence and widespread usage of portable mobile phone numbers. In Romania, the National Authority for Administration and Regulation in Communications (2017) draws a picture of the migration phenomenon of clients from one telecommunication company to another. This shows that over 30% of mobile phone users have transferred their phone number at least once during the period under review (2008–2016) since launching this program.

This paper aims to determine the causal factors of churn in the telecommunications industry. The multitude of papers published over the last 10 years on customers migrating from a telecom service provider to a competitor proves that this issue has become a major concern for this industry and beyond. To solve this problem, we need to identify the root of the problem by determining the factors that influence this behavior. With this aim, we use a method of classifying the indicators analyzed according to their importance in the churning pattern. Permutation importance achieves this classification of the importance of the model characteristics by randomly permuting the values of the trained indicators and measuring the average increase in relative errors. Apart from the proper enumeration of the features according to their importance, we can quantify the results, meaning that the measurement of their importance is of the utmost importance. The importance score generated by the same technique will match our metric study.

The paper contributes to the literature by combining and applying two methodologies from two different categories of data analysis: classification methods, Balanced Random Forest and technical agnostic model, Permutation Importance. The paper also presents a very broad subject studied in the literature, but still very poorly studied on the Romanian datasets: churn prediction in telecommunications.

There are several ways to measure the importance of indicators, but to optimize all resources and for easy visualization and quick understanding of the results, we need a newer, widely used and fast performing technique, such as permutation importance. So far, the application of this method to Romanian datasets has not been the subject of published articles. Managing the chinking characteristics will be done graphically, using the thermographic paper, which shows the important measures of the features in the dataset. Thus, a classification of causal factors is automatically generated in the churning pattern, depending on their informative power.

The paper is composed of five parts. The first part describes the problem studied, the purpose of the work, and some small details about the usefulness of the technique applied on the churn model. The second part describes a brief passage through the

specialized literature is presented. The third and fourth chapters of the article discuss the applied methodology and the results obtained, and in the last chapter are determined the main ideas of the conclusions drawn.

2 Literature Review

The prediction of the churn and the determination of the main characteristics of influence in this issue is becoming an area increasingly scrutinized worldwide. Businesses want to keep their customers satisfied by observing their needs based on resource constraints. In churn prediction, an important but challenging question is the imbalance in the data distribution. Yaya et al. (2009) approach a new learning method called Balanced Random Forest to deal with the churn problem for a Chinese company where data are unbalanced and rarely sampled. The traits are iteratively taught by altering the distribution of the class and by imposing greater sanctions on the wrong classification of the minority class. They find a significant improvement in prediction accuracy compared to other algorithms, such as artificial neural networks, decision trees, and vector support machines.

Achawanantakun et al. (2015) deal with unbalanced data and choose Balanced Random Forest because this method contains multiple random trees and each one is built from a subset of training data. Balanced Random Forest allows the model to learn from unbalanced training data. Data science techniques are becoming more and more popular because they are dealing with the big problems of behavioral prediction.

In the churn issue, it is essential to know and measure the importance of the main variables and not only of the forecast models to identify which indicator brings informational value and which variables in the dataset can be discarded. All this can be achieved by means of the importance of permutations, the selection of variables and the derivation from schemes, Strobl et al. (2008).

The measurement of the impact of the factors analyzed is the most useful tool for interpretation, and data scientists regularly examine the model parameters to identify the most important features. The importance of permutation can be applied to any model, though few machine learning practitioners seem to do so. The importance of permutations is a common, reliable, and very efficient technique. It directly measures the importance of indicators by observing their net effect on the precision of the random mix of each variable in the prediction model, Parr et al. (2018).

Gregorutti et al. (2015, 2017) describes the importance of permutation and concludes that the permutation mechanism is far more expensive than the average decrease in the impurity mechanism, but the results are more reliable. The strategy based on permutated importance does not require re-modeling after the permutation of each column, but we only should resume the test samples disturbed by the already trained model.

We can use permutation importance to classify or select predictions. Over time, among other criteria, the measurement of permutational importance shows good

tracking of selection algorithms. However, the classification of characteristics according to their importance is a difficult problem, especially when predictors are very correlated. The results of the simulation study by Nicodemus and Shugart (2007) show that the ability of the permutation to detect predictive variables in large datasets is more reliable than alternative learning machines.

Strobl et al. (2008) present on a theoretical level the applicability of the technique studied in this paper over the entire characteristic space, to illustrate the effect of all the variables in the model. Nason et al. (2004), however, tested permutation significance on only two categorical variables in the dataset. Baptiste et al. used the permutations of an additive regression model to describe how the correlation between predictors influences the importance of permutations. They use two algorithms. The first calculates the measures of permutational importance in the complete model that produces a ranking of variables, the algorithm proposed by Gregorutti et al. (2017) and applied for the first time together with Random Forests. It keeps this ranking unchanged. Guyon et al. (2002) propose a second algorithm based on the context of vector support machines (VSM), founded in the literature as Recursive Feature Elimination (RFE).

Genuer et al. (2010) study the sensitivity of the measure of permutational importance when dealing with a multitude of parameters and the sensitivity to the number of correlated variables. They note that the technique performance depends on the correlation of the indicators. Auret and Aldrich (2011) confirm these observations. Archer and Kimes (2008) believe that the Gini measure is less capable of detecting the most relevant variables when the correlation increases and states that the same holds for the importance of permutations.

Tolosi and Lengauer (2011) identify two key correlation effects on the permutations of importance: first, the values of the least correlated variables are not necessarily higher than the least discriminating variables and, second, the extent of the permutation depends on the size of the correlated groups.

3 Methodology

We want to predict important characteristics in the consumer's decision to migrate to another supplier or not. Our data include useful features, synthesized in 15 indicators, such as the number of months since the last bid, the number of months since the contract change, the time frame in the company, the contractual typology, the average value of the three-month invoice, the amount of the additional cost, consumed, expressed both quantitatively and in percentile, the sum of minutes received outside other networks, home environment, age, sex, and target variable, CHURN.

Data processing comprises the following process: for all non-numeric variables, we make One Hot Encoding. This technique consists in reconstructing the categorical variables in the dataset, transforming them into numerical indicators. Random reorganization of a single indicator should generate less accurate predictions because the resulting data no longer correspond to the observations so far. If we combine the

information from a column on which the model strongly relies on predictions, the accuracy suffers. Applying and generating the classification of indicators according to their importance in the churn problem, their importance score consists of three steps:

1. Build a predictive model. In this case, we applied a Balanced Random Forest on the validation set, the entire set of data being divided into 75% validation set and 25% test set. This model is based on decision trees and uses two key concepts:
   (a) A random sampling of training information points during the construction of trees: every tree is trained by a random data sample. The samples are replaced by a bootstrapper which implies that many samples are used in one tree several times. In order to obtain a lower variance for the entire forest with no cost for increasing the bias, each tree is trained on different samples having into consideration that they could have a higher variance individual, however, not affecting the general result of the forest. In test phase, predictions are calculated by average each decision tree prediction. This procedure is known as bagging – bootstrap aggregating.
   (b) Random feature subsets considered when dividing nodes: another main concept in the random forest is represented by just one subset of all the features that are considered in splitting each node into each decision tree. We can also train random forest, by presuming that all the features at every node as is common in regression. We get a model performance coefficient, measured by AUC, of 0.708. We cannot consider the model correct; however, it passes the acceptance criteria, because the value is very close to the minimum limit, 0.7. The model consists in several instantiated iterations equal to 1000 and has the CHURN indicator as the target variable.
2. Apply the permutation importance algorithm on the trained model. Permutation Feature Importance produces a random feature column that evaluates the input model's performance on the altered dataset. Iterating is done one by one for each column of the function. The module then returns a list of variables and their respective values. The value is described as the efficiency decrease after the functional values have been changed. The *PFI* scoring is simply described as:

$$PFI = Pb - Ps \tag{1}$$

where *Pb* is the basic score, and *Ps* is the metric score for results after shuffling when the measuring metrics used are measuring how precise the predictions are (which is when bigger values like accuracy, precision, determination, etc.). If, however, the evaluation metric used is an error/loss metric (such as Root Mean Square Error, Log Loss, etc.), then the score is defined as:

$$PFI = -(Pb - Ps) \tag{2}$$

Thus, no matter which metric is chosen within the module, a higher value implies the feature is more important. It blends the values in a single column and then makes predictions using the resulting dataset. Using these predictions and actual target values, we calculate how much the loss function has suffered. The performance deterioration measures the importance of the damaged variable.

3. Return the data in the initial order, disabling the blending from step 2, then repeating step 2 with the next column in the dataset until the importance of each column is calculated according to how much the loss function affected the deterioration of each indicator. This importance is measured by a score, named in the importance score.

Interpretation of the results is based on two sources: the generated graph, where all the features of the predictive model are represented, a graphical representation of the ranking of the most important traits of the churn behavior, in our case, and the table of importance scores assigned to each variable in the model. Interpretability will be downward, as we lower the gradient of the graph, the fewer indicators bring less and less information, the lower part counting the least. The scores in the table below show how much the performance of the model has decreased with a random move, in this case using precision as the performance metric. Negative values generated by permutation significance show that mixed data predictions were more exact than actual data. This happens when the pointer does not matter and is more common on small sets of data.

4 Results

The precision metric we will use is the ROC curve and, implicitly, the AUC. As mentioned above, the value of the coefficient is low, 0.708 (Fig. 1), showing a low discriminating power, which makes it difficult for a clean and accurate prediction of the churn phenomenon.

The prediction model of churn determined by Balanced Random Forest correctly predicted 56% of non-churn clients and 70% of churn clients, according to the normalized confusion matrix (Fig. 2 and Fig. 3).

We note that of all fifteen indicators used in modeling, the most important in forecasting churn behavior is the number of months since the last change in the account (MonthsO), the number of minutes off the network (MinC), the invoice value (Invoice), the male individuals (Gender_M), and the age of the clients in the network (Tenure). These are the only variables located on the right of the axis (Fig. 4), which means that these are the characteristics that most discriminate against the churn and non-churn situation. We can consider the left ones as damaging variables to the model because it is more than clear – when they are randomly permutated – that they tell us nothing about churn/non-churn. Besides, their presence can lead to a misleading model.

MonthsO, besides being the main decision-maker in churn, is about ten times more important than the MinC. This can be remarked from the assigned importance

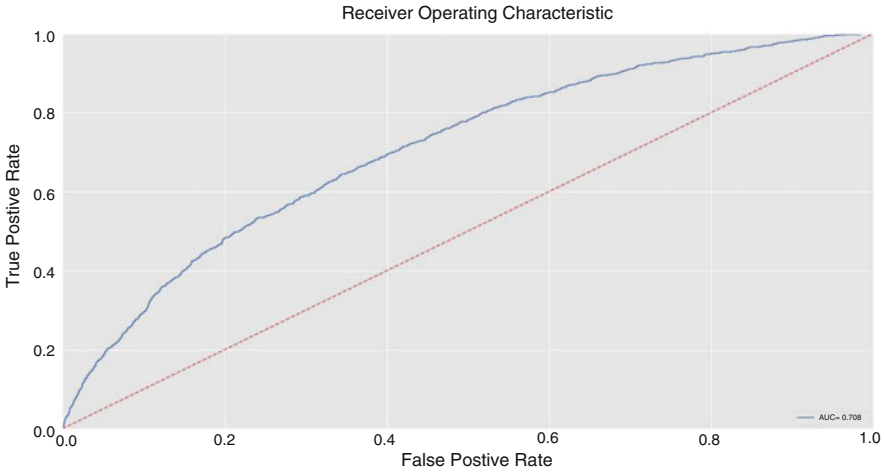

Fig. 1 ROC Curve. Source: Authors' own research

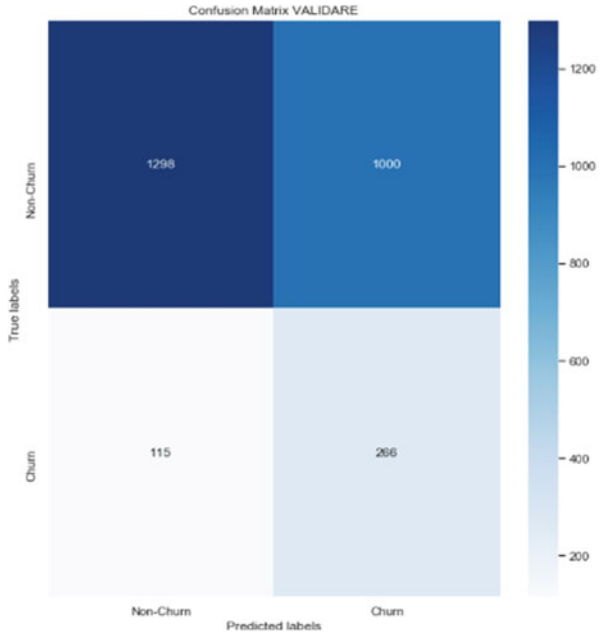

Fig. 2 Confusion Matrix. Note: It presents the quantitative results of the prediction model: 266 observations classified correctly from the churn class and 1296 from the non-churn group. Source: Authors' own research

scores, MonthsO has a score of 0.102301, while the MinC shows an importance score equal to 0.013080. Important scores (Table 1) are calculated according to delta,

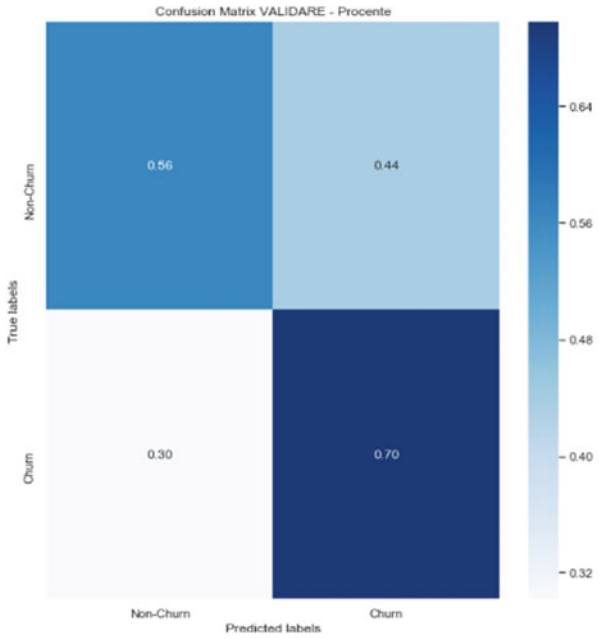

Fig. 3 Confusion Matrix. Note: It presents the percentage results of the prediction model: 70% of the observations correctly classified from the churn class and 56% from the non-churn group. Source: Authors' own research

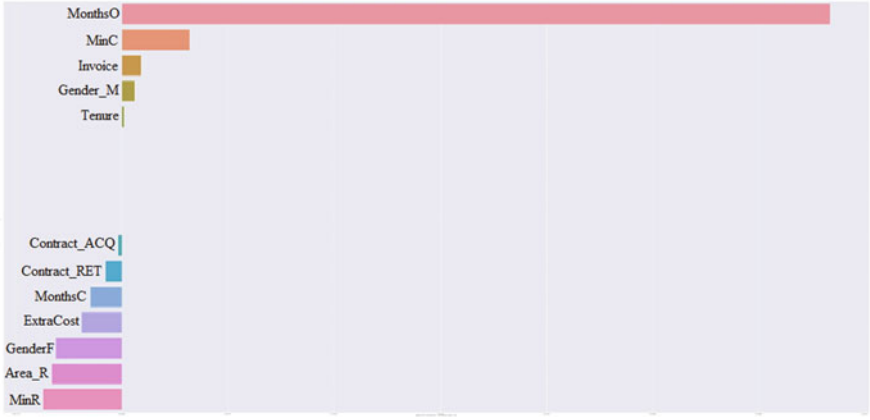

Fig. 4 Permutation Importance in Churn Prediction. Note: The figure shows the degree of importance of the indicators in the model. The longer the line, the greater their importance. The location of the markings on the right shows a positive importance in the predictive model, and on the left a negative one. Source**:** Authors' own research

Table 1 Importance Scores

Feature	Importance Score
MonthsO	0.102301
MinC	0.01308
Invoice	0.005908
Gender_M	0.002189
Tenure	0.001167
Age	0.000215
Area_urban	0
Contract_ACQ	0
Contract_RET	0
MonthsC	−0.000663
ExtraCost	−0.000877
Gender_F	−0.001093
Area_rural	−0.001093
MinR%	−0.002217
MinR	−0.006522

Source: Author own research

f1-score. If this indicator is bigger, represents that the variable became a better discriminator. Negative values tangle the pattern.

The table above (Table 1) shows the importance of the indicators in the model. Depending on the importance score, we can rank and sort the most important predictive factors in the problem of churn phenomenon in telecommunications. The sign of these values shows whether the importance of the variable to which it refers is a positive one in the prediction model or a negative one (−). Thus, we notice that the number of months since the last offer change in the account (MonthsO), the sum of the national minutes made (MinC), and the invoice (Invoice) are the first three predictive indicators that bring a positive score to the model. These can be considered as the most important predictive decision factors in the churn action in Romanian telecommunications.

As has been shown previously in other studies, the use of agnostic model techniques in the context of predictive modeling is very beneficial for understanding the drivers in the case of the studied problem. Permutation Importance is indeed a useful tool for interpretation, which identifies and generates results that are easy to see and interpret. The application of this instrument in the problem of churn prediction in the Romanian telecommunications industry clarified which are the most important characteristics in the analyzed situation. Other agnostic tools will be tested in a further study, and the dataset characteristics will be expanded with historical data.

5 Conclusion

The phenomenon of churn is a big challenge in the telecommunications market. Multiple theoretical and empirical works have tried to compare it with predictive methods and not only. In our study, we try to add another brick to this wall built from

research, namely, combating churn in the Romanian telecommunications sector by combining a predictive algorithm, Balanced Random Forest, with an agnostic one, Permutation Importance, from which the factors result in influencers of this consumer action. Thus, on the dataset, we applied Balanced Random Forest, and then, on the predictive model, we applied the agnostic model, Permutation Importance to determine and classify the most important predictive factors in the churn model of the Romanian telecom industry.

Therefore, the most important factors in the prediction of churn behavior are the number of months since the last change in the account, the number of minutes off the network and the value of the invoice, the big difference in the score, the first indicator being much more important than the other two. Instead, we observe six indicators that do not bring informative value to the predictive model, with negative scores of importance. Even if the model shows a reduced value of the AUC, permutation importance classifies causal factors generating a ranking in the importance of the indicators. Following the study, we can conclude which of the ten educated indicators bring value to the prediction model of churn and to what extent. In the Romanian context, the interaction with customers and the renewal of existing offers can be considered as the first action in resolving the churn problem, the number of months since the change of the last offer on the account is the most predictive factor in the phenomenon of migrating consumers to the competition.

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Peer-to-Peer Lending Development in Latvia, Risks and Opportunities

Irina Petersone and Ilmars Kreituss

Abstract Investment opportunities have become limited due to low interest rates; therefore, investors are searching for alternative investment sources. Peer-to-peer (P2P) platforms act as mediators between investors and borrowers and provide an opportunity for mutually beneficial interaction. The aim of the research is to study the P2P lending process and to identify risks and opportunities related to this area. The research is focused on the investors' side due to the specifics of Latvian P2P lending platforms, i.e., they do not grant loans directly but use loan originators. Mixed research methods were performed as follows: a field experiment (trial investments through P2P lending platforms), a survey, structured interviews, and a focus group discussion. The study shows that rapid development of P2P lending in Latvia is driven by providing relatively lower risks to investors. The main investors' risk mitigation tools are critical originator selection, when a due diligence procedure is executed for each prospective loan originator, buyback guarantees, and payment guarantees, when marketplaces compensate the invested principal and earned interest if the borrower is late with the repayment. Most Latvian marketplaces offer to diversify investors' risk by investing in fractions of loans across different borrowers, originators, loan types, and geographies. Some marketplaces offer loan ratings based on the internal evaluation of the risks. Secondary loan market provides liquidity to investors. However, some specific risks still exist such as the P2P lending operating model's sensitivity to adverse economic development scenarios.

Keywords Peer-to-peer lending · Crowd lending · Alternative investment sources · Investors

I. Petersone (✉) · I. Kreituss
RISEBA University of Applied Sciences, Riga, Latvia
e-mail: ilmars.kreituss@riseba.lv

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1 Introduction

The alternative finance industry is becoming a significant part of the global economy. The financial sphere is evolving along with the constant development of information technology, emerging innovative solutions in the global market, and changes in the existing business environment. The alternative finance area which, in the past few years, has also developed rapidly in the Baltic region is P2P lending.

Locally developed P2P lending platforms have become among the top-rated in Europe. Since the launch of Latvia's first P2P lending platform in January 2015, more than 2.5 billion EUR in credit investments have been made through Latvia-based platforms (LAFSA 2019). However, the financial services provided through P2P lending platforms are not widely known by regular users and, like all newly introduced business solutions, they have certain risks and opportunities. Although the P2P lending industry in Latvia is developing very rapidly, there are still too many uncertainties here, the industry is under-researched, and no appropriate regulatory framework has been introduced. The study results are topical for the following reasons: bank deposit rates have dropped to a rather low level and investors are searching for alternative investment opportunities. At the same time, local banks remain conservative in granting loans; therefore, private individuals and small and medium-sized enterprises tend to turn more often to non-banking sector lenders. P2P platforms in this case act as mediators between both parties—investors and borrowers—and provide an opportunity for mutually beneficial interaction.

The aim of this research is to study the P2P lending process in Latvia and identify risks and opportunities related to this area. The main research objectives are to study P2P lending as an alternative finance tool, evaluate its regulatory basis, analyze P2P lending risks and their minimization possibilities, and assess public awareness of P2P lending. The research is focused on the investor side due to the specifics of Latvian P2P lending platforms, i.e., they do not grant loans directly but use loan originators. There is a lack of information in the literature on this kind of P2P lending marketplaces and their investors risk mitigation possibilities.

This paper is organized as follows: after this introduction, in the second section, we review the previous academic literature on banking transformation process and development of P2P lending. In the third section, we describe the research methodology. In the fourth section, we outline the results obtained from the analysis of operating model of Latvian P2P lending platforms and primary data from the survey and a field experiment. The article ends with final conclusions.

2 Transformation from Traditional Banking to P2P Lending

Currently, some signs indicate that Bill Gates's prediction in 1994, "banking is necessary, but banks are not" (Gandhi 2016), could become our reality in the next few decades. The financial area is evolving along with the development of

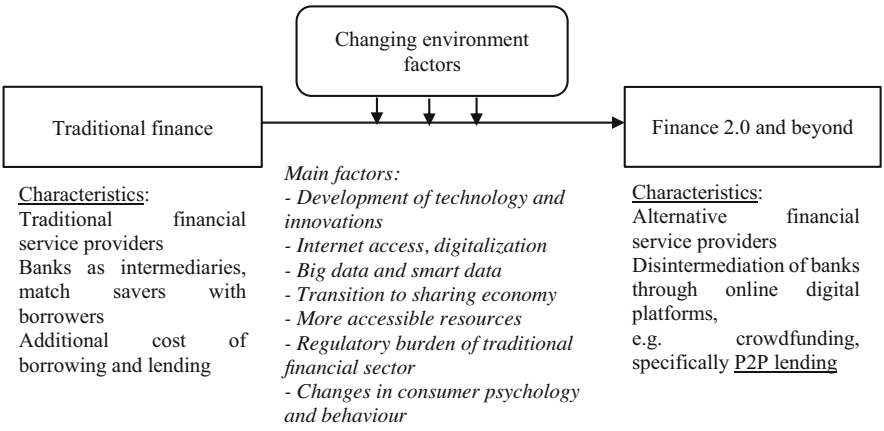

Fig. 1 The transformation process and its influencing factors. Source: created by the authors. Note: Finance 2.0—the term, by which the authors describe a transition of finance to a new stage, which is closely related to a digital transformation process and new customer behavior trends. Effective use of Big Data and Blockchain technology, as well as use of other innovative solutions, may result in revolutionary shift to a new stage beyond 2.0

technology and the emergence of innovations. Traditional banking is in a transition process to alternative financial solutions.

There are many factors influencing the transformation process of finance. King (2013) supports the opinion that banking is in constant and unrelenting change and mentions technology diffusion and changes in customer psychology and behavior as the main factors for these changes. He believes that banking evolves from being somewhere you used to go, to something you do (King 2013). New digital online services appeared as competition to traditional bank services, for instance, P2P lending. Such a form of alternative lending refers to financial instruments and distribution channels that have emerged outside the traditional financial system (Lee 2017). Figure 1 shows the authors' visualization of the transformation process of traditional banking.

The first part of the term "peer-to-peer lending" shows that interaction between two parties in the lending process is performed without central intermediation (Milne and Parboteeah 2016). Borrowers and lenders are connected directly through digital online platforms without the participation of banks or other mediators. Kuratko (2017) calls P2P lending a "twenty-first century phenomenon." Dresner (2014) notes that P2P lending is a form of crowdfunding where lenders and borrowers bypass traditional financial institutions. This is supported by Wang et al. (2015), who explain that P2P lending is generally defined as the practice of lending funds to unrelated individuals (peers) without going through a traditional intermediary—a commercial bank. The European Commission (n.d.) defines P2P lending as a direct alternative to a bank loan with the difference that, instead of borrowing from a single source, companies can borrow directly from individuals who are ready to lend. Dresner (2014) emphasizes that investors in P2P lending "provide a specified

amount of money that is then lent in small increments to many borrowers," which ensures risk diversification. Other widely used terms: "crowdlending" and "debt-based crowdfunding," give us a hint that P2P lending is classified as a type of crowdfunding, which is an umbrella term which unites several its types (Kirby and Worner 2014).

The formation of digital online platforms began in 2005 with the objective to "democratize consumer financial services by dynamically matching individual borrowers and lenders, using technology as the enabler" (Lee 2017). Platform operation was based on the age-old idea of borrowing from friends (Kuratko 2017). The first P2P lending platform Zopa was established in the United Kingdom (hereinafter referred to as the UK) in 2005; a year later in 2006, the platforms Lending Club and Prosper started their operations in the United States (hereinafter referred to as the US), and CreditEase started its operations in China (Lee 2017). Lack of traditional financing sources during crises led to P2P lending platforms' multiplication in the last economic downturn (Kuratko 2017). During the financial crisis, banks reduced their lending activity, and in the post-crisis, low-yield environment investors started searching for new alternative ways to allocate their funds (Tasca et al. 2016).

P2P lending spreads very rapidly across the globe. Still, the UK, the US, and China are the largest P2P lending markets. According to the estimations of the consultancy agency Massolution's Crowdfunding Report, the global P2P lending market as of the end of 2015 is worth 23 billion EUR (Crowdfunding industry statistics 2016), which comprises 74% of the crowdfunding industry's estimated total fundraising volume (Fig. 2).

According to Sudip (2016), the opportunity in the global P2P market could be worth 825 billion EUR by the year 2024 and the market is anticipated to rise at a whopping CAGR of 48% between 2016 and 2024 (Sudip 2016). At the same time, Prableen (2016) predicted the global growth of the P2P lending market at a CAGR of 53% during the five-year period between 2016 and 2020.

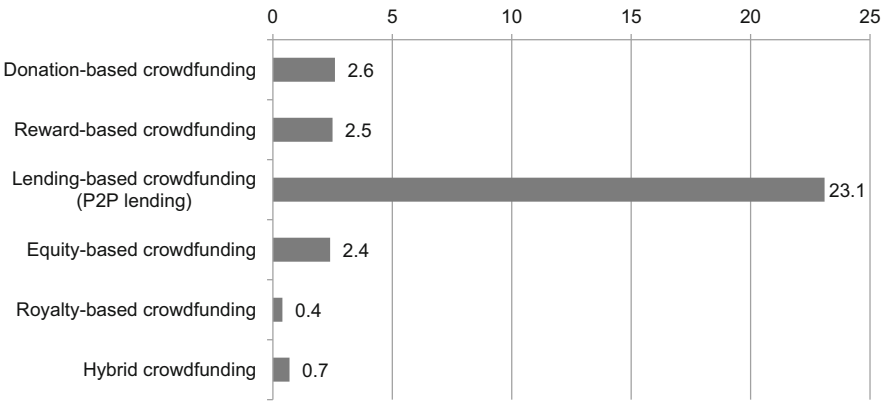

Fig. 2 Global funding volumes by crowdfunding types in 2015, billion EUR. Source: Crowdfunding industry statistics (2016)

P2P lending platforms exist in the majority of the European Union member states (European Commission 2016). The largest part of P2P lending platforms entered the market in the last 5 years (European Commission 2016). According to Ziegler et al. (2019), in 2017 the total European market grew by 36% to reach 10.44 billion EUR and the largest share of European volume originates from the United Kingdom (68%); excluding the UK, the European alternative finance market grew at nearly double the UK's annual growth rate—63% in comparison with 35% (Ziegler et al. 2019).

The top three European alternative finance markets at the end of 2017 are France (661 million EUR), Germany (595 million EUR), and the Netherlands (280 million EUR). Among other European countries, Bulgaria, Poland, and Latvia clearly stand out by annual alternative finance growth rate amounts, 781%, 677%, and 274%, respectively (Ziegler et al. 2019).

The emergence of P2P lending platforms and other alternative services is related not only to technology and innovation development, but also to the regulatory burden imposed on the banking sector. Stricter banking regulations after the crisis resulted in increased compliance costs and higher capital requirements (Basel 3, AML, CSR regulations). This influences bank product pricing and makes traditional bank loans less affordable to customers, who in their turn search for alternative funding possibilities. As a result, bank deposits become less attractive to investors, who tend to search for more profitable investment opportunities.

Walker and Degirmencioglu (2015) pointed out that P2P lending platforms significantly reduce operating costs. Platforms are digital and provide the opportunity for customers to easily access required services online. It is becoming harder for banks to compete with platforms in terms of cost, easiness of access, and rapidness of processing required services (King 2013). According to Jenik et al. (2017), the major benefits of P2P lending are convenience, efficiency, and the potential to improve access to loans for excluded and underserved groups.

The existing literature related to the P2P lending concept is discussed and classified in various research works. For example, Bachmann et al. (2011) discuss existing studies on P2P lending; Moritz and Block (2016) review and classify literature by groups (focus on capital seekers, focus on capital providers, focus on the intermediary, etc.). The authors observed that there is a lack of detailed research on P2P lending development in Latvia; a single Šetlers and Valdmanis (2016) study is devoted to the investigation of factors driving investors' decision-making within the Latvian P2P lending market.

3 Research Methodology

Mixed research methods were performed such as a public survey, structured interviews with P2P lending platform representatives, a field experiment (trial investments through P2P lending platforms), and a focus group discussion among P2P lending platform users. Secondary data were obtained by analysis of statistical

information, legislative acts, documentation, and web-page information from P2P lending platforms.

The survey was distributed via an online survey tool; the questionnaire, consisting of 30 questions divided into 6 blocks, was available in two languages: Latvian and English. Answers from 1540 respondents from 21 countries were obtained. 24.4% of all respondents were actual P2P lending platform users (investors), 30.6% of them were from Latvia, and 69.4% were from other countries. The opinions of investors and the general public were analyzed separately. The results of the survey were enriched by the focus group interview to obtain focus group participant experiences, attitudes, reactions, and comments regarding research concepts and to use this data to contribute to quantitative data from the survey.

A field experiment was performed to analyze the operations of P2P lending platforms, to get access to agreements and other investor documentation, and to analyze the impact of the selected investment strategy of the P2P lending platform on the investment results. For testing purposes, the authors invested a certain amount of funds in the two largest Latvian P2P lending platforms Mintos and Twino and tested different procedures and risk minimization tools.

4 P2P Lending in Latvia

Although the biggest share of European volume still originates from the UK, the Baltic states and particularly Latvia clearly stand out among European countries by annual alternative finance growth rate amounts and market volume per capita (Ziegler et al. 2019) (see Fig. 3).

The great reformers of Eastern Europe were also the countries that exhibited some of the highest volumes per capita (Ziegler et al. 2019) and Latvia jumped to third place in 2017, with 47.51 EUR per capita up 243% from its 2016 volume of 13.86 EUR per capita.

The pace of P2P lending development in Latvia is extremely high—more than 2.5 billion EUR in credit investments have been made through Latvian platforms by the end of the first quarter of 2019 (see Fig. 4).

The authors believe that such growth is technology and innovation-driven and expect the trend to continue, since local platforms are focusing on further expansion to foreign markets. At the time of the examination, there are 12 P2P lending platforms registered in Latvia (see Appendix 1).

4.1 Operating Model of Latvian P2P Lending Platforms

The Latvian platform model differs significantly from standard global practice and is related to specific risks for investors (see Fig. 5).

Fig. 3 The alternative finance market volume per capita by country in Europe, 2017. Source: Ziegler et al. (2019)

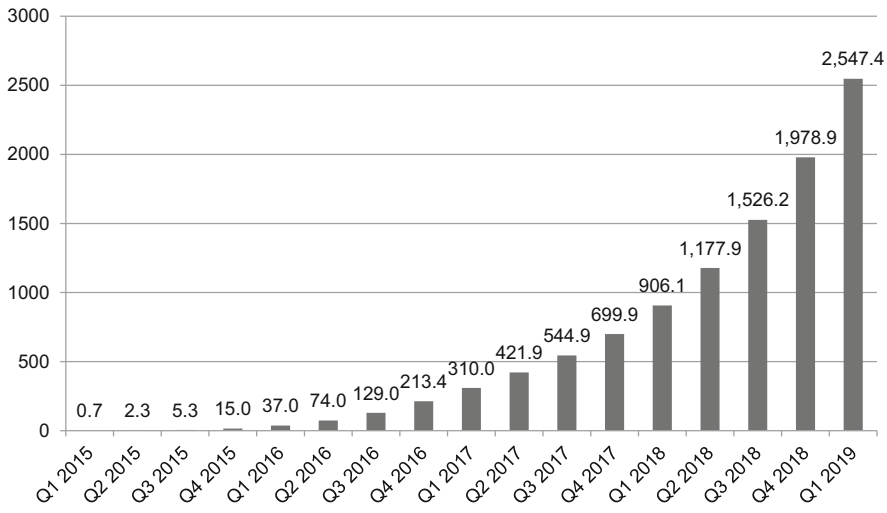

Fig. 4 Investments in Latvian P2P lending platforms cumulatively, million EUR. Source: LAFSA (2019)

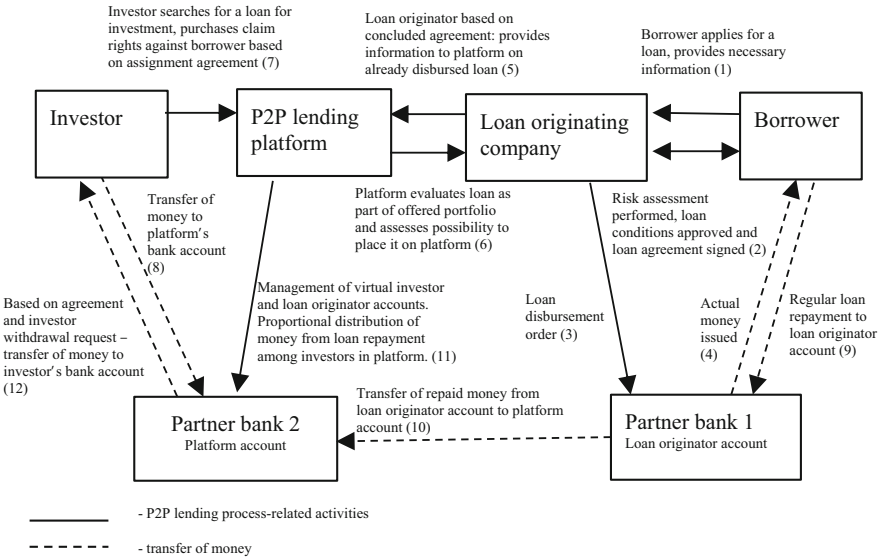

Fig. 5 Latvian model of P2P lending process organization. Source: created by the authors

Under this model, platforms do not independently connect borrowers and investors online, but provide online space for non-banking sector lenders to place loans issued already in advance. These loans are offered to investors for purchasing claims rights against the borrowers. In some sources, this new type of P2P lending is called "P2P lending version 2.0" (e.g., Welltrado 2017).

The new P2P lending model provides various benefits for all involved parties. Investors get the opportunity to profit from their investments and to diversify investment portfolios. Platforms gain income from the difference between borrower and investor interest rates and may collect other fees from the investors' side. Non-bank lenders (loan originators) under this model get fees from borrowers, pass part of the risks to investors (in some cases mitigated by buyback or other guarantees), and get "fresh money" injections into their lending business (Iuvo 2017). The more investors they attract, the more funds they get for new loan issuance. Loan originators get additional non-bank financing, which can be used for further loan issuance, for a "more attractive interest (and all other fees, collaterals, covenants, etc.) than they would have to pay if they finance themselves through a bank loan or issuing of bonds to the public" (Iuvo 2017).

The authors observed that some platforms in Latvia are related to loan originators and thus are not fully independent. In such cases, no fees are applied to the loan originators by the platforms[1] and the loan originators get interest-free short-term loans from investors for their lending operation financing.

[1]Based on the information obtained during the interview with platform management (Swaper)

We found that some aspects of P2P lending platform operation are regulated by existing EU and local regulations; however, common P2P lending area regulations have not yet been developed at the time of the examination. This area is also not supervised by the Latvian financial regulator. The development of Latvian and EU-wide regulations is in the process at the time of the examination (Cabinet of Ministers of the Republic of Latvia 2017; European Crowdfunding Network 2018).

Based on a review of the draft of Crowdfunding Services Law (Cabinet of Ministers of the Republic of Latvia 2017), the authors suggest that more specific requirements could be stipulated for loan originator assessment and agreement conclusion. Responsibility for the enforcement activities could be stipulated in an agreement between platform and loan originator since a situation could arise where it is not economically profitable for the loan originator to perform enforcement-related activities to regain investments on behalf of investors. Responsibility for a sufficient capital requirement level, certain operating conditions, and activities in case of loan originator insolvency could also be determined by legislation.

During the examination, some inconsistencies in the local P2P lending platform information disclosure and reporting process were identified. In addition, lack of public statistical data in different segregations (e.g., loss ratio, overdue by periods, etc.) was observed; such data would be essential for P2P lending portfolio quality analysis.

4.2 Public Awareness and Investor Behavior

Despite the rapid development paces of Latvian P2P platforms, the survey results showed that public awareness of P2P lending in Latvia is quite low (see Fig. 6).

Only 22.4% of Latvian respondents know what P2P lending is, and the remaining 77.6% of respondents haven't heard about it or do not know exactly what it means. The main reasons are lack of public information and the focus of platforms on foreign markets. A strong correlation between P2P lending awareness level and respondent gender was observed (correlation coefficient—0.29, p-value 0.002). The

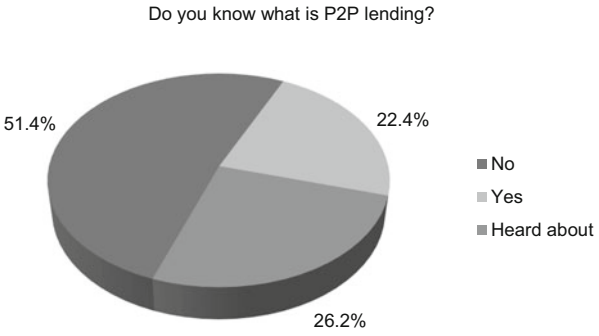

Fig. 6 Latvian respondent awareness of P2P lending. Source: created by the authors

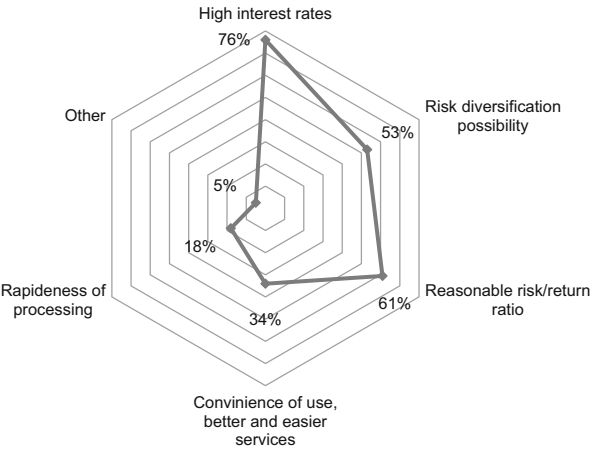

Fig. 7 Reasons for starting to use P2P lending platforms. Source: created by the authors

survey results show that female respondents are 24% less informed about the P2P lending concept than male respondents.

It was found that the main source of information about P2P platforms is digital media (63% of cases). The second most common source of information is a recommendation by a friend or colleague (17% of cases).

The survey results show that the main motives for investors to start using P2P lending platforms are high interest rates, a reasonable risk/return ratio and risk diversification possibilities (see the survey results in Fig. 7).

It was found that the lack of trust and high risks in P2P lending are the main factors keeping potential investors from starting to invest through P2P lending platforms. The research results indicate that the typical Latvian platform user is male, aged 25–44, a foreigner, most likely from Germany, with higher education, working as a high-level specialist in finance or IT. The above profile also matches the information obtained during the interviews with Latvian platform representatives.

According to the study results, the average Latvian P2P lending platform investor uses various platforms, prefers short-term investments up to one year, expects a minimum interest rate of 10–15%, and invests on average 1–5 thousand EUR in a year. The average investor uses both forms of investing: manual and an automatic investing tool—autoinvest. The study reveals that more than half of the surveyed investors (56%) had problems with recovery of investment in a P2P lending platform, which were partly solved afterward (24%). Among the main problems mentioned: problematic debt recovery, lack of information and recovery efforts by platforms, delays with transfer of funds by platforms, non-transparent and subjective calculation of earnings and defaults.

The essential question for consideration is understanding of Latvian platform investor needs and motives when deciding to invest or not to invest in particular instruments. Respondents were asked to evaluate the significance of 16 factors based on a Likert 1–5 scale, where 1 is not important and 5 is the factor of the highest importance. The authors observed that these factors' means are distributed in a range

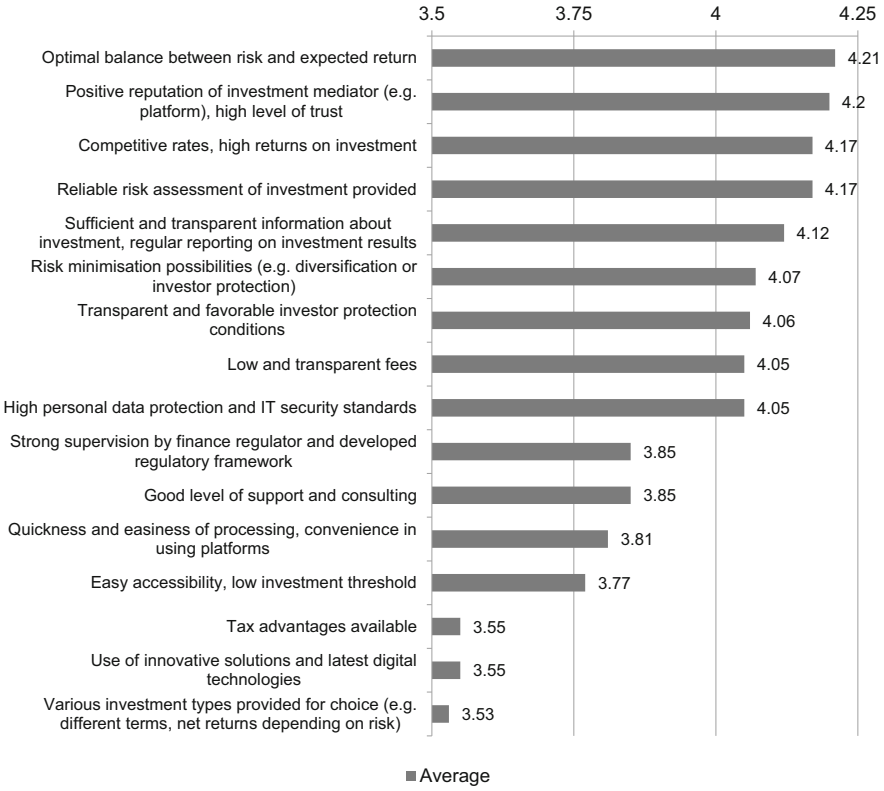

Fig. 8 Importance of factors to potential investors when deciding about investing in a P2P lending platform. Source: created by the authors

from 3.53 to 4.21 (see Fig. 8). The standard deviation for these factors varies in a range from 0.9 to 1.17. The standard deviation shows the spread of data distribution around the averages—for all the factors, it is clustered closely enough to the averages.

It is found that the top factors mentioned are related to profit maximization and risk minimization. The most important factors for potential investors are maintaining the optimal balance between risk of exposure and expected return (av. 4.21, std. 0.94), positive reputation and high level of trust (av. 4.2, std. 0.97), reliable risk assessment of investments (av. 4.17, std. 0.90), and competitive rates and high returns on investment (av. 4.17, std. 0.96). Sufficiency and transparency of information about investments and regular reporting of investment results are also considered as substantial factors when taking decisions on investment opportunities (av. 4.12, std. 0.95). Risk minimization possibilities, such as diversification or investor protection, are also quite important to potential investors (av. 4.07, std. 1.00). The remaining factors are mainly related to favorable platform conditions for investors as well as convenience of platform use and external protection (industry regulations, data security standards, and regulatory supervision).

4.3 Risk Mitigation Tools in P2P Lending

Investing through p2p lending platforms is associated not only with high profit opportunities, but also with high inherent risks, such as platform and loan originator defaults, regulatory changes, fraudulent activities, cyber security risks, etc. However, these and other inherent risks in p2p lending are mitigated by different investor risk-reducing measures, which are provided by the Latvian platforms.

Conditions of Latvian platform tools for investors' protection vary, but in general can be divided into the following groups[2]:

- Critical originator selection. Loan originators are being assessed by platforms' risk teams prior to joining the marketplace. A due diligence procedure is usually executed for each prospective loan originator before beginning cooperation. According to platforms' provided information, analysis of financial statements, management quality, underwriting policy, credit scoring, loan portfolio performance, and data accuracy has been done to ensure that the loan originator complies with the set risk standards. Continuous monitoring is performed on an ongoing basis after the launch of the partnership to avoid risks. In addition, according to Mintos platform practice, all loan originators that place loans on the Mintos marketplace are required to keep a certain percentage of each loan on their balance sheet to ensure that the interests of the loan originator are closely aligned with the interests of investors—both sides have a stake in the loan (Mintos 2019). There are some cases when the platform terminates cooperation with originators (Mintos 2017).
- Buyback guarantees. To protect investors from borrower defaults, all Latvian platforms provide buyback guarantees for the large part of loans. The buyback guarantee means that if the loan is delayed by more than certain number of days (e.g., more than 30 days in Twino case, more than 60 days in Mintos case), the loan originator should repurchase the investment for the nominal value of the principal and the accrued interest till the date of repurchase. This happens automatically and with no additional efforts required from the investors' side. Usually loans with a buyback guarantee are specially marked in platform solution to attract the investors' attention (Mintos 2019).
- Payment guarantees. Under the payment guarantee investor protection scheme, some marketplaces compensate both the invested principal amount and earned interest as per original loan repayment schedule, even if the borrower is late with the repayment more than a certain period of days (more than 30 days in Twino case). The payment guarantee applies to the whole duration of the loan.
- Secondary loan market. The reason why some Latvian marketplaces introduce the secondary loan market is to provide liquidity to investors, especially those invested in longer-term loans such as mortgages and car leases. But at the same

[2]Information about risk reducing measures is based on P2P lending platform public information and information provided during performed interviews with the platform representatives.

time, this is a risk mitigation tool, which provides investors the opportunity to stop investing faster and withdraw funds from this type of investment.

- Risk diversification. Diversification is the most important component of reaching long-term financial goals while minimizing risk. Most Latvian marketplaces offer opportunities to diversify investors' risk by investing in fractions of loans across different borrowers, originators, loan types, and geographies—starting from small amounts (e.g., 10 EUR) per investment. Investors can do this manually, but marketplaces offer to put their desired diversification parameters into an automatic investment solution/autoinvest tool, where it happens automatically.
- Secured loans vs. unsecured. In the case of mortgage-backed loans and business loans, borrowers must provide collaterals, which are normally real state property, cars, etc. The collateral will be used to recover the loan in case of default. Investors have the possibility to invest in secured loans instead of unsecured loans.
- Loan ratings. Some marketplaces offer investors loan ratings based on the internal evaluation of the risks associated with the particular loan. For instance, in the Twino marketplace, loans with ratings A, B, and C are offered without the buyback or payment guarantee. Loans with the rating of A represent the lowest risk investment, while loans with the rating C represent the highest risk investment. Loan ratings help to adjust investors' risk tolerance with appropriate risk level loans.
- All of these risk mitigation factors together could to a reasonable extent minimize risk and protect investors. At the same time, not all Latvian platforms provide all of the above-mentioned risk-reducing tools. And it is also important to carefully study certain agreement provisions in each individual case because of substantial differences in guarantee provisions provided by different platforms.

A summary of the main risk minimization tools provided by Latvian platforms is shown in Table 1.

The importance of different risk-reducing techniques to investors was found by the survey. The survey showed that the most important risk minimization tools for investors in Latvian platforms are diversification of risk among various credit exposures, the possibility to sell loans in the platform's secondary market and investing in secured loans instead of unsecured loans (see Fig. 9).

Buyback guarantees and payment guarantees are less important but significant for investors as well. The paper also examined the perception of risks by P2P lending investors. P2P lending platform users were asked to evaluate to what extent they agree with the statements. A Likert scale was used with the answer options from strong disagreement to strong agreement. The authors calculated the weighted average of each question by weighting respondent choices from −2 (strong disagreement) to 2 (strong agreement). According to the survey results, Latvian P2P lending platform users are confident about their knowledge of P2P lending risks and investment risks and perceive themselves as experienced investors (see Fig. 10).

The results of the survey show that investors are not sufficiently confident and do not fully trust the borrower evaluation process and assigned credit ratings in P2P

Table 1 Risk minimization tools provided by Latvian P2P lending platforms

	Number of platforms	Platform names
Platforms providing buyback guarantees for certain exposures	11	All platforms
Platforms providing payment guarantees for certain exposures	3	Twino, Viventor, PeerBerry
Platforms with developed secondary market	3	Mintos, Twino, Viventor
Availability of autoinvest/ automatic investment solution	9	Debitum network, DoFinance, Mintos, PeerBerry, RoboCash, Swaper, Twino, Viainvest, Viventor

Source: created by the authors

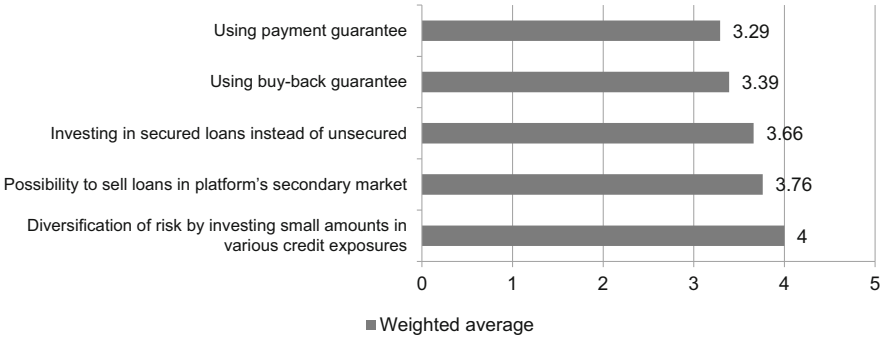

Fig. 9 Importance of risk-reducing techniques to investors. Source: created by the authors

lending platforms. In the survey carried out by Ziegler et al. (2019), P2P lending platforms were asked to rank five risk factors as related to their operations (Ziegler et al. 2019). Looking at the key debt-focused models, the top risk factors evaluated as high and medium high risks by platforms themselves were "notable increase in default" (82% of P2P consumer lending platforms) and "collapse due to malpractice" (73% of platforms). One other key risk factor was "changes to regulation," which registered as the third most significant risk. From this point of view, Latvia is at some disadvantage. Alternative finance market development is very high, but adequate market regulation has not followed yet.

Changing alternative finance market regulation should be perceived both as a positive market organization improvement and as an uncertainty and risk factor for investors. Despite the multilevel investor risk protection provided by Latvian P2P lending marketplaces, some risk factors still exist. In contrast to some other EU countries, platform investor protection policy at the state level in Latvia has not developed yet. For instance, in Germany retail investors (a term describing crowdfunding platform investors) are protected from doubtful companies and offers by the Retail Investors Protection Act (Meldere 2018). In France, specific regulations applicable to crowdfunding platforms have already existed since 2014 and,

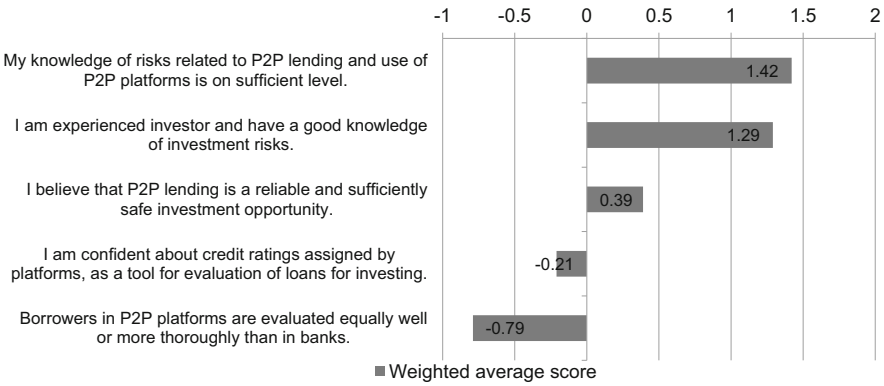

Fig. 10 P2P lending platform user perception of risks. Source: created by the authors

according to the European Crowdfunding Network, they have had not just protective, but also considerable positive influence on the industry in general (Meldere 2018). In Latvia, investor risk protection and crowdfunding market regulation have not started yet.

It was also found during the case study that investor protection tools and techniques do not necessarily work in all cases, e.g., buyback guarantees: in case claims are against loan originators, not platforms or borrowers, and if the loan originator goes default—the process of reimbursement of funds could be burdened, as in the Polish Eurocent case (Mintos 2017; Harrington 2017). The equity of loan originators could be sufficient to cover only some of their borrowers' defaults. Investors are not protected sufficiently in case of a global or regional financial crisis when the greater part of borrowers is not able to fulfill their obligations. In this situation, crowdfunding platforms also cannot ensure the promised payment guarantees due to insufficient equity. Some additional risk for investors appears if they choose unsecured loans instead of secured loans. A large part of loans represented in Latvian platforms are unsecured consumer loans which are issued online in different world regions, including emerging markets, such as Latin America, Africa, and Central Asia. Unsecured loans are exposed to greater credit risk than secured loans. Consumer lending is based on more simplified procedures; internally designed automated scoring systems are used by loan originators for potential borrower creditworthiness assessment. Different approaches are used for borrowers' evaluation and credit scoring in each lender case.

Additional risks for investors could also arise if loan originators are directly or indirectly related to P2P lending platforms, as takes place in the case of some Latvian platforms.

Latvian market-specific risks are mostly related to Latvian p2p lending operating model and adverse development scenarios of Latvian economy. Since p2p lending industry is relatively young, on the macroeconomic level it has not yet proven whether it could successfully survive an economic downturn. Bulkestate platform representative M. Zutis supports this concern, as it states in LAFSA Fin-Tech

Industry Report 2018: "the main risk, at least in the lending area, is that the new Fin-Tech industry has not yet experienced any economic downturn that could be an important test of the effectiveness of risk management, since under these circumstances the first category of losses is related to unsecured consumer loans. And then the risk of losing investors will also increase (LAFSA 2017)."

The authors consider that in case the focus of platform and loan originator management is on quick profits (incredibly high development paces could be an indication), and in case of a lack of motivation to introduce risk retention policies, this could raise concerns about existing P2P lending sector development trend stability from the long-term perspective. However, the implementation of a new regulatory base should decrease this risk. The authors also note that platforms and loan originators "may face moral hazard as their fee-based income gives them an incentive to originate large volumes of loans with potentially less attention to credit quality" (Financial Stability Board 2017).

Different approaches could be recommended to investors for risk minimization in P2P lending. First, investors can decrease the risk of losses by carefully selecting P2P platforms in which to invest their funds. Based on the Latvian platform analysis, the authors suggest that the certain risk minimization measures could be considered in the platform selection process. Investors should choose independent and time-verified platforms with appropriate licenses and disclose information about their operations, risks, and financial results. Marketplaces making sure that proposed agreement provisions are sufficiently clear and favorable to investors. Preferably platforms with a developed secondary market where P2P loans can be sold prior to their maturity as well as platforms with a transparent process of loan originator selection.

Second, the authors point out that the risk of potential losses can be decreased by choosing the appropriate investment techniques. Based on the platform analysis performed, the application of the following investment techniques could be suggested as follows: (1) Diversification of risk among various platforms; (2) Diversification of risk by investing small amounts in various credit exposures (autoinvest tool); (3) Investing in secured types of loans (e.g., mortgage loans, car loans), rather than in unsecured loans (e.g., consumer loans); (4) Investing in platforms with buyback and payment guarantees; (5) Assessment of loans' safeness based on assigned credit ratings (e.g., A, B, C) and assessment of the country of origin of the loan originators; (6) Managing liquidity risk by using opportunities of the secondary market, choosing platforms that provide early termination possibilities or investing in shorter-term exposures; (7) Careful use of the autoinvest function and well-considered choice of criteria in case of automatic investments; (8) Careful analysis of a particular investment's riskiness, ensuring a balance between reasonable risk and return.

Systematic work on risk mitigation tool development with the aim to reduce investors' risk ensured the rapid development of Latvian platforms. Mintos become one of the biggest global marketplaces for investments and in August 2019 reached the milestone of 3 billion EUR in loans financed through its platform (Magnetic Latvia 2019). Several Latvian P2P platforms (Mintos, Twino, Robocash, etc.) are

ranked among the best marketplaces in Europe. Latvia has developed a financial sector development plan for 2017–2019, which is focused on alternative financial industry development (Ministry of Finance of the Republic of Latvia 2018). Positive industry development could result in a positive impact on the Latvian economy: investments, taxes, a decrease in the unemployment level, a positive international image of the country. One of the opportunities for Latvia is to become one of the new centers of alternative finance and Fin-Tech development. This could be realized in case of implementation of successful state policies and a wise approach. The focus should be on favorable organization of the environment and better state support to Fin-Techs. There are cases where some Latvian platforms change their country of registration because of the unfavorable business environment with no serious impact on their operations (e.g., Stukalo 2017). Improvements are also required with regard to P2P market regulation and clearer taxation policies for investors (i.e., different interpretations exist; supported by focus group discussion) and state-supported investor protection.

5 Conclusion

The UK and Baltic states, particularly Estonia and Latvia, clearly stand out among the European countries by the annual alternative finance growth rate and market volume per capita. The P2P lending sector in Latvia is developing very rapidly and this development is technology and innovation-driven, related to the usage of the new P2P lending platform operating model, the focus on foreign markets, and various investor protection mechanisms implemented for investor risk reduction.

The main risk mitigation tools are critical loan originator selection by the marketplace, buyback guarantees, payment guarantees, secondary loan market, diversification of risk among various credit exposures by autoinvest tool, investing in secured loans instead of unsecured loans and loan ratings developed by the platforms. It was found out that despite the multilevel investor risk protection offered to investors by Latvian P2P lending marketplaces, some risk factors still exist. The alternative finance market regulations and platform investor protection policy at the state level still have not been developed in Latvia. The investor protection tools and techniques could not necessarily work in all cases, e.g., buyback guarantees. Investors' claims are against the loan originators, not the platforms or borrowers. The equity of loan originators could not be sufficient to cover their borrowers' defaults. In case when the loan originator becomes unable to fulfill its obligations—the process of reimbursement of funds could be burdened. On the macroeconomic level, the specific investor risks also still exist, such as the P2P lending operating model's sensitivity to adverse economic development scenarios**.** Since the P2P lending industry is relatively young, it has not been proven yet, whether it can successfully survive an economic downturn.

Appendix 1: Latvia-Based P2P Lending Platforms

	Platform	Platform launch period	Legal entity	Platform web location
1	MINTOS	January 2015	AS "Mintos marketplace" Reg. No.40103903643	https://www.mintos.com/en/
2	TWINO	May 2015	SIA "TWINO" Reg. No.40103919184	https://www.twino.eu/en/
3	VIVENTOR	October 2015	SIA "Viventor" Reg. No.40103920304	https://www.viventor.com/
4	SWAPER	October 2016	SIA "Swaper" Reg. No.40203005445	https://www.swaper.com/
5	VIAINVEST	December 2016	SIA "Viainvest" Reg. No.40203015744	https://viainvest.com/
6	BULKESTATE	December 2016 July 2017—platform operation transferred to Estonia[a]	SIA "LP private property" Reg. No.40103891306	https://www.bulkestate.com/en/
7	GRUPEER	February 2017	SIA "Grupeer" Reg. No.40203023192	https://www.grupeer.com/
8	ROBOCASH	February 2017	SIA "ROBOCASH" Reg. No.40203022676	https://robo.cash/
9	DOFINANCE	April 2017	SIA "Dofinance" Reg. No.40203016025	https://www.dofinance.eu/
10	LENNDY	September 2016—in Lithuania; May 2017—platform operation transferred to Latvia[b]	SIA "Lenndy" Reg. No.40203066717	https://system.lenndy.com/
11	PEER BERRY	June 2017	SIA "AV marketplace" Reg. No.40203073653	https://peerberry.com/
12	DEBITUM NETWORK	September 2018	SIA "Prosperitu" Reg. No.40103288584	https://debitum.network/

Source: Table created by the authors based on Lursoft database data (https://www.lursoft.lv/) and other official public resource information

[a]Based on information from the Estonian register of economic activities Majandustegevuse Register (Republic of Estonia Ministry of Economic Affairs and Communications 2017)

[b]According to an official Lenndy press release (Stukalo 2017)

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Health Spending and Medical Innovation: A Theoretical Analysis

Toshitaka Fukiharu

Abstract The aim of this paper is to explain an empirical fact by economic models. The fact is that there is a tendency for the share of health spending in GDP to rise. This paper asserts that the fact is partly due to medical innovation. The novelty of models is the explicit incorporation of hospital and doctors who treat patients, with the rise in the parameter of the illness treatment function defined as the medical innovation. Under the monopolistic case, the share always rises, while under the competitive case, it declines for the advanced medical society with a high parameter value; it rises for the basic medical society depending on the ratio between healthy and sick workers, and it rises for the backward medical society with a low parameter value. The theoretical ambiguity of assertion is partly removed by the empirical fact of the monopolistic tendency in the US medical sector. As by-products of this formulation, the emergence of moral hazard and adverse selection is discussed theoretically, where medical insurance—discount of sick workers' medical fee—is procured as a subsidy from healthy workers to them. Moral hazard and adverse selection emerge depending on the parameters of the models.

Keywords Adverse selection · General equilibrium · Health spending · Innovation · Moral hazard · Simulation

1 Introduction

The advancement of medical technology has contributed to the improvement of human well-being. For example, some of the incurable diseases, such as cancer, have become curable, and the human life expectancy has been lengthened. This enhanced benefit, however, has been accompanied by the enhanced cost. The health spending has steadily increased, and sometimes its growth rate exceeded the one of GDP. Data

T. Fukiharu (✉)
School of Business Administration, Kansai University of International Studies, Amagasaki, Japan
e-mail: fukiharu@si.aoyama.ac.jp

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on health spending for 44 countries, including 36 OECD members, reveal that between 2000 and 2017, only two countries reduced their percentage of health spending per GDP (OECD 2020). The USA, the highest spender of GDP on health care, raised its health spending per GDP from 5.542% in 2000 to 14.421% in 2017, which remained the same in 2018 (Pear 2018).

In the present paper, with medical innovation as one of the main culprits in mind, we focus our attention on the reason why national health spending has increased worldwide. For the purpose of examining this problem, Fuchs (1996, p.8) examined whether health economists, economic theorists, and practicing physicians could come to a consensus on the issue: "the primary reason for the increase in the health sector's share of GDP over the past 30 years is technological change in medicine." On this issue, 81% of the health economists agreed with a 99% statistical significance, 37% of the economic theorists agreed with no statistical significance, and 68% of practicing physicians agreed with a 95% statistical significance. From a theoretical viewpoint, Chandra and Skinner (2012) attempted to examine this problem in terms of a two-period partial equilibrium model. Their theoretical model follows the health-capital accumulation approach designed by Grossman (1972) (See also Ehrlich and Yin 2013).

The present paper adopts a different approach. Following Arrow (1963), a one-period general equilibrium model is constructed in which there are two types of households: i.e., the "fortunate" one with 365 working days, and the "unfortunate" one with, say, 300 working days—and the hospital recovers a part of "the lost working days" of the unfortunate households with medical treatment. The households maximize utility subject to the income constraint, where sick households purchase medical services from the hospital. The (aggregate) doctor is nothing but a medical engineer (worker) in the present paper, hired by the hospital with a rental fee. The hospital is a "firm" which supplies the medical service, hiring the doctor and procuring medicines. Along with the hospital, there is another firm, which produces a variety of commodities including medicines, hiring households under profit maximization.

Utilizing this general equilibrium model, the relation between the total health spending per GDP and the medical innovation is examined at first. Medical innovation in the present paper is defined as a shift of the illness treatment function with no modification of cost structure. In terms of the simulation approach, we examine whether the medical innovation raises total health spending for the two models. The first model is the one in which the hospital is a competitive medical service supplier, while the second model is the one in which the hospital is a monopolistic medical service supplier. It must be noted that Arrow (1963) describes the medical sector as "collusive monopoly," and Cutler and Morton (2013) reveal the sector's statistical trend toward a monopoly in the USA.

Next, as a by-product of this approach, we examine the moral hazard and adverse selection problems emerging on the medical insurance. Following the Arrow-type insurance, medical insurance in the form of medical fee deduction is adopted as a subsidy from the "without sickness" households to the "with sickness" households. The present paper is an extension of Fukiharu (2005), which examined the moral

hazard under the monopolistic medical sector. The computation was conducted in Fukiharu (2018a, b, c, d).

In Sect. 2 of the present paper, competitive health care market without medical insurance is formulated as the basic model I. After general equilibrium of the model is guaranteed, the effect of the medical innovation on the health spending is derived for the specified parameters. In Sect. 3, monopolistic health care market without medical insurance is formulated as the basic model II. After general equilibrium of the model is guaranteed, the effect of the medical innovation on the health spending is derived for the specified parameters and the comparison with the one in the competitive case is conducted. In Sect. 4, selecting the parameters randomly, the robustness of the conclusion is examined. In Sect. 5, the medical insurance is introduced in the basic models I and II, and the emergence of moral hazard and/or adverse selection is examined. Section 6 concludes these examinations.

2 Basic Model I: Competitive Health Care Market

In this section, a general equilibrium model incorporating competitive medical sector is constructed, where medical insurance is not available. It is assumed there are three types of economic agents: "fortunate" and "unfortunate" workers, first and second agents, respectively, and doctors, the third agent. Every worker knows the distribution of workers is constant in each year: a_1 workers are fortunate (i.e., with good health), and a_2 workers are unfortunate (i.e., without good health). No one knows whether each worker is fortunate or unfortunate before the opening of the particular year. Only when the particular year starts, a_1 workers know that they are fortunate, while the remainder know that they are unfortunate. In this sense, each worker has the probability, $\alpha = a_2/(a_1 + a_2)$, of being unfortunate in each year. In this section, it is assumed that $a_1 = 90$ and $a_2 = 10$, and the probability of workers being unfortunate is 10%. This assumption is relaxed later in the robustness analysis.

2.1 Behavior of "Fortunate" Workers

When a worker is fortunate and healthy, he or she initially has 365 days of leisure days. Their behavior is stipulated by the traditional utility maximization under the income constraint:

$$\max\ u(z_1, le_1) \text{ subject to } p_z z_1 = w(365 - le_1) + Y_1 \tag{1}$$

where $u(z_1, le_1)$ is the utility function, z_1 is the consumption of goods, le_1 is the leisure consumption, p_z is the price of goods, w is the wage rate, and Y_1 is the transfer

of income to and from others, such as profit, tax, etc. Since a simulation approach is utilized in this paper, the utility function is stipulated by

$$u(z, le) = z \times le \tag{2}$$

Under (1) and (2), the fortunate and healthy workers' demand function for the goods, z_{11}, and the labor supply function, l_1, are derived.

2.2 *Behavior of "Unfortunate" Workers*

When a worker is unfortunate, i.e., without good health, he or she has H_0 days of initial leisure days, say $H_0 = 300$. He or she goes to a hospital, in order to recover a part of lost leisure days in the year. It is assumed that the hospital can recover $(365–H_0)(1– e^{-s_0 x})$ days of leisure for the sick worker by supplying x medical treatment, employing doctors with a rental price (wage for doctors) w_D, and using medicines, while the hospital receives a service charge p_x per one unit of medical treatment, where s_0 is the parameter of the "illness treatment function." It is assumed in this section that $s_0 = 1/10$. In Fig. 1, the function $G(x) = (1–e^{-s_0 x})$ is depicted as the straight curve when $s_0 = 1/10$, while it is depicted as the dashed curve when $s_0 = 1/7$: i.e., the medical innovation case.

The unfortunate worker's behavior is stipulated by the following utility maximization under the income constraint:

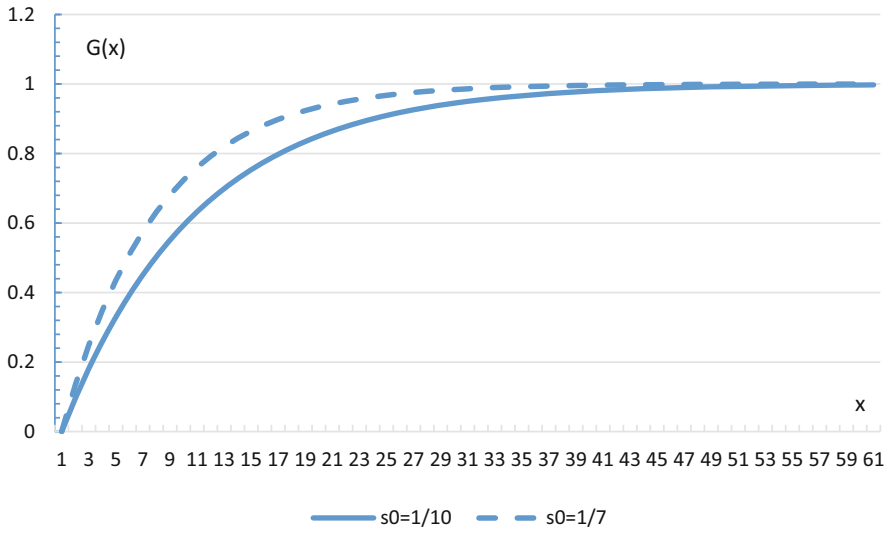

Fig. 1 $G(x) = \left(1 - e^{(-s_0 x)}\right)$ in the illness treatment function. Source: author's own study

$$\max u(z_2, le_2) \text{ subject to } p_z z_2 + p_x x = w(H_0 + (365 - H_0)(1 - e^{-s_0 x}) - le_2) + Y_2 \quad (3)$$

where u (z_2, le_2) is utility function, z_2 is consumption of goods, le_2 is leisure consumption, and Y_2 is transfer of income to and from others such as profit and tax, etc. In this paper, the simulation approach is utilized with utility function stipulated by (2). Under (2) and (3), the unfortunate household's demand function for the goods, z_{21}, the demand function for the medical services, x_1, and the labor supply function, l_2, are derived analytically, where $H_0 = 300$.

2.3 Behavior of Good-Producing Firm

It is assumed that the good-producing firm is under constant returns to labor input. The behavior of this firm is stipulated by profit maximization with production function given by

$$z = f(l_g) = l_g \quad (4)$$

where z is the output of goods and l_g is labor input. The profit maximization under (4) gives rise to $p_z = w$ as one of the conditions for general equilibrium.

2.4 Behavior of Hospital and Doctors

The behavior of hospital is stipulated by a "competitive" profit maximization in this section. The production function of medical service is given by

$$x = g(l_x, z_x) = {l_x}^{1/2} {z_x}^{1/2} \quad (5)$$

where l_x is the input of the doctors' working days and z_x is the input of goods (e.g., medicines, etc.). In order to provide the medical service demanded by the sick households, $a_2 \times x_1$, the hospital has the demand function for the doctors, l_{x1}, and the one for goods, z_{x1}, derived analytically under cost minimization, where cost is denoted by $c = w_D l_x + p_z z_x$ and w_D is the wage (rental price) for the doctors. There are D_0 doctors, and each doctor's initial endowment of working days is 365 days.

For simplicity, it is assumed that $D_0 = 1$. The doctor's behavior is the utility maximization under the income constraint:

$$\max\ u(z_D, le_D) \text{ subject to } p_z z_D = w_D(365 - le_D) \tag{6}$$

where u_D (z_D, le_D) is the utility function, z_D is the consumption of goods, and le_{D} is the leisure consumption. It is assumed that doctors do not possess the shares of firms. Since the simulation approach is utilized in this paper, the utility function is stipulated by

$$u_D(z_D, le_D) = z_D \times le_D \tag{7}$$

Under (6) and (7), the doctor' demand function for goods and leisure, z_D and le_D, are derived analytically. It is shown that $le_D = 365/2$ under (6) and (7).

2.5 *Competitive General Equilibrium with Competitive Medical Sector*

Equilibrium condition for the good-labor market is given by the following equation:

$$a_1 l_1 + a_2 l_2 = a_1 z_{11} + a_2 z_{21} + z_{x1} + z_D \tag{8}$$

Equilibrium condition for the doctors' market is given by the following:

$$l_{x1} = 365 - le_D \tag{9}$$

Utilizing the Newton Method, we can solve competitive medical service charge, $p_{x00,}$ and the rental price of doctor, w_{D00}, as follows:

$$p_{x00} = 1.56233$$
$$w_{D00} = 0.6102$$

It is easy to check that in equilibrium, c is indeed equal to $p_x \times a_2 \times x_1$. Now, the utility level and income for the fortunate worker in this general equilibrium are given by u_{100} and $i_{100,}$ while the utility level and income for the unfortunate worker in this general equilibrium are given by u_{200} and i_{200}. The doctor's utility level and income in the competitive general equilibrium are given by u_{d00} and i_{d00}. Sum of these utilities in this competitive general equilibrium, the Bentham-type social welfare, is given by W_{LD00}, which is computed as follows:

$$W_{LD00} = a_1 u_{100} + a_2 u_{200} + D_0 u_{d00} = 3285378.75344$$

Health spending, HS_{00}, defined by $p_{x00}\ a_2\ x_1$, and GDP_{00}, defined by $a_1 i_{100} + a_2 i_{200} + D_0 i_{d00}$, are computed as follows:

$$HS_{00} = 222.72943$$

$$GDP_{00} = 18394.6$$

Thus, health spending per GDP, HS_{00}/GDP_{00}, is approximately 1.2%:

$$HS_{00}/GDP_{00} = 0.01210$$

2.6 Medical Innovation under a Competitive Framework

Under this general equilibrium model incorporating a competitive framework, we examine the effect of medical innovation, where medical insurance is unavailable. Medical innovation is defined simply as a shift in "illness treatment function." In this subsection, we assume that medical innovation emerges and s_0, the parameter of "illness treatment function," rises from 1/10 to 101/1000. Utilizing the Newton Method, we can solve competitive medical service charge, $p_{x0,}$ and the rental price of doctor, w_{D0}, as follows:

$$p_{x0} = 1.55957 < p_{x00}$$

$$w_{D0} = 0.60807 < w_{D00}$$

It is easy to check that in equilibrium, c is indeed equal to $p_x \times a_2 \times x_1$. Now, the utility level and income for the fortunate worker in this general equilibrium are given by u_{10} and i_{10}, while the utility level and income for the unfortunate worker in this general equilibrium are given by u_{20} and i_{20}. The doctor's utility level and income in the competitive general equilibrium are given by u_{d0} and i_{d0}. The sum of these utilities in this competitive general equilibrium, the Bentham-type social welfare, is given by W_{LD0}, which is computed as follows:

$$W_{LD0} = a_1 u_{10} + a_2 u_{20} + D_0 u_{d0} => W_{LD00}$$

Health spending, HS_0, defined by $p_{x0}\ a_2\ x_1$, and GDP_0, defined by $a_1 i_{10} + a_2 i_{20} + D_0 i_{d0}$, are computed as follows:

$$HS_0 = 221.94426 < HS_{00}$$

$$GDP_0 = 18394.73771 > GDP_{00}$$

Thus, health spending per GDP, HS_0/GDP_0 is approximately 1.2%, lower than HS_{00}/GDP_{00}:

$$HS_0/GDP_0 = 0.01207 < HS_{00}/GDP_{00}$$

3 Basic Model II: Monopolistic Health Care Market

In this section, the medical sector is assumed to be monopolist. Cutler and Morton (2013) pointed out the trend of monopolization in the US medical sector. For simplicity, we assume that this monopolistic medical sector is owned by the workers with an equal share holding. Thus, monopolistic profit is distributed equally to each worker, whether fortunate or unfortunate. Other assumptions are the same as in Sect. 2, e.g., the good-producing sector is assumed to be a competitive firm. In this modified general equilibrium model, named Basic Model II, we examine the existence of a general equilibrium and a comparison is made with the result in Basic Model I.

3.1 Behavior of "Fortunate" Workers, "Unfortunate" Workers, and Good-Producing Firm

We have exactly the same assumptions as mentioned in Sect. 2. Thus, $H_0 = 300$, $a_1 = 90$, $a_2 = 10$, with the same utility functions and the same production functions. From the same computation, we have exactly the same demand functions and supply functions as in Sect. 2. Note that, the hospital's demand functions for the doctor and commodities are derived under the cost minimization.

3.2 Behavior of Hospital as a Monopolist and General Equilibrium

We derive the "objective" profit function of the medical sector, OPRO (p_x), which equalizes the demand and supply of the goods and doctors' markets. OPRO (p_x) is derived analytically as follows, from (8) and (9), with $w = 1$, $Y_1 = \text{OPRO}\ (p_x)/100$, $Y_2 = \text{OPRO}\ (p_x)/100$, and $p_z = 1$:

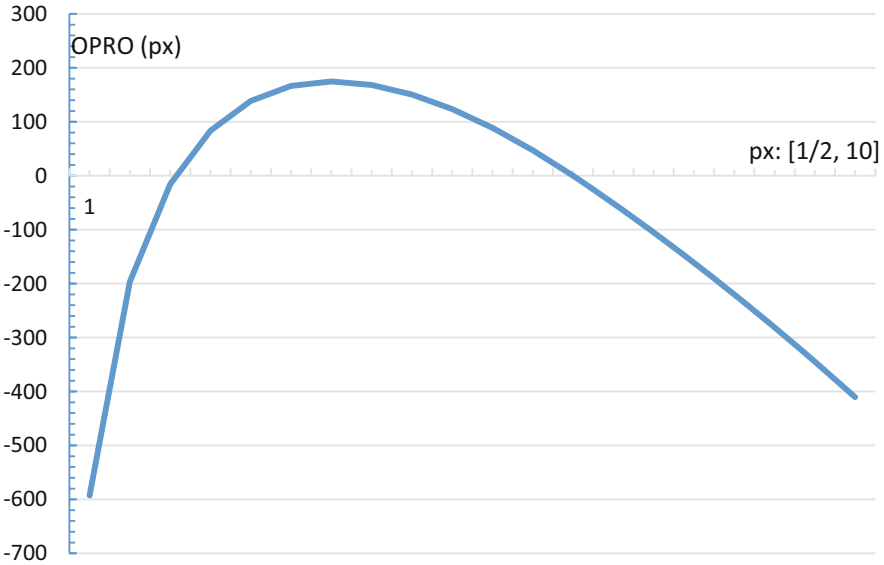

Fig. 2 OPRO (p_x). Source: author's own study

$$\text{OPRO}\ (p_x) = \frac{100}{73}\left(-73p_x \log\left[\frac{2p_x}{13}\right] + 80\log\left[\frac{2p_x}{13}\right]\sqrt{\log\left[\frac{2p_x}{13}\right]^2}\right)$$

The "objective" profit function of the medical sector, OPRO (p_x), is depicted in Fig. 2.

The monopolistic medical charge by the hospital, p_{xM00}, is computed as follows by the Newton Method, which is higher than p_{x00}. The wage rate (rental price) of the doctor in the monopolistic medical sector, w_{DM00}, is lower than w_{D00}.

$$p_{xM00} = 3.51167 > p_{x00}$$
$$w_{DM00} = 0.11382 < w_{D00}$$

Now, the utility level and income for the fortunate worker in this monopolistic general equilibrium are given by u_{1M00} and $i_{1M00,}$ while the utility level and income for the unfortunate worker in this general equilibrium are given by u_{2M00} and i_{2M00}. The doctor's utility level and income in the monopolistic general equilibrium are given by u_{dM00} and i_{dM00}. The sum of these utilities in this monopolistic general equilibrium, the Bentham-type social welfare, is given by W_{LDM00}, which is computed as follows:

$$W_{LDM00} = a_1 u_{1M00} + a_2 u_{2M00} + D_0 u_{dM00} = 3270374.86591 < W_{LD00}$$

The difference between W_{LD00} and W_{LDM00} may correspond with the dead weight loss in the monopoly. Health spending, HS_{M00}, defined by $p_{xM00}\, a_2\, x_1$, and GDP_{M00}, defined by $a_1 i_{1M00} + a_2 i_{2M00} + D_0 i_{dM00}$, are computed as follows:

$$HS_{M00} = 216.21711 < HS_{00}$$

$$GDP_{M00} = 18290.63351 < GDP_{00}$$

Thus, the "monopolistic" health spending per GDP, HS_{M00}/GDP_{M00}, is approximately 1.2%, lower than the "competitive" health spending per GDP, HS_{00}/GDP_{00}:

$$HS_{M00}/GDP_{M00} = 0.01182 < HS_{00}/GDP_{00}$$

3.3 Medical Innovation under a Monopolistic Framework

As in Sect. 2, medical innovation is defined simply as the shift of "illness treatment function." In this section, we assume that the medical innovation emerges and s_0, the parameter of "illness treatment function," rises from 1/10 to 101/1000 as in Sect. 2. By exactly the same procedure as in 3.2, we have the following result.

Utilizing the Newton Method, we can solve the monopolistic medical service charge, $p_{x0M,}$ and the rental price of doctor, w_{D0M} as follows:

$$p_{xM0} = 3.53333 > p_{xM00}$$

$$w_{DM0} = 0.11296 < w_{DM00}$$

It is easy to check that in equilibrium, c is indeed equal to $p_{xM} \times a_2 \times x_1$.

Now, the utility level and income for the fortunate worker are given by u_{1M0} and i_{1M0}, while the utility level and income for the unfortunate worker are given by u_{2M0} and i_{2M0}. The doctor's utility level and income are given by u_{dM0} and i_{dM0}. The sum of these utilities, the Bentham-type social welfare, is given by W_{LDM0}, which is computed as follows:

$$W_{LDM0} = a_1 u_{1M0} + a_2 u_{2M0} + D_0 u_{dM0} = 3270622.49894 > W_{LDM00}$$

Health spending, HSM_0, defined by $p_{xM0}\ a_2\ x_1$, and GDP_{M0}, defined by $a_1 i_{1M0} + a_2 i_{2M0} + D_0 i_{dM0}$, are computed as follows:

$$HS_{M0} = 216.72668 > HS_{M00}$$

$$GDP_{M0} = 18116.31366 < GDP_{M00}$$

Thus, health spending per GDP after the medical innovation, HS_{M0}/GDP_{M0} is approximately 1.2%, higher than HS_{M00}/GDP_{M00}:

$$HS_{M0}/GDP_{M0} = 0.01196 > HS_{M00}/GDP_{M00}$$

4 Robustness

In the previous sections, opposite conclusions were reached on the problem of whether the medical innovation causes the health spending to rise. The competitive framework asserts that it causes a decline in spending, while the monopolistic framework asserts that it causes a rise in spending. These opposite conclusions were obtained with the parameters of the models specified numerically. In this section, through a relaxing of the assumption of specified parameters, we examine how the opposite conclusions vary, where the relaxation does not imply that all the parameters are selected randomly. Thus, in the following sub-subsections, we examine the robustness for the three cases: the *basic* medical society-when $s_0 = 1/10$, the *advanced* medical society-when $s_0 = 10$, and the *backward* medical society-when $s_0 = 1/1000$. The production and utility functions, and so on, are assumed to be exactly the same as in the previous sections.

4.1 Basic Medical Society ($s_0 = 1/10$)

In this subsection, we conduct simulations for the competitive and monopolistic medical sector cases. We start with the competitive case.

4.1.1 The Competitive Medical Sector Case

We start from the examination of *the orthodox case* in which $a_1 = 90$ and $a_2 = 10$. In Basic Model I, we derived the health spending when $s_0 = 1/10$ as 222.72943, while the health spending when $s_0 = 101/1000$ was 221.94426: i.e., the medical innovation reduces the health spending for the society. This is the case when there are 80 fortunate workers and 20 unfortunate workers. However, as we move to *the unorthodox*

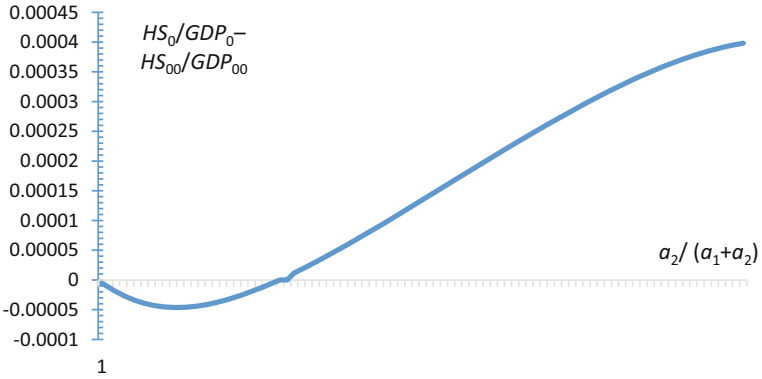

Fig. 3 $HS_0/GDP_0–HS_{00}/GDP_{00}$ for the basic medical society. Source: author's own study

case in which $a_1 = 10$ and $a_2 = 90$, we enter into a different phase. By simulation, when $a_1 = 70$ and $a_2 = 30$, health spending when $s_0 = 1/10$ is 708.10055, while health spending when $s_0 = 101/1000$ is 709.22855: i.e., medical innovation increases health spending for the society. This conclusion holds even when health spending is divided by the GDP. We have the same situation as the society becomes more unfortunate. Thus, we may conclude that the reduction of the health spending per GDP can be realized through the medical innovation only when the society is quite fortunate. Figure 3 reveals this relation, where the horizontal axis indicates the probability of unfortunate worker: $100a_2/(a_1+ a_2)$ and the vertical axis indicates $HS_0/GDP_0- HS_{00}/GDP_{00}$.

4.1.2 Monopolistic Medical Sector Case

Defining the medical innovation as the shift of "illness treatment function," we examine if the shift of this function can reduce health spending when the medical sector is under a monopoly. Suppose that s_0 rises from 1/10 to 101/1000. When $a_1 = 90$ and $a_2 = 10$, the health spending when $s_0 = 1/10$ was 229.41696, while the health spending when $s_0 = 101/1000$ was 229.67466: i.e., the medical innovation raises the health spending for the society. This is the case when $a_1 = 20$ and $a_2 = 90$. The same situation continues until there are $a_1 = 10$ and $a_2 = 90$. Thus, we may conclude that the reduction of health spending cannot be realized through medical innovation under the monopolistic case. This relation holds even when health spending is divided by GDP. Figure 4 reveals this relation, where the horizontal axis indicates the probability of an unfortunate worker: $100a_2/(a_1+ a_2)$ and the vertical axis indicates $HS_{0M}/GDP_{0M}- HS_{00M}/GDP_{00M}$.

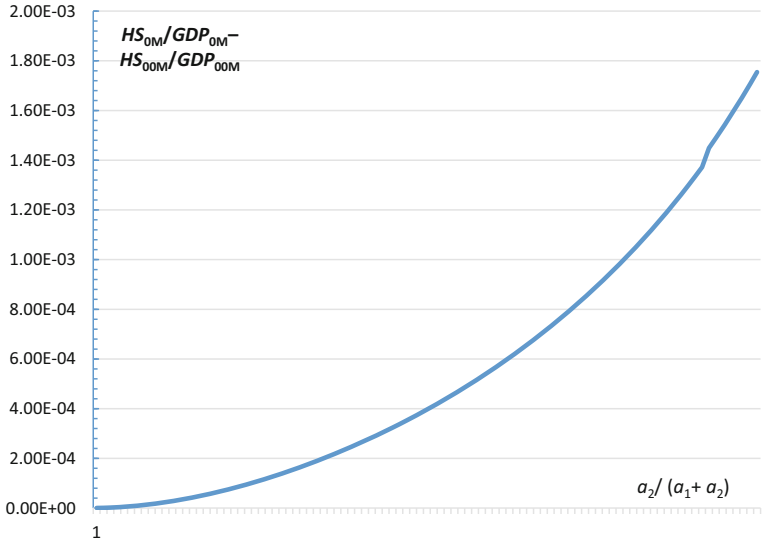

Fig. 4 $HS_{0M}/GDP_{0M}–HS_{00M}/GDP_{00M}$ for the basic medical society. Source: author's own study

4.2 Advanced Medical Society ($s_0 = 10$)

The society with a high s_0 is named in this paper as the *advanced* medical society. Compared with the *basic* society with $s_0 = 1/10$, we examine how the conclusion in this society differs. Suppose that $s_0 = 10$.

4.2.1 Competitive Medical Sector Case

Suppose that s_0 rises from 10 to 10 + 1/100. The simulation shows that the health spending declines by the innovation. The conclusion remains the same even if health spending is divided by GDP. Figure 5 reveals this relation, where the horizontal axis $100a_2/(a_1+a_2)$ and the vertical axis indicates $HS_0/GDP_0 – HS_{00}/GDP_{00}$.

4.2.2 Monopolistic Medical Sector Case

Under the monopolistic case, suppose that s_0 rises from 10 to 10 + 1/100. The simulation shows that health spending rises by the innovation. The conclusion remains the same even if the health spending is divided by GDP. Figure 6 reveals this relation, where the horizontal axis $100a_2/(a_1+a_2)$ and the vertical axis indicates $HS_{0M}/GDP_{0M} – HS_{00M}/GDP_{00M}$.

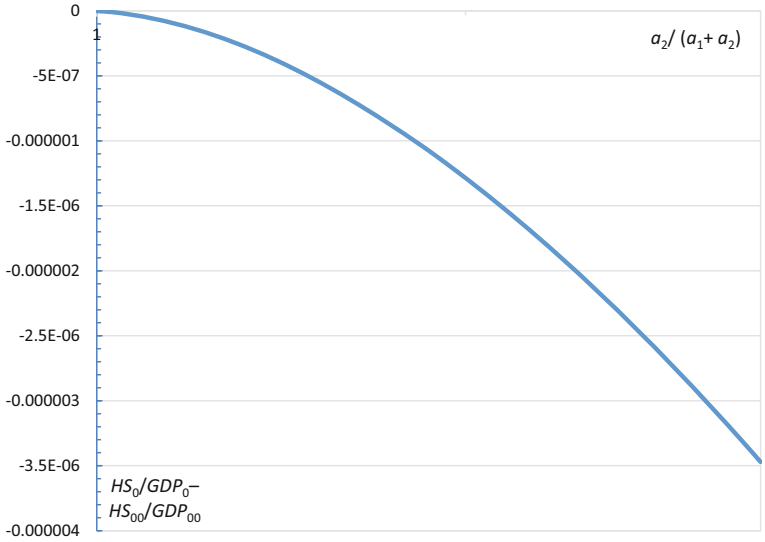

Fig. 5 $HS_0/GDP_0–HS_{00}/GDP_{00}$ for the advanced medical society. Source: author's own study

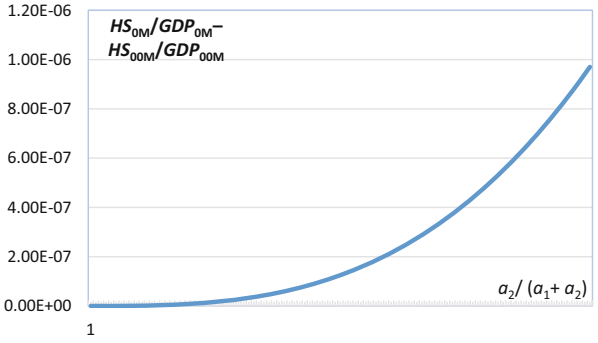

Fig. 6 $HS_{0M}/GDP_{0M}–HS_{00M}/GDP_{00M}$ for the advanced medical society. Source: author's own study

4.3 Backward Medical Society ($s_0 = 1/1000$)

When s_0 is extremely small, we name the society the *backward* medical society. In this section, we examine a *backward* medical society, assuming that $s_0 = 1/1000$.

4.3.1 Competitive Medical Sector Case

As in the previous sections, suppose that s_0 rises from 1/1000 to 1/1000 + 1/10000. The simulation shows that health spending rises by the innovation. The conclusion remains the same even if health spending is divided by GDP. Figure 7 reveals this

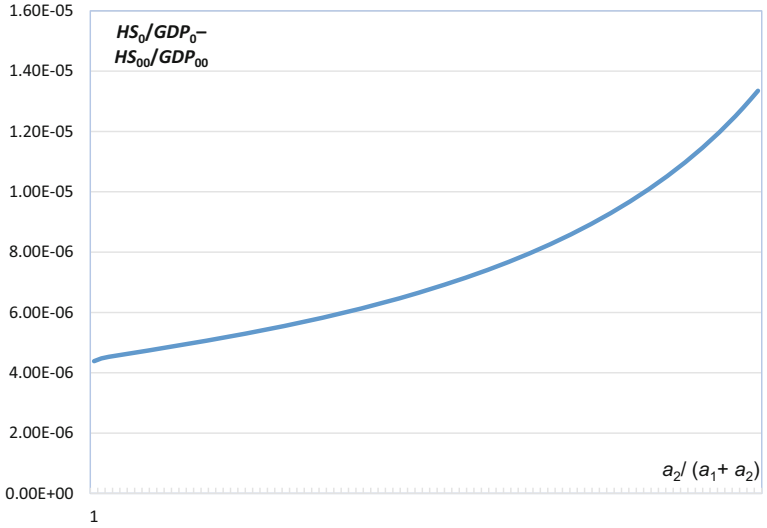

Fig. 7 $HS_0/GDP_0–HS_{00}/GDP_{00}$ for the backward medical society. Source: author's own study

relation, where the horizontal axis indicates$100a_2/\ (a_1+\ a_2)$ and the vertical axis indicates $HS_0/GDP_0– HS_{00}/GDP_{00}$.

4.3.2 Monopolistic Medical Sector Case

Under the monopolistic case, suppose that s_0 rises from 1/1000 to 1/1000 + 1/10000. The simulation shows that health spending rises by the innovation. The conclusion remains the same even if the health spending is divided by GDP. Figure 8 reveals this relation, where the horizontal axis $100a_2/\ (a_1+\ a_2)$ and the vertical axis indicates $HS_{0M}/GDP_{0M}– HS_{00M}/GDP_{00M}$.

The analysis in this section is summarized in Table 1. In the backward medical society in which s_0 is low, the health spending per GDP rises by the medical innovation. In the advanced medical society in which s_0 is high, the health spending per GDP rises by the medical innovation when the hospital is monopolist while it declines when the hospital is a competitor.

It must be noted that Cutler and Morton (2013) pointed out that the US medical sector has a tendency toward monopoly. Furthermore, Arrow (1963) described the medical sector as the "collusive monopoly." Through the robustness analysis in this section, we may conclude that health spending per GDP tends to rise by the medical innovation.

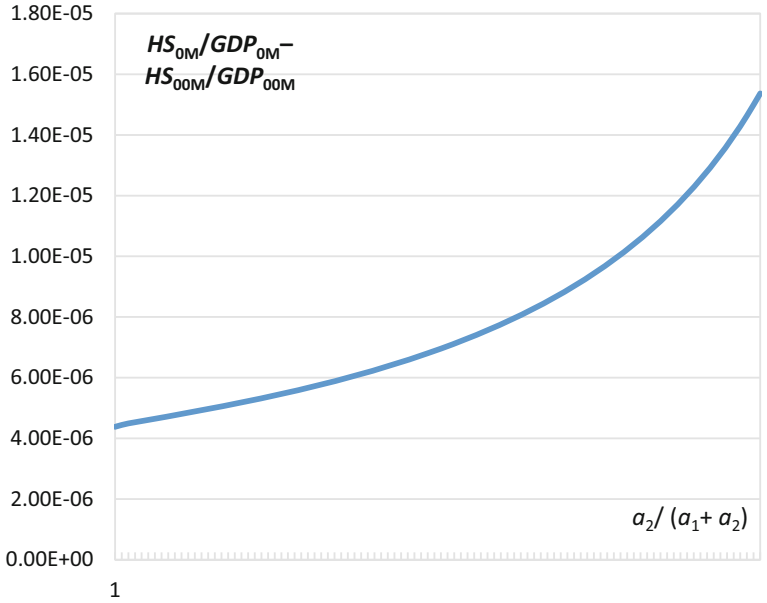

Fig. 8 $HS_{0M}/GDP_{0M}–HS_{00M}/GDP_{00M}$ for the backward medical society. Source: author's own study

Table 1 Variation of *HS*/*GDP* when the medical innovation emerges

Medical Society Hospital	Advanced (High s_0)	Basic	Backward (Low s_0)
Competitor	Decline	Uncertain	Rise
Monopolist	Rise	Rise	Rise

Source: author's own study

5 Medical Insurance

As a by-product of the formulation in this paper, we can examine the moral hazard and the adverse selection in the context of general equilibrium.

5.1 Competitive Basic Medical Society ($s_0 = 1/10$) under Medical Insurance

In this subsection, a competitive general equilibrium model incorporating the medical sector is constructed, where medical insurance is available. As in the competitive case, under this medical insurance, 100 *k*% of medical charges on unfortunate and sick workers is deducted by this insurance, while this deduction is made possible by

the fortunate workers' insurance premium. Except for this point, the same assumptions are adopted. We start with an orthodox case in which $a_1 = 90$ workers are fortunate and $a_2 = 10$ workers are unfortunate, and the probability, $\alpha = a_2/(a_1 + a_2) = 10/100$, of being unfortunate in each year. As for the general equilibrium model incorporating taxing system, see Fukiharu (2014).

5.1.1 Behavior of Agents

When a household is fortunate and healthy, it has 365 days of initial leisure days. Its behavior is stipulated by (1) and (2). Remarks on Y_1 are appropriate in this section. We start with the case in which $k = 1/10$. Thus, the deduction cost, divided by the number of fortunate workers, $k\,p_x \times a_2 \times x_1/a_1$ is the transfer payment from the fortunate workers to the unfortunate workers as the health insurance premium. The fortunate worker's demand function for goods, z_1, and the labor supply function of healthy worker, l_1, are analytically derived. The unfortunate worker's behavior is stipulated by the following utility maximization under income constraint:

$$\begin{aligned} &\max\ u(z_2, le_2) \text{ subject to } p_z z_2 + (1-k)p_x x \\ &= w(H_0 + (365 - H_0)\,(1 - e^{-x/10}) - le_2) + Y_2 \end{aligned} \tag{10}$$

Under (2) and (10), the unfortunate household's demand function for goods, z_{21}, the demand function for medical services, x_1, and labor supply function, l_2, are derived analytically. The behavior of the good-producing firm is stipulated by profit maximization, where production function is given by (4). The profit maximization under (4) gives rise to the equilibrium condition, $p_z = w$. The behaviors of the hospital and the doctor are exactly the same as in 2.4.

5.1.2 Competitive General Equilibrium under Medical Insurance in the Basic Medical Society ($s_0 = 1/10$)

Equilibrium conditions are given by (6) and (7), where $w = p_z = 1$, $Y_1 = -k\,p_x\,a_2\,x_1/a_1$, and $Y_2 = 0$.

Suppose that $s_0 = 1/10$. Utilizing the Newton Method, we can solve competitive medical service charge, p_{x00k}, and the rental price of doctor, w_{D00k} as follows:

$$p_{x00k} = 1.63079 > p_{x00}$$
$$w_{D00k} = 0.66487 > w_{D00}$$

It is easy to check that in equilibrium, c is indeed equal to $p_x \times a_2 \times x_1$. Now, the utility level and income for the fortunate worker in this general equilibrium are given by u_{100k} and i_{100k}, while the utility level and income for the unfortunate worker in

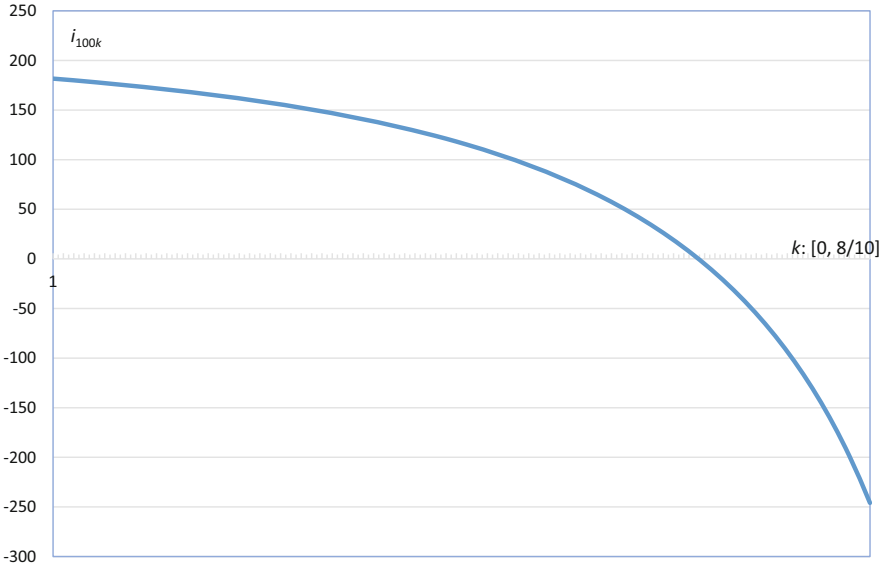

Fig. 9 Incomes of the fortunate worker, i_{100k}. Source: author's own study

this general equilibrium are given by u_{200k} and i_{200k}. The doctor's utility level and income in the competitive general equilibrium are given by u_{d00k} and i_{d00k}. The sum of these utilities in this competitive general equilibrium, the Bentham-type social welfare, is given by W_{LD00k}, which is computed as follows:

$$W_{LD00k} = a_1 u_{100k} + a_2 u_{200k} + D_0 u_{d00k} = 3285030.48319 < W_{LD00}$$

This result corresponds with the moral hazard argument (Pauly 1968). Next, we examine the moral hazard for the *orthodox* case in which $a_1 = 90$ and $a_2 = 10$ when $k = 2/10, \ldots, 9/10$. The Bentham-type social welfare, W_{LD00k}, computed continues to decline until $k = 9/10$. Thus, we may assert that the Pauly-type moral hazard does take place for *the orthodox case*. Finally, we examine the *unorthodox* case in which $a_1 = 10$ and $a_2 = 90$. Note that the competitive general equilibrium with the medical sector is not necessarily guaranteed for the arbitrary medical payment deduction rate, k, $0 < k < 1$, since the incomes of the fortunate worker, i_{100k}, are negative for $k = 7/10, 8/10, 9/10$, as shown in Fig. 9, in which the x-axis indicates k, $0 < k < 1$, and the y-axis indicates the incomes of the fortunate worker, i_{100k}.

In this *unorthodox case*, we compute the Bentham-type social welfare, W_{LD00k}, for $k = 0, 1/10, \ldots, 7/10$. When $k = 0$, $W_{D00k} = 2568661.92085$, and it declines until $k = 3/10$. As k increases, however, from $k = 4/10$, and when $k = 5/10$, we have $W_{LD00k} = 2589358.42616$, which is greater than the one when $k = 0$. Thus, near the boundary of k, the Pauly-type moral hazard does not emerge. In other words, the social inefficiency does not take place when the government adopts the 50% medical payment deduction rate for this *unorthodox* case.

5.1.3 Competitive General Equilibrium under Medical Insurance in the Advanced Medical Society ($s_0 = 10$)

Suppose that $s_0 = 10$. In the advanced medical society, the competitive general equilibrium with the medical sector incorporating medical insurance is guaranteed for arbitrary k, $0 < k < 1$ for both the *orthodox* and *unorthodox* cases. Contrary to the basic medical society, the income for the fortunate workers is positive for arbitrary k, $0 < k < 1$ in the *unorthodox* case, as shown in Fig. 10.

Utilizing the Bentham-type social welfare, it is confirmed that the moral hazard emerges for both the *orthodox* and *unorthodox* cases: i.e., $W_{LD00k} < W_{LD00}$ for $k = 0$, 1/10, . . ., 9/10.

5.1.4 Competitive General Equilibrium under Medical Insurance in the Backward Medical Society ($s_0 = 1/1000$)

First, it is shown that the existence of general equilibrium with medical sector incorporating medical insurance is guaranteed for k, $0 < k < 1$, for the *orthodox* and *unorthodox* cases. For the *orthodox* case, we compute the Bentham-type social welfare, W_{LD00k}, for $k = 0$, 1/10, . . ., 9/10. When $k = 0$, $W_{LD00k} = 3222597.65517$, and it continues to decline until $k = 9/10$. Thus, we may assert that when the Bentham-type social welfare is adopted, the Pauly-type moral hazard does take place. For the *unorthodox* case, when $k = 0$, $W_{LD00k} = 2358097.67700$, and it declines until $k = 9/10$. Thus, Pauly-type moral hazard takes place.

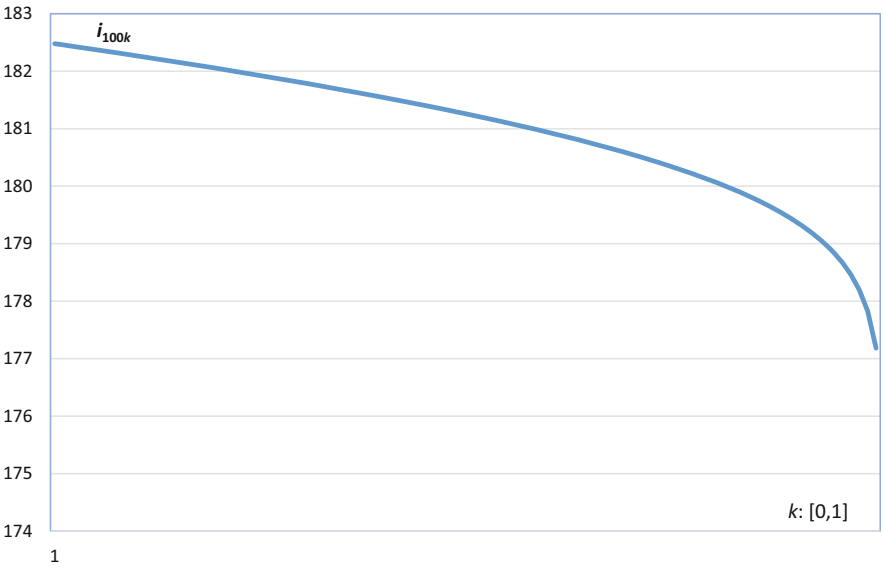

Fig. 10 Incomes of the fortunate worker, i_{100k}. Source: author's own study

5.2 *Monopolistic Basic Medical Society ($s_0 = 1/10$) under Medical Insurance*

In this subsection, a monopolistic general equilibrium model incorporating medical sector is constructed, where medical insurance is available. Except for this point, the same assumptions are adopted. Thus, the medical insurance is introduced into Basic Model II: i.e., $a_1 = 90$ workers are fortunate and $a_2 = 10$ workers are unfortunate, and the probability, $\alpha = a_2/(a_1 + a_2) = 10/100$, of being unfortunate in each year. By the medical insurance, 100 k% of the medical charge of the unfortunate workers is deducted, while the deduction is covered by the insurance premium, paid by the fortunate workers. In this subsection, it is assumed that $k = 1/10$.

5.2.1 Behavior of Agents

The behaviors of the "fortunate" and "unfortunate" workers are stipulated by (1) and (10), respectively. The remarks, however, on Y_1 and Y_2 are appropriate. The hospital, as the monopolist, is owned by the workers with an equal share holding, so that the monopolistic profit is distributed into Y_1 and Y_2. In order to compute the monopolistic equilibrium under a general equilibrium, the "objective" profit function of the medical sector, $\mathrm{OPRO}_k(p_x)$, which equalizes demand and supply in the goods and doctors markets is derived analytically as follows, from (6) and (7), with $w = 1$, $Y_1 = \mathrm{OPRO}_k(p_x)/100 - ka_2p_xx_1/a_1$, $Y_2 = \mathrm{OPRO}_k(p_x)/100$, and $p_z = 1$:

$$\mathrm{OPRO}_k(p_x) = \frac{5}{146}\left(-2920p_x\log\left[\frac{9p_x}{65}\right] - 1600\log\left[\frac{9p_x}{65}\right]^2 + 1600\log\left[\frac{9p_x}{65}\right]\sqrt{\log\left[\frac{9p_x}{65}\right]^2}\right)$$

5.2.2 Monopolistic General Equilibrium under Medical Insurance in the Basic Medical Society ($s_0 = 1/10$)

Suppose that $s_0 = 1/10$. The hospital maximizes OPRO_k with respect to p_x. The monopolistic medical charge by the hospital, p_{xM00k}, is computed as follows by the Newton Method, which is higher than p_{xM00} and p_{x00}. The wage rate (rental price) of the doctor in the monopolistic medical sector, w_{DM00k}, is higher than w_{DM00}:

$$p_{xM00k} = 3.82463 > p_{xM00} > p_{x00}$$
$$w_{DM00k} = 0.12133 > w_{DM00}\ (w_{DM00} < w_{D00})$$

Now, the utility level and income for the fortunate worker in this monopolistic general equilibrium are given by u_{1M00k} and i_{1M00k}, while the utility level and income

for the unfortunate worker in this general equilibrium are given by u_{2M00k} and i_{2M00k}. The doctor's utility level and income in the monopolistic general equilibrium are given by u_{dM00k} and i_{dM00k}. The Bentham-type social welfare is given by W_{LDM00k}, which is computed as follows:

$$\begin{aligned} W_{LDM00k} &= a_1 u_{1M00k} + a_2 u_{2M00k} + D_0 u_{dM00k} \\ &= 3271206.00604 \\ &> W_{LDM00} \end{aligned}$$

The moral hazard does not emerge under the monopoly. The reason W_{LDM00k} is greater than W_{LDM00} stems from the fact that the medical insurance in the present paper is a subsidy in the monopoly. Next, it is shown that the existence of monopolistic general equilibrium with the medical sector is guaranteed for the arbitrary medical payment deduction rate, k, $0 < k < 1$, in the *orthodox* case. The non-negativity of $\boldsymbol{i_{100k}}$ is guaranteed. We compute the Bentham-type social welfare, W_{LDM00k}, for $k = 0, 1/10, \ldots, 9/10$. When $k = 0$, $W_{LDM00k} = 3274807.59664$, and it continues to rise until $k = 8/10$. While it declines when $k = 9/10$, it is still greater than W_{LDM00k} when $k = 0$. Thus, we may assert that when the Bentham-type social welfare is adopted, the Pauly-type moral hazard does not take place in this case. Finally, it is shown that the existence is not necessarily guaranteed for arbitrary k, $0 < k < 1$ when the society is assumed to be of the *unorthodox case*. In this *unorthodox* case, it is impossible to adopt more than a 60% medical payment deduction rate: i.e., $k \geq 6/10$. It is the case, since $i_{1M00k} < 0$, for $k \geq 6/10$. With respect to the moral hazard, we have the following: when $k = 0$, $W_{LDM00k} = 2552288.28913$, and it rises until $k = 5/10$. Thus, the Pauly-type moral hazard does not take place until $k = 5/10$.

5.2.3 Monopolistic General Equilibrium under Medical Insurance in the Advanced Medical Society ($s_0 = 10$)

First, it is shown that the existence of monopolistic general equilibrium with the medical sector is guaranteed for the arbitrary medical payment deduction rate, k, $0 < k < 1$, in the *orthodox case*. We compute the Bentham-type social welfare, W_{LDM00k}, for $k = 0, 1/10, \ldots, 9/10$. When $k = 0$, $W_{LDM00k} = 3291715.71402$, and it continues to decline until $k = 9/10$. Thus, we may assert that the Pauly-type moral hazard takes place in the *orthodox case*. Next, it is shown that the existence of a monopolistic general equilibrium is not necessarily guaranteed for the arbitrary medical payment deduction rate, k, $0 < k < 1$ when the society is assumed to be of the *unorthodox* case. In this *unorthodox* case, it is impossible to adopt more than a 60% medical payment deduction rate: i.e., $k \geq 6/10$. Finally, we compute the Bentham-type social welfare, W_{LDM00k}, for $k = 0, 1/10, \ldots, 6/10$. When $k = 0$, $W_{LDM00k} = 3012255.33964$, and it rises until $k = 5/10$. Thus, the Pauly-type moral hazard does *not* take place.

5.2.4 Monopolistic General Equilibrium under Medical Insurance in the Backward Medical Society ($s_0 = 1/1000$)

First, it is shown that the existence of the monopolistic general equilibrium with the medical sector is guaranteed for the arbitrary medical payment deduction rate, k, $0 < k < 1$, in the *orthodox case*. We compute the Bentham-type social welfare, W_{LDM00k}, for $k = 0, 1/10, \ldots, 9/10$. When $k = 0$, $W_{LDM00k} = 8901303584456.00296$, and it continues to decline until $k = 9/10$. Thus, we may assert that the Pauly-type moral hazard takes place in the *orthodox case*. Next, it is shown that the existence of the monopolistic general equilibrium is guaranteed for the arbitrary medical payment deduction rate, k, $0 < k < 1$ when the society is assumed to be of the *unorthodox* case. We compute the Bentham-type social welfare, W_{LDM00k}, for $k = 0, 1/10, \ldots, 9/10$. When $k = 0$, $W_{LDM00k} = 169788593194194090.59993$, and it declines until $k = 9/10$. Thus, the Pauly-type moral hazard does take place in this *unorthodox* case.

5.3 The Adverse Selection

Akerlof (1970) argued that the market for used cars might disappear due to asymmetric information, providing the dynamic adjustment process toward the disequilibrium, where the sellers of used cars know the quality of them, while the purchasers don't. Rothschild and Stiglitz (1976) asserted that there may not exist (partial) equilibrium in a competitive insurance market with asymmetric information, where the competitive sellers of insurance do not know the exact probabilities of diseases of the purchasers and the insurers must set the insurance fee by the average of those probabilities in a game-theoretic framework. This contribution was extended by Engers and Fernandez (1987), and Dubey and Geanakoplos (2002) in the framework of game theory.

The insurer in the present paper may well be a government, the sole insurer, who attempts to introduce the universal health insurance system. We examined the same non-existence of the market equilibrium under quality uncertainty. In this sense, the adverse selection emerges in the general equilibrium with the medical sector under equilibrium when the insurance system is introduced when the government does not know the probability of health condition of the workers.

6 Conclusion

The main aim of this paper was to conduct an examination on the problem of whether the rise of the health spending's share in GDP is caused by medical innovation utilizing general equilibrium models with medical sector. In doing so, a minor aim has been to shed light on the problem of the moral hazard and the adverse

selection. In this paper, two types of general equilibrium model were constructed for the purpose of comparison of their conclusions. One of them is the general equilibrium model incorporating medical sector under perfect competition. The other is the one under monopoly.

Independently of the assumption on the competition, there are three economic agents: i.e., fortunate workers, unfortunate workers, and (aggregate) doctor. The numbers of *fortunate* workers with initial labor endowment 365 days and *unfortunate* workers with initial labor endowment H_0 days are a_1, and a_2, respectively. It was assumed that workers do not know whether they are fortunate or not until the beginning of the year. Thus, the probability of workers being *fortunate* is $a_1/(a_1 + a_2)$, and this induces the health care insurance, the deduction of *unfortunate* workers' medical payment through the subsidy by the *fortunate* workers. This insurance follows the idea by Arrow (1963).

The novelty in this paper is the introduction of the "illness treatment function" of the medical sector, with the parameter s_0. As s_0 rises, it raises the medical sector's ability of treating patients, a measure of medical technology. In this paper, we defined the medical innovation as the rise of s_0. The hospital recovers a part of $365–H_0$ with a medical charge. The determination of this medical charge is made either competitively or monopolistically. We compared three types of medical society: the *basic* medical society with $s_0 = 1/10$, the *advanced* one with $s_0 = 10$, and the *backward* one with $s_0 = 1/1000$.

With respect to the medical innovation, its effect on health spending per GDP depends on the level of s_0 itself in the competitive case: i.e., when s_0 is high (the advanced medical society), the further increase of s_0 reduces the health spending per GDP. On the contrary, when s_0 is low (the backward medical society), the further increase of s_0 raises the health spending per GDP, while in between, the conclusion depends on $a_2/(a_1+ a_2)$. In the monopolistic case, however, the effect of innovation does not depend on the level of s_0 itself: i.e., the increase of s_0 always raises the health spending per GDP.

In order to reach a conclusion on the problem with respect to the relation between medical innovation and health spending, it may be appropriate to refer to Arrow (1963) and Cutler and Morton (2013). The former describes the medical sector as a "collusive monopoly," whereas the latter pointed out that the US medical sector has a tendency toward monopoly. In consideration of Arrow (1963) and Cutler and Morton (2013), we might be able to assert that the recent rise of health spending in the USA has been, in part, caused by the medical innovation and that there is a causal relation in general between medical innovation and the rise of health spending per GDP.

Utilizing the partial equilibrium analysis, Pauly (1968) argued that the dead weight loss emerges under medical insurance for the health care market with competitive medical sector. On the one hand, in this paper it was shown that the Pauly-type moral hazard emerges in the sense that the Bentham-type social welfare declines under medical insurance for the general equilibrium model with competitive medical sector, except for cases on the boundary. On the other hand, it was shown that the Pauly-type moral hazard does not emerge under medical insurance for the

general equilibrium model with monopolistic medical sector in the basic medical society and for the unorthodox cases in the advanced medical society. Akerlof (1970) argued that the market for used cars might disappear due to asymmetric information. In this paper, it was shown that in the sense of the non-existence of the market equilibrium under quality uncertainty, adverse selection may emerge in the general equilibrium with the competitive and monopolistic medical sectors when medical insurance is introduced.

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Part IV
Empirical Studies on Emerging Economies

Asymmetric Impacts of the Geopolitical Risk on the Oil Price Fluctuations

Oguzhan Ozcelebi and Kaya Tokmakcioglu

Abstract In this study, the vector autoregression (VAR) model framework is enhanced by the incorporation of nonlinear effects. More specifically, this study employs a nonlinear VAR model for the post-global financial crisis (GFC) period, and thus, the impacts of the geopolitical risk on oil futures and volatility are discussed for Israel, Russia, Saudi Arabia, and Turkey. It is found that an increase in geopolitical risk will lead to an increase in oil futures, whereas the geopolitical risk changes in Israel, Saudi Arabia, and Turkey measured by 1, 2, 4, and 10 standard deviation shocks have higher impacts than that of Russia. In the case of Israel, it is revealed that the rise in geopolitical risk may lead to a steady upward trend in oil futures by reducing oil price volatility. Our study highlights the role of Israel, Saudi Arabia, and Turkey in oil prices, and it is suggested that the geopolitical risks of all countries may have symmetrical effects on oil futures. The impact of country-specific geopolitical risk shocks on oil price volatility can be considered asymmetric, and the responses are size-dependent. In this respect, we also show that the global geopolitical risk benchmark index may have an asymmetric impact on oil price volatility.

Keywords Oil futures · Oil price volatility · Geopolitical risk · Asymmetry · Censored VAR

O. Ozcelebi (✉)
Department of Economics, Istanbul University, Istanbul, Turkey
e-mail: ogozc@istanbul.edu.tr

K. Tokmakcioglu
Department of Management Engineering, Istanbul Technical University, Istanbul, Turkey
e-mail: tokmakcioglu@itu.edu.tr

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1 Introduction

When the economic situation of the Middle Eastern countries is considered, it is acknowledged that the oil-exporting countries in the region will be significantly affected by fluctuations in oil prices. The changes in oil prices are closely related to the macroeconomic performance of oil-importing countries, and it can be assumed that the growth rates of developing countries are also changing the oil demand. A significant portion of the studies in the scientific literature examines the relationship between the macroeconomic financial variables and the oil prices (ElFayoumi 2018; Lorusso and Pieroni 2018). Additionally, the dynamics of the oil market can also be influenced by supply conditions, and the shocks in oil production have significant impacts globally (Balke and Brown 2018; Ewing et al. 2018; Gong and Lin 2018). For instance, a decrease in oil production raises inflation on a worldwide scale via the increase in the production cost. This can be explained by the shift of the Philips curve, which is also due to the geopolitical risks. In this context, it is known that the Arab-Israeli War in 1973 significantly increased oil prices and caused structural breaks in macroeconomic and financial indicators. Therefore, explaining the relationship between geopolitical risks and oil prices will give evidence of the macroeconomic situation.

With the First Gulf War, the importance of the geopolitical risks in the Middle East has re-emerged, and the process has continued with the 9/11 terrorist attacks and with the US invasion of Afghanistan and Iraq. The annexation of Crimea by Russia and the terrorist attacks in various parts of the world, primarily in Paris, caused geopolitical risks to be evaluated within the scope of political science (Bompard et al. 2017; Korotayev et al. 2018). In addition, the Geopolitical Risk index (GPR index) developed by Caldara and Iacoviello (2016) has opened a new dimension in the scientific literature (Antonakakis et al. 2017; Balcilar et al. 2018; Aysan et al. 2019; Cheng and Chiu 2018; Dong et al. 2019; Labidi et al. 2018). On the other hand, there are differences between the economic impacts triggered by the increase and the decrease in geopolitical risks. More specifically, this situation can be analyzed within the scope of the asymmetry concept. In other words, other macroeconomic variables, especially oil prices, may increase geopolitical risks more rapidly and with severe negative reactions, but the decrease in geopolitical risks may not lead to positive responses to the same degree. This has led to the adaptation of the concept of asymmetry in advanced time series models to explain the long-term relationship between geopolitical risks and oil prices. In this study, the effects of positive and negative changes in geopolitical risk on oil futures and volatility are examined based on the approach developed by Kilian and Vigfusson (2011). However, our study differs from previous studies, which stress the GPR index in general, by examining the effects of the country-specific geopolitical risks on oil prices. More specifically, the effects of the geopolitical risk of non-oil producers and the countries that do not have close relations with the Middle East can be neglected. In this study, we used the country-specific GPR index developed by Caldara and Iacoviello (2016) for Israel, Russia, Saudi Arabia, and Turkey to

study the asymmetric impacts on the basis of a VAR model with censored variables. Hence, we explore whether changes in the GPR Indices of Israel, Russia, Saudi Arabia, and Turkey have had considerable impacts on oil futures and oil price volatility. Secondly, we compare these results with the impacts of the global benchmark index on oil futures and oil price volatility. In doing so, we intend to address the issue of whether geopolitical risk can be an important determinant of oil price fluctuations. Because geopolitical risks also influence long-term expectations and have a considerable impact on future contracts, the main contribution of our study is that we analyze the asymmetric relationship between the GPR index and the WTI Crude Oil Futures. The GPR index is taken from the study by Caldara and Iacoviello (2016), and WTI crude oil futures and CBOE crude oil ETF volatility data are taken from the statistical database of Thomson Reuters. All series are seasonally adjusted with plausible techniques, and RATS 9.2 routines are used for the empirical exercise.

2 Literature Review

In the era of the globalization, the economic policy uncertainty causes significant fluctuations in the macroeconomic situation. One of the important determinants of the economic uncertainty is the political uncertainty which have reached high levels due to the geopolitical risk. In this context, the approach by Azzimonti (2018) differentiated political uncertainty from economic policy uncertainty. One of the main determinants of political uncertainty is the geopolitical risk of the countries, which has significant effects on economic activity. In this context, Cheng and Chiu (2018) estimated the structural vector autoregression (SVAR) model for 38 developing countries, assuming that global geopolitical risks have significant effects on business cycles of developing countries. The variables of the SVAR model used in the study are the GPR index, the real output per capita, the real gross investment per capita, the real private consumption per capita, the real exchange rate, and the trade balance. The model is enhanced by the terms of trade, the US interest rate spreads, the US EPU index, and the US stock market volatility. The authors concluded that the increase in the geopolitical risk leads to significant economic contractions, but according to Cheng and Chiu (2018), global geopolitical risks account for at least 10% of the average weight of the output variation. However, it has been confirmed that geopolitical risks should be assessed in terms of country-specific factors, and they found that each developing country is subject to a considerable geopolitical risk. Along with the real business cycles, global geopolitical risk has indispensable effects on foreign trade volume, which is also an important indicator of the course of the global economy. In this respect, Gupta et al. (2019) employed a classical gravity model, assessing the influences of geopolitical risks on the trade flows for developing and developed countries geopolitical risks on the global trade flows. Gupta et al. (2019) found that the geopolitical risks cause negative impacts on the global trade

flows, whereupon it was suggested policymakers should implement policies to sustain trade flows during the times of higher geopolitical risks.

Geopolitical risks significantly affect the financial market dynamics as well as business cycles and may have impacts on asset prices, leading to a deterioration in financial stability. In this regard, Balcilar et al. (2018) used the nonparametric causality-in-quantiles tests to analyze the effect of geopolitical uncertainty on return and volatility dynamics in the BRICS stock markets. They confirmed that geopolitical risks can be heterogeneous across the BRICS stock markets. Moreover, it was found that the increase in geopolitical risk in the countries considered, except Russia, does not significantly raise the stock returns, but increases the volatility. While geopolitical risks are determinant of economic uncertainties, the evaluation of other indicators of the economic uncertainty and the time-related effects between macroeconomic and financial variables is another crucial issue. On the basis of this assumption, Labidi et al. (2018) analyzed the cross-quantile dependence between developed and emerging market stock returns with recursive sample estimations. According to their results, there was a heterogeneous quantile relation for the USA, UK, German, and Japanese stock returns. Moreover, the indicators implying the systematic risk (the US Economic Policy Uncertainty index, the US Equity Market-Related Economic Uncertainty index, the Chicago Board of Exchange Volatility index and the GPR index) did not reveal the cross-country dependence structure. Herein, stock returns are related to macroeconomic variables and economic uncertainties, as well as other financial market dynamics. Considering the phenomenon of global financial development, it is assumed that the stock markets, especially in developing countries, are closely related to oil prices. Antonakakis et al. (2017) developed this approach and assumed that the relationship between the stock and the oil market depends on geopolitical risk. In their study, the relationship between the Standard & Poors (S&P) 500 stock index and the WTI oil index real returns was analyzed using the volatility modeling approach. Taking into consideration the time-varying stock-oil covariance, their returns, and their variances, they found that geopolitical risk leads to a negative effect on oil returns and volatility. Moreover, Antonakakis et al. (2017) stressed that the relationship between these two markets weakened. In a similar approach, Dong et al. (2019) confirmed that there exists a long-term relationship between crude oil, global economic activity, and geopolitical risk by using cointegration analysis.

Although the effect of the increase and decrease in oil prices on macroeconomic and financial variables cannot have the same magnitude, macroeconomic and financial developments may not have symmetrical effects on oil prices. In this context, the role of asymmetry in explaining the interaction between the oil prices and macroeconomic financial variables is increasing in importance in the scientific literature (Karaki 2017; Apergis and Vouzavalis 2018; Kang et al. 2019). However, some recent studies have examined oil price uncertainty (Wang et al. 2017; Dutta et al. 2017; Phan et al. 2019; Xiao et al. 2018), as oil market dynamics show considerable uncertainties due to various factors. In terms of oil price dynamics, it can be argued that the interplay between the economic indicators of the Middle East and oil price uncertainty may even be higher. In this context, Dutta et al. (2017) studied the

impacts of oil market uncertainty indicated by the implied crude oil volatility index (OVX) on the realized volatility of Middle East and African stock markets. By using a generalized autoregressive conditional heteroskedasticity (GARCH)-type model, they found that oil market uncertainty has considerable effects on the realized volatility. Moreover, the GARCH-jump model revealed that stock returns are generally sensitive to the fluctuations in the OVX, which highlights the time-varying impacts on the stock returns. On the other hand, Xiao et al. (2018) employed quantile regression analysis to study the effects of crude oil volatility on the Chinese aggregate and sectoral stock returns. They decomposed the OVX according to the positive and negative sums, whereupon Xiao et al. (2018) found that the OVX changes mainly show significantly negative effects on the aggregate and sectoral stock returns in the bearish market. More specifically, they implied the role of the asymmetric effects by showing that the positive shocks of the OVX are more dominant than that of the negative shocks.

In this study, we assume that geopolitical risk is the major driving force of the dynamics of long-term oil prices and oil price volatility. More specifically, we analyze the impacts of the benchmark GPR index and the GPR indices of Israel, Russia, Saudi Arabia, and Turkey on crude oil futures and crude oil volatility, incorporating the role of asymmetric impacts in the estimation process of the VAR model with censored variables similar to Kilian and Vigfusson (2011). We employ a censored VAR model to take the advantage of impulse-response tools and to detect the influences of the GPR index on positive and negative changes in the crude oil futures and the crude oil volatility in the following periods. In this respect, the censored variables approach allows us to capture the positive changes in the GPR index, while the negative changes are assumed to be zero. We follow the empirical methodology of Kilian and Vigfusson (2011) and apply Mork and Wald's slope-based tests to determine whether there are considerable differences in the impulse responses due to positive and negative shocks. Our empirical exercise covers the period after the 2008–2009 GFC and differs from the work of Antonakakis et al. (2017) and Dutta et al. (2017), who used GARCH modeling, because our primary concern is to detect asymmetry via slope-based tests.

3 Methodology of Analysis

3.1 Empirical Model

Departing from the vector autoregression (VAR) model framework, we employ nonlinear VAR modeling in line with Kilian and Vigfusson (2011) to show the asymmetric relationship between the effects of positive and negative changes in the geopolitical risk and the oil futures and the volatility. For this purpose, the global benchmark GPR index (gpr_t^{glb}) and the GPR indices of Israel, Russia, Saudi Arabia, and Turkey ($gpr_t^{il}, gpr_t^{ru}, gpr_t^{sa}, gpr_t^{tr}$), the crude oil volatility index (ovx_t), the crude

oil futures (ofu_t) are employed, respectively. All the variables are (2010 = 100) and they are in logarithms. In this respect, we estimate censored VAR models for the period from 2010:01 to 2018:08, whereupon impulse response functions and slope-based tests are performed. Our sample coincides the period after the GFC where expansionary monetary policies are implemented by major central banks. Thus, a period in which the effects of geopolitical risks on oil prices have been prominent is evaluated.

More precisely, we use the approach of Kilian and Vigfusson (2011) which derived from the linear and symmetric and asymmetric data generating processes. Censored variable VAR model constitutes a base for the computation of the nonlinear VAR model's impulse-response functions.[1] The relevant model can be expressed as below;

$$x_t = b_{10} + \sum_{i=1}^{p} b_{11,i} x_{t-i} + \sum_{i=1}^{p} b_{12,i} y_{t-i} + \varepsilon_{1,t} \tag{1}$$

$$y_t = b_{20} + \sum_{i=1}^{r} b_{21,i} x_{t-i} + \sum_{i=1}^{r} b_{22,i} y_{t-i} + \sum_{i=1}^{r} g_{21,i} x_{t-i}^{+} + \varepsilon_{1,t} \tag{2}$$

The equation (1) is a linear VAR model showing the influences of $\boldsymbol{x_t}$ on $\boldsymbol{y_t}$, whereas the equation (2) exposes both the impacts of $\boldsymbol{x_t}$ and $\boldsymbol{x_t^+}$ on $\boldsymbol{y_t}$. Accordingly, the dynamic responses of $\boldsymbol{y_t}$ to positive and negative changes in $\boldsymbol{x_t}$ can be computed. A set of equations having both censored variables, and thus, nonlinear VAR model can be identified as below;

$$s_t = b_{10} + \sum_{k=1}^{p} b_{11,k} s_{t-k} + \sum_{k=1}^{p} b_{12,k} \lambda_{t-k} + \varepsilon_{1,t} \tag{3}$$

$$\lambda_t = b_{20} + \sum_{k=1}^{p} b_{21,k} s_{t-k} + \sum_{k=1}^{p} b_{22,k} \lambda_{t-k} + \sum_{k=1}^{p} g_{21,k} s_{t-k}^{+} + \varepsilon_{2,t} \tag{4}$$

where p denotes the lag order of the VAR model and s_t corresponds to the variable whose possible asymmetric impacts are searched for. λ_t vector contains variables that can be affected by the s_t. Equation (3) is a linear symmetric model with s_t, while equation (2) includes both s_t and censored variable of s_t^+. The s_t^+ shows the positive changes and it can be assumed that; $s_t^+ = \begin{cases} s_t \; s_t > 0 \\ 0 \; s_t \leq 0 \end{cases}$. Additionally, b_{10} and b_{20} in

[1]The data generation process of x_t can both be assumed as symmetric and asymmetric in the context of the regression model; $x_t = \alpha_1 + \varepsilon_{1,\,t}$. Accordingly, the substitution of negative values of x_t with zero exposes a censored variable x_t^+. The censored variable can be defined as; $x_t^+ = \begin{cases} x_t^+ \; x_t > 0 \\ 0 \; x_t \leq 0 \end{cases}$.

Table 1 Lumsdaine-Papell unit root test results

Variables	Test statistic	Number of lagged differences by AIC	Suggested break date
ovx_t	−6.5635	2	2011:07, 2014:09
Δovx_t	−10.4106	0	2011:10, 2016:02
ofu_t	−4.9339	1	2012:04, 2014:09
Δofu_t	−9.2868	0	2014:06, 2016:01
gpr_t^{glob}	−5.3392	0	2014:02, 2017:03
Δgpr_t^{glob}	−9.0091	2	2014:09, 2016:01
gpr_t^{il}	−8.9044	0	2013:09, 2015:11
Δgpr_t^{il}	−7.6211	4	2014:05, 2017:03
gpr_t^{ru}	−5.6696	2	2011:11, 2014:02
Δgpr_t^{ru}	−11.0232	1	2013:02, 2014:05
gpr_t^{sa}	−4.1660	2	2016:01, 2017:06
Δgpr_t^{sa}	−10.9588	1	2013:01, 2014:05
gpr_t^{tr}	−5.2506	1	2013:09, 2017:01
Δgpr_t^{tr}	−8.8086	2	2014:05, 2016:06

Note: According to 1%, 5%, 10% significance level, the critical values of the test are −6.74, −6.16, −5.89, respectively
Source: Authors' calculations

(1) and (2) are the vector of intercept and dummy variables, respectively. The coefficients of the changes in s_t are included in b_{12} and b_{22}vectors. g_{21} signifies the vector of the coefficient of the censored variable and finally, $\varepsilon_{1,\,t}$ and $\varepsilon_{2,\,t}$ denotes the residual vectors of (3) and (4). In this context, four VAR models are considered and each bivariate VAR model can be written as $\left(gpr_t^{country,+}, ofu_t\right)'$ $\left(gpr_t^{country,+}, ovu_t\right)'$ $\left(gpr_t^{country,-}, ofu_t\right)'$ $\left(gpr_t^{country,-}, ovu_t\right)'$, respectively. Thus, $gpr_t^{country,+}$ and $gpr_t^{glb,+}$ are derived by negative values to zero. In other words, it is assumed that only increases have impact on the other variable of the model via censored variables approach. Herein, it should also be noted that the VAR models are determined in line with the unit root test results of gpr_t^{glb}, gpr_t^{il}, gpr_t^{ru}, gpr_t^{sa}, gpr_t^{tr}, ovx_t, and ofu_t.

3.2 Empirical Data

In order to determine the unit root properties of the variables under consideration, the Lumsdaine-Papell unit root test allowing multiple structural breaks is performed. Table 1 shows the unit root properties of the series and the break dates that each variable may have. Moreover, the Zivot-Andrews and Lee-Strazicich unit root tests with multiple break tests are parallel to the Lumsdaine-Papell unit root test for the model variables.

On the other hand, no cointegration relationship is found for all cases based on the vector specifications as; $\left(gpr_t^{glob}, ofu_t\right)'$, $\left(gpr_t^{glob}, ovx_t\right)'$, $\left(gpr_t^{country}, ofu_t\right)'$ and $\left(gpr_t^{country}, ovx_t\right)'$ with the help of at least one of the cointegration tests in the literature. The Lumsdaine-Papell unit root tests suggest that each variable may have different structural breakdown data from the other; in this regard, Bai-Perron tests have also verified that there can be multiple and different structural breaks for the model variables. Accordingly, we do not divide the full sample into particular sub-samples, and VAR models with censored variables for each country are computed on the full sample. As a result of the Lumsdaine-Papell unit root test, the variables included in the empirical exercise are the percentage change in the global benchmark GPR index Δgpr_t^{glb} and the percentage changes in GPR indices of Israel, Russia, Saudi Arabia, and Turkey ($\Delta gpr_t^{il}, \Delta gpr_t^{ru}, \Delta gpr_t^{sa}, \Delta gpr_t^{tr}$), the percentage change in the crude oil volatility index (Δovx_t), the percentage change in the crude oil futures (Δofu_t).

4 Empirical Results

Changes in geopolitical risk closely affect investor behavior, and financial asset prices show significant variations due to increased geopolitical risk. In the context of financial market fluctuations, oil is accepted as the most rapidly responding commodity to short- and long-term geopolitical risks. Additionally, it can be argued that the effects of geopolitical risks on financial asset prices will not be the same. In other words, it can be suggested that the rise in geopolitical risks for the Middle Eastern countries will have more serious effects on oil prices given the dynamics of the world economy. The effects of changes in geopolitical risks are assumed to be asymmetrical, and the increase/decrease in geopolitical risk may not have the same magnitude. In accordance with Kilian and Vigfusson's (2011) approach, we estimate a VAR model with censored variables, and the presence of asymmetric effects is also examined with Mork and Wald's slope-based tests. Accordingly, *p*-values of both tests show that the country-specific do not have asymmetric effects on oil prices. However, the Mork and Wald tests have produced opposite results in terms of the effects of the global benchmark GPR index on the oil price volatilities. According to the 10% significance level, the impact of the global benchmark GPR index on oil price volatilities can be considered asymmetric, while the Wald test points out that the effect could be symmetric. Slope-based tests can be used to measure the possible asymmetric effects of one variable on another variable and cannot be regarded as a determinant factor on the direction and magnitude of the relationship.

In this study, we examine whether the effects of the country-specific and global GPR indices on oil prices could be symmetrical by impulse-response functions, parallel to Kilian and Vigfusson (2011). In line with the work of Kilian and Vigfusson (2011), 1, 2, 4, and 10 standard deviation positive/negative shocks computed as shown in Fig. 1. In this respect, the censored variables approach is

used to investigate the effects of positive/negative geopolitical risk shocks on oil futures, and it is found that the rise in geopolitical risks in Russia, Saudi Arabia, and Turkey led to an increase in oil prices in the long term. These findings can be interpreted as potential risks associated with Turkey's and Russia's involvement in the Syrian civil war, which may have considerable impacts on oil prices. In addition, it can be claimed that the risks for Russia in terms of its own geography may increase oil prices. In this context, it can be inferred that Russia's relations with Ukraine and possible terrorist acts may have a boosting effect on oil prices. The political turmoil in Saudi Arabia, the Yemeni-Saudi relations, and the murder of journalist Jamal Khashoggi have made the kingdom an important country in terms of financial markets. Our findings suggest that the rise in the geopolitical risk of Saudi Arabia may raise the oil prices in the long run. In our study, the effects of the increase in the geopolitical risk of Israel, which has been experiencing serious problems with its neighbors since its foundation, were also examined. In this respect, it was revealed that positive shocks in the GPR of Israel led to an increase in oil futures. On the other hand, when the responses of the oil futures to the 10 standard deviation positive country-specific geopolitical risk shocks (represented by the gray line) are evaluated with respect to the magnitude of the coefficients, it has been revealed that the increase in geopolitical risks of Russia would be less impactful than the other

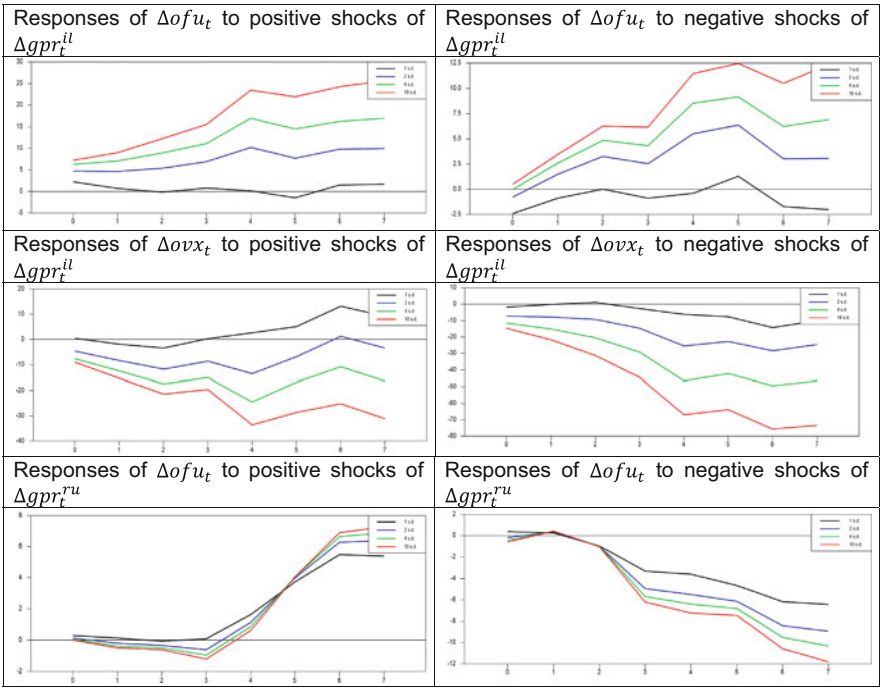

Fig. 1 Responses of oil futures and oil price volatility to positive and negative shocks of country-specific GPR index. Source: Authors' calculations

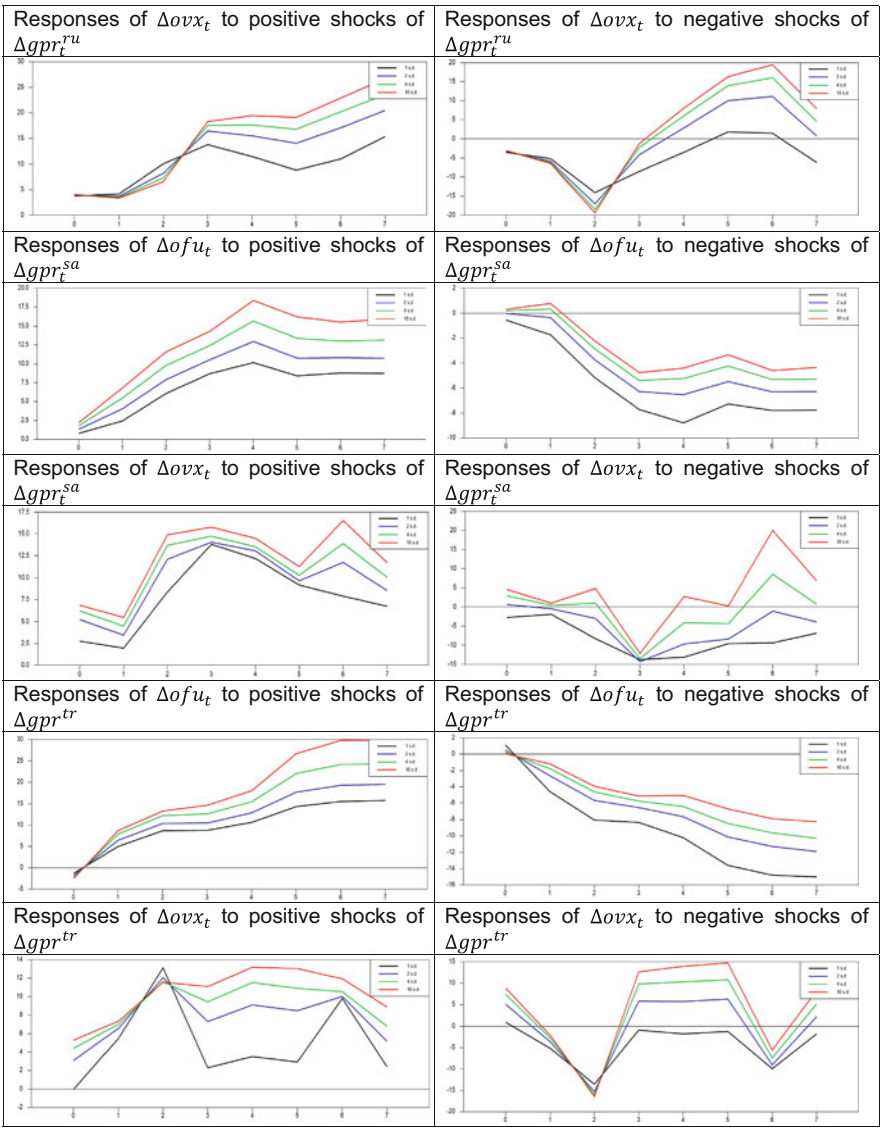

Fig. 1 (continued)

countries. These findings confirm that the geopolitical risks in the Middle East can be acknowledged as the major driving force for the rise in oil prices.

The *p*-values of the slope-based Mork and Wald statistics indicate that the effects of the GPR index shocks for all countries are not asymmetrical; in other words, they can be regarded as symmetrical. In addition to this, the existence of asymmetry via the coefficients of the responses of oil futures to the negative country-specific

geopolitical risk shocks was also examined. Accordingly, it was detected that the 1, 2, 4, and 10 standard deviation negative shocks in Russia, Saudi Arabia, and Turkey's GPR indices led to a downtrend in oil futures for the following periods. When the direction of impulse-response functions on oil futures is considered to determine whether the shocks in the country-specific GPR indices create asymmetric effects on oil futures, positive/negative shocks will lead to an increase/decrease in oil prices, in line with theoretical expectations. In this context, it can be suggested that the geopolitical risk shocks in Russia, Saudi Arabia, and Turkey may be symmetrical. On the other hand, the analysis upon impulse-response functions indicates that the geopolitical risk shocks in Israel may be asymmetrical. As a result of the 2, 4, and 10 standard deviation negative shocks for the case of Israel, it was found that oil prices would increase in contrast to the theoretical expectations, while the line with values close to zero corresponds to the 1 standard deviation shock in Fig. 1. However, the characteristics of 2, 4, and 10 standard deviation shocks in Israel have not generated robust results concerning the symmetrical relationship. Thus, our findings indicated that Russia, Saudi Arabia, and Turkey can be more crucial actors in the oil market compared to Israel, when their large population are considered.

In terms of the country-specific GPR indices, it was found that the 1, 2, 4, and 10 standard deviation positive shocks in the indices of Russia, Saudi Arabia, and Turkey would increase oil price volatility as shown in Fig. 1. When considered together with the responses of oil futures, the increase of geopolitical risk in Russia, Saudi Arabia, and Turkey would generate a volatile uptrend in oil prices. More specifically, it can be claimed that some investors may realize their profits in terms of oil futures due to the increasing geopolitical risks and rising oil prices. As a result of country-specific negative geopolitical risk shocks, it was revealed that the crude oil volatility index did not exhibit a significant trend for the cases of Russia, Saudi Arabia, and Turkey. The 1, 2, 4, and 10 standard deviation negative GPR index shocks in Russia, Saudi Arabia, and Turkey indicate a downtrend, where the oil price volatility does not reach high levels. We also found that the 1 standard deviation of positive/negative shocks in Israel's geopolitical risk would increase/decrease the oil price volatility in the upcoming periods. However, the result— that the 2, 4, and 10 standard deviation positive/negative shocks in the GPR index of Israel would reduce crude oil volatility index—can be interpreted as showing that Israel's geopolitical risk may have asymmetrical impacts. Nevertheless, the Mork and Wald tests for Israel have not confirmed the existence of any asymmetric relationship. The empirical findings of our study emphasize that the weights of the geopolitical risks of Russia, Saudi Arabia, and Turkey in oil futures and the crude oil volatility index are higher than those of Israel.

In addition to the country-specific GPR indices, the global benchmark GPR index may also have a considerable impact on oil prices. The effects of the global benchmark GPR index should also be taken into account, especially considering the terrorist acts around the world. As shown in Fig. 2, the finding that the increases in global geopolitical risk will raise oil prices and the impulse-response analysis revealed that the effect of the global geopolitical risk on oil prices may be asymmetrical. Additionally, it was suggested that the changes in global geopolitical risk

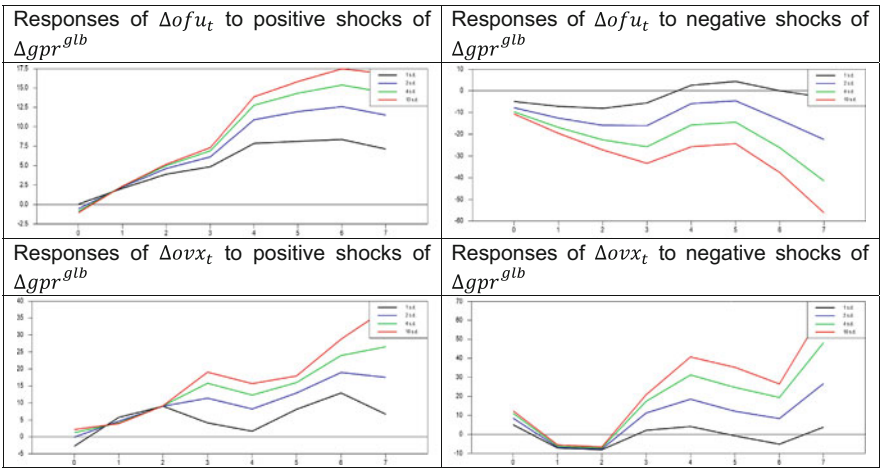

Fig. 2 Responses of oil futures and oil price volatility to positive and negative shocks of global benchmark GPR index. Source: Authors' calculations

Table 2 Slope-based test results

	Mork test		Wald test	
Shock: Δgpr_t^{il}	F-test	*p*-value	F-test	*p*-value
Response: Δofu_t	1.1748	0.3195	0.0158	0.9999
Response: Δovx_t	0.3868	0.8181	0.0022	0.9999
Shock: Δgpr_t^{ru}	F-test	*p*-value	F-test	*p*-value
Response: Δofu_t	0.1898	0.9438	0.0043	0.9999
Response: Δovx_t	0.6990	0.5924	0.0047	0.9999
Shock: Δgpr_t^{sa}	F-test	*p*-value	F-test	*p*-value
Response: Δofu_t	0.4812	0.7495	0.0076	0.9999
Response: Δovx_t	0.7963	0.5272	0.0043	0.9999
Shock: Δgpr_t^{tr}	F-test	*p*-value	F-test	*p*-value
Response: Δofu_t	0.2337	0.9194	0.00992	0.9999
Response: Δovx_t	0.1408	0.9670	0.00316	0.9999
Shock: Δgpr_t^{glb}	F-test	*p*-value	F-test	*p*-value
Response: Δofu_t	2.0780	0.0807	0.0382	0.9992
Response: Δovx_t	3.7032	0.0051	0.02269	0.9997

Note: *p*-values 0.01, 0.05 and 0.10 corresponds to the statistical significance at 1%, 5%, and 10%, respectively
Source: Authors' calculations

could cause fluctuations in oil prices. In terms of the impulse-response functions estimated in our study, we can infer whether there are asymmetric effects. This phenomenon was strengthened by the help of slope-based tests, indicated in Table 2. Considering the Mork test, it can be said that the shocks in the global benchmark GPR index will have asymmetric effects on oil futures and oil price volatility at a

10% significance level. However, the Wald test revealed that those relationships may be symmetrical. Considering the impulse-response functions, it can be claimed that the impact of the shocks in the global benchmark GPR index on the oil futures may be symmetrical, while the effect on the oil price volatility may be asymmetric.

5 Conclusion

It is acknowledged that the increase in geopolitical risk may create significant changes in oil prices over the short- and long-term. However, it can be assumed that the increase in the geopolitical risk of some countries will have a higher impact on oil prices compared to other countries. In this study, the asymmetric impacts of the country-specific geopolitical risks, which are related to the countries that have close relationships with the Middle East, on oil futures and oil price volatility, were examined with the help of slope-based tests and impulse-response functions. In this context, Israel, Russia, Saudi Arabia, and Turkey were accepted as crucial countries in terms of oil prices. According to the slope-based tests, it was implied that the changes in the geopolitical risk of those countries could not have asymmetric effects on oil futures and oil price volatility.

However, due to the importance of time-specific characteristics of the asymmetric effects, the impacts of the country-specific positive and negative geopolitical risk shocks were investigated separately. As a result of the positive country-specific geopolitical risk shocks, the responses of the oil futures in Israel, Saudi Arabia, and Turkey suggested that the rise in geopolitical risk could lead to an uptrend in oil prices in the long run. Similar findings were obtained for Russia, and the impact of the factors on the oil futures in Israel, Saudi Arabia, and Turkey increasing the geopolitical risk was found to be higher than that of Russia. In line with the theoretical expectations, it was detected that the increase in the country-specific risk would raise the oil price volatility in Russia, Saudi Arabia, and Turkey, and thus, it can be suggested that the increase in the country-specific risk for those countries may cause an uptrend, which also contains falls in oil prices. When the impulse-response functions were examined, it was seen that the rise in the geopolitical risk in Israel has led to a consistent uptrend in oil prices, where oil price volatility was decreasing. Therefore, we emphasize the role of other Middle Eastern countries having problems with Israel, which may increase the geopolitical risks associated with Israel. In this context, it is generally acknowledged that solving the problems originating from the West Bank and the Gaza Strip by peaceful means will decrease geopolitical risks; however, the impulse-response functions highlight the fact that decreasing the geopolitical risk does not lower oil prices. According to our results, it can be claimed that the decrease in the geopolitical risk of Israel will have asymmetric impacts on oil prices. However, we also found that negative geopolitical risk shocks in Russia, Saudi Arabia, and Turkey lower oil futures, and according to the slope-based test results, it can be suggested that there exist symmetrical effects of the geopolitical risk on the oil prices for those countries.

In our study, it was also found that the country-specific positive geopolitical risk shocks would increase the oil price volatility. This finding is in line with the theoretical expectations, and it was confirmed that the decrease in the country-specific geopolitical risk would not lower the oil price volatility for Israel, Russia, Saudi Arabia, and Turkey. Therefore, we showed that the impact of the country-specific geopolitical risk shocks on oil price volatility may be asymmetric based on the impulse-response functions. The impact of the country-specific GPR index on oil price volatility may be considered sticky, and the Mork slope-based test revealed that the effect of the global GPR index on oil futures and oil price volatility may be asymmetric. This finding was verified by the impulse-response analysis, and it was determined that the positive and negative shocks in the global GPR index would not oppositely affect oil price volatility. However, in accordance with the theoretical expectations, the effects of the shocks in the global GPR index on oil futures could be accepted as symmetrical by taking the coefficients of the impulse-response functions into account.

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Influence of Selected Internal Factors on the Outputs of the Financial-Sector Companies Traded on the Warsaw Stock Exchange

Ewa Majerowska and Ewa Spigarska

Abstract Financial-sector companies differ significantly from other enterprises in terms of the business activity carried out, which mainly consists in provision of financial services and consultancy with regard to financial products. Financial institutions, similarly to other companies, issue shares that are traded on the stock exchange in order to obtain additional capital. The purpose of the paper is to indicate which financial ratios significantly affect the rates of return of the shares issued by the financial institutions analyzed. The empirical analysis involves financial institutions operating on the Warsaw Stock Exchange in the years 2000–2018. The source data adopted for the analysis result from financial statements that are compliant with the applicable regulations regarding financial reporting, in particular with the International Financial Reporting Standards. Financial reports constitute the basis for analyses and evaluations of the activity of a given financial institution as well as are the source of relevant information that is used by depositors and investors in decision-making processes. The results of the unbalanced panel estimation, carried out using appropriate diagnostic tests, indicated a financial ratio, such as return on assets, that proved to be significant. Moreover, effects were indicated that are specific for particular sectors. The banking sector should be analyzed separately from other financial-sector companies.

Keywords Financial institutions · Financial ratios · Panel data estimation · Warsaw Stock Exchange · Poland

E. Majerowska (✉)
Department of Econometrics, University of Gdansk, Gdansk, Poland
e-mail: ewa.majerowska@ug.edu.pl

E. Spigarska
Department of Accounting, University of Gdansk, Gdansk, Poland
e-mail: ewa.spigarska@ug.edu.pl

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1 Introduction

In recent years, rapid development of the financial market has taken place in Poland and on an international scale. When analyzing the contemporary financial market, following sectors can be distinguished: credit (banking) services, investment, payment, and insurance. The boundaries between individual sectors, however, are not sharp, which results from the tendency to universalize the services offered on the financial market (Fojcik-Mastalska 2016).

Due to the nature of financial institutions, separate legal regulations have been created for domestic and international economies, regulating the functioning of the financial market (Becerra Alonso et al. 2016; Piotrowska et al. 2017). As Fojcik-Mastalska (2016) states, these regulations aim to create appropriate legal framework for this market, including a set of cooperating institutions, the goal of which is to ensure system stability (a *safety net*). At the same time, the regulations also apply to individual types of financial services and to the requirements to be met by the institutions providing these services.

From year to year, the importance of the financial institutions on the capital market has been rapidly increasing. According to Bieszki (2010), the basic factors determining the scale and the growth of financial assets include as follows:

- departure from the traditional originate and hold model and transition to the originate and distribute model, on the part of the traditional financial groups encompassed by the TBTF (too big to fail) doctrine;
- development of derivatives that are based on mortgage-backed securities (MSB);
- anti-regulatory innovations that allowed leverage increase while maintaining appropriate capital adequacy ratios.

Financial institutions, due to their specificity, differ significantly from non-financial companies (manufacturing, commercial, or non-financial services). This specificity primarily results from the structure of their financing, the assets they trade, and the supervisory authority control they are subjected to. They are also required to strictly apply the provisions of the balance-sheet law, which, in the case of the companies listed on the Warsaw Stock Exchange (WSE), means compliance with the International Financial Reporting Standards. Banks and insurance companies are additionally required to prepare reports, in accordance with separate regulations, for a supervisory authority (the Polish Financial Supervision Authority).

The financial statements published by financial institutions are the main source of information regarding assessment of the effectiveness of business operations. The most important factors affecting the profitability of financial institutions are profit, type of the risk taken, or financial leverage.

Due to the specificity of financial institutions' operations, however, the indicators used in assessment of the financial statements prepared by enterprises other than banks and insurers in most situations cannot be used to assess the financial statements published by financial institutions. According to Mioduchowska-Jaroszewicz

(2012), this results from the fact that the formulas of sector indicators do not correspond to those published in the scientific literature on financial analysis by insurers, international rating agencies, the Polish Financial Supervision Authority. Also calculation of sectoral indicators, in relation to financial institutions, is often impossible (for example, calculation of the inventory turnover ratio or the current ratio), because financial statements of financial institutions contain no items that make up the indicator. Additionally, sectoral indicators for financial institutions easily can be manipulated, falsified, or burdened with errors, because reports of some financial institutions lack many items that make up the indicator formulas (for example, sales revenues, short-term liabilities, long-term liabilities, trade receivables, or delivery obligations).

In many papers, we can find models describing the rates of return of non-financial companies. Some papers concern banks only. For example, Le (2016) tested the macro-financial linkages and bank behavior. Karminsky and Kostrov (2014) tried to find a model of default in Russian banking. The purpose of this paper is to identify the factors affecting the rates of return on assets of the financial institutions traded on the Warsaw Stock Exchange. The research hypothesis assumes that identification of the internal factors of financial institutions affecting those institutions' market results, represented by the rates of return of their listed shares, is possible.

The article consists of four parts. After the introduction, the theoretical foundations underlying the analysis as well as an overview of the literature addressing the issues discussed are presented. The next part entails characterization of the empirical data and presentation of the research methodology. The following part contains the research results. The conclusion part presents the outcomes resulting from the considerations presented.

All calculations were made using the Gretl v. 2018b package and the Statistica 13.1. The data used for the calculations come from the Notoria website, the stooq.pl, and the Warsaw Stock Exchange (www.gpw.pl).

2 Theoretical Background

One of the elements affecting the profitability of financial market's functioning, in particular of the financial sector, is the banking tax. The purpose of a well-defined tax is to minimize or even eliminate the financial market distortions resultant from, among others, information asymmetry. It should not, at the same time, create incentives for pushing the collection of the sector tax beyond the point where the marginal costs of financial market distortions exceed those of the distortions that occur in other areas of economy (Martysz and Bartlewski 2018). Concurrently, as Pawłowicz (2015) notes, a good tax system is a combination of the achievement of the goals set by the state or an organization, such as the European Union for instance, while maintaining stability of the financial system and its investment attractiveness.

An example of such a tax in Poland is the tax on certain financial institutions (Act of 15 January 2016 on tax on certain financial institutions, Journal of Laws 2016 item 68 as amended), which is paid on the surplus of the sum of the value of the taxpayer's assets that results from the trial balance determined on the last day of the month, on the basis of the entries in the general ledger accounts, in accordance with the applicable balance-sheet law (Accounting Act of 29 September 1994 (Journal of Laws 2016 items 1047 and 2255, Journal of Laws 2017 items 61, 245, 791 and 1089 as amended; International Financial Reporting Standards). This tax applies to financial institutions, primarily including: banks, cooperative savings and credit unions, insurance companies, and loan institutions.

The existing research on the impact of specific factors on the profitability of financial institutions primarily concerns the banking sector. Białas (2014) examines how management of particular types of risk (solvency risk, interest rate risk, diversification strategy, credit risk) impacts banks' profitability (ROE). It allowed her to distinguish three groups of banks, with regard to the similarity of risk management. The first group included the banks that pursued a prudent policy regarding solvency risk management. These banks had a high share of equity in the balance-sheet total, achieved high interest and commission margins. As a result, they obtained high ROA values, which in turn resulted in a high ROE value. The other two groups of banks conducted more risky solvency activities, which translated into lower margins and, consequently, into lower ROE values.

Studies on the issues related to the impact various factors have on the profitability of financial institutions on the Chinese market were carried out by Huang and Wang (2018). Using a panel regression model, they identified factors affecting systemic importance of financial institutions. In their research, they used the theory of Granger (1969) causality in a vector autoregressive model VAR.

The Islamic financial market has been the subject of research by Chelhi et al. (2017). The research was primarily focused on Islamic financial products (PFIs) that are concordant with Islam (for more information on Islamic products, see: Pera (2015)). In their research, they drew attention to the economic factors that may affect the results obtained on Islamic financial products, which in turn is expected to influence optimal investment decision-making. They used neural networks and time series (stochastic processes).

By contrast, the financial situation of Taiwanese institutions was investigated by Ma et al. (2019). To carry out the research, they used data envelopment analysis (DEA). They found that many of the institutions examined showed unstable financial results, which necessitated improvement their business strategies. Conversely, at the same time, some of the entities researched showed stable financial results while forecasts showed change in these results. As a consequence, significant differences were observed among the groups of financial institutions under examination, in terms of the ROA and the ROE ratios, as indicated by the Wilcoxon Test (1945). Based on the research, it was concluded that, for some institutions (the weakest ones), the government should provide a more cautious strategy for monitoring their activities.

The Brazilian market was the subject of the research carried out by Mendonca et al. (2018). The purpose of this study was to identify the factors affecting bank profitability. The authors used structural equations modeling (SEM) in their research. The research sample consisted of 150 Brazilian bank financial institutions, while the research period covered the years 2012–2016. The variables used to represent profitability were the return on assets (ROA) and the return on capital (ROE). It was found that the higher the financing (the institution's ability to receive deposits on demand), the higher the profitability of the banking institution. Diversification of the revenue sources was also positively related to profitability. In contrast, it was found that the higher the operating costs, in terms of the size of the bank, the less profitable the banking activity. It should be noted that financing, in the model analyzed, was the most important factor explaining the profitability of Brazilian banking institutions.

In Europe, the Croatian market was the subject of research (Jurcevic'a and Mihelja Zaj 2013). The purpose of the Jurcevic and Mihelja Zaja study was to identify and compare the results of the measurement of bank and insurance company profitability/performance, using Data Envelopment Analysis (DEA) and financial indicators, calculated on the basis of financial statements. The research period covered the time before and after the recent financial and economic crises in the Republic of Croatia. Due to their relatively high asset share, of around 83% of the total assets of the financial sector, the study involved the banking and insurance sectors in the Republic of Croatia. The main difference observed in the research results for the DEA and the financial indicator analysis involved delays in the measurement of efficiency of the accounting approach during the crisis. The DEA efficiency assessments had the lowest values in 2007 for the insurance sector and in 2008 for the banking sector. In the accounting approach, however, the lowest values of the ROA and the ROE indicators occurred in 2009. Based on the research, it was found that although, in terms of costs and results, financial institutions operate more effectively in a period of crisis, the financial indicators determined on the basis of the data derived from financial reporting cannot achieve such good results as during the boom period, due to the deterioration of the market conditions and more cautious business policies.

Insurance companies, in turn, were the subject of research in Slovakia (Grmanová and Strunz 2017). The authors examined the relationship between technical efficiency and profitability of insurance companies. Profitability of insurance companies was expressed using such indicators as ROA, ROE, and the size of assets. The DEA model was used to assess the technical profitability. The relationship between the technical performance result and the profitability indicators was expressed using the Tobit regression model and the Mann-Whitney U test. Based on the research conducted, the relationship between the technical efficiency results, both in the CCR model (the name of this model comes from the first letters of its authors' names, i.e., Charnes et al. (1978); it is an oriented model, in which existence of permanent scale benefits is assumed) and the BCC model (an oriented model, developed by Banker et al. (1984), in which variable scale benefits are assumed),

and the profitability of insurance companies, expressed via the ROA, ROE indicators and the asset size, has not been confirmed and demonstrated. Studies on the effectiveness of the functioning of insurance companies were also carried out by Hussels and Ward (2007) in Germany and Great Britain, Delhausse et al. (1995) in Belgium and France, Diacon et al. (2002) in European countries.

Other studies highlighted the banking sector within the European Union (Gavurova et al. 2017). Based on financial data, the relationship between the financial data and the concentration of the banking services market was examined. The mentioned study involved analysis of the structure and the results on the banking market of the European Union (EU) as a whole, in 2008–2015. The structure of this market was measured using two main concentration indicators: the Herfindahl-Hirschman index (HHI) and the concentration ratio for five largest banks (CR5). The results were measured using profitability indicators: return on assets (ROA) and return on capital (ROE). Based on the analyzes carried out, it was found that development of a given market was affected by the financial crisis which, up until the end of 2013, had led to low profitability.

3 Data and Research Methodology

The stock market in Poland is relatively young. After years of political and economic changes that had taken place in the eighties and at the beginning of the nineties of the last century, the Warsaw Stock Exchange was opened on April 16, 1991. At the end of 2018, shares of over 460 companies, including more than 410 domestic companies, were listed on the WSE, 66 of which were companies operating in the financial sector. Due to the lack of data and short quotation periods of some companies, results of 53 companies constitute the subject of the analyses, which represents 80.3% of the entire population. Annual data were used for the analyses. Table 1 presents detailed numerical information on the companies examined.

Table 1 The financial companies traded on the WSE, as of the end of 2018

	Number of companies	
Sector	Traded on the WSE	Included in the analysis
Banks	15	14
Investment	22	14
Leasing & Factoring	3	3
Financial services	7	6
Capital market	8	6
Insurance	5	5
Mortgage	6	5
Total	66	53

Source: Warsaw Stock Exchange web page (2019), www.gpw.pl

Table 2 Summary statistics of the variables

Variable	Mean	Median	Standard deviation	Volatility coefficient	Skewness	Excess kurtosis
MOP	−1.462	0.140	18.406	12.585	−13.756	272.798
MGP	−8.407	0.171	171.450	20.394	−14.491	267.196
MNP	−8.669	0.141	170.742	19.697	−15.883	292.793
ROE	0.038	0.085	0.741	19.371	−3.576	72.621
ROA	−0.003	0.013	0.346	122.459	−5.788	61.501
r	−0.073	−0.021	0.735	10.120	−0.096	5.786

Source: own calculation based on the data from the Notoria website service (2019) and Warsaw Stock Exchange (2019) www.gpw.pl

A linear econometric model, in the following form, will be used for empirical analysis:

$$r_{i,t} = \beta_0 + \sum_{k=1}^{K} \beta_k f_{k,i,t} + \varepsilon_{i,t} \tag{1}$$

where $r_{i,t}$ represents the rate of return of the *i'th* asset over time t, β are the structural parameters of the model, $\varepsilon_{i,t}$ is the error term. Elements f_k are the internal factors potentially influencing the rates of return. These factors can be represented by the financial ratios or latent factors obtained via the exploratory factor analysis (EFA). The model will be estimated by a panel OLS method, followed by a fixed effects model and a random effects model. Selection of the final form of the model will be based on the statistics of the following tests: a joint significance test, applied to different groups of means, the Breusch-Pagan test, and the Hausman test.

The next step was aimed at checking whether the level of return differs significantly, depending on the sector analyzed. Inclusion of additional dummy variables in the model was propounded, taking the value of one if the company belongs to a given sector, zero in other cases. The form of the model is then as follows:

$$r_{i,t} = \beta_0 + \sum_{k=1}^{K} \beta_k f_{k,i,t} + \gamma_1 SecBank + \gamma_2 SecInv + \gamma_3 SecLeas + \gamma_4 SecFin + \gamma_5 SecCap + \gamma_6 SecInv + \gamma_7 SecMor + \varepsilon_{i,t} \tag{2}$$

As already mentioned, the financial companies listed on the stock exchange differ in terms of the activities they conduct. They encompass banks, financial intermediaries, and others. The model's explanatory variables are selected internal factors, represented by financial indicators, which are common for all the financial companies analyzed. There are five such variables in total, divided into two groups. The first comprises of margin indicators: operating profit margin (MOP), gross profit

Table 3 Models estimated for all sectors and the test statistics

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
	Random effects	Pooled	Random effects	Random effects	Random effects	Random effects
const	0.048 (0.099)		−0.061** (0.030)	0.027 (0.098)	−0.063** (0.029)	−0.062** (0.029)
MOP	0.001 (0.002)	0.001 (0.002)				
MGP	0.004 (0.003)	0.004 (0.003)				
MNP	−0.005 (0.003)	−0.005 (0.003)				
ROE	0.014 (0,049)	0.014 (0.049)				
ROA	0.347** (0.138)	0.347** (0.138)	0.175** (0.085)	0.145* (0.087)		
SecBank	−0.043 (0.110)	0.005 (0.048)		−0.018 (0.110)		
SecInv	−0.152 (0.115)	−0.103* (0.059)		−0.144 (0.114)		
SecLeas	−0.154 (0.172)	−0.106 (0.0.141)		−0.125 (0.175)		
SecFin	−0.183 (0.135)	−0.134 (0.090)		−0.183 (0.134)		
SecCap	−0.319** (0.145)	−0.270** (0.107)		−0.143 (0.140)		
SecIns	−0.158 (0.154)	−0.110 (0.119)		−0.114 (0.156)		
SecMor		0.048 (0.099)				
Factor 1					0.032 (0.037)	
Factor 2					0.105*** (0.033)	0.061** (0.029)
R-squared		0.037				
DW		2.163				
Joint sign. Test	0.385		0.356	0.261	0.500	0.466
Breusch-Pagan test	10.842		10.500	14.227	7.118	7.860
Hausman test	5.064		0.187	0.193	3.563	1.002

*, **, *** represent significance at the level of 0.1, 0.05 and 0.01 respectively
Source: own estimation

Table 4 Models estimated for selected sectors and the test statistics

Variables	Banks Pooled	Mortgage Pooled	Banks Random effects	Mortgage Pooled
const	−0.065 (0.041)	0.016 (0.067)	−0.028 (0035)	0.026 (0.066)
MOP				
MGP	−0.347*** (0.119)			
MNP	0.429*** (0.158)			
ROE	1.689*** (0.534)	0.414** (0.193)		
ROA	−7.618** (3.443)			
Factor 1				
Factor 2			0.702*** (0.266)	0.267* (0.135)
Joint sign. Test	0.302	0.117	0.213	0.141
Breusch-Pagan test	3.718	2.094	4.019	2.032
Hausman test	1.531	0.267	0.013	0,168

*, **, *** represent significance at the level of 0.1, 0.05 and 0.01 respectively
Source: own estimations

margin (MGP), and net profit margin (MNP), the second – rates of return: return on equity (ROE) and return on assets (ROA). Summary statistics of the variables analyzed are presented in Table 2, where r is the logarithmic rate of return, determined on the basis of the share prices of the companies analyzed.

4 Results

Based on annual data from 1998–2018, an unbalanced panel was built, covering financial indicators of the 53 companies dealing with financial activities. In the first step, model (1) was estimated, taking into account all the variables proposed. The results of these estimates are presented in Table 3. As it can be seen, only one variable, representing an internal factor – return on assets (ROA), turned out to be statistically significant. Other factors do not statistically significantly affect the level of return rates. After inclusion of dummy variables, it turned out that significant differences can be seen in the sector of capital market.

Factor analysis was then carried out and one latent factor was identified, representing a given group of indicators, i.e., factor 1 represents the combined impact of the operating profit margin, the gross profit margin, and the net profit margin. Factor 2 contains the combined impact of the return on assets and the return on equity. The estimation results indicated that only the second factor turned out to be statistically significant.

The next step was to check whether identification of the impact individual internal factors, out of those previously selected, have on the return rates of the shares of the companies in individual sectors is possible. As such, the models proposed for individual sub-samples, i.e., panels for companies from given sectors, were estimated. The results of the estimates are presented in Table 4.

The Table 4 shows results of estimations carried out exclusively for the sectors for which structural parameters of the models estimated proved to be statistically significant. Thus, it can be seen that in the case of the banking sector, as many as four factors statistically significantly affect the rates of return of the shares issued. These factors are the gross profit margin, the net profit margin, return on equity, and return on assets. The structural parameters for three factors have the same sign as for full sample. In contrast, only the latent factor 2 showed cumulative impact. In the case of the companies in the mortgage sector, the return on equity has impact on the level of return. As it was mentioned, there are not many papers concerning modeling rates of return of financial institutions. Above results are generally in line with literature. The main statistically significant factors are return on assets and return on equity. Statistically significant factors created using factor analysis are new to the research and allow for the inclusion of a group of indicators using one variable.

5 Conclusions

In the literature on the subject, a lot of space has been devoted to modeling of results and, above all, to productivity of listed companies. The authors indicate, taking into account the markets in different countries, which internal factors influence investors' decisions, resulting in greater interest in the shares of these companies. Such increased interest causes an increase in the share turnover and therefore an increase in the share prices and, consequently, an increase in the return rates. Far less research has been devoted to financial-sector companies.

The above-described analysis of the financial companies in Poland has shown that only few indicators are common for this type of companies, despite the fact that they mainly operate with the clients' capital. Based on the research, it has been shown that an increase in the return on assets increases the rate of return on the shares. As such, the research hypothesis presented in the introduction has been confirmed. It also turned out that other factors clearly affect the rates of return in the banking sector; therefore, this sector should be treated separately in research, especially since many other financial indicators, such as, e.g., the IMF liquidity ratio, the equity ratio, the earning assets ratio, and others, are estimated for this sector.

The above conclusions have also been confirmed by the factor analysis carried out, which allowed construction of one common factor for the return on assets and the return on equity.

The next stage of the research should entail comparison of the results obtained with the results of similar studies carried out in other countries, taking into account the factors of the economic situation in the country.

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The Influences of Birth and the Child—Raising on Household Finances: An Analysis of Lost Income

Anna Jędrzychowska and Ewa Poprawska

Abstract In personal finance, child rearing involves a stream of costs, incurred expenses, and lost profits. The second category includes the partial loss of earnings due to the breaks in parents' (mainly mothers') career paths resulting from pregnancy, maternity leave, and slowdowns. This article's purpose is to propose a method of estimating a mother's financial gap over the course of her whole career as a result of raising children. The article is the next stage of the authors' research, in which the cases of 1–3 children and a wage growth rate consistent with data published by the Central Statistical Office (higher at the beginning of career) are analyzed. The considerations are universal and applicable to the realities of other markets, but the numerical illustration is based on Poland's reality. The results obtained can be useful for determining compensation claims related to accidents that result in the death of a child. This analysis also contributes to the discussion of social programs being considered in Poland, such as an additional state pension for women with more children.

Keywords Value of life · Cost of maternity · Personal finance management · Insurance · Motherhood gap · Child penalty

1 Introduction

In the insurance literature, analyses of the economic consequences of the loss of a household member include typical approaches, such as estimates based on the cost of production. This approach is based on the classical theory of economics (Murphy 2006), which states that the value of a good is equal to the cost of its production, as well as the willingness to pay approach and the utility theory. In our research, we use theories related to the valuation of goods, including the value of human lives (in this

A. Jędrzychowska · E. Poprawska (✉)
Department of Insurance, Wrocław University of Economics and Business, Wrocław, Poland
e-mail: anna.jedrzychowska@ue.wroc.pl; ewa.poprawska@ue.wroc.pl

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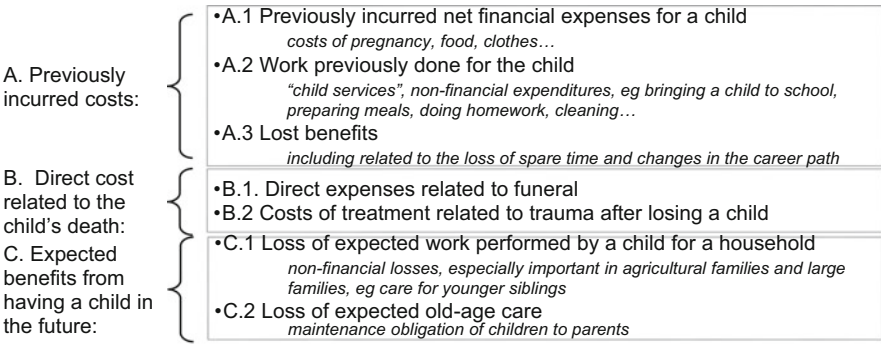

Fig. 1 The economic consequences of losing a child in the household. Source: Authors' own study

case, a child's value). These include Hofflander (1966), Schultz (1961), Becker (1975), Leimberg et al. (1999), and Letablier et al. (2009), as well as the sociological elements addressed by Zelizer (1994).

The financial consequences of the loss of health or life by household members are important in the context of calculating the value of compensation for this loss (e.g., compensation by liability insurance). Previously, Jędrzychowska and Kwiecień (2016) analyzed personal injury from the perspective of the changing claims culture and market compensation trends. Our research concerned changes in household finances under several circumstances: in terms of lost income (Jędrzychowska and Poprawska 2016) and increased needs (Jędrzychowska 2017), as well as from the side of the protection system resulting from compulsory motor third-party liability insurance (Ronka-Chmielowiec et al. 2015; Jędrzychowska and Poprawska 2014). In addition, personal injuries related to accidents at work (Jędrzychowska and Kwiecień 2015) and medical damages (Jędrzychowska 2015) were analyzed. Currently, the authors are considering damages for those indirectly affected (Jędrzychowska and Kwiecień 2019).

After analyzing the literature, the authors identified three groups of household economic consequences related to a child's death. They were divided based on the time to which they refer. These include past costs, necessary current costs, and future consequences, as presented in Fig. 1.

In the research, we focus on one such category of lost profits (A.3): breaks and slowdowns in the mother's career as a result of childbirth and child rearing. This financial gap arises as a difference between the expected career path of a childless person (as a benchmark) and that of a person with children. Based on the selected scenarios, it will be shown what are differences in the aggregate value of the mother's income result from having one, two, or three children. The article also shows that the cost of the next child is not equal to the cost of the earlier child. In addition, the moment of the appearance of subsequent children (in terms of age differences between the children and the time since the mother started working) affects the mother's total lost income. This problem assumes a different scale depending on the country's economic situation, social policy, and social security,

as well as cultural differences resulting from tradition, mentality, and the dominant family model. However, the problem is international and is described in such terms.

The paper is divided into the following parts: in point 2. Changes to career development, discussed are: main reasons for changes to one's career path caused by having children, than in Sect. 2.1 methodology is shortly described, in Sect. 2.2 numerical examples are described, then point 3 contains conclusions.

2 Changes to Career Development

We accounted for the mother's situation, as mothers have more breaks in their career path, which last for longer than they do for fathers. The changes in the career path can be caused by many reasons. Three main important reasons have been chosen for further analysis (Table 1).

The mentioned reasons cause interruptions in professional work and in the later period of slower wage growth.

Table 1 Main reasons for changes to one's career path—mothers' case

Reason	Explanation
Period of pregnancy	The main reasons for a break during pregnancy include recommendations for increased rest, medical complications, and one performing work with increased risks, e.g., heavy physical work or work in medical professions involving contact with infectious diseases. In many countries, the sickness benefit during pregnancy is equal to 100% of one's salary (e.g., in Poland), so one's salary has a constant nominal value.
Maternity and parental leave	Parents can take this leave together, depending on the law. In Poland, this time is 20 weeks for the mother (fully paid maternity leave) and an additional 32 weeks that parents can divide among themselves (60% of one's salary). We consider the example of the mother, so we assume that she uses the whole 52 weeks. The mother's wages are "frozen" and then even reduced during this period.
Periods of slowdown after returning to work	When the mother returns to work, because of the frequent illnesses of children during their first few years of life women take leave from work to care for sick children. For this reason, employers perceive mothers of young children, in particular, as being worse employees than childless people and men (medical allowances for childcare are mainly used by women). Thus, women often cannot show results at work to justify be promoted, as is the case for childless people or men.

Source: Own study

2.1 Methodology

The considerations made in the article were based on selected case studies, reflecting typical scenarios of career development interrupted by the period of childcare. In these scenarios, statistical data from the CSO, OECD, and Eurostat reports were used. In the study, the option for a woman to have no children was adopted as the basic version (benchmark). Next, three variants were referred to this option, which indicate different intensity of changes as a result of childbirth, upbringing, and the number of children in the household.

- **Variant "0"—childless person**—Wage growth throughout the entire period of work is equal to the statistical value according the work experience;
- **Variant "1"—optimistic**—There is a break in work for 2 years (the salary level is held constant in nominal value); then, the salary grows according to the statistical value of the wage growth according to work experience;
- **Variant "2"—pessimistic**—After a 2-year break in work (constant level of salary), the salary grows according to a reduced wage growth rate because the mother "missed" the moments of the best professional development; and.
- **Variant "3"—middle**—After a 2-year break in work (constant level of salary), salary grows according to a reduced wage growth rate for the next 4 years (she still cannot get fully involved in the work because of frequent medical exemptions for her child) and then returns to the statistical value of the wage growth according to her work experience.

In the analysis, for all four options, we compare the total sum of real salary earned over the entire career (until retirement age). Therefore, $\boldsymbol{PVA}_{"\boldsymbol{n}"}$ describes the present value (at moment 0—the beginning of the career) of the total earnings, if the first wage amount is equal to 1.

$$\boldsymbol{PVA}_{"\boldsymbol{n}"} = \sum_{\boldsymbol{k}=\boldsymbol{1}}^{\boldsymbol{C_{end}-C_{start}}} \frac{\boldsymbol{E_k}}{(\boldsymbol{1}+\boldsymbol{i})^{\boldsymbol{k}}}, \tag{1}$$

where:

C_{end}—age at the end of her professional career (retirement age).
C_{start}—age at beginning of her professional career.
i—yearly inflation,
E_k—sum of wages (earnings) at year k (paid at the end of a year), $E_1 = 1$

$$\boldsymbol{E_{k+1} = E_k\left(1 + i \cdot I_B + e_k \cdot I_{B/S}\right)} \tag{2}$$

$$I_B = \begin{cases} 0 \text{ in case of a break in career} \\ 1 \text{ in other cases} \end{cases}, I_{B/S}$$

$$= \begin{cases} 0 \text{ in case of a break in career} \\ s \text{ in case of a slowdown in career} \\ 1 \text{ in other cases} \end{cases}$$

and e_k is additional increases in wages connected to work experience at year k. Finally, the formula $\boldsymbol{Total\ motherhood\ wage\ gap_{"n"} = (PVA_{"n"} - PVA_{"0"}) \cdot first\ wage}$ describes the value of the mother's financial gap.

2.2 Numerical Examples

In the authors' opinion, four factors had strong influences on the results: salary at the beginning of work and the mother's age when starting work, getting pregnant, and retiring. In order to indicate the significance of these factors, assumptions for numerical examples have been adopted:

- the level of salary at the beginning of work—the net average wage in the economy;
- the age when beginning her career—two cases are taken into consideration: a woman who is 20 years old and a woman who is 25 years old (after the studies);
- age of pregnancy: 1, 5, and 10 years after beginning work; and,
- retirement age: 65 years old (which is currently at 60 years in Poland, but this will soon change).

To illustrate the problem, three options for the appearance of the first child were selected: 1, 5, or 10 years after starting work. For the second and third children, only variants were considered, i.e., subsequent children appear 2 (an age difference of 2–3 years between children proved to be the most "expensive" for the mother) or 5 years after the previous one. The wage growth rate (above inflation) depended on the length of the work experience and was calculated on the basis of the Polish Central Statistical Office (GUS), as published in *Structure of wages and salaries by occupations in October 2016*. For simplicity, it was assumed that the mother's age is counted at the beginning of the year and her salary is paid at the end of the year (once a year). The data concerning dependence between salary and the length of the work experience were used in the calculations (Fig. 2).

In addition, the following economic assumptions were adopted in the calculations:

- inflation and the discount rate are equal to 2.5%, in accordance with the inflation target set by the National Bank of Poland;

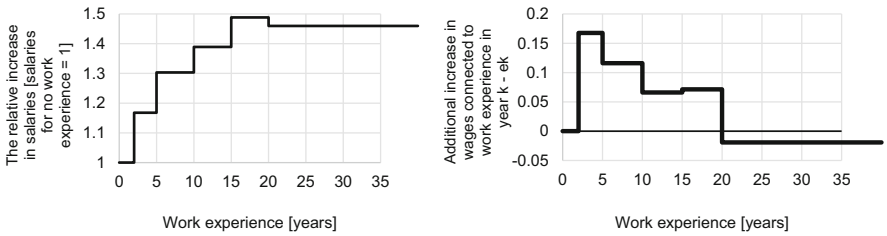

Fig. 2 The dependence of wages on the length of work experience—women 2016. Source: authors own work based on data published in Report Central Statistical Office (2016)

- the EUR-to-PLN exchange rate is 1 EUR = 4.30 PLN (the average exchange rate for the National Bank of Poland from 16 December 2019 was 1 EUR = 4.2659 PLN); and,
- monthly net earnings at the beginning of the career are equal to the average net salary in Poland (in the first quarter of 2019): 3390 PLN (788 EUR).

We made assumptions regarding the reduced rate of pay growth in options 2 and 3. They were accepted by experts at a 10% level. This value was adopted to represent the employee's salary being reduced by 20% while on sick leave. It was considered that the mother does not spend the whole year on sick leave and that her salary and commitment to work (which gives, for example, wage bonuses) fall by 10% (half of the value of the reduction).

Tables 2 and 3 show the scale of the problem related to the break in work and child care at different moments in the mother's life.

When comparing the same patterns of the appearance of children in the household, all of these scenarios cause a greater gap for a woman who starts work at the age of 20 (Table 2) than at 25 years of age (Table 3). The presented values show the numerical scale of the problem related to the break in work and childcare at different moments in the mother's life. When comparing the same timing of the appearance of children in the household, all of the scenarios cause a greater gap for a woman who starts work earlier, at 20 years (Table 2).

The mother also has a greater loss in earnings with more children, but it is not a multiple of the loss from having the first child (subsequent children are "cheaper"). The largest financial loss occurs when children appear in the family at close intervals. This applies especially to the first two children.

The biggest gap occurs for a young mother who will have three children in short intervals (e.g., the 20 + 1 + 2 + 2 case). This gap in variant 2 will be approximately EUR 114,000, which is 145 monthly salaries. For comparison, in the 25 + 1 + 2 + 2 case, variant 2, the gap is approx. EUR 103,000. By far the smallest gap was for one child. However, an additional child does not always significantly increase the mother's gap. The timing of their birth is very important. For example, a mother of three children born late within large time intervals (20 + 10 + 5 + 5) has a lower gap than the mother of two children born early, within short intervals (20 + 1 + 2). The above conclusions can also be observed by analyzing the trajectories of real

Table 2 Total net salaries GAP (real values) for 20 years old woman in start work career

Age variant	Age of start work	Age of having 1st child	Age of having 2nd child	Age of having 3rd child	Variant "0"		Variant "1"		Variant "2"		Variant "3"	
					PVA	PV of salaries [EUR]	PVA–gap	PV gap [EUR]	PVA–gap	PV gap [EUR]	PVA–gap	PV gap [EUR]
20 + 1	20	21	–	–	766	604,154	−46	−36,483	−68	−53,382	−56	−43,950
20 + 1 + 2	20	21	23	–			−89	−69,953	−108	−85,183	−97	−76,711
20 + 1 + 2 + 2	20	21	23	25			−128	−100,615	−145	−114,296	−135	−106,715
20 + 1 + 2 + 5	20	21	23	28			−122	−96,538	−140	−110,503	−136	−106,983
20 + 1 + 5	20	21	26	–			−83	−65,670	−103	−81,197	−98	−77,241
20 + 1 + 5 + 2	20	21	26	28			−117	−92,254	−135	−106,518	−131	−102,998
20 + 1 + 5 + 5	20	21	26	31			−112	−88,529	−131	−103,071	−129	−101,635
20 + 5	20	25	–	–			−40	−31,453	−52	−41,020	−46	−36,529
20 + 5 + 2	20	25	27	–			−76	−60,134	−87	−68,726	−82	−64,714
20 + 5 + 2 + 2	20	25	27	29			−109	−86,238	−119	−93,928	−115	−90,357
20 + 5 + 2 + 5	20	25	27	32			−105	−82,459	−115	−90,382	−113	−88,926
20 + 5 + 5	20	25	30	–			−71	−56,163	−82	−65,001	−80	−63,359
20 + 5 + 5 + 2	20	25	30	32			−100	−78,488	−110	−86,657	−108	−85,201
20 + 5 + 5 + 5	20	25	30	35			−96	−75,469	−106	−83,808	−104	−82,352
20 + 10	20	30	–	–			−33	−26,100	−39	−30,637	−36	−28,774
20 + 10 + 2	20	30	32	–			−63	−49,687	−68	−53,741	−66	−52,082
20 + 10 + 2 + 2	20	30	32	34			−90	−70,942	−95	−74,549	−93	−73,078
20 + 10 + 2 + 5	20	30	32	37			−86	−67,853	−91	−71,609	−91	−72,053
20 + 10 + 5	20	30	35	–			−59	−46,442	−64	−50,652	−65	−51,165
20 + 10 + 5 + 2	20	30	35	37			−82	−64,609	−87	−68,520	−87	−68,964
20 + 10 + 5 + 5	20	30	35	40			−78	−61,276	−83	−65,369	−83	−65,813

Source: own calculations

Table 3 Total net salaries GAP (real values) for 25 years old woman in start work career

Age variant	Age of start work	Age of having 1st child	Age of having 2nd child	Age of having 3rd child	Variant "0"		Variant "1"		variant "2"		Variant "3"	
					PVA	PV of salaries [EUR]	PVA–gap	PV gap [EUR]	PVA–gap	PV gap [EUR]	PVA–gap	PV gap [EUR]
25 + 1	25	26	–	–	680	535,700	−42	−33,185	−61	−47,838	−50	−39,735
25 + 1 + 2	25	26	28	–			−81	−63,515	−97	−76,607	−88	−69,401
25 + 1 + 2 + 2	25	26	28	30			−116	−91,188	−130	−102,836	−122	−96,459
25 + 1 + 2 + 5	25	26	28	33			−110	−87,111	−126	−99,042	−122	−96,135
25 + 1 + 5	25	26	31	–			−75	−59,232	−92	−72,622	−88	−69,310
25 + 1 + 5 + 2	25	26	31	33			−105	−82,828	−121	−95,057	−117	−92,150
25 + 1 + 5 + 5	25	26	31	36			−100	−79,103	−116	−91,610	−115	−90,438
25 + 5	25	30	–	–			−36	−28,154	−46	−36,372	−41	−32,569
25 + 5 + 2	25	30	32	–			−68	−53,696	−77	−61,005	−73	−57,646
25 + 5 + 2 + 2	25	30	32	34			−97	−76,812	−106	−83,280	−102	−80,331
25 + 5 + 2 + 5	25	30	32	37			−93	−73,032	−101	−79,734	−100	−78,546
25 + 5 + 5	25	30	35	–			−63	−49,725	−73	−57,280	−71	−55,919
25 + 5 + 5 + 2	25	30	35	37			−88	−69,062	−96	−76,009	−95	−74,821
25 + 5 + 5 + 5	25	30	35	40			−84	−66,042	−93	−73,160	−91	−71,972
25 + 10	25	35	–	–			−29	−22,802	−34	−26,645	−32	−25,081
25 + 10 + 2	25	35	37	–			−55	−43,249	−59	−46,643	−57	−45,268
25 + 10 + 2 + 2	25	35	37	39			−78	−61,516	−82	−64,495	−80	−63,294
25 + 10 + 2 + 5	25	35	37	42			−74	−58,427	−78	−61,554	−79	−61,888
25 + 10 + 5	25	35	40	–			−51	−40,004	−55	−43,554	−56	−43,951
25 + 10 + 5 + 2	25	35	40	42			−70	−55,182	−74	−58,465	−75	−58,799
25 + 10 + 5 + 5	25	35	40	45			−66	−51,850	−70	−55,315	−71	−55,648

Source: own calculations

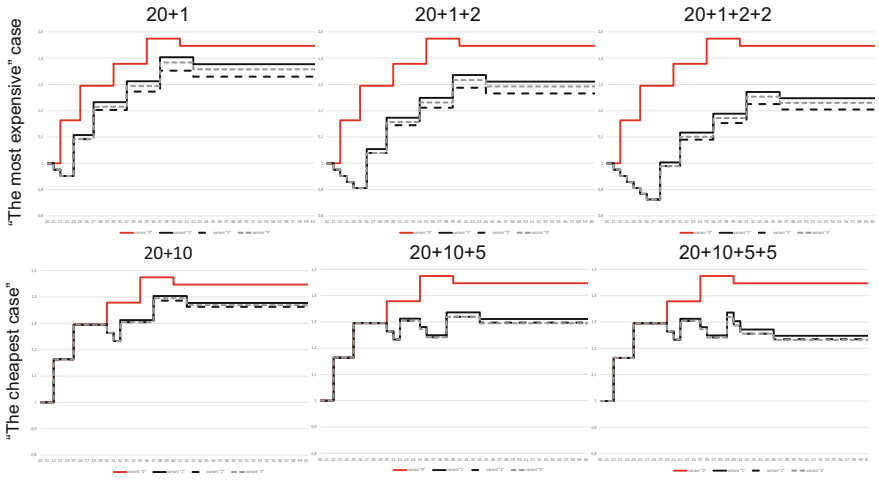

Fig. 3 Wage trajectories—real values for 1 EUR of the first wage of 20-year-old women. Source: own calculations

values for earnings among mothers who have the same number of children but whose children appear at different times (Fig. 3).

However, changes in the mother's career path cannot be analyzed in isolation from the overall analysis of the household's financial decisions. As already mentioned, a child or children most often appear during the implementation of an important financial goal for the family, i.e., the purchase of real estate. It is also necessary to complete the conclusions from the numerical examples and relate them to the fact that the biggest losses in a family's career path are borne by the mother, if the children appear at short intervals, i.e., 20 + 1 + 2 + 2 or 25 + 1 + 2 + 2. In such situations, however, other areas of household finances show a positive impact; namely, some childcare-related equipment from previous children can be used for subsequent children (car seats, clothes, toys). This is a partial relief for the household budget. In addition, a mother on parental leave with a second child does not have to send the first child to the nursery. Similarly, while on parental leave for the third child, she can take care of the other two children.

The results obtained in the paper should be compared with the results of other studies. However, it is not always possible to compile them because research generally focuses on comparisons between woman and man, rarely woman-mother vs childless woman. The cases analyzed in the paper indicate that the cost of one child in pension capital was 4%–8%. For comparison, in Waldfogel (1998), one child reduces a woman's wages by 6% and two by 15%. Motherhood pay gap is not the only consequence of a career break. Another is the emerging gap in the amount of pensions, which is a consequence of both shorter seniority and lower cumulated retirement capital. In the case of defined contribution pension systems (e.g., the Polish system), the total wage gap results in a similar size of the pension gap. Thus, the financial consequences of a career break continue for almost the rest of the

mother's life. According to research of OECD countries (2019), the pension gap connected to motherhood is around 4%, but big differences among countries are also observed. In this study, the motherhood pension gap in Poland was assessed at the level of 10%, for low and average earners with a 5-year childcare break vs workers without interruptions in career (the slowdown in career was not analyzed in this study).

3 Conclusions

The presented valuation model can be used to determine the amount of compensation for people who are indirectly affected by defender of car accident—in this case, for a mother. This may be used in civil liability insurance (medical malpractice, MTPL). Loss of a child also affects the results. The presented method of calculating the income gap is based on a number of simplifications. In addition, selected case studies are analyzed, which can be expanded to further considerations, including elements not analyzed here:

- if the mother receives lower earnings, then her pension contributions will be lower, so she will receive a lower pension from the social system in the future;
- the salaries in the article were based only on work experience, so it is worth considering the differences in salaries at the beginning of the job for a person without higher education versus one with higher education (only at the moment of entering the labor market); and,
- the differences in the rate of increase in wages, depending on profession and education.

It is also possible to introduce a different calculation model, such as an actuarial annuity. In this model, the probabilities of death for a mother at different moments of time are included.

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Debt Financing and Financial Performance: Empirical Evidence of Indian SMEs Listed in BSE-SME Platform

K. Rajamani

Abstract The main emphasis of this research is to empirically study the impact of debt financing on the firm performance of SMEs in India. Panel data analysis is applied to study the association among debt and SMEs firm performance using three financial measures: return on assets (ROA), return on equity (ROE), and gross profit margin (GPM). The sample includes 164 non-financial Indian small and medium enterprises listed in the Bombay stock exchange—Small and medium enterprises (BSE-SME) platform from 2014 to 2018. The results of the study demonstrate that capital structure, especially short-term and long-term debt, has an adverse effect on the efficiency of small and medium enterprises. The study reveals that decisions on capital structures have little impact on SMEs' financial results. The analysis also proves that the pecking order theory relates to small- and medium-sized enterprises in India. This is the primary research that explores the connection between debt financing and the financial results of Indian SMEs listed on the BSE-SME platform.

Keywords Capital structure · Debt financing · Financial performance · India · SMEs

1 Introduction

The economic development of both established and emerging markets such as India is driven by small and medium enterprises (SMEs) (Jutla et al. 2002). They are primarily responsible for poverty alleviation, employment generation, income generation, and wealth creation (Cook and Nixon 2000). According to MSME annual report 2017–2018, there are around 63.4 million units, which account for about 45% of the total manufacturing output, 40% of the exports from the country, and employs around 120 million persons. SMEs contribute 6.11% of the manufacturing GDP and 24.63% of the service sector GDP and also 33.4% of manufacturing output in India. SMEs are providing support to the larger industries as ancillary units and contribute

K. Rajamani (✉)
Research Wing – State Bank Institute of Leadership, State Bank of India, Kolkata, India

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tremendously to the socio-economic growth of the country. SMEs have drawn the attention of researchers, academicians, and policymakers into this area to create transformational opportunities, particularly in emerging economies.

Debt financing policy is one of the fields of the financial economy, which is highly concerned by academicians and practitioners. While there were several prior research work on the capital structure of bigger corporations and listed enterprises, the academicians recently began paying attention to SMEs (Hall et al. 2000). Capital structure is described as a particular combination of debt and equity a business uses to fund its activities (Abor 2005). Theories of capital structure such as the trade-off theory and pecking order theory were developed with the emphasis on large listed firms. However, hypothetical ramifications of capital structure can likewise be applied to SMEs, where determinants differently affect SMEs contrasted with huge organizations. (Daskalakis and Thanou 2010). Though the capital structure issues have been broadly studied, the importance of SMEs was mostly negligent in the literature (Hamilton and Fox 1998; Michaelas et al. 1999). It is vital for SMEs to find out the appropriate capital structure in order to leverage their firm. Finally, the availability of external financing and SME growth are closely related.

So far, the funding for SMEs mainly comes from its own funds and Banks. Indian SMEs will now have an opportunity to raise their funds from the public on the share market through the SME Stock Exchange platform (BSE & NSE) (Prime Ministers Task Force 2010). BSE-SME and NSE-EMERGE were established in the year 2012 with the following features (1) liquidity by market-making concept, (2) 100% underwriting of issue, (3) simple and low-cost listing procedure, and (4) facility to graduate from SME board to mainboard. In addition to the above, cost, the requirement of track record, corporate governance norms, time frame for listing, and reporting requirements are quite relaxed for an SME, making a listing on an SME platform comparatively easier. Listing in the SME stock exchange platform will provide SMEs with equity financing opportunities to grow their business, which unlisted SMEs do not have. This research paper addresses the absence of study into the determinants of capital structure for listed small and medium enterprises in India and underlines the need for a detailed review. The present research also aims to broaden the theory of capital structure by explaining the financial decision of the listed small and medium enterprises in India.

The key objective of this research is to analyze the impact of the debt financing policy and firm performance of SMEs listed on the BSE-SME platform in the period 2014–2018 utilizing three financial measures: return on assets (ROA), return on equity (ROE), and gross profit margin (GPM). This study employed the panel regression model. The study reveals that debt financing has a substantial adverse impact on SMEs' financial results. The analysis also proves that the pecking order theory relates to small and medium enterprises in India. It is anticipated that the findings of this study would have significant policy implications for Indian small and medium enterprises. The remainder of the paper is as follows. Section 2 presents a summary review of related literature. Section 3 refers to the data and methodology. Section 4 presents the empirical findings, while Sect. 5 concludes the paper with policy implications.

2 Literature Review

2.1 Theoretical Framework on Capital Structure

Modigliani and Miller (1958) put forward the capital structure irrelevance theory. The firm's valuation is built on the capital structure in keeping with this principle. The rational interpretation of fact relaxed the argument, taking into consideration the value of corporate taxes (Modigliani and Miller 1963), personal taxes (Miller 1977), agency cost (Jensen and Meckling 1976; Myers 1977), and asymmetric information (Myers 1977, 1984; Myers and Majluf 1984). Theories of capital structure include trade-off theory, pecking order theory, agency cost theory, and the market timing theory. Kraus and Litzenberger (1973) presented the trade-off theory, and it implies the balance between the deadweight cost of bankruptcy and tax-saving benefits of debt and often includes the agency cost. The pecking order theory popularized by Myers and Majluf (1984) argues that firms assign preference to their funding source (from internal finance to equity) based on the relative cost of financing. Asymmetric information between firms and investors favors the issue of debt over equity. The theory proposed by Jensen and Meckling (1976) is called an agency cost theory. This cost incurred from the dispute between equity and debt holders. Baker and Wurgler (2002) proposed a theory called market timing theory, which claims that market timing is the first-order determinant of the firm's capital structure to use debt or equity. This theory is in contrast with the pecking order theory and trade-off theory.

2.2 Capital Structure and SMEs

Based on the above theoretical implications, several empirical works were performed on the capital structure determinants. It is also clear that maximum research work on the capital structure was conducted in developed countries (Michaelas et al. 1999; Hall et al. 2004; López-Gracia and Sogorb-Mira 2008; Mac an Bhaird and Lucey 2010). Previous research studies of the capital structure primarily concentrated on larger companies (Harris and Raviv 1991; Krishnan and Moyer 1997; Majumdar and Chhibber 1999; Bevan and Danbolt 2002; Abor 2005; Bancel and Mittoo 2011). SMEs' decisions on capital structure vary from those of big corporations on account of considerations such as size, age, asset structure, profitability, and growth (Marsh 1982; Bradley et al. 1984; Kester 1986; Titman and Wessels 1988; Kiogora 2000). SMEs may fund financial operations through either debt or equity. SMEs are preferring internal equity over external leverage (Myers and Majluf 1984; Berger and Udell 1998; Myers 2001; Lemmon and Zender 2010) in the light of the ramifications of pecking order theory. Recently, the growth of the SME exchange portal in BSE and NSE in India, which connects small businesses to equity investors, has thus been spurred by the rise in demand for SME's external equities.

Cassar and Holmes (2003) investigated the capital structure determinants and usage of finance for SMEs and indicates that asset structure, efficiency, and development are important factors affecting the capital structure. In Abor (2008), the association among firm characteristics and capital structure issues of Ghana small and medium enterprises was analyzed. The regression analysis was applied to measure capital structure determinants. The research reported that the parameters like enterprise age, scale, asset structure, productivity, and development influence Ghanaian SME's capital structure. Abor (2007) has examined the impact of capital structure on small and medium enterprises efficiency in Ghana and South Africa and, in doing so, suggests the performance of the SMEs are negatively influenced by long and total debt ratios. Data for 200 Zimbabwean SMEs were analyzed in 2006 by Obert and Olawale (2010) to point to an adverse and substantial link among debt and firm results. Short-term debt was also recognized as a significant source of funding for Ghanaian small and medium enterprises. Forte et al. (2013) supported the pecking order hypothesis by proposing that small and medium enterprises prefer to fund expansion by debt only after their internal capital has been exhausted and identified that profitability and age are linked negatively to leverage and size; asset growth is positively associated with leverage. Rao et al. (2019) put forward about the relevance of the pecking order hypothesis to SMEs in India. The favorable interaction between equity return and debt clarifies that the expense of debt funding is relatively lower and thus improves a firm's ROE. The adverse relationship among the debt levels and efficiency, according to the principle of the pecking order, indicates that SMEs would tend to fund their projects internally rather than externally. Because the external borrowing costs are at higher risk (Balios et al. 2016; Proença et al. 2014; Czerwonka and Jaworski 2019). Gál (2013) analyzed that the more labor-intensive enterprises finance themselves with a lower rate of durable external resources and are not able to access trade credit in Hungarian small and medium enterprises. These SMEs are also categorized by a lower equity ratio. Kumar (2014) examined the financing pattern as well as the composition of the capital structure of SMEs for a period from 2010–2013 and concludes that almost two-third of total funds allocated to long-term funds compared to short-term funds in the SMEs selected for the study. He further finds that the SMEs have used more equity funds compared to borrowed funds from various sources.

The study of academic literature reveals that a lot of research work has been conducted in the capital structure. Empirical work has produced contrasting and conflicting results in developing and developed countries on the association between capital structure and firm effectiveness. The present study broadens the literature on the capital structure by empirically analyzing the relationships between debt financing and financial performance in Indian SMEs listed on BSE-SME exchanges.

3 Data and Empirical Model

3.1 Sample and Data

The study sample includes 164 non-financial Indian SMEs listed on the BSE-SME platform. The financial results were collected from the SME's financial reports for the five years, 2014–2018. As standard practice, financial firms were excluded from the sample because of their specific nature of financial statements. In order to avoid missed data issues, firms that do not have five years of financial results were also omitted from the study.

3.2 Variables Measurement

3.2.1 Dependent Variables

The financial measures such as return on assets (ROA), return on equity (ROE), gross profit margin (GPM) (Abor 2005; El-Sayed Ebaid 2009), market-driven metrics like stock returns and volatility (Welch 2004) as well as Tobin's Q measure (Zeitun and Tian 2007; Abor 2007) are the multiple variables used by the researchers to assess the firm performance. Three common accounting-based performance measures, ROA, ROE, and GPM, are used in this study to assess firm efficiency. Financial performance metrics are described as GPM = gross profit / sales; ROE = net profit / average total equity and ROA = net profit / total assets.

3.2.2 Independent Variables

The independent variables used in the study are debt ratios (Goddard et al. 2005). Short-term debt ratio (SDR), long-term debt ratio (LDR), and total debt ratio (TDR) are the debt ratios included in the study.

3.2.3 Control Variables

Literature suggests that corporate size and sales growth can impact firm efficiency. Bigger companies are skilled with a wider diversity of competencies compared to smaller firms and have a propensity to utilize economies of scale that may impact their performance. Compared to SMEs, larger firms also enjoy better product diversification and larger market shares (Jermias 2008; Frank and Goyal 2003). The research thus monitors the variances in the working condition of the firm by incorporating the size and growth variables.

3.3 Model Specification

The model for empirical research to study the relationship between debt financing and firm performance (Table 1 Variable Definition and Explanation) can be stated as follows:

$$\mathrm{ROA}_{i,t} = \beta_0 + \beta_1 \mathrm{SDR}_{i,t} + \beta_2 \mathrm{LDR}_{i,t} + \beta_3 \mathrm{TDR}_{i,t} + \beta_4 \log\mathrm{FS}_{i,t} + \beta_5 \log\mathrm{SG}_{i,t} + \mu_{i,t} \quad (1)$$

$$\mathrm{ROE}_{i,t} = \beta_0 + \beta_1 \mathrm{SDR}_{i,t} + \beta_2 \mathrm{LDR}_{i,t} + \beta_3 \mathrm{TDR}_{i,t} + \beta_4 \log\mathrm{FS}_{i,t} + \beta_5 \log\mathrm{SG}_{i,t} + \mu_{i,t} \quad (2)$$

$$\mathrm{GPM}_{i,t} = \beta_0 + \beta_1 \mathrm{SDR}_{i,t} + \beta_2 \mathrm{LDR}_{i,t} + \beta_3 \mathrm{TDR}_{i,t} + \beta_4 \log\mathrm{FS}_{i,t} + \beta_5 \log\mathrm{SG}_{i,t} + \mu_{i,t} \quad (3)$$

where,

$\mathrm{ROA}_{i,t}$ = Return on assets of firm *i* at time *t*.
$\mathrm{ROE}_{i,t}$ = Return on equity of firm i at time *t*.
$\mathrm{SDR}_{i,t}$ = Short-term debt / total assets for firm *i* in time *t*.
$\mathrm{LDR}_{i,t}$ = Long-term debt / total assets for firm *i* in time *t*.
$\mathrm{TDR}_{i,t}$ = Total debt/total assets for firm *i* in time *t*.
$\mathrm{FS}_{i,t}$ = Firm size (log of total assets) for firm *i* in time *t*.
$\mathrm{SG}_{i,t}$ = Sales growth (log of sales growth) for firm *i* in time *t*.
$\mu_{i,t}$ = The error term.

Table 1 Variables definition and explanation

Variables	Definition & Explanation
ROA	Return on assets is measured as the ratio of net profit to average total assets by the end of the fiscal year 2014–2018.
ROE	Return on equity is measured as the ratio of net profit to average total equity by the end of the fiscal year 2014–2018.
GPM	Gross profit margin is measured as the ratio of gross profit to sales by the end of the fiscal year 2014–2018.
SDR	Short-term debt ratio to total assets is calculated by dividing the short-term debt book value by the overall asset book value by the end of the fiscal year 2014–2018.
LDR	Long-term debt ratio to total assets is calculated by dividing the long-term debt book value by the overall asset book value by the end of the fiscal year 2014–2018.
TDR	The total debt ratio to total assets is calculated by dividing the total debt book value by the total assets book value by the end of the fiscal year 2014–2018.
FS	FS denotes the firm size. The natural log of the total assets book value by the end of the fiscal year 2014–2018 is used as a proxy for firm size.
SG	SG denotes sales growth. Natural log of the sales growth for the firm i at time t is used for sales growth.

3.4 Estimation Method

The study employs a panel data regression method for verifying the robustness of findings. The panel data regression method contains two models—fixed-effect regression model and Random effect regression model. The fixed model permits heterogeneity or independence between the cross-sections and makes each intercept, while the random effect model allows variability and time-invariants; however, the actual result of each cross-section is uncorrelated to the independent variables. The Hausman test is applied to assess the correct model amongst the fixed and random effect models. The null hypothesis for the Hausman test is that the individual outcomes are not associated with the regressors and that the concept of random effect will not be used as well. When the likelihood value is less than 5%, the null hypothesis is rejected, which implies that the individual effects are linked to the regressors. The findings of the Hausman test in our sample reject the null hypothesis at 5% significance value, which indicates that the model of fixed effect has an advantage over the model of random effect.

4 Empirical Results

4.1 Descriptive Statistics

The summary statistics of all the dependent and explanatory variables are presented in Table 2. The average value of the short-term debt ratio, long-term debt ratio, and total debt ratio is shown as 0.5644, 0.0434, and 0.6074, respectively. The findings suggest that Indian SMEs listed on the BSE-SME platform rely more on short-term debt for financing their operation than long-term debts.

The lack of a developed debt market in India could contribute to SMEs' reliance on short-term debt than long-term debt. In order to satisfy working capital demands and fund its operating cost, SMEs are utilizing short-term debt. The primary long-term funding source available for Indian SMEs is borrowing directly from banks. SMEs can get this kind of financing without sacrificing ownership of the firm. The

Table 2 Descriptive statistics

Variables	Mean	Standard deviation	Standard error
SDR	0.5644	0.2473	0.0784
LDR	0.0434	0.0828	0.0343
TDR	0.6074	0.1339	0.3469
FS	1.1756	0.4936	0.0172
SG	0.5946	0.2820	0.0098
GPM	0.3449	0.0186	0.2590
ROA	0.1766	0.1611	0.2011
ROE	0.2404	0.1858	0.1252

Source: own calculation

average return on assets, return on equity, and gross profit margin are 0.1766, 0.0.3449, and 0.2404, respectively. These results suggest that Indian SMEs listed on the BSE-SME platform have relatively poor performance during the test period concerning ROA, ROE, and GPM.

4.2 Correlation Analysis

A correlation analysis, along with the variance inflation factor (VIF), examined the multicollinearity among the variables included in the model. The correlation analysis was also done to examine the relationships among the explanatory variables. Table 3 recorded the findings of the study of the associations between dependent, independent, and control variables. As seen in Table 3, SMEs have a negative and important association between their financial (ROA, ROE, and GPM) results and all independent (SDR, LDR, and TDR) variables at 0.01 and 0.05 significance levels. Whereas, the control variables (FS and SG) and firm performance have a strong and optimistic relationship. This significant and positive relationship indicates that large enterprises are more competitive than the small and medium enterprises. The VIF values are far below the appropriate limits (VIF $>$ 5 indicates multicollinearity according to Gujarati 2009), indicating that the variables of the study are non-multicollinear. The findings further show that the correlation coefficient among variables is low, and among the explanatory variables included in the model, there is no multicollinearity.

4.3 Regression Analysis

The findings of regression using a fixed-effect model are summarized in Tables 4, 5, and 6 which discuss the association between debt financing and firm efficiency calculated by ROA, ROE, and GPM. The regression test findings using a fixed-effect

Table 3 Correlation matrices and variation inflation factors (VIF)

Variables	GPM	ROA	ROE	SDR	LDR	TDR	FS	SG	VIF
GPM	1								1.26
ROA	0.11*	1							1.05
ROE	0.01**	0.04*	1						1.22
SDR	−0.17**	−0.02**	−0.03**	1					1.17
LDR	−0.02*	−0.08*	−0.01**	−0.05*	1				1.08
TDR	−0.15**	−0.06**	−0.02**	−0.04*	−0.05*	1			1.12
FS	0.07*	0.05*	−0.05**	0.14*	0.08*	0.06*	1		1.35
SG	0.17*	0.12*	0.01**	0.05*	0.01*	0.01*	0.11**	1	1.03

Notes: ***, ** denotes significance at 1% and 5%
Source: own calculation

Table 4 Regression results—gross profit margin

	Model 1		Model 2		Model 3	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	0.3463***	0.1543	0.3621***	0.0321	0.2956***	0.0200
SDR	−0.3101**	0.2642				
LDR			−0.3912**	0.0153		
TDR					−0.1664**	0.0352
FS	0.5636**	0.3807	0.1785**	0.0012	0.2065**	0.0231
SG	0.7990***	0.4047	0.2193***	0.1023	0.4037***	0.0465
R^2	0.3069		0.4450		0.3071	
F	18.7421		23.3574		46.8236	
Sig	0.000		0.000		0.000	

Notes: ***, ** denotes significance at 1% and 5%, SE is the standard error
Source: own calculation

Table 5 Regression results—return on assets

	Model 1		Model 2		Model 3	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	0.5762**	0.0697	0.4983***	0.1715	0.0573**	0.0170
SDR	−0.0899**	0.0148				
LDR			−0.5410**	0.2697		
TDR					−0.0188**	0.0200
FS	0.5409***	0.0809	0.2702**	0.0811	0.2124***	0.0641
SG	0.0952***	0.0641	0.2092***	0.0639	0.3608***	0.0806
R^2	0.4946		0.4976		0.4952	
F	38.8497		38.9759		38.6014	
Sig	0.000		0.000		0.000	

Notes: ***, ** denotes significance at 1% and 5%, SE is the standard error
Source: own calculation

Table 6 Regression results—return on equity

	Model 1		Model 2		Model 3	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	0.0675**	0.0127	0.0614**	0.0634	0.6162**	0.0481
SDR	−0.0086**	0.0156				
LDR			−0.4515**	0.0460		
TDR					−0.4525**	0.0747
FS	0.4784**	0.0481	0.0568**	0.0906	0.6628*	0.0137
SG	0.5623**	0.1273	0.05613**	0.0782	0.6779**	0.0449
R^2	0.2045		0.3046		0.3071	
F	10.1181		13.9608		46.8236	
Sig	0.004		0.032		0.000	

Notes: ***, ** denotes significance at 1% and 5%, SE is the standard error
Source: own calculation

model to study the association among debt financing and financial results calculated by ROA, ROE, and GPM presented in Tables 4, 5, and 6. The effect of the capital structure relationship measured by the SDR—total assets ratio, the LDR—total asset ratio, the TDR—total assets ratio, and the financial results calculated by GPM is summarized in Table 4. The findings reveal a strong negative association, as seen in Table 4, between SDR, LDR, TDR, and GPM. In model 1, model 2, and model 3, the SDR coefficient was negative and statistically relevant at a 95% confidence level, suggesting that a rise in debt corresponds to a drop in SMEs gross profit margin. Table 5 summarizes the effects of the capital structure relationship measured by the SDR—total assets ratio, the LDR—total asset ratio, the TDR—total assets ratio, and the ROA—measured financial results. The findings are shown in Table 5 suggest the major negative association between SDR, LDR, and TDR and financial results calculated by ROA. Table 6 summarizes the effects of the association among the capital structure calculated by the SDR to total assets ratio, the LDR to total assets ratio, the TDR to total assets ratio, and the ROE-measured financial performance. The findings in Table 6 also reveal that SDR, LDR, and TDR are substantially detrimental to company success assessed by the return on equity. The findings are shown in Table 6 also suggest the major negative association between SDR, LDR, and TDR and financial results calculated by ROE.

The results indicate that the association among debt and profitability is significantly negative. The negative coefficient of debt (SDR, LDR, and TDR) at 0.01 and 0.05 significance level implies that a rise in debt is related to a drop in the firm performance of SMEs. The firm size and sales growth contribute to company success favorably and dramatically. In turn, the optimistic and important result indicates that larger small- and medium-sized firms are continuing to profit from economies of scale and to have greater effects on commodity or factor business.

5 Conclusion & Policy Implications

This paper has analyzed the association among debt policy and the firm efficiency of Indian SMEs listed in the BSE-SME Platform. The current research offers empirical proof of this problem for Indian SMEs by utilizing a broad variety of samples and accurate econometric models. The findings of the analysis indicate that all indices of capital structures, including SDR, LDR, and TDR, are adversely and significantly related to the firm's success assessed by three financial measures (ROA, ROE, and GPM) using fixed-effect estimation model. Modigliani and Miller (1958) suggest that debt preference has no impact on business results. The interaction among capital structure and firm efficiency is contradictory to the debt irrelevance hypothesis. The reasons for the SMEs to choose high debt level are to avoid agency problems between shareholders and managers, to avoid losing control, and to avoid high transaction cost. To benefit from tax gain on interest payment may be the other reason why SMEs tend to use maximum debt. However, the empirical results further demonstrate that factors other than debt do affect the firm performance of small and

medium enterprises. For instance, control variables, size, and sales growth are linked to firm success favorably and significantly. The conclusion is aligned with the trade-off theory indicating that bigger firms prefer to invest more because of their risk diversification capacity.

The overall results of this research show the important and detrimental influence of short-term debt and long-term debt on the competitiveness of SMEs. The study findings conflict with the findings reported by Champion (1999), Ghosh et al. (2000), Hadlock and James (2002), Frank and Goyal (2003), and Berger and Di Patti (2006) and consistent with the studies El-Sayed Ebaid (2009), Rajan and Zingales (1995), Zeitun and Tian (2007), and Abor (2007). The findings of the current research illustrate pecking order theory and indicated that effective small and medium enterprises desire to use more internal financing than outside finance (Myers and Majluf 1984). The analyzed SMEs show that short-term debts are more often used than long-term debts. Such a policy may cut information asymmetry costs and disputes among agencies. The lower level of leverage indicates the lower agency cost of external debt and higher firm performance. The firm size and sales growth have a significant impact on the financial results of the firm. This finding confirms those of Juan García-Teruel and Martínez-Solano (2007), Lin and Chang (2011), Dawar (2014), and Yazdanfar and Öhman (2015), who reported that firm size has a considerably optimistic influence on performance.

The research results have major policy implications on owners/managers, lenders, and investors in SMEs. The disproportionate usage of SMEs debt in contrast to the market average may contribute to high litigation costs that can have a significant effect in terms of firm performance. SMEs have to raise their equity percentage of the capital structure to mitigate the detrimental effect of heavy debt usage on the financial results of SMEs. Financial managers will look at the effect of leveraging on results before changing debt levels. Policymakers can create an environment where SMEs may maintain sufficient income within their businesses to fund the greatest amount of commercially feasible ventures.

Besides, fiscal policy should focus on creating opportunities to maintain earnings and encouraging investment in growth-driven strategies. The research has only been focused on five years because of restricted access to data. Future studies may span a longer time. Further research may address the comparison of reporting listed small and medium enterprises with non-listed firms. Comparison of listed and unlisted SMEs will help the researchers to explore the advantage of listed SMEs over unlisted SMEs as regards, ownership control, capital structure, and corporate governance.

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Part V
International Trade

Trade of the EU and China with South America After the 2008 Financial Crisis

Wioletta Nowak

Abstract The paper discusses Sino-European trade competition in South America over the period from 2008 to 2017. The aim of the paper is to show the scale of and trends in merchandise trade of the European Union and China with South American countries after the global financial crisis. During the analyzed period, the average annual growth rate of China's exports to South America was nearly 7% while the growth rate of EU's exports was less than 1%. The Chinese exports of goods to South America surpassed the European exports to the region in 2017 as a result. Besides, South American countries, except Brazil, Surinam, and Trinidad and Tobago, imported more goods from China than from the European Union. The decomposition of growth rates of the EU's exports shows that they heavily depend on the growth rates of exports of Germany, Italy, and Spain. Since 2013, China has been importing more goods from South America than the European Union. In the years 2015–2017, China's bilateral trade with the region was bigger than the EU's one.

Keywords Merchandise trade · Financial crisis · South-South cooperation

1 Introduction

The European Union was the second major trading partner (after the United States) for South America for many years. Between 2000 and 2008, the EU-South America trade in goods was growing annually by nearly 12%. The EU increased its advantage over China in merchandise trade with the continent (Nowak 2016). However, important changes in South America's trade patterns have been happening since the start of the 2008 global financial crisis. The European Union has been steadily losing its advantage over China in trade with the continent. In 2015, China's bilateral

W. Nowak (✉)
Institute of Economic Sciences, University of Wroclaw, Wroclaw, Poland
e-mail: wioletta.nowak@uwr.edu.pl

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trade in goods with South American countries surpassed the EU's one. Besides, in contrast to the EU, China has been constantly increasing its share in markets of all countries in the region.

The aim of the paper is to show the scale of and trends in merchandise trade of the EU and China with South America after the 2008 financial crisis. The analysis comprises the 28 member states of the EU, 13 South American countries and China. It is based on the data retrieved from the World Integrated Trade Solution. The paper presents not only aggregate values of the EU's trade in goods with the continent but also the contribution of each member country to the EU's total trade with the South American countries. Moreover, the decomposition method is used to show which member countries had the biggest impact on growth rates of the EU's exports to and imports from South America in the analyzed period.

There are several studies on trade between the European Union and South American countries and between China and the continent in the twenty-first century. For instance, the EU-Latin America trade was analyzed by Nowak (2014, 2016). China's bilateral trade with Mexico, Chile, Costa Rica, and Peru was studied by Arevalo et al. (2019). Trade between China and Brazil was examined by Gouvea et al. (2020).

The main contribution of the paper is a presentation of China's trade expansion in South America after 2008 compared to the EU's dwindling importance as a trading partner for the continent.

The rest of the paper is structured as follows. In section two, a brief history of trade relations and trends in bilateral merchandise trade between the EU and South America and between China and the region are presented. Section three discusses the EU's and China's imports of goods from the region. The scale of and trends in merchandise exports of the EU and China to South America after the 2008 financial crisis are performed in section four. The last section contains concluding remarks.

2 The EU's and China's Trade Relations with South America

The European Union-South America economic and trade relations were regulated during the first EU-LAC (Latin America and the Caribbean) summit in 1999. Since then, issues referring to a mutual cooperation in the area of free trade between the partners have been discussed during regular EU-LAC summits (Nowak 2016).

The European Union has privileged relations in trade in goods and services with a few South American countries. The European Union signed Free Trade Agreement (FTA) and Economic Integration Agreement (EIA) with Chile. They came into force in 2003 and 2005, respectively. The EU-Colombia and Peru agreement on free trade in goods and services was signed in 2012. Ecuador acceded to the agreement in 2016, after two years of negotiations.

The EU and MERCOSUR (Argentina, Brazil, Paraguay, Uruguay, and Venezuela) reached agreement in principle in 2019 after two decades of negotiations. The EU initiated negotiations with MERCOSUR in 1999. However, they were suspended between 2004 and 2010. The main subject of the dispute was the access of MERCOSUR to the European agricultural market and the access of the EU to South American market of manufactured goods (Roy 2012). It is worth noting that when the EU-MERCOSUR negotiations were suspended, the EU shifted to bilateralism and launched a strategic partnership with Brazil in 2007.

China-South America trade relations have been intensively developed since the beginning of twenty-first century. China signed Free Trade Agreement with Chile in 2005 and Economic Integration Agreement in 2008. Chile-China FTA came into force in 2006 and EIA in 2010. Peru-China FTA and EIA were signed in 2009, and they came into force a year later. The agreements concern not only the deregulation and liberalization of goods markets but also services, investment, and intellectual property rights (Wise 2016). In 2012, China established strategic partnerships with Argentina and Brazil (Yu 2015). Besides, it initiated negotiations with Colombia on FTA. In 2012, China also declared readiness to negotiate with MERCOSUR on a free trade area. The agreement is the most supported by Uruguay for which China has been the main destination market since 2014.

China-South America trade relations are strengthened during high-level visits. Since 2008, South American countries have been visited by the Chinese leaders (President, Vice President, and Prime Minister) almost each year. Between 2008 and 2019, the most often visited countries were Brazil (six times), Chile (five times), Argentina (times), and Peru (three times). In 2015, the Forum of China and Community of Latin American and Caribbean States (China-CELAC Forum) was set up. China-CELAC Forum aims at promoting development of the comprehensive cooperative partnership between China and LAC countries. The partnership is based on equality, mutual benefit, and common development (China-CELAC Forum 2016). Before 2015, nine China-Latin America business summits were held.

China uses also lending mainly in the form of low-interest loans to increase its trade with the South American countries. Gallagher and Myers (2019) estimated that between 2005 and 2018, the biggest beneficiaries of China's foreign aid were Venezuela ($67.2 billion), Brazil ($28.9 billion), Ecuador ($18.4 billion), Argentina ($16.9 billion), and Trinidad and Tobago ($2.6 billion). During the financial crisis, China was the last resort of financing for Argentina, Ecuador, and Venezuela that were not able to borrow easily in international capital markets. An increase in the China's financing provided to South America coincided with the rise of trade between China and countries in the region (Nowak 2014).

Both the EU and China significantly increased their trade with South America in this century. The value of EU's bilateral trade with South America rose from $70.4 billion in 2001 to $196.9 billion in 2008. At the same time, China increased its merchandise trade with the continent from $9.8 billion to $107.5 billion. The 2008 financial crisis led to a sharp drop in the EU's and China's bilateral trade with South American countries. In 2009 compared to 2008, the EU-South America trade declined by 26% and China-South America trade by 17%. After the crisis, Europe

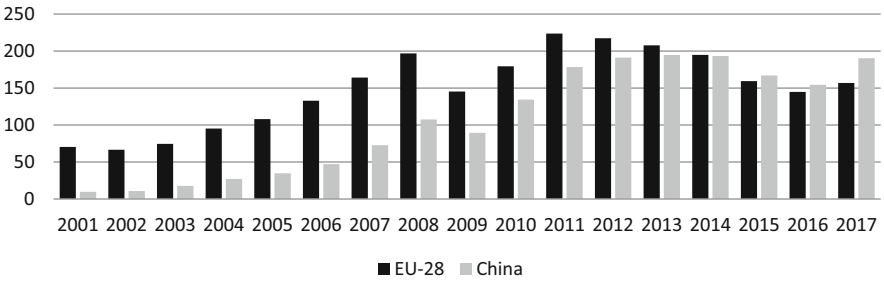

Fig. 1 Bilateral trade in goods with South America, 2001–2017 ($ billion). Source: Own calculations based on data retrieved from WITS (2020)

managed to increase its merchandise trade with the region to $223.7 billion in 2011. Eventually, the value of EU's bilateral trade with South America collapsed to $156.9 billion in 2017. China's trade in goods with the continent peaked in 2013 ($194.7 billion) and then slowed down in the years 2014–2016 (Fig. 1).

The EU was increasing its advantage over China in merchandise trade with South America in the years 2002–2007. The value of the EU's bilateral trade with the region exceeded China's one by $55.7 billion in 2002 and $91.5 billion in 2007. After the outbreak of the 2008 global financial crisis, the opposite trend has been observed. In 2017, China's total trade in goods with South America surpassed the EU's one by $33.6 billion. Since 2015, China has been dominated over the EU in merchandise trade with the region.

In 2008, South America's bilateral trade in goods with the EU accounted for nearly 65% and with China for 35% of its trade with both trading partners. Nine years later, China's share in South America's total trade with those partners amounted to 55%. From 2008 to 2017, the EU recorded about a 20 percentage point decline in South America's trade with both regions. After the 2008 financial crisis, China to a greater extent increased its advantage over the EU in imports of goods from South America than in exports of goods to South American countries.

3 The EU's and China's Imports of Goods from South America

Merchandise imports from South American countries are more important for China than the EU. In the years 2008–2017, South America accounted for less than 2% of the EU's total imports and for about 6% of China's imports from the world.

Between 2009 and 2017, China's imports of goods from South America were growing at 6.5% annually while the average annual growth rate of the EU's imports from South American countries was negative (−4.5%). Since 2013, the value of China's merchandise imports from the region has been surpassing the value of goods imported by the EU from South America (Fig. 2).

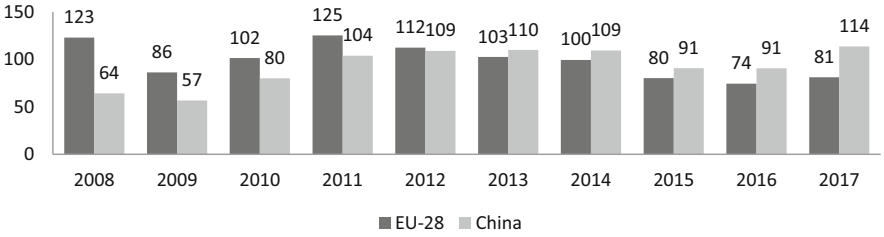

Fig. 2 Imports of goods from South America, 2008–2017 ($ billion). Source: Own calculations based on data retrieved from WITS (2020)

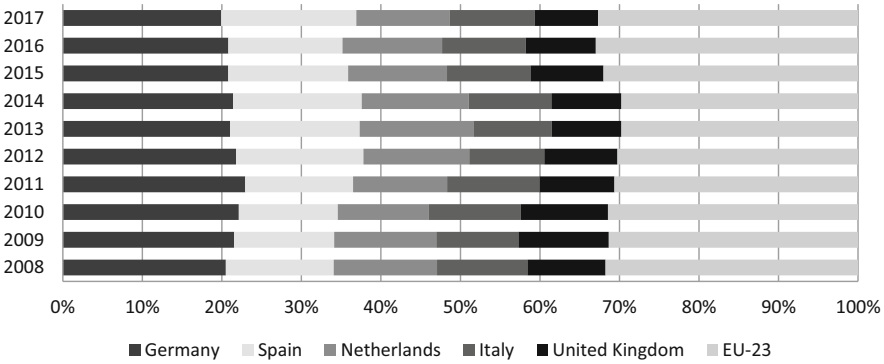

Fig. 3 The biggest European importers from South America, 2008–2017. Source: Own calculations based on data retrieved from WITS (2020)

In the years 2008–2017, the biggest European importers from South America were Germany (21.4% of the EU's merchandise imports from the continent), Spain (14.7%), Netherlands (12.7%), Italy (10.6%), and the United Kingdom (9.5%). Imports of the remaining European 23 countries accounted for 31.2% of the EU's imports from the region. The domination of top five European importers over the EU-23 was the biggest in 2014 (Fig. 3).

After 2008, all the biggest European importers recorded negative average annual growth rates of imports from South America. Among the EU's member countries, only Malta, Ireland, Poland, Hungary, and Lithuania have been increasing their imports from South American countries (Table 1).

A decomposition of the EU's growth rate of merchandise imports from South America shows that the negative average growth rate of the EU's imports in the years 2009–2017 was mainly caused by a substantial decline in imports of the top five European importers (Fig. 4).

The EU imported goods primarily from Brazil (45.7% of the EU' imports from South America), Argentina (12.3%), Chile (11.9%), Colombia (8.6%), and Peru (6.9%). The values of imports from those countries are presented in Table 2.

Table 1 Average annual growth rate of imports from South America, 2009–2017

Country	Rate (%)	Country	Rate (%)	Country	Rate (%)	Country	Rate (%)
Malta	4.4	Spain	−2.1	Germany	−4.8	Denmark	−6.6
Ireland	3.8	Slovenia	−2.5	Italy	−5.2	United Kingdom	−6.7
Poland	2.8	Belgium	−3.2	Luxembourg	−5.3	Romania	−7.0
Hungary	2.6	Czech Rep.	−3.3	Greece	−5.3	Austria	−7.6
Lithuania	2.3	Portugal	−3.4	France	−5.4	Cyprus	−10.9
Latvia	−1.0	Finland	−4.4	Netherlands	−5.6	Bulgaria	−14.4
Estonia	−1.8	Slovak Rep.	−4.7	Sweden	−6.5	Croatia	−16.6

Source: Own calculations based on data retrieved from WITS (2020)

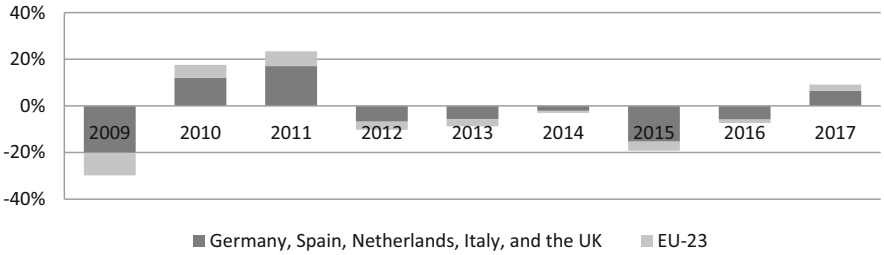

Fig. 4 Decomposition of the EU's growth rate of merchandise imports from the South American countries. Source: Own calculations based on data retrieved from WITS (2020)

Table 2 Top five EU's trading partners in South America, 2008–2017 ($ billion)

	The EU's imports		The EU's exports		Bilateral trade	
Rank	Trading partner	Value	Trading partner	Value	Trading partner	Value
1	Brazil	451.4	Brazil	417.4	Brazil	868.8
2	Argentina	121.0	Argentina	102.2	Argentina	223.2
3	Chile	117.2	Chile	93.4	Chile	210.6
4	Colombia	85.3	Colombia	64.9	Colombia	150.2
5	Peru	68.0	Venezuela	57.7	Peru	106.3

Source: Own calculations based on data retrieved from WITS (2020)

China has been also imported goods mainly from Brazil. Over the period 2008–2017, imports from that country accounted for nearly 50% of China's merchandise imports from South America. Among top five import markets for China are the following countries: Chile (19.7%), Venezuela (9.5%), Peru (8.5%), and Argentina (6.5%). The values of China's imports of goods from the South American countries are presented in Table 3.

Since 2008, South America has been a source of vegetables (21%), food products (15%), minerals (15%), and fuels (14%) for the biggest European importers. China's

Table 3 Top five China's trading partners in South America, 2008–2017 ($ billion)

	China's imports		China's exports		Bilateral trade	
Rank	Trading partner	Value	Trading partner	Value	Trading partner	Value
1	Brazil	455.7	Brazil	271.8	Brazil	727.5
2	Chile	183.0	Chile	109.2	Chile	292.2
3	Venezuela	87.9	Argentina	72.5	Venezuela	134.8
4	Peru	78.9	Colombia	57.9	Argentina	132.7
5	Argentina	60.2	Peru	50.0	Peru	128.9

Source: Own calculations based on data retrieved from WITS (2020)

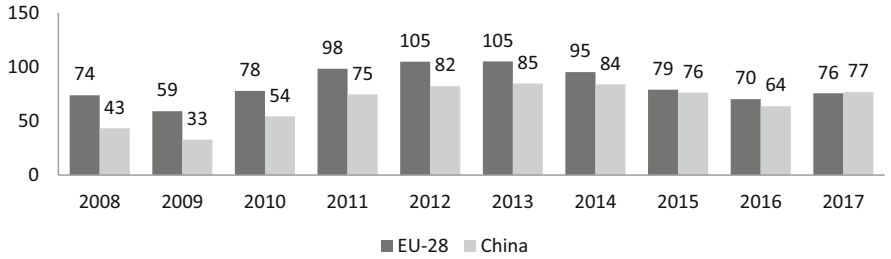

Fig. 5 Exports of goods to South America, 2008–2017 ($ billion). Source: Own calculations based on data retrieved from WITS (2020)

merchandise imports from South America have been dominated by minerals (33%), vegetables (22%), fuels (18%), and metals (14%).

4 Merchandise Exports of the EU and China to the South American Countries

After the 2008 financial crisis, South America did not increase noticeably its significance as a destination market for the European Union. In both 2008 and 2017, the EU exported 1.3% of its goods to the continent. European exports of goods to South America picked up in the years 2012–2013 and amounted to 1.8% of the EU's total exports. The European Union was increasing its merchandise exports to South America at rate of 0.3% per annum.

South America has become slightly more important destination market for Chinese commodities after the outbreak of global crisis. It absorbed 3.0% of China's total exports in 2008 and 3.4% in 2017. Between 2009 and 2017, the Chinese exports in goods to the region grew at 6.6% annually. In 2017, the value of China's exports surpassed the EU's ones. Trends in the EU's and China's exports of goods to South America are presented in Fig. 5.

Over the period from 2008 to 2017, the biggest European exporters to South America were Germany (28.1% of the EU's merchandise exports to the region), Italy

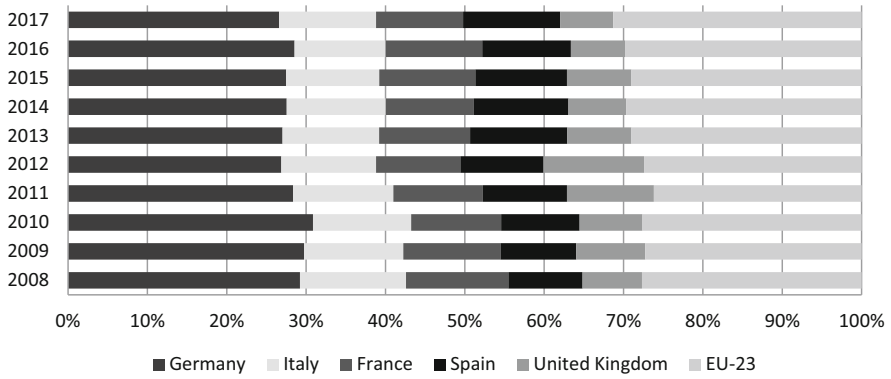

Fig. 6 The biggest European exporters to South America, 2008–2017. Source: Own calculations based on data retrieved from WITS (2020)

Table 4 Average annual growth rate of exports to South America, 2009–2017

Country	Rate (%)	Country	Rate (%)	Country	Rate (%)	Country	Rate (%)
Cyprus	39.5	Malta	4.6	Lithuania	0.8	Austria	−1.2
Hungary	12.4	Spain	3.3	Greece	−0.2	France	−1.5
Portugal	7.9	Belgium	3.0	Denmark	−0.5	Ireland	−1.7
Estonia	6.9	Luxembourg	3.0	Slovak Rep.	−0.6	Sweden	−3.5
Slovenia	6.6	Bulgaria	2.7	Italy	−0.7	Croatia	−3.9
Romania	4.9	Czech Rep.	2.1	Germany	−0.8	Finland	−6.2
Netherlands	4.8	Poland	1.6	United Kingdom	−1.0	Latvia	−9.6

Source: Own calculations based on data retrieved from WITS (2020)

(12.3%), France (11.5%), Spain (11.0%), and the United Kingdom (8.7%). Less than 30% of the European commodities were exported by the remaining 23 member countries. The advantage of top five European exporters over the EU-23 was the biggest in 2011 (Fig. 6).

After 2008, several EU members significantly increased their merchandise exports to the South American countries. However, except Spain, the most important European exporters recorded negative average annual growth rates of exports to the region (Table 4).

The share of EU members which intensively exported their commodities to South America in the EU's total exports to the continent was relatively small. Therefore, a fast growth of exports of some EU members had no big impact on the EU's average annual growth rate of exports to the region. A decomposition of the EU's growth rate of exports shows that it has been mainly determined by growth rates of the biggest European exporters (Fig. 7).

In the years 2008–2017, nearly 90% of the EU's exports of goods to South America were absorbed by five countries in the region. The EU's major destinations

Fig. 7 Decomposition of the EU's growth rate of exports of goods to South America. Source: Own calculations based on data retrieved from WITS (2020)

markets were Brazil (49.7% of the EU's exports to South America), Argentina (12.2%), Chile (11.1%), Colombia (7.7%), and Venezuela (6.9%). China's exports to South America have been slightly more diversified. However, over 80% of Chinese commodities were directed to five countries. China exported commodities to Brazil (40.4% of China's exports to the region), Chile (16.2%), Argentina (10.8%), Colombia (8.6%), and Peru (7.4%). Values of the EU' exports and China's ones to South America are presented in Table 2 and Table 3, respectively.

Exports of the biggest European exporters to South America consisted principally of machinery and electronics (38%), chemicals (16%), and transportation (16%). China's merchandise exports to South America were dominated by machinery and electronics (37%), textiles and clothing (13%), and metals (10%). According to Narins (2017), technological sophistication of China's exports to South America, compared with European exports to the region, remains low and moderate. However, a sophistication level of Chinese exports to South American countries has been constantly increasing, and Chinese commodities might soon displace similar products made in the EU.

After 2008, China increased its share in markets of all South American countries while the share of the EU declined in three markets (Guyana, Suriname, and Trinidad and Tobago). Between 2008 and 2017, China increased its share in markets of Bolivia, Chile, and Uruguay by ten or more percentage points. In 2008, China dominated over the EU in five markets while in 2017, the EU had a bigger share than China only in three markets in the region (Brazil, Suriname, and Trinidad and Tobago). The shares of imports in goods from the EU and China in South American countries' total imports are presented in Table 5.

After the 2008 financial crisis, dependence of South American economies on their merchandise imports from China significantly increased. Paraguay, Chile, Peru, and Bolivia import only from China more than one-fifth of all commodities.

Table 5 Merchandise imports from the EU and China as a percent of South American countries' total imports

	2008		2017	
Trading partner	The EU-28 (%)	China (%)	The EU-28 (%)	China (%)
Argentina	15.7	12.4	17.2	18.4
Bolivia	8.3	8.3	11.3	21.8
Brazil	20.9	11.6	21.3	18.1
Chile	12.5	13.0	15.1	23.8
Colombia	13.5	11.5	14.8	19.0
Ecuador	8.4	8.7	13.1	18.6
Guyana	8.1	5.7	7.6	8.9
Paraguay	5.6	27.3	10.7	30.9
Peru	12.1	13.6	12.2	22.3
Suriname	23.2	8.0	22.1	8.6
Trinidad and Tobago	13.2	5.1	10.3 (2015)	7.1 (2015)
Uruguay	8.5	10.0	15.5	20.0
Venezuela	12.8	9.5	14.0 (2013)	17.0 (2013)

Source: Own calculations based on data retrieved from WITS (2020)

5 Conclusion

In 2015, China-South America bilateral trade surpassed the trade of EU-28 with the region and China became the second important trading partner for the continent. China has substantially increased its importance as a source of imports for South American countries.

In order to intensify its trade, China combines trade arrangements with investment and foreign aid policy. Besides, it intensively develops South-South cooperation and diplomatic relations with countries in the region. China enhances its trade relations during high-level visits and economic forums. The EU's trade policy toward South American countries has been losing with China's trade and development aid policy.

South American countries benefit from trade with China. However, the expansion of China's goods causes displacing South American products from local markets. Besides, Chinese products compete with them in the international market. A few countries in the region are dependent on trade with China.

It seems that changes in China's economy and end of commodity boom will force a new era in China-South America relations.

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Panel Estimation of High-technology Export Determinants: Evidence from Fast-Growing Countries

Sevilay Konya, Mücahide Küçüksucu, and Zeynep Karaçor

Abstract This study is including fast-growing emerging countries (Brazil, Russia, India, China, South Africa, and Turkey) and using the panel data analysis methods for high-technology exports of determinants 1996–2017 period. We chased some variables for our analyses, they are as follows: high-technology export is dependent variable, and economic growth, foreign direct investment, gross capital formation, patent, and trade openness were used as independent variables. After the stability of the variables was tested with first-generation unit root tests, cointegration tests were used to investigate the long-term relationship between the variables. As a result of the study, long-term relationship was determined between the variables discussed. After determining the cointegration relationship, the coefficients were estimated with the FMOLS (Full Modified Ordinary Least Square) estimator. The effects of economic growth, foreign direct investments, patents, and trade deficit on high-technology exports were found to be significant. As a result, product exports should be increased with the support of high technological product exports.

Keywords High-technology export · Panel data analysis · Economic development · Cointegration

S. Konya (✉)
Department of Management and Organization, Selçuk University, Konya, Turkey
e-mail: sevilaykonya@selcuk.edu.tr

M. Küçüksucu
Department of Economics, Necmettin Erbakan University, Konya, Turkey

Z. Karaçor
Department of Economics, Selçuk University, Konya, Turkey
e-mail: zkaracor@selcuk.edu.tr

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1 Introduction

The inclusion of technology within the boundaries of economic science, as we understand it today, is based on discussions of growth and development. The theory of internal growth is based on the concept of technological development that neoclassical economics ignores and externalizes. When Solow (1956) put forward the growth model that is still debated today, dates show in 1956, while the validity of their hypothesis has not been tested and is widely accepted. Analyzes using empirical tests in the 1980s revealed that many of his views, including the thesis that the differences between countries implied by Solow (1956), would be closed over time. The debate on whether technology is external or internal on growth has been fueled from this point, and Romer (1986) and Lucas (1988) have accepted the assumption that technology is internal. Thus, progress has been made in understanding and interpreting development differences between economies. This is how the concept of technology began its journey to dominate the last thirty years of economic literature.

Technology, qualified labor and natural resources, and economic and political stability are considered to be the basis of the income level differences observed among countries (Smith 2004). In order to cover these differences, countries increase the amount of resources they devote to education, encourage foreign direct investments involving technology transfer, encourage public and private sector to make R & D investments, and accelerate the search for new natural resources. Turkey is also in the composition of exports in developing countries, among them while there are usually labor-intensive products and raw materials, including advanced technology products are imported from developed countries in technological and economic terms. This form of foreign trade has consequences for all developing countries and worsens their foreign deficits.

In our study, the countries selected during econometric analysis are remarkably different. The studies in the literature are examined, and it is seen that European Union countries and OECD countries are generally discussed in the studies where panel data analysis is applied. However, in our study, unlike other studies, we discussed emerging fast-growing countries and applied panel data analysis.

The aim of this study is to reveal the determinants of high-tech product exports in the leading high-tech product exporting countries and fast-growing developing countries (Brazil, Russia, India, China, South Africa, and Turkey). For this reason, in this study Pedroni cointegration, Kao cointegration, and Pedroni FMOLS estimator were applied. First of all, the relationship between high-technology export and economic growth, foreign direct investment, investment, patent, and trade openness has been put forward through previous studies, and then, the relationships between economic growth, foreign direct investment, investment, patent, and trade openness for the fast-growing developing countries (Brazil, Russia, India, China, South Africa, and Turkey) of the period 1996–2017 were investigated.

2 Theoretical Framework

The main point determining the trade of goods and services between countries is shaped according to the theory of comparative advantage. Accordingly, whichever country is relatively superior in the production of a product, it will produce and export it to the outside world. As we have already stated, technology is considered external in the Solow growth model, and the shortcomings of this theory have led to the emergence of internal growth theories, in which technology is internalized for growth. One of the most important economic development goals of globalizing economies is to increase their foreign trade performance by producing highly qualified and competitive production. The increasing foreign trade volume and openness due to economic growth, significantly affect the export performance of contries. In this context, as stated in export-oriented growth theories, being competitive in exports has started to gain importance. Producing and exporting high value-added products has become an important target.

OECD classified exports of products: under high, medium-high, medium-low, and low technology titles considering the share of R & D expenditures in total value added and the technology level of input and intermediate products (Hatzichronoglou 1997). According to OECD's classification, it is important for countries to export medium-high or high-tech products in order to achieve sustainable competitive performance in international markets. Exports of high-tech products mean high value-added products, which are key to achieving sustainable welfare growth in a country (Ioannıdıs and Schreyer 1997). The share of technology-intensive products in global foreign trade is increasing rapidly. The export value of the world's high-tech products increased from $ 1158 billion in 2000 to $ 1947 billion in 2016 (Worldbank 2018). High-tech product exports to only 11 countries account for about 78% of total high-tech exports. Among these countries, China ranks first with $ 496 billion; Germany and the United States follow it with $ 190 and $ 153 billion, respectively. Other countries in the top 11 are Singapore, Korea, France, Japan, the United Kingdom, Malaysia, Switzerland, and the Netherlands. Turkey ranks 37th in the $ 2.2 billion in exports.

This article focuses on the export of products identified as being of high-technology. High-tech products are divided into nine groups according to the Standard International Trade Classification. These are as follows: aerospace, computers and office machines, electronics-telecommunications, pharmacy, scientific instruments, electrical machinery, chemistry, non-electrical machinery, and armament. From 2008 to 2018, high-tech product exports grew from EUR 202 billion to EUR 349 billion. The trend in EU exports of high-tech followed roughly the same pattern as total exports, showing the same decline during the global financial and economic crisis, followed by an increase. The most high-tech product exporting countries are, respectively, USA, China, Switzerland, Japan, Russia, and Singapore. The fact that the two countries—Russia and China in this study—are included in this list proves the accuracy of our categorization (Worldbank 2018).

One of the countries included in our analyses is India's seventh place on the list. Turkey is in the middle of the list, while during the tenth has found its place in Brazil during the thirteenth of the list. In the group of countries we are dealing with, only South Africa is not in the top twenty. Comparing 2018 to 2008, there was a EUR 147 billion increase in the value of extra-EU exports in the high-tech sector. Pharmacy (EUR 55 billion) had the largest increase followed by aerospace (EUR 50 billion). In all nine product groups, there was an increase in exports between 2008 and 2018. For the United States, these were highest in pharmacy (EUR 25 billion), aerospace (EUR 8 billion), scientific instruments (EUR 7 billion), and electronics-telecommunications (EUR 6 billion). For China, they were highest in aerospace (EUR 8 billion), electronics-telecommunications (EUR 7 billion), and scientific instruments (EUR 6 billion), and for Switzerland, they were highest in pharmacy (EUR 6 billion). In the comparison between the years 2008 and 2018, Russia decreased except aerospace, chemistry, and pharmacy areas. India, on the other hand, has made progress between the years mentioned except for electronics and telecommunications and armaments exports. In Turkey, electronics and telecommunications, computers office machines, and armament have been a decline in exports point from 2008 to 2018. In Brazil, only non-electrical machinery exports decreased, exports of all other items increased (Worldbank 2018).

3 Literature Review

High-tech exports have been among the most frequently discussed issues among economists in recent years as they affect the economic performance of countries. Recent studies generally focus on the determinants of high-tech exports. Economists are looking for answers to the question of how to increase of high-tech exports. This is due to the fact that high-tech exports affect the competitiveness of the global market to a large extent. There are not enough studies in the literature on the determinants of high-tech exports (Kızılkaya et al. 2017).

Liu and Wang (2003) investigated the impact of foreign direct investment on technological progress in Chinese industries. As a result of the study, determined that foreign direct investments are an effective way in advanced technology. Srholec (2007) investigated of high-tech export in developing countries. Determined that the impact of participation in higher education, patent residents, and access to information communication on advanced technology exports was positive. Yanardağ and Süslü (2007) explored the means of technological innovation in Turkey. They examined the relationship between technological innovation and technological innovation tools R & D, trade openness, license patent agreements, and article numbers. As a result of the analysis, found that trade openness increases technological innovations.

Braunerhjelm and Thulin (2008) examined the relationship between advanced technology exports and R&D expenditures for the period 1981–1999 in 19 OECD countries. R & D expenditures positively affected the high-tech export. Yoo (2008)

examined the relationship between high-tech export and economic output. In this study he used 91 countries' datas for the period 1998–2000. As a result of the work, he used the GMM method stated that the export of technology products contributes significantly to the economic output. Falk (2009) discussed 22 OECD countries for the period 1980–2004. In this study, he examined the relationship between high-tech export and economic growth. As a result of the work applied by GMM method, the relationship between high-tech export and economic growth has been determined. Ivus (2010) investigated for the period 1962–2010 whether stronger patent rights increased the export of high-tech products in emerging economies. He supported the view that patent rights have an impact on high-tech export.

Bojnec and Ferto (2011) studied the effects of R&D expenditures on manufacturing trade in the OECD countries for the period 1995–2003. Stated that R&D expenditures in OECD countries are an effective way for manufacturing exports. Tebaldi (2011) investigated the determinants of high-tech exports for the period 1980–2008 with the panel dataset. As a result of the study, was determined that the effect of gross capital formation and savings on high-technology product exports was insignificant. FDI and trade openness are the main determinants of high-tech exports. Yıldırım and Kesikoğlu (2012) examined the causal relationship between R&D expenditure and exports in Turkey. As a result of their studies covering the 1996–2008 period and 25 subsectors, they found unidirectional causality from R&D expenditures to exports.

Abedini (2013) explored the main factors of high-tech exports in some emerging markets. Determined that the main factors of high-technology exports are foreign direct investment with high export volume. Göçer (2013) studied the impact of R & D expenditures on high-tech exports for 11 Asian countries in the period 1996–2017. The impact of R&D expenditures on high-tech exports was positive and significant. Found unilateral causality from R&D expenditures to high-tech product exports. Gökmen and Turen (2013) examined the determinants of high-tech exports in the 15 member states of the European Union for the period 1995–2010. Found that the effect of economic freedom, human capital, and foreign direct investment on high-tech exports was positive and significant.

Kılıç et al. (2014) investigated the effect of R&D expenditures on high-tech exports in G-8 countries. In their study, panel data analysis was performed by considering the period of 1996–2011. As a result of the study, determined that the effect of R&D expenditures and real exchange rate on high-tech export was positive. Found bidirectional causality between R & D expenditures and high-tech exports, and a unilateral causality from high-tech exports to real exchange rates. Sandu and Ciocanel (2014), investigated the impact of R&D expenditure and innovation of high-tech export. They used 27 European Union countries' variables, based on the 2006–2010 period in their study and used panel data analysis. As a result of study, found a positive relationship between R&D expenditures and high-tech exports. Karahan (2015) investigated the high-technology determination of R&D expenditures in the European manufacturing sector for the period 2000–2013 by using GMM method. Found a high causality that R&D spending expands high manufacturing technology.

Sertić et al. (2015) investigated the determinants of high-tech exports in the member states of the European Union. Used the GMM method by addressing the period 2000–2011. Found that the effect of industrial production and domestic demand on high-tech exports was positive and significant.

Kabaklarlı et al. (2017) discussed in their study the determinants of high-tech exports in selected 14 OECD countries for the period 1989–2015. Used FDI, patent application, GDP growth rate, and gross capital formation as independent variables. At result of their study, the effect of FDI and patent application on high-technology export was positive and significant. Kızılkaya et al. (2017) in their study examined the impact of foreign direct investment and trade openness on high-tech exports in 12 developing countries. They Found that the foreign direct investments and trade openness had a positive effect on high-tech exports. Özşahin and Gömleksiz (2017) examined the effects of human capital, foreign direct investments, trade openness, fixed capital accumulation, exchange rate, domestic saving volume, and inflation on high-tech exports. In their study, covers the 11 leading countries in high technology and the period of 1990–2015. Found that human capital, foreign direct investments, trade openness, fixed capital accumulation, and exchange rate had a positive effect on high-tech exports, and that inflation had a negative effect. Śledziewska and Akhvlediani (2017) investigated the determinants of advanced technology exports in Visegrad Countries (V4: Poland, Czech Republic, Slovakia and Hungary) and EU-15 countries for the period 1999–2011. Found that in V4 countries physical and human capital on high-tech export.

Özçelik et al. (2018) examined the relationship between R&D expenditures and high-tech exports for the period 1996–2014 in 10 OECD countries. Identified cointegration and a two-way causality relationship between R & D expenditures and high-tech exports.

4 Data, Econometric Methods and Research Findings

4.1 Data

In this study, fast-growing developing countries (Brazil, Russia, India, China, Turkey and South Africa) with annual data for the period of 1996–2017, was investigated determinants of high-tech exports. Table 1 shows the definition of the dataset:

Table 2 shows the mean, median, maximum and minimum values, and standard deviations of dependent and descriptive variables. Standard deviation value of the investment variable is relatively higher. The highest minimum value is seen in economic growth, and the highest maximum value is seen in investment data.

The correlation matrix of the variables used in Table 3 is given. The correlation coefficients between the variables seem to be low in the periods discussed. The correlation coefficient is below 0.75 in 13 out of 15 correlation coefficients. The

Table 1 Data and resources

EXPORT	High-technology exports (% of manufactured exports)	World Bank
LNGDP	GDP (current US$)	World Bank
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank
INVESTMENT	Gross capital formation (% of GDP)	World Bank
LNPATENT	Patent applications, residents	World Bank
LNOPEN	Trade (export + import)/GDP	World Bank

Source: World Bank

Table 2 Descriptive statistics

	Export	LNGDP	FDI	INVESTMENT	LNPATENT	LNOPEN
Mean	10.35596	27.46029	2.175544	26.71475	8.716499	3.743857
Median	7.656793	27.47514	1.972131	23.73378	8.450405	3.854037
Maximum	30.84360	30.12781	5.978862	47.81881	14.03522	4.288614
Minimum	1.474043	25.47238	0.229456	14.83030	4.927254	2.749550
Std. Dev.	7.534109	1.057605	1.325388	9.157410	1.984612	0.344465
Observations	132	132	132	132	132	132

Source: Authors' calculations

correlation coefficient between patent and high-tech export is 0.78, and the correlation coefficient between patent and economic growth is 0.83.

4.2 Econometric Methods

Im, Pesaran and Shin (IPS 2003) unit root test deals with the first-order autoregressive process.

$$\Delta Y_{it} = u_i + \partial_i Y_{it-1} + \varepsilon_{it} \tag{1}$$

Accordingly, valid and alternative hypotheses in the IPS (2003) test are as follows:

$H_o : \partial_i = 0$ (For all i)
$H_1 : \partial_i < 0$ (i = 1,2,. . .. . ., N_i), $\partial_i = 0$ (i=N_{1+1}, N_{1+2}, ... , N).

The basic hypothesis of the IPS (2003) test is that all units contain unit root, while the alternative hypothesis is that some units are stationary.

Maddala and Wu (1999) developed the unit root test based on Augment Dickey Fuller (ADF) for panel unit root test. This test recommends the Fisher type ADF test. The formulation is as follows:

Table 3 Correlation matrix

	Export	LNGDP	FDI	INVESTMENT	LNPATENT	LNOPEN
EXPORT	1					
LNGDP	0.614417	1				
FDI	0.482651	0.448622	1			
INVESTMENT	0.523729	0.683721	0.234992	1		
LNPATENT	0.782220	0.831638	0.401555	0.663522	1	
LNOPEN	−0.023178	−0.172779	−0.160606	0.182333	0.082712	1

Source: Authors' calculations

$$P = -2\sum_{i=1}^{N}(\rho_i) \rightarrow x_{2N}^2 \tag{2}$$

ρ_i, expressed in the equation, represents the probability value of the unit root test for unit i.

After stationarity was investigated with unit root tests, Pedroni and Kao cointegration tests were performed.

Pedroni (1999, 2004) cointegration test is expressed by the following regression equation:

$$\Delta Y_{it} = a_i + \partial_{it} + \beta_i X_{it} + u_{it} \tag{3}$$

In the equation stated above, Y is the dependent variable, a_i is the constant coefficient, t is the time trend, and X is the independent variable. The basic hypothesis of Pedroni tests is:

H_o: There is no cointegration for all units of the panel.
H_1: There is cointegration for all units of the panel.

Pedroni (1999, 2004) cointegration test contains seven different tests. Four of these are panel and three are group test statistics. All tests show normal distribution. The seven test statistics are shown in the figure below. Panel statistics;

$$Panel\ v\ statistic\ (v) : T^2N^{3/2} = \frac{1}{\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\widehat{L}_{11i}^{-2}\widehat{2}_{it-1}^{2}\right)} \tag{4}$$

$$Panel\ p\ statistic\ (rho) : T\sqrt{N}\sum_{i=1}^{N}\sum_{t=1}^{T}\widehat{L}_{11i}^{-2}\left(\frac{\widehat{e}_{it-1}\Delta\widehat{e}_{it} - \widehat{\lambda}_i}{\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\widehat{L}_{11i}^{-2}\widehat{e}_{it-1}^{-2}\right)}\right) \tag{5}$$

$$Panel\ t\ statistic\ (non-parametric\ model) : Z_{\hat{t}_{NT}} = \frac{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\left(\hat{e}_{it-1}\Delta\hat{e}_{it} - \hat{\lambda}_i\right)}{\sqrt{\left(\check{\sigma}_{N,T}^2\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{it-1}^2\right)}} \tag{6}$$

$$Panel\ t\ statistic\ (parametric\ model, adf) = Z^*_{tNT} = \frac{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\left(e^*_{it-1}\Delta\hat{e}^*_{it}\right)}{\sqrt{\left(\check{s}^{*2}_{N,T}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}^{*2}_{it-1}\right)}} \quad (7)$$

Group statistics,

$$Group\ p\ statistic\ (rho) : TN^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{\widehat{e}_{it-1}\Delta\widehat{e}_{it} - \widehat{\lambda}_i}{\sum_{i=1}^{T}\widehat{e}^2_{it-1}}\right. \quad (8)$$

$$Group\ t\ statistic\ (non-parametric\ model) : N^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{\widehat{e}_{it-1}\Delta\widehat{e}_{it} - \widehat{\lambda}_i}{\widehat{\sigma}_i^2\sum_{i=1}^{T}\widehat{e}^2_{it-1}}\right. \quad (9)$$

$$Group\ t\ statistic\ (adf) : N^{-1/2}\sum_{i=1}^{N}\frac{\sum_{t=1}^{T}\left(\widehat{e}^*_{it-1}\Delta\widehat{e}^*_{it}\right)}{\left(\sum_{t=1}^{T}\widehat{S}_i^{*2}\widehat{e}^{*2}_{it-1}\right)} \quad (10)$$

The second applied cointegration test is Kao (1999) cointegration test.
Kao (1999) in the cointegration test is the basic hypothesis:

H_o: There is no cointegration between variables.
H_1: There is cointegration between variables.

4.3 Research Findings

In order to test the stability of the variables, unit root tests will be applied first. The unit root tests to be applied are Im et al. (2003), Maddala and Wu (1999), and Choi (2001) unit root tests.

Table 4 shows the unit root test results. High-tech exports are stable at both constant and constant and trend model at the level of IPS and Maddala and Wu test. According to the Choi test, the first difference becomes stable. In both constant and constant and trend models, GDP is becoming the first difference stationary according to the IPS, Maddala and Wu, and Choi tests. In the FDI constant model, both IPS and Maddala and Wu level are stable. However, the first difference model becomes stable in the constant and trend model. FDI, according to Choi unit root test, both

Table 4 Unit root test results

Variables	Test	Constant		Constant and trend	
		Statistic	*p*-value	Statistic	*p*-value
Level					
EXPORT	IPS	−2.73410	0.0031	−1.80190	0.0358
	Maddala & Wu	27.0334	0.0076	21.8602	0.0391
	Choi	18.7731	0.0942	13.7177	0.3191
LNGDP	IPS	2.13403	0.9836	−0.95894	0.1688
	Maddala & Wu	2.90521	0.9962	15.5959	0.2105
	Choi	2.78279	0.9969	3.84115	0.9861
FDI	IPS	−2.47667	0.0066	−0.97768	0.1641
	Maddala & Wu	27.4800	0.0066	14.9834	0.2423
	Choi	29.9255	0.0029	22.4291	0.0326
INVESTMENT	IPS	−0.34318	0.3657	−0.53576	0.2961
	Maddala & Wu	10.5742	0.5657	21.0269	0.0500
	Choi	10.5572	0.5672	14.5619	0.2663
LNPATENT	IPS	1.15538	0.8760	−0.19108	0.4242
	Maddala & Wu	7.16414	0.8466	11.3088	0.5027
	Choi	7.11777	0.8497	6.59184	0.8834
LNOPEN	IPS	−1.75888	0.0393	−2.90161	0.0019
	Maddala & Wu	19.1877	0.0841	40.6470	0.0001
	Choi	17.4638	0.1330	24.0227	0.0202
First difference					
EXPORT	IPS	−5.90363	0.0000	−5.88280	0.0000
	Maddala & Wu	55.1208	0.0000	50.3474	0.0000
	Choi	54.3657	0.0000	40.2104	0.0001
LNGDP	IPS	−4.38223	0.0000	−2.97321	0.0015
	Maddala & Wu	40.6812	0.0001	28.7131	0.0043
	Choi	37.9267	0.0002	24.3673	0.0181
FDI	IPS	−8.40077	0.0000	−6.26490	0.0000
	Maddala & Wu	78.6756	0.0000	54.4527	0.0000
	Choi	329.138	0.0000	305.971	0.0000
INVESTMENT	IPS	−7.65688	0.0000	−5.53553	0.0000
	Maddala & Wu	71.0452	0.0000	48.1590	0.0000
	Choi	76.1009	0.0000	59.0998	0.0000
LNPATENT	IPS	−6.54342	0.0000	−5.49776	0.0000
	Maddala & Wu	60.3192	0.0000	47.2129	0.0000
	Choi	72.2262	0.0000	111.006	0.0000
LNOPEN	IPS	−7.12021	0.0000	−5.76674	0.0000
	Maddala & Wu	66.0956	0.0000	49.8380	0.0000
	Choi	67.3639	0.0000	62.4766	0.0000

Source: Authors' calculations

Table 5 Pedroni cointegration test results

Test	Statistic	Probability
Panel v	−0.153775	0.5611
Panel rho	2.094260	0.9819
Panel PP	−1.659679	0.0485
Panel ADF	−3.862899	0.0001
Group rho	2.903679	0.9982
Group PP	−2.315292	0.0103
Group ADF	−4.389408	0.0000

Source: Authors' calculations

Table 6 Kao cointegration test results

t-statistic	Probability
−4.307375	0.0000

Source: Authors' calculations

constant and constant and trend model has become stable at level value. Investment Maddala and Wu test is the first difference station except the results of the constant and trend model. Patent, according to IPS, Maddala and Wu, and Choi test, is the first difference stable. Trade openness is stable in both constant and constant and trend models according to IPS and Choi tests. According to the Maddala and Wu test, while the constant model is stationary at the level value, the constant and trend model is the first difference stationary.

Following the determination of the stationarity of the variables, Pedroni and Kao cointegration tests were performed to determine the long-term relationship between the variables. Table 5 shows the results of the Pedroni Cointegration Test.

The null hypothesis that there was no cointegration in all tests except Panel v, Panel rho, Group rho tests was rejected. Pedroni (1999) stated that panel ADF and group ADF tests would give more meaningful results for small panel structures. In the model we discussed, the results of panel ADF and group ADF tests were significant, indicating an indication of cointegration in the panel test.

To confirm the Pedroni cointegration test, the Kao cointegration test was performed.

The results of the Kao cointegration test are presented in Table 6.

In the Kao cointegration test, the basic hypothesis that there is no cointegration was rejected as a result of the probability value, and an alternative hypothesis was established that there is cointegration. That is, the existence of the cointegration relationship has been confirmed.

Following the determination of the cointegration relationship, long-term coefficients were determined using the FMOLS (Full Modified Ordinary Least Square) estimator. Table 7 shows the results of the FMOLS estimator.

Table 7 shows panel FMOLS estimator results. According to the results of the FMOLS estimator, the impact of economic growth and foreign direct investment on high-tech exports was negative and significant. The impact of patents and trade openness on high-tech exports was determined to be positive and significant. The impact of investments on high-tech exports is negative and meaningless.

Table 7 Full modified ordinary least square estimator results

Variables	Statistic	Probability
LNGDP	−1.734069	0.0385**
FDI	−0.691692	0.0264**
INVESTMENT	−0.061041	0.6536
LNPATENT	1.501714	0.0099***
LNTRADE	7.308403	0.0005***

Source: Authors' calculations
Notes: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively

Kabaklarlı et al. (2017) determined that the effect of economic growth on high-tech export is negative and significant, and the effect of patents on high-tech export is positive and significant. In our study, the results of the effect of economic growth and patent on high-tech export support each other with the results of this study.

5 Conclusions

In this study, the relationship between high-technology exports, which create high added value in foreign trade, and targeted economic growth is analyzed. The main goal in our study, in terms of Turkey's economic position in international markets and the macroeconomic situation is to make a comparision with Brazil, Russia, India, China, South Africa, are similar to his own. On the other hand, it is to measure the impact of exports of high-tech to Turkey's economic growth. There are many studies in the literature that analyze that the relationship the eceonomic growth and high-tech exports for the Turkish economy. At the same time, there are studies in the literature which examine developed markets such as OECD countries and European Union countries. However, for emerging economies such as the Brazil, Russia, India, China, South Africa, and Turkey countries, the studies under this heading are quite limited. Therefore, this study is important in terms of filling the gap in the literature.

We analyzed that the relationships between high-technology export and economic growth, foreign direct investment, investment, patent, and trade openness are examined with the data covering 1996–2017 period in fast-growing developing countries. The study was analyzed with balanced panel data methods. Stability of variables was tested with unit root tests and long-term relationship between cointegration tests was determined.

According to the results of the analysis, long-term relationship between the variables was determined. According to the results of the FMOLS estimator, the impact of economic growth and foreign direct investment on high-tech exports is negative and significant; the impact of patents and trade openness on high-tech exports was determined to be positive and significant. The result of the study,

coincide with the work of Kabaklarlı et al. (2017) in terms of the relationship between economc growth and high-tech exports.

As a result, incentive policies should be implemented in terms of direct foreign capital investments and technology transfer in order to realize high-technology exports.

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Part VI
Labor Economics

Non-standard Employment and Wages Across Sectors in Croatia

Marija Bečić and Perica Vojinić

Abstract Recent trends of rapid globalization and digitalization have influenced national labor markets, changing the nature of work and increasing non-standard forms of employment. Non-standard forms of employment, such as temporary, part-time, or casual work, are seen as a precarious and may influence earnings. Croatia is no exception from these trends. In the last fifteen years, the service sector due to the high increase of activities in tourism has been growing intensively, becoming the main diver of the Croatian economy. However, large servitization implies the growth of temporary employment, with pronounced seasonality during the peak of tourist season. The aim of this paper is to analyze the trends of non-standard employment and wages across sectors in Croatia for the period from 2008 to 2018. The main research question is whether changes in the structure of job types (from standard to non-standard) influenced wage growth in different sectors, listed by NACE2. Two datasets are used in order to perform panel model. The results suggest the existence of a rapid increase in temporary employment and precarious employment in all sectors of economy accompanied by the stagnation of wages or low increase in wages. However, the situation was slightly improved in 2018 since the majority of industries experienced an increase in wages. Furthermore, empirical results suggest that there is a statistically significant and positive relationship between temporary, especially, precarious employment and wage growth. Accordingly, an increase in the share of temporary and precarious employment has an impact on the monthly wages growth across sectors in Croatia.

Keywords Non-standard employment · Wages · Croatia

M. Bečić (✉) · P. Vojinić
Department of Economics and Business Economics, University of Dubrovnik, Dubrovnik, Croatia
e-mail: marija.becic@unidu.hr; perica.vojinic@unidu.hr

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1 Introduction

Over the past few decades, non-standard forms of employment have become a contemporary feature of labor markets in both industrialized and developing countries. Even though there is a growing interest in non-standard forms of employment, the official definition of non-standard employment does not exist. However, in general, four different employment arrangements may be seen as a form of non-standard employment. According to the European Commission, non-standard work is simply defined "as fixed-term contracts, temporary agency work, part-time work and independent contract work" (European Commission 2015). In other words, non-standard employment can be defined as any job that differs from full-time, permanent, dependent (i.e., wage and salary) employment (OECD 2015). These forms of employment are typically seen as "precarious," with adverse consequences for workers flowing from greater economic insecurity (Tweedie 2013; Lewchuk 2017; Menon 2019).

According to ILO (2016), non-standard employment, particularly when it is not voluntary, may increase workers' insecurities in different areas. Even though insecurities can also exist in standard employment relationships, they are less prevailing than in the different forms of non-standard employment. Those insecurities are evident in terms of employment security, earnings, hours and occupational safety and health. Regarding earnings, workers in non-standard employment face significant wage penalties relative to comparable standard workers. The economic crisis in Europe has influenced national labor markets by deepening the gap between workers with standard employment contracts and workers with non-standard employment contracts who are faced with increasing insecurity. Non-standard work contracts have increased, especially in Central and Eastern European Countries (CEEC), and atypical work became a significant feature of the labor market.

Non-standard employment relations have been a topic in labor economics for a long time since the arrangements that do not fit "standard" forms exist. This gap between workers with standard employment contracts and workers with non-standard employment contracts may also have implications for wages (Tilly 2010; Ferber and Waldfogel 1998; Menon 2019). More recently, Leschke (2014) points out that non-standard workers and among them fixed-term, temporary agency workers, regular part-time workers, and mini-jobbers are disproportionally affected by low wages in Germany. Haldane (2017) emphasizes that weak wages growth in the UK is affected by the changing nature of work and especially growth in self-employment, temporary employment, and zero-hours contracts. Correspondingly, regarding Cassidy and Parsons (2017) in Australia, part-time jobs are concentrated in low paying occupations and industries. In addition, they point out that relatively low levels of bargaining power among part-time workers could drive down observed wages growth. The relationship between part-time work and wages is not a new issue in labor economics. Even though the importance of above-mentioned relationships is recognized, these issues, to the best of our knowledge, have not been addressed for

Croatia previously. Our research seeks to fill this gap in the existing Croatian literature.

In the last fifteen years, the main diver of the Croatian economy is the service sector that has been growing intensively, mostly due to the high increase of activities in tourism. However, large servitization implies the growth of temporary employment, with pronounced seasonality during the peak of tourist season. The aim of this paper is to analyze the trends of non-standard employment and its impact on wages across sectors in Croatia for the period from 2008 to 2018. The rest of this paper is structured as follows. The next section establishes the theoretical concept of wage determination. The stylized facts about non-standard employment and wage trends are given in Sect. 3. The specification of the model, methodology, and results are presented in Sect. 4, followed by the conclusion in Sect. 5.

2 The Theoretical Framework of Wage Determination

According to the neoclassical labor economics, in a competitive labor market where the firm is price-taker, the demand for labor is a price-adjusted summation of labor demand by independently acting individual employers, and the supply of the labor is a summation of the responses of individual workers to different wage rates. Correspondingly, the equilibrium wage rate and level of employment are determined by the market supply and demand. The worker's equilibrium wage rate equates to the worker's marginal product of labor (Becker 1993; Schultz 1961). If market wage is set up below productivity, this situation will encourage the firm to hire workers until their marginal product fell below the wage rate (under the assumption of diminishing marginal returns). If a market wage were set up above productivity, this situation would induce the firm to fire workers until marginal product of employee increases sufficiently to restore equilibrium. If the labor market is imperfectly competitive and the firm is price-maker, impacts of the firm's hiring and firing behavior on the market wage would only intensify this equilibrating tendency (Katovich and Maia 2018).

The link between wages and productivity is essential because it determines the standard of living of the employed population as well as of the distribution of income between labor and capital. If wages rise at the same rate as productivity, the share of labor in national income remains unchanged. However, in reality, wages rarely equate to productivity levels. One explanation for the existence of disparity between neoclassical model and reality points out that wages are just a part of total employee compensation. The other part includes additional benefits such as insurance. If the real wages stagnate, while additional benefits increase, the growth of overall employee compensation could be hidden (Feldstein 2008). The second explanation is based on information asymmetries. Information asymmetries exist when it is difficult for firms to assess employee's real level of effort and productivity. In this situation, employer can pay employees according to signals that are related to productivity. Very often, education is taken as the signal of productivity. However, education does not have to be directly related to the true employee's productivity.

The firm can also construct compensation schedules based on seniority. Through this system, the growth of compensation is related to the length of service, i.e., job tenure. The discrimination can be the third explanation of disparity between theory and reality in wage determination (Li 2019). Employers may systematically discriminate against employees based on race, gender, or other characteristics, by setting wage penalties on discriminated employees who are equally as productive as their non discriminated colleagues are and therefore paying them lower compensations (Ucal and Gunay 2019). Compensating wage differentials can cause disparity between theory and reality in wage determination process too (Yu and Peetz 2019; Magnusson 2019). This differential is defined as the extra amount an employer must pay to recompense a worker for an undesirable job characteristic (insecurity) that does not exist in alternative employment.

3 Stylized Facts about the Non-standard Employment and Wages in Croatia

The principal objective of this research is to explore a link between non-standard forms of employment and wage changes across sectors in Croatia. To trace the non-standard employment trends and wage changes in Croatia, the database is constructed from two sources. The data on wages and productivity used in this paper are provided by the Croatian Bureau of Statistics annual reports available online, while the rest of the data comes from the Eurostat database. The final sample covers average wage by educational level and classified by NACE 2 classification for the period 2009–2018. Time framework is limited due to the lack of data for the years prior to 2009.

Table 1 presents some trends in temporary, precarious, and part-time employment in the Croatian labor market from 2008. Non-standard forms of employment have increased its share in total employment across labor markets over the world, and the Croatian market is no exception. This kind of employment is typically under greater insecurity considering wages or/and duration of employment. Although term precarious employment encompasses a wide range of insecurities related to work (Greenhalgh and Rosenblatt 1984; Kalleberg 2009; Anyfantis and Boustras 2020), in this case, it is a specific form of temporary employment defined as a percentage of employees with a short-term contract of up to 3 months.

According to the Fig. 1, there is a rapid increase in temporary employment in the latter half of a period (from 12% in 2014 to 18% in 2018) also followed by the increase in precarious employment (from 5% to 7%). At the same time, the share of part-time workers was relatively stable, fluctuating between 6% and 7% what coincidences with a significant increase in the number of tourists visiting Croatia. Therefore, the short-term seasonal contracts in tourism and related industries can partly explain the rise in non-standard employment.

Table 1 Temporary employees in total employment by sectors (%)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Agriculture, forestry, and fishing	2.11	2.47	2.56	3.03	4.14	7.42	8.46	9.21	6.83	10.02
Manufacturing	10.87	11.72	11.81	10.37	12.46	14.56	17.04	19.79	19.43	18.84
Construction	11.62	9.59	10.47	12.32	14.10	20.83	20.83	23.95	21.93	16.86
Wholesale and retail trade; repair of motor vehicles	13.07	1.32	12.79	13.66	13.35	13.75	18.54	19.51	18.06	21.13
Transportation and storage	10.03	10.79	12.38	17.49	16.89	12.96	18.57	18.53	16.10	14.72
Accommodation and food service	17.17	20.89	26.52	24.27	24.20	31.30	32.87	39.72	39.78	32.74
Information and communication	5.91	13.51	13.33	6.91	9.94	21.10	19.29	22.63	18.02	16.78
Financial and insurance activities	9.66	7.55	7.67	6.60	5.82	8.99	11.76	8.44	12.11	12.64
Professional, scientific, and technical activities	6.37	7.39	11.04	9.02	11.07	9.96	14.94	12.16	12.21	9.23
Administrative and support service activities	14.70	15.30	18.52	16.88	18.90	20.23	27.66	29.26	27.45	33.63
Public administration and defense; compulsory social security	7.22	8.15	9.65	7.68	10.99	10.51	13.01	11.24	10.31	5.63
Education	7.07	7.62	8.23	11.80	12.94	12.74	13.97	16.84	13.13	15.85
Human health and social work	8.81	9.77	7.83	6.79	8.61	9.53	10.74	12.45	13.09	14.57
Arts, entertainment	19.09	17.74	14.04	11.20	13.44	19.92	23.28	34.01	33.45	24.53
Other service activities	9.93	9.69	10.90	9.23	6.56	13.33	19.21	25.88	27.56	24.22

Source: EUROSTAT (2008–2018)

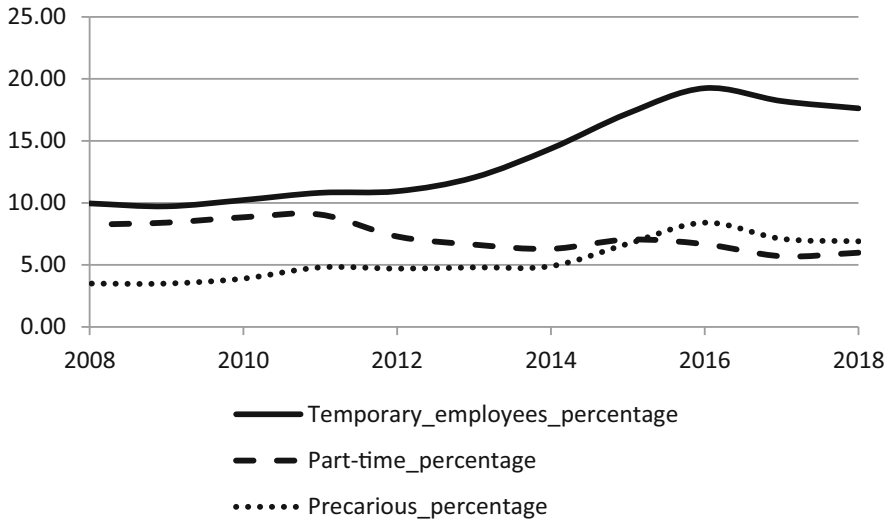

Fig. 1 Share of some forms of non-standard employment in total employment in Croatia, 2008–2018. Source: EUROSTAT (2008–2018)

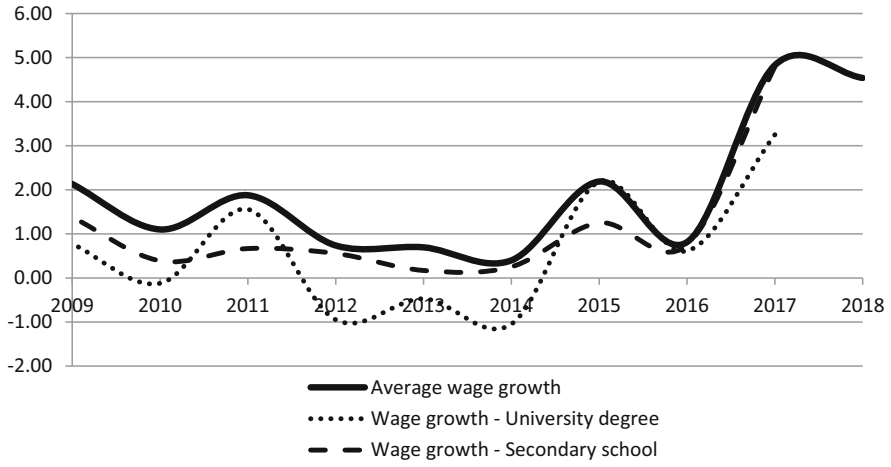

Fig. 2 Average wage growth in Croatia by the level of education, 2009–2018. Source: CBS (2008–2018)

Table 1 shows the share of temporary employees in total employment across sectors sorted by the Croatian National Classification of Activities, synchronized with NACE Rev. 2 classification, obligatory for all EU Member States. Temporary employment increased in all of the sectors, but one of the most significant shares of temporary workers is in the accommodation and food service activities. The question

is as follows: what was happening with the wages at the same time? Figure 2 shows the average wage growth by educational level in Croatia for the period 2009–2018.

Wage measure in Croatia is the average monthly wage. According to Fig. 2, during the recession,[1] until 2015, wage growth was not higher than 2% and even negative for highly educated workers, meaning that, on average, the wage for graduates was declining at the rate of 1%. From 2015, with the recovery in the Croatian economy (again mostly related to tourism) wages started to increase, and in 2017, average wage increased 3% at the minimum. However, looking more closely, trends differ across different sectors (Table 2).

According to the Table 2, in 2018, the majority of industries experienced an increase in wages. The most significant increase was in the sectors of Education (13.6%), Agriculture (12%), and Human health and social work (11.5%). All other sectors had a rate of up to 7%, and accommodation and food service activities are exceptions with a decrease in wages. The decade prior to 2018 was characterized by stagnation or low wage growth rates, as well as oscillations between positive and negative rates across sectors in 2012 and 2013.

4 Methodology of the Research

The wages of Croatian industries are investigated by a model that encompasses factors and forces recognized in the existing literature as essential determinants of the wage setting, primarily productivity. The model is augmented by the variable covering non-standard forms of employment in order to see whether there is an additional influence in wage setting across sectors in Croatia, and the general form of research equation is (Lass and Wooden 2019):

Wages_i = f(non-standard form of employment, gross operating ratio, productivity)

$$lnW_{it} = \alpha_1 + \beta_1 NonSt_{it} + \beta_2 GOR_{it} + \beta_3 ApProd_{it} + \epsilon_i \quad (1)$$

Indices i and t stand for the observation and time respectively. Every equation is also done with dummy variables for every sector in Croatia:

$$lnW_{it} = \alpha_1 + \beta_1 NonSt_{it} + \beta_2 GOR_{it} + \beta_3 ApProd_{it} + \sum_{i=1}^{19} \gamma_i D_{it} + \epsilon_i \quad (2)$$

Both random effects panel regressions are extended to three different wage regressions with three different dependent variables to cover the changes in the average wage, but also the changes in average wages for the workers with university

[1] Croatia entered in recession in the last quarter of 2008. Recession lasted for six years, and recovery started the end of 2014.

Table 2 Average wage growth by sectors in Croatia (%)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Agriculture, forestry, and fishing	1.02	0.43	2.80	4.07	−0.70	−0.66	3.22	1.78	−2.50	12.11
Manufacturing	1.46	0.83	2.45	1.06	1.05	2.09	3.75	2.39	4.15	4.70
Construction	0.34	−0.73	1.14	0.27	0.09	3.10	2.05	3.74	4.76	2.56
Wholesale and retail trade; repair of motor vehicles	1.85	1.91	1.98	0.46	1.22	2.41	2.59	−1.36	9.23	2.58
Transportation and storage	0.70	0.99	2.57	−0.26	2.88	−0.56	2.49	−3.13	5.81	3.21
Accommodation and food service	1.54	2.94	1.37	2.54	4.09	0.80	−1.53	2.62	2.97	−1.26
Information and communication	0.34	2.38	3.48	2.59	0.87	2.35	0.12	0.68	4.28	3.45
Financial and insurance activities	1.67	2.60	0.71	−1.12	−0.22	2.38	3.20	2.26	2.65	1.52
Professional, scientific, and technical activities	−2.50	−0.82	−3.99	6.28	4.21	0.78	0.20	3.39	3.38	0.01
Administrative and support service activities	−0.51	−0.67	−0.68	−0.37	−0.66	3.02	2.47	−1.58	10.88	10.76
Public administration and defense; compulsory social security	3.30	−0.14	1.39	−0.97	−1.89	−0.52	2.63	0.51	4.60	7.38
Education	2.98	0.27	2.65	−0.19	−0.28	−2.36	1.12	−0.38	3.87	13.60
Human health and social work	1.95	−0.02	1.40	−0.41	−0.16	−4.25	4.63	1.34	4.30	11.54
Arts, entertainment	2.57	−1.29	1.72	−0.31	0.83	1.11	−1.34	1.21	4.21	2.57
Other service activities	2.93	1.30	2.63	2.66	1.08	1.36	−0.25	1.78	3.14	−1.30

Source: CBS (2008–2019)

diploma and workers with a secondary school diploma. The dependent variable is the natural logarithm of wages.

Existing traditional literature recognizes labor productivity as a primary factor in wage setting, so as an independent variable, we included apparent labor productivity (*ApProd*), defined as a value-added generated per person employed. Gross operating rate (*GOR*) is taken from CBS structural business statistics, and it is defined as a share of gross operating surplus in generated turnover.

Academic literature also suggests that there is a link between non-standard employment and wages (Garz 2013; Menon 2019; O'Brady 2019). That is why non-standard forms of employment are included as an independent variable (*NonSt*). This research includes temporary employees, precarious employment, and part-time employment. All mentioned variations of wages and non-standard employment turn initially two into eighteen equations. Temporary employment is traditionally viewed as replacements for permanent workers who were absent from work for different reasons, such as illness or vacation (Von Hippel et al. 1997), although practice today shows differently. These workers are no longer just replacement, but the only ones at particular workplace employed only during the period of time because labor requirements exist only temporary. Part-time work is usually defined as regular wage employment in which the hours of work are less than "normal" (Kalleberg 2000).

5 Results of the Research

Estimates of the key parameters of equations that include temporary and precarious employment are reported in Table 3. The dependent variables are natural logarithms of average wages, university graduates' wages, and secondary school graduates' wages. Columns 1–6 include temporary employment and columns 7–12 include precarious employment as independent, and every equation is done with and without the dummy variables representing sectors of the Croatian economy to see whether there are significant differences among different sectors. Due to the lack of data, not all of the sectors were always included in the analysis.

The Table 3 shows that productivity is a statistically significant determinant of wages in all of the equations. This is in accordance with the findings of previous researches, such as Tilly (1996), Ferber and Waldfogel (1998), and Menon (2019). Their findings suggest that non-standard employment contracts may also have implications for wages. Temporary and precarious employment also turned out to be statistically significant in wage trends. Coefficients of the variables of interest are small but positive and statistically significant at 1% level. Positive coefficient suggests that, on average, the increase in the share of temporary employment and especially the increase in the share of up to 3-month contracts creates a small, but still an increase in wages for all the levels of education included in the analysis. This finding can partly be explained by compensating wage differential, or the extra amount that an employer has to pay to compensate a worker for an unattractive job characteristic that does not exist in alternative employment. In other words, if

Table 3 Panel analysis results for temporary and precarious employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	lnAvgWage	lnAvgWage	lnAvgWage University degree	lnAvgWage University degree	lnAvgWage secondary school	lnAvgWage secondary school	lnAvgWage	lnAvgWage	lnAvgWage University degree	lnAvgWage University degree	lnAvgWage secondary school	lnAvgWage secondary school
Temporary employ. %	0.00471*** (5.50)	0.00567*** (7.06)	0.00264*** (3.80)	0.00281*** (3.82)	0.00240** (2.68)	0.00368*** (4.21)						
Precarious Employ. %							0.0102*** (6.89)	0.0107*** (7.33)	0.00744*** (5.45)	0.00769*** (5.72)	0.00756*** (4.13)	0.00895*** (5.47)
Gross operating ratio	−0.00332 (−1.20)	−0.00101 (−0.35)	−0.00386 (−1.72)	−0.00294 (−1.13)	−0.00331 (−1.27)	−0.00238 (−0.77)	−0.00115 (−0.71)	−0.000473 (−0.28)	−0.00146 (−1.11)	0.000334 (0.21)	−0.00147 (−0.92)	0.000319 (0.17)
lnAppproductivity	0.144** (2.62)	0.0208 (0.33)	0.139** (3.12)	0.113 (1.92)	0.183*** (4.03)	0.0499 (0.72)	0.128*** (4.31)	0.102** (3.23)	0.0906*** (3.82)	0.0520 (1.77)	0.136*** (4.85)	0.0445 (1.25)
Administrative and support service activities		−0.236*** (−5.61)		−0.262*** (−6.80)		−0.169*** (−3.70)		−0.145*** (−6.00)		−0.264*** (−11.79)		−0.140*** (−5.14)
Accommodation and food services		−0.0549 (−0.99)		−0.0587 (−1.15)		0.0207 (0.34)		0.0339 (1.06)		−0.0796** (−2.70)		0.0331 (0.92)
Construction		−0.0582* (−2.09)		−0.0938*** (−3.68)		0.0289 (0.95)		−0.0253 (−1.31)		−0.104*** (−5.84)		0.0318 (1.47)
Information and communication		0.427*** (10.88)		−0.0335 (−0.93)		0.300*** (7.04)		0.375*** (15.34)		−0.0210 (−0.93)		0.278*** (10.13)
Water supply; sewerage, waste management		0.139*** (3.59)		−0.0663 (−1.87)		0.228*** (5.42)		0.0931*** (3.60)		−0.106*** (−4.42)		0.179*** (6.14)
Real estate activities								0.106* (2.35)		−0.117** (−2.79)		0.146** (2.87)
Manufacturing		0.00763 (0.43)		0.0413* (2.55)		0.0250 (1.30)		0.0155 (1.03)		0.0409** (2.94)		0.0255 (1.51)
Transportation and storage		0.190*** (7.08)		0.0232 (0.94)		0.210*** (7.18)		0.168*** (8.55)		0.00504 (0.28)		0.184*** (8.34)
Mining		0.310*** (4.67)		−0.0695 (−1.14)		0.274*** (3.80)		0.209*** (6.62)		0.0242 (0.83)		0.301*** (8.48)

Professional, scientific and technical activities		0.313*** (10.58)		−0.0810** (−2.99)		0.112*** (3.49)		0.299*** (14.19)		−0.0962*** (−4.94)		0.0924*** (3.90)
_cons	7.120*** (13.80)	8.200*** (13.51)	7.691*** (18.50)	7.992*** (14.37)	6.636*** (15.64)	7.835*** (11.86)	7.269*** (26.11)	7.399*** (24.71)	8.130*** (36.70)	8.547*** (30.85)	7.085*** (26.93)	7.856*** (23.34)
N	81	81	81	81	81	81	105	105	105	105	105	105

t statistics in parentheses. Source: authors' own calculation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

employers want for workers to work for them for a short period of time (which per se is not attractive), they have to give a higher wage what creates a positive relationship between this kind of non-standard employment and wages.

Another form of non-standard employment that we included in the analysis is part-time employment: individuals working less than eight hours a day. Working week in Croatia is forty hours per week or eight working hours every day from Monday to Friday. The results of the regression are shown in Table 4.

Although previous studies (Pissarides et al. 2005; Booth and Woods 2008; Manning and Petrongolo 2008) find relationship between part-time employment and wages, this research shows (Table 4) that there is no statistically significant relationship between the share of part-time employment and the changes in monthly wages across sectors in the Croatian economy. The possible explanation can be a small share of part-time employment in total employment. For example, in Manufacturing there is less than 5% of people working part-time. A large share of full-time employment generally characterizes Croatian labor; in some sectors, a share of part-time employment is close to zero (CBS 2018).

6 Concluding Remarks

A vast amount of literature explores various forms of non-standard employment and its impact on different labor market aspects, including wages. A sizeable body of knowledge has been produced studying temporary, part-time, temporary agency work, and independent contract work. Although non-standard forms of employment have some advantages in the labor market, it is generally assumed that non-standard employment relationships involve work conditions that are inferior to more traditional employment. Such a view comes from the labor market mismatches (skill, informational, geographical. . . .) manifested in negative forms of non-standard employment, but also from the fact that people tend to prefer secure and long-term, rather than risky and short-term work contracts.

Over past decades, non-standard forms of employment have become a contemporary feature of the Croatian labor market. From 2014, there has been a rapid increase in temporary employment and precarious employment in all sectors of economy accompanied by the stagnation of wages or low increase in wages. In 2018, the situation slightly improved since the majority of industries experienced an increase in wages.

The objective of this paper was to investigate whether the changes in the share of non-standard employment affected wages across different sectors of the economy. Empirical results suggest that there is a statistically significant relationship between temporary, especially, precarious employment and wage growth. The link exists and it is the positive one, which means that an increase in the share of temporary and precarious employment contributed to the monthly wages growth across sectors in Croatia. This finding can partly be explained by compensating wage differential—if employers want for workers to work for them for a short period of time, they have to

Table 4 Panel analysis results for part-time employment

	(1)	(2)	(3)	(4)	(5)	(6)
	lnAvgWage	lnAvgWage	lnAvgWage University degree	lnAvgWage University degree	lnAvgWage secondary school	lnAvgWage secondary school
Part-time percentage	0.00384 (1.55)	0.00518* (2.11)	0.00147 (0.81)	0.00207 (1.09)	−0.00247 (−1.07)	0.00339 (1.41)
Gross operating ratio	−0.00451 (−1.40)	−0.00474 (−1.30)	−0.00512* (−2.10)	−0.00393 (−1.38)	0.000897 (0.38)	−0.00426 (−1.18)
lnAppproductivity	0.286*** (4.37)	0.226** (3.11)	0.222*** (4.49)	0.212*** (3.76)	0.244*** (5.39)	0.173* (2.43)
Administrative and support service activities		−0.127** (−2.75)		−0.212*** (−5.91)		−0.105* (−2.33)
Accommodation and food services		0.119 (1.85)		0.0163 (0.32)		0.124* (1.96)
Construction		0.00632 (0.18)		−0.0673* (−2.49)		0.0665 (1.95)
Information and communication		0.309*** (5.85)		−0.106** (−2.58)		0.222*** (4.28)
Water supply; sewerage, waste management		0.134 (1.81)		−0.107 (−1.86)		0.220** (3.03)
Real estate activities		0.0415 (0.41)		−0.150 (−1.89)		0.131 (1.31)
Manufacturing		0.0231 (0.92)		0.0439* (2.24)		0.0331 (1.34)
Transportation and storage		0.199*** (4.60)		0.0169 (0.50)		0.213*** (5.02)
Professional, scientific and technical activities		0.290*** (7.39)		−0.102*** (−3.35)		0.0927* (2.40)

(continued)

Table 4 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	lnAvgWage	lnAvgWage	lnAvgWage University degree	lnAvgWage University degree	lnAvgWage secondary school	lnAvgWage secondary school
_cons	5.784*** (9.46)	6.281*** (9.06)	6.920*** (14.97)	7.058*** (13.07)	6.010*** (14.26)	6.682*** (9.80)
N	69	69	69	69	69	69

Source: Authors' calculation

give a higher wage what creates a positive relationship between this kind of non-standard employment and wages. In addition, during the tourist season, there is a shortage of workers what forces employers to pay higher wages if they want to attract workers. Part-time employment did not turn out to be statistically significant in wage growth in Croatia.

Limited access to macro and micro data on the labor market of Croatia highlights the necessity of expanding the analysis to broaden findings of this paper. Including micro data in the analysis, future researches could cover larger number of wage determinants, both at the supply and demand side of the market (age, gender, educational attainment, firm size, ownership of the firm, region, etc.).

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Role of Personality Traits in Work-Life Balance and Life Satisfaction

Sevda Köse, Beril Baykal, Semra Köse, Seyran Gürsoy Çuhadar, Feyza Turgay, and Irep Kıroglu Bayat

Abstract In this study, we examine the role of personality traits in ensuring work-life balance and life satisfaction. For this purpose, 434 people working in service sector in Kocaeli/Turkey are interviewed through face-to-face. Five-Factor Personality scale is used to measure personality traits, and scales that have international validity and reliability are used to measure work-life balance and life satisfaction. Hayes Process analysis is used to determine whether personality traits have a role in ensuring work-life balance and life satisfaction. According to the results of the analysis, it has been determined that personality has a role in ensuring work-life balance and life satisfaction. When detailed analysis of the sub-dimensions of personality is conducted, it is seen that extroversion, conscientiousness, openness to experience, and emotional balance have a role in terms of work-life balance and life satisfaction, but no relationship is found in the dimension of agreeableness.

Keywords Personality · Big five personality traits · Work-life balance · Life satisfaction · Hayes process

1 Introduction

Increasing global competition as a result of technological developments has brought many changes from the wider economy to the business world, organizational structures, and working relations. As a result, expectations from employees have diversified and increased. Now, most employees spend most of their time at work or

S. Köse (✉) · B. Baykal · S. G. Çuhadar · F. Turgay
Labour Economics and Industrial Relations, Kocaeli University, Kocaeli, Turkey

S. Köse
AydınÜniversitesi, İstanbul, Turkey

I. Kıroglu Bayat
Labour Economics and Industrial Relations, Mersin University, Mersin, Turkey
e-mail: irepbayat@mersin.edu.tr

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cannot substantially escape work life mentally and physically. However, work life is not the only life that employees have. Human life, such as family, friends, and social life, gets through between work life and non-work life. In terms of both physical and mental health and the satisfaction of individuals, it is important to balance these two areas.

It is not always possible to balance work life and non-work life. In addition to individualistic factors such as age, gender etc., factors related to work life such as work hours, work order, organizational attitude can be effective in maintaining work-life balance. In case the work-life balance cannot be achieved, the personal and organizational lives of individuals will be negatively affected, creating dissatisfaction in both areas and thus will affect the life satisfaction of the individual. Therefore, work-life balance is an important phenomenon with its incidents and results.

Work-life balance is the perceived balance between these two areas, and life satisfaction is the degree to which an individual positively evaluates the overall quality of his/her life as a whole. It is assumed that individuals who achieve this balance will also be satisfied with life.

Personality too, which causes individuals to differentiate their thoughts and behaviors, emotions, abilities, perception of events, and their reactions to events, is the determinant of both work-life balance and life satisfaction. In this context, it can be thought that personality traits have a role in ensuring work-life balance and thus, in turn, ensuring life satisfaction.

When the literature is examined, it is seen that while there are many studies examining the effect of personality on work-life balance or the effect of personality on life satisfaction; there are few studies examining the effect of personality on work-life balance and together with life satisfaction. In this respect, the aim of this study is to reveal the role of personality traits in ensuring work-life balance and thus achieving life satisfaction. Therefore, first, the conceptual framework will be drawn and then the methods and results of the research will be discussed.

2 Theoretical Framework

2.1 Personality

It is difficult to define personality, a complex concept, because it is comprehensive enough to include internal features, social effects, qualities of the mind, qualities of the body, relations to others, and inner goals (Larsen and Buss 2008). Therefore, although there is not a single definition that psychologists agree on, it is possible to define it as a set of permanent characteristics that reflect all the features of the individual and differentiates the subject from other individuals. Personality is the sum of the characteristics that make the individual himself and covers all the characteristics of an individual's interests, attitudes, abilities, harmony with their environment, speech style, and external appearance (Tutar 2016). Aiken defines

personality as the sum of all these physical, mental, emotional, and social characteristics of the individual (Somer et al. 2011). Factors that form personality can be grouped as hereditary and physical factors, socio-cultural factors, family factors, social structure and social class factors, and geographical and physical factors (Güney 2001). In the development of personality, (genetic factors) biological nature, nurture, environmental factors, culture (behavior, belief, learning rituals), social class, family, and peers are effective determinants (Cervone and Pervin 2008).

Researchers who want to examine personality traits have tried to make a classification (taxonomy) covering personality structure based on the thesis that individual differences can be coded and reflected in words in all languages, and they have used dictionaries as a tool to determine personality traits (Somer et al. 2011). Adjectives which are used to describe characteristics of individuals are called trait descriptive adjectives. The English language has more than 20 thousand feature descriptive adjectives (Larsen and Buss 2008). The most widely used personality model in the studies conducted by many researchers is the five-factor personality model developed in 1985 by Paul Costa and Robert McCrea (Pekdemir and Koçoğlu 2014). Dimensions of the Big Five are as follows:

- Extraversion–Introversion: Costa and McCrae (1985) correlated the extraversion dimension with warmth, gregariousness, activity, and excitement seeking, on a positive emotions subscale in their personality inventory (Cited in: Somer et al. 2011). Extraverted individuals are social and cheerful and exhibit assertive behavior. These individuals prefer a large number of friends, entrepreneurship, sporting activities, and participation in club memberships in their work-related behaviors (Cited in: Sarıcı Bulut 2017).
- Agreeableness–Hostility: Agreeableness, which is effective in interpersonal relationships, expressing one's self-perception, developing social attitudes and philosophy of life, is characterized by being gentle, subtle, respectful, safe, flexible, open-hearted, and compassionate. Agreeableness is defined by the sub-dimensions of trust, honesty, altruism, compliance, humility, and compassion (Somer et al. 2011).
- Conscientiousness–Undirectedness: This dimension was defined by Murray and Kluckhohn in 1953 using terms such as responsibility, willingness, and initiative. While the progressive aspect of the conscientiousness dimension is seen in the need for success and the determination to work, the restrictive aspect emerges with the characteristics of moral rigor and prudence. Competence, order, task performance, success effort, self-discipline, and cautiousness are the sub-dimensions of this dimension. (Somer et al. 2011). In individuals with this characteristic, there is an effort to succeed, a strong sense of purpose and a high level of desire and leadership skills, long-term plans and technical expertise can also be observed (Sarıcı Bulut 2017).
- Emotional Stability–Neuroticism/Unstability: Neuroticism is a dimension that is considered anxious, insecure, dealing with itself, irritable. Personality psychologists, in particular Eysenck, use the term Neuroticism as a personality dimension characterized by a tendency to experience psychological restlessness (Somer et al.

2011). Neurotic individuals tend to experience negative emotions, anxiety, depression, sadness, hopelessness, and guilt. Low self-esteem, unrealistic perfectionist beliefs, and pessimistic attitudes can be observed in these individuals (Sarıcı Bulut 2017).

- Openness to Experience–Unintelligence: This is the least agreed upon dimension by researchers. Goldberg (1992), Digman and Inouye (1986), and Peabody and Goldberg (1989) call this factor intelligence, Norman (1963) describes it as culture, and Costa and McCrae (1985) describe this dimension as openness to experience (Somer et al. 2011). These individuals with imagination, a wide range of interests, and courage are interested in travel, many different hobbies, various business interests, and friends who share these pleasures (Sarıcı Bulut 2017).

2.2 Work-Life Balance

The term "work-life balance," which was first used in the mid-1970s, generally refers to individuals' ability to achieve satisfaction in both areas by establishing a balance of activities between work and life (Akın et al. 2017). With a more detailed definition, "work-life balance is the capability to manage stability between work and personal life and to stay dynamic and competitive at work while maintaining a cheerful, healthy home life with necessary ease, in spite of having work stress and endless actions which need your time and consideration" (Kundnani and Mehta 2014). Work-life balance means that the employee should devote equal time and attention to their roles in both areas and make equal commitments, and therefore, that work and life are in balance.

This balance can be positive or negative. The positive balance expresses a high level of equal interest, relevance, and time; the negative balance indicates a low level of equal interest, relevance, and time. Since the work-life balance may vary according to the individual, the perceived balance is subjective. Therefore, the balance that applies to one employee can be perceived as imbalance in another employee. For an individual who attaches more importance to family life, the intense demands coming from the business life cause the person to experience role tension by contradicting the perception of work-life balance. For the individual who attaches more importance to business life, the fact that they devote less time to the family does not mean that this individual is moving away from balance. It can be said that this individual establishes the balance by centering on business life and does not see the situation that arises with their own will as an imbalance (Erben and Ötken 2016).

The Guest's Model (2002) presents the structure, reasons and results of the work-life balance. In Guest's model, the determinants of work-life balance are composed of organizational and individual factors. Individual factors which are determinants of the work-life balance, especially personality characteristics, affect work-life balance perception. Individual factors affecting perception of work-life balance include orientation to work and in particular to extend to which work is a central life interest and aspects of personality including need for achievement and propensity for work

involvement. According to Guest's model, life satisfaction is one of the results of work-life balance. Work-life balance has an impact on many outcomes such as employee health, life satisfaction, job satisfaction, and performance (Guest 2002). It is expected that life and job satisfaction levels, performance, psychological and physical well-being of individuals achieving a work-life balance will be higher. In cases where work-life balance cannot be established, individual (behavioral, psychological, and physical) or organizationally undesirable consequences emerge. This imbalance situation results in an increase in intention to quit, increased stress in work and private life, a decrease in the level of satisfaction from life, and deterioration of mental-physical health (Akın et al. 2017).

2.3 Life Satisfaction

Life satisfaction has been one of the subjects of human interest for centuries. Life, in general terms, is the total amount of time an individual spends in and out of work (Polatçı 2015). There are many definitions of life satisfaction. Heller et al. (2002) consider life satisfaction a summary evaluation of the likes and dislikes of one's own life, while Haybron (2007) states that the individual likes, approves, and is satisfied with their life (Polatçı 2015). According to another definition (Özdevecioğlu and Aktaş 2007), life satisfaction is the emotional response or attitude of the person to the whole of life defined as leisure time and other non-work time. Life satisfaction is seen as an attitude because it is a summary evaluation of the aspects that the person likes or dislikes about his or her life (Özdevecioğlu and Aktaş 2007).

In the literature, factors affecting life satisfaction are generally considered in four sub-categories. In the first category, there are job-related factors, such as the quality of the work done by the individual in the organization, the salary received, the individual's role in the organization, the workload, the opportunities for promotion, the training given in the workplace, and the experiences related to the work. The second category includes individual factors such as age, gender, educational background, personality traits, negative or positive sensuality, and expectations. In the third category of environmental factors, the individual has the opportunity to find alternative. In the last category, there are social factors, such as the social networks of the individual, the social organizations they belong to, their relations with their family and relatives, family isolation, and hometown (Özdevecioğlu and Aktaş 2007).

3 Method

The aim of the study is to reveal the role of personality in ensuring work-life balance and ensuring life satisfaction. This issue has been chosen because there has been limited research about this issue and, as stated in the literature section, personality

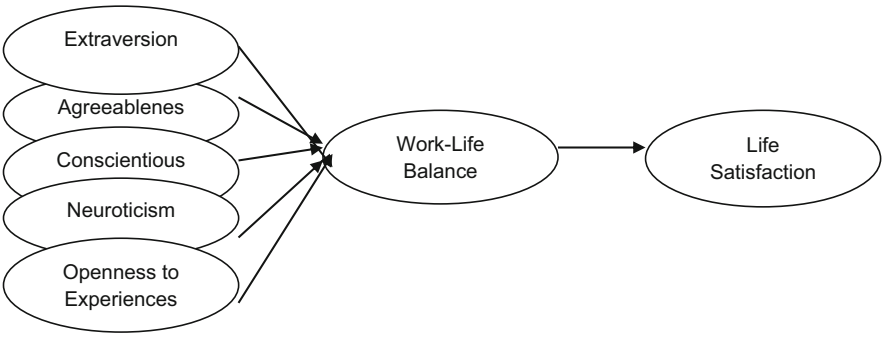

Fig. 1 Mediator role of work-life balance in relationship between sub-dimensions of personality and life satisfaction. Source: developed by the authors

traits are one of the individual factors that are effective in achieving work-life balance and life satisfaction, and life satisfaction is one of the results of work-life balance. In this context, to reveal the role of personality traits, work-life balance was determined as a mediator variable (Fig. 1) in the relationship between personality traits and life satisfaction.

Quantitative research method was used in the research. In this context, the population of the research consists of service workers in Kocaeli province, and a face-to-face interview method was used with 434 people determined circumstantially.

3.1 Scales

As a data collection tool, three scales that are reliable and valid in the international literature were used. Big Five Personality Scale: The 44-item scale developed by John and Srivastava (1999) was used in the research. In the scale, there are five personality trait factors as extroversion, agreeableness, conscientiousness, neuroticism, and openness to experiences. The Cronbach's alpha value of the scale was 0.820, the Cronbach's alpha value of the extroversion is 0.850, the Cronbach's alpha value of the agreeableness is 0.922, the Cronbach's alpha value of the conscientiousness is 0.753, the Cronbach's alpha value of the neuroticism is 0.682, and lastly, the Cronbach's alpha value of the openness to experiences is 0.785. Participants state their answers using a 5-point Likert-type scale ranging from "strongly disagree" to "strongly agree." Forty-four questions about personality traits were subjected to confirmatory factor analysis. KMO value: 0.876 and p: 0.000 were found to be significant in the scale, 5 dimensions emerged. Work-Life Balance Scale: The four question scale developed by Brough et al. (2014), was used in this study. Participants state their answers using a 5-point Likert-type scale ranging from "strongly disagree" to "strongly agree." The Cronbach's alpha value of this scale was 0.879. Life

Satisfaction Scale: The five question scale developed by Pavot and Diener (1993), was used in this study. Participants state their answers using a 7-point Likert-type scale ranging from "strongly disagree" to "strongly agree." The Cronbach's alpha value of this scale was 0.872. Demographic Questions: There are some demographic questions such as age, gender, education level, marital status, employment status.

3.2 Analysis

In order to determine the mediator effect of a variable, Baron and Kenny (1986) stated that there should be four basic conditions in determining a model containing mediating variables.

(a) The independent variable and the mediator variable have a significant relationship.
(b) The mediator variable and the dependent variable have a significant relationship.
(c) There is a significant relationship between the independent variable and the dependent variable.
(d) When the mediator variable is included in the model, the effect of the independent variable on the dependent variable decreases.

In general, three methods are used in mediator and moderator effect analysis studies. These are grouped as: regression based analysis, analysis based on structural equation modeling and analysis via the PROCESS macro. In this study, the fourth model of the PROCESS macro, developed by Andrew Hayes and based on SPSS, was used to test the mediator effect. For the significant relationship, we will look at the Lower Level of Confidence Interval (LLCI) and Upper Level of Confidence Interval (ULCI)value; it should not include a zero (0) value, and the p value must be smaller than 0.05 ($p < 0.05$). Lastly, to explore the mediator effect, we will look indirect and direct effect values. While the direct effect implies the effect of the independent variable on life satisfaction without the mediator variable, in the indirect effect it is expected that the effect level will be statistically insignificant or decrease with the inclusion of the mediator variable in the analysis.

4 Results

When the demographic characteristics of the participants are evaluated, 50.2% of the participants are female and 49.8% are male. In terms of age, the highest density is between 26 and 33 years with 34.3%. The educational level of the majority of the participants is high school and university level (Table 1).

Table 1 Demographic characteristics of participants

Variables	N	%
Gender		
Female	218	50.2
Male	216	49.8
Age		
18–25	108	24.9
26–33	149	34.3
34–41	85	19.6
42–49	62	14.3
50 +	30	6.9
Education level		
Literate	5	1.2
Primary school	16	3.7
High School–Vocational High School	90	20.7
University	288	66.4
Postgraduate	35	8.1
Marital status		
Married	197	45.4
Single	237	54.6
Professions		
Lawmakers, Senior managers, Managers	39	9
Professionals	161	37.1
Assistant Professionals	41	9.4
Office and Customer Service Employees	44	10.1
Service and Sales Employees	109	25.1
Artisans and Related Employees	6	1.4
Plant and Machine Operators	12	2.8
Nonqualified Employees	22	5.1
Total	434	100

Source: Authors' own work

Table 2 The effect of extraversion on work-life balance

	β	SH	T	LLCI	ULCI	p	R2
Work-life balance	0.1532	0.0625	2.4497	0.0303	0.2761	0.0147	0.0137

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

4.1 Extraversion

A statistically significant relationship is found between extraversion and work-life balance ($p < 0.05$), and the relationship defined by Baron and Kenny (1986) is revealed (a path). This result also shows that the extraversion level of the employees has a significant and positive effect on their work-life balance. To sum up, as the extraversion level of the employees increases, their work-life balance increases (Table 2). In the second part of the analysis, the effect of mediator variable work-life balance (b path) on life satisfaction(c path), which is the dependent variable, is

Table 3 The role of extraversion in the effect of work-life balance on life satisfaction

	β	SH	T	LLCI	ULCI	p	R2
Extraversion	0.3966	0.0747	5.3070	0.2497	0.5435	0.0000	0.2338
Work-life balance	0.5410	0.0571	9.4734	0.4287	0.6532		

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

Table 4 Mediating effect final table

	Direct effect	Indirect effect	SH	p	BoLLCI	BoULCI	Mediating effect
Work-life balance	0.3966	0.0829	0.747	0.000	0.0104	0.1555	Yes

Source: Authors' own work

examined. Information on the analysis of results is given in Table 3. According to this, there is a significant effect ($p < 0.05$) of the variable related to the inclusion of work-life balance on life satisfaction. Work-life balance has a significant and positive effect on life satisfaction ($\beta = 0.541$, 95%, LLCI-ULCI: 0.4287/0.6532) In addition, the results of the analysis reveal that extraversion has a significant effect on life satisfaction ($\beta = 0.397$, 95%, LLCI-ULCI: 0.2497/0.5435) Extraversion and work-life balance account for about 23.4% (R2 = 0.2338) of the change in life satisfaction (b and c path).

The final analysis is made by adding the mediator variable which has a direct effect on the independent variable in the model. These analyses reveal the direct or indirect effect of the extraversion variable on life satisfaction through the mediating variable (work-life balance). While the direct effect implies the effect of extraversion on life satisfaction without the mediator variable, in the indirect effect it is expected that the effect level will be statistically insignificant or diminish with the inclusion of the mediator variable in the analysis. The information about the analysis is given in the table. When the results of the analysis are evaluated (Table 4), it was seen that the extraversion personality trait had a beta interaction value of 0.3966 on life satisfaction, whereas it decreases to 0.0829 with the inclusion of the mediator variable in the model. In this context, the fourth proposition of Baron and Kenny is revealed and it is found that in the effect of extraversion on life satisfaction, work-life balance has a mediator effect and that effect was statistically significant ($p < 0.05$) (d path).

Therefore, the Hayes Process analysis results show that work-life balance has a mediator effect on the relationship between extraversion and life satisfaction.

4.2 Conscientiousness

A statistically significant ($p < 0.05$) relationship is found between the sub-dimension of personality, the conscientiousness dimension, and work-life

Table 5 The effect of conscientiousness on work-life balance

	β	SH	T	LLCI	ULCI	p	R2
Work-life balance	0.3103	0.0790	2.4497	0.1550	0.4656	0.0001	0.0345

LLCI value Lower Level of Confidence Interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

Table 6 The role of conscientiousness in the effect of work-life balance on life satisfaction

	β	SH	T	LLCI	ULCI	p	R2
Conscientiousness	0.4432	0.0973	4.5565	0.2520	0.6344	0.0000	0.2212
Work-life balance	0.3103	0.0790	2.4497	0.1550	0.4656		

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

Table 7 Mediating effect final table

	Direct effect	Indirect effect	SH	p	BoLLCI	BoULCI	Mediating effect
Work-life balance	0.4432	0.1636	0.0973	0.000	0.2520	0.6344	Yes

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

balance, which is the mediating variable, and the first relationship defined by Baron and Kenny (1986) is revealed (a path). This result also shows that the level of conscientiousness of the employees has a significant and positive effect on work-life balance. In short, as the conscientiousness level of the employees increases, work-life balance increases (Table 5).

In the second part of the analysis, the effect of the mediator variable work-life balance (b path) on life satisfaction(c path), which is the dependent variable, is examined. Information on the analysis results is given in Table 6. According to this, there is a significant effect ($p < 0.05$) of the variable related to the inclusion of work-life balance on life satisfaction. In short, work-life balance has a significant and positive effect on life satisfaction ($\beta = 0.527$, 95%, LLCI-ULCI: 0.4129/0.6416) ($\beta = 0.541$, 95%, LLCI-ULCI: 0.2520/0.6344) In addition, the results of the analysis reveal that responsibility has a significant effect on life satisfaction ($\beta = 0.541$, 95%, LLCI-ULCI: 0.4827/0.6532). Conscientiousness and work-life balance account for about 22.1% (R2 = 0.2212) of the change in life satisfaction.

The final analysis is made by adding the mediator variable which has a direct effect on the independent variable in the model. These analyses reveal the direct or indirect effect of the conscientiousness variable on life satisfaction through a mediating variable (work-life balance). The information about the analysis is given in Table 7. When the results of the analysis are evaluated, it is seen that the conscientiousness personality trait has a beta interaction value of 0.4432 on life satisfaction, whereas it decreases to 0.1636 by the inclusion of the mediator variable in the model. In this context, the fourth proposition of Baron and Kenny is accepted and it is found

that in the effect of the conscientiousness personality trait on life satisfaction, work-life balance has a mediator effect and that the effect was statistically significant ($p < 0.05$) (d path).

Therefore, the Hayes Process analysis results show that work-life balance has a mediator effect on the relationship between conscientiousness and life satisfaction.

4.3 Neuroticism

A statistically significant relationship is found between neuroticism and work-life balance which is the mediating variable ($p < 0.05$), and the first relationship defined by Baron and Kenny (1986) is revealed (a path). This result also shows that the level of neuroticism affects the work-life balance significantly and negatively. In short, as the level of neuroticism decreases, the life balance of the person increases (Table 8).

In the second part of the analysis, the effect of the mediating variable work-life balance (b path) and neuroticism (c path) on the dependent variable life satisfaction is examined. Information on the analysis results is given in Table 9. According to this, there is a significant effect ($p < 0.05$) of neuroticism on life satisfaction with the inclusion of work-life balance. In short, work-life balance has a significant and positive effect on life satisfaction ($\beta = 0.543$, 95%, LLCI-ULCI: 0.4315/0.6552) In addition, analysis of the results reveals that neuroticism has a significant effect on life satisfaction ($\beta = 0.495$, 95%, LLCI-ULCI: 0.6717/0.3174). Neuroticism and work-life balance account for about 24% (R2 = 0.2370) of the change in life satisfaction.

The final analysis is made by adding the mediator variable which had a direct effect on the independent variable in the model. These analyses reveal the direct or indirect effect of the neuroticism variable on life satisfaction through the mediating variable (work-life balance). The information about the analysis is given in Table 10. When the results of the analysis are evaluated, it is seen that the neuroticism has a beta interaction value of 0.4945 on life satisfaction, whereas it decreases to 0.0911

Table 8 The effect of neuroticism on work-life balance

	β	SH	T	LLCI	ULCI	p	R2
Work-life balance	−0.1677	0.0758	−2.2131	−0.3166	−0.0188	0.0274	0.0112

LLCI value lower level of confidence interval, *ULCI* value Upper level of confidence interval
Source: Authors' own work

Table 9 The role of neuroticism in the effect of work-life balance on life satisfaction

	β	SH	T	LLCI	ULCI	p	R2
Neuroticism	−0.4945	0.0901	−5.4867	.-6717	−0.3174	0.0000	0.2370
Work-life balance	−0.1677	0.0758	−2.2131	−0.3166	−0.0188		

LLCI value lower level of confidence interval, *ULCI* value Upper Level of Confidence Interval
Source: Authors' own work

Table 10 Mediating effect final table

	Direct effect	Indirect effect	SH	p	BoLLCI	BoULCI	Mediating effect
Work-life balance	−0.4945	−0.0911	0.0901	0.000	0.1863	0.0020	Yes

Source: Authors' own work

Table 11 The effect of openness on work-life balance

	β	SH	T	LLCI	ULCI	p	R2
Work-life balance	0.1572	0.0776	2.0251	0.0046	0.3097	0.0043	0.0094

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

Table 12 The role of openness to experience in the effect of work-life balance on life satisfaction

	β	SH	T	LLCI	ULCI	p	R2
Openness to experiences	0.2867	0.0943	3.0397	0.1013	0.4720	0.0000	0.2008
Work-life balance	0.5593	0.0582	9.6111	0.4449	0.6737		

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

with the inclusion of the mediator variable in the model. In this context, the fourth proposition of Baron and Kenny is accepted and it is found that in the effect of the conscientiousness personality trait on life satisfaction, work-life balance has a mediator effect and that effect is statistically significant ($p < 0.05$) (d path). Therefore, the Hayes Process analysis results show that work-life balance has a mediator effect on the relationship between neuroticism and life satisfaction.

4.4 Openness to Experience

A statistically significant relationship is found between openness and work-life balance which is the mediating variable ($p < 0.05$), and the first relationship defined by Baron and Kenny (1986) is revealed (a path). This result also shows that the level of openness affects the work-life balance significantly and positively. In short, as the level of openness increases, the work-life balance of the person increases (Table 11).

In the second part of the analysis, the effect of the mediator variable work-life balance (b path) and openness to experience variable (c path) on the dependent variable life satisfaction is examined. Information on the analysis results is given in Table 12. According to this, there is a significant effect ($p < 0.05$) of the variable related to the inclusion of the work-life balance on life satisfaction. In short, work-life balance has a significant and positive effect on life satisfaction ($\beta = 0.559$, 95%, LLCI-ULCI: 0.4499/0.6737). In addition, analysis of the results reveals that openness to experience has a significant effect on life satisfaction ($\beta = 0.287$, 95%, LLCI-

Table 13 Mediating effect final table

	Direct effect	Indirect effect	SH	p	BoLLCI	BoULCI	Mediating effect
Work-life balance	0.2867	0.0879	0.0943	0.025	0.0032	0.1820	Yes

Source: Authors' own work

Table 14 The effect of agreeableness on work-life balance

	β	SH	T	LLCI	ULCI	p	R2
Work-life balance	−0.0079	0.00557	−0.1428	−0.1173	0.1015	0.8866	0.0000

LLCI value lower level of confidence interval, *ULCI* value upper level of confidence interval
Source: Authors' own work

ULCI: 1013/0.4720). Openness to experience and work-life balance account for about 20% of the change in life satisfaction (R2 = 0.2008).

The final analysis is made by adding the mediator variable, which has a direct effect on the independent variable in the model. These analyses reveal the direct or indirect effect of the openness variable on life satisfaction through the mediating variable (work-life balance). The information about the analysis is given in Table 13. When the results of the analysis are evaluated, it is seen that openness had a beta interaction value of 0.2867 on life satisfaction, whereas it decreases to 0.0879 with the inclusion of the mediator variable in the model. In this context, the fourth proposition of Baron and Kenny is accepted and it is found that in the effect of openness on life satisfaction, the work-life balance has a mediator effect and that effect is statistically significant ($p < 0.05$) (d path). Therefore, the Hayes Process analysis results show that work-life balance has a mediator effect on the relationship between openness and life satisfaction.

4.5 Agreeableness

No statistically significant relationship is found between agreeableness, and the mediator variable, work-life balance ($p > 0.05$), and it is shown that the first relationship defined by Baron and Kenny (1986) is not revealed (1986) (a path). This result also shows that the level of agreeableness affects work-life balance statistically insignificantly. The results of the analysis show that the values of LLCI-ULCI are −0.1173 and 0.1015, in short, they include 0 (zero). Briefly, employees' agreeableness does not have a statistically significant effect on work-life balance and work-life balance has no mediator effect (Table 14).

5 Discussion

Since the studies could not be reached other than Gorsy and Panwar's (2016) and Kaur's (2013) studies which deal with personality, work-life balance, and life satisfaction, the findings of our study will be evaluated together with these two studies. Thereafter, findings will be evaluated by investigating the relationship between personality and work-life balance, personality and life satisfaction, and work-life balance and life satisfaction.

According to the results of our study, the extraversion, conscientiousness, neuroticism, and openness to experience dimensions have a role in ensuring work-life balance and life satisfaction. Gorsy and Panwar (2016) found in their study, which was limited to teachers only, that agreeableness, conscientiousness, and openness to experience were related to work-life balance and life satisfaction, but extraversion was not related to work-life balance and life satisfaction. Moreover, they found that agreeableness and consciousness are the two basic dimensions which may be the leading cause of work-life balance and life satisfaction being experienced, thus finding that work-life balance is directly related to life satisfaction and dimensions of personality. Gorsy and Panwar found that personality plays a role in work-life balance and life satisfaction and this finding is similar to our study. The only differentiation occurred in the sub-dimensions of personality, and in our study, it was found that the agreeableness dimension was not related to life satisfaction and work-life balance; Gorsy and Panwar's (2016) study revealed that the extraversion dimension was not related. The reason for this differentiation is that Gorsy and Panwar stated in their studies that the sample was a single occupational group and that detailed/appropriate statistical tools were not used. In this context, more occupational groups were emphasized in our study and more detailed statistical analyses were included. In another study, a significant relationship was found only in the extraversion dimension in the relationship of work-life balance, life satisfaction, and personality traits. In short, extraversion leads to work-life balance which leads in turn to life satisfaction (Kaur 2013). This finding is parallel to our results regarding the extraversion dimension.

When we look at the results of our study in terms of personality and work-life balance, there is a significant relationship between all dimensions of personality and work-life balance except agreeableness; only the relationship between neuroticism was found to be inverse. In this context, Soni and Bakhru (2019) and Kundnani and Mehta (2014) found a significant relationship between all dimensions of personality and work-life balance. Wayne et al. (2004) found a significant relationship between work-life balance and the dimensions of openness to experience and conscientiousness. In addition, Devadossi and Minnie (2013) found a significant relationship between work-life balance and agreeableness, conscientiousness, and openness to experience. Tandon and Chawla (2018) found a positive relationship between work-life balance and extraversion and openness to experience. These results support our findings in dimensions of personality other than the agreeableness dimension. In another study, Akanni and Oduaran (2017) found a significant relationship between

work-life balance and agreeableness, openness to experience, and the conscientiousness dimension, but could not find a significant relationship with extraversion and neuroticism.

When we look at the results of our study in terms of personality life satisfaction, there is a significant relationship between all dimensions of personality and life satisfaction except agreeableness; only the relationship between neuroticism was found to be inverse. Supporting our findings, Schimmack et al. (2004) found a negative relationship between neuroticism and life satisfaction, and a positive relationship with extraversion. Magee et al. (2013) found a negative relationship between neuroticism and life satisfaction, and found a positive relationship between personality dimensions and life satisfaction other than openness to experience. Finally, when our findings were evaluated in terms of work-life balance and life satisfaction, a positive and significant relationship was found between work-life balance and life satisfaction. The findings of Yusuf and Khan (2018) and Tavassoli and Sune (2018) support our study.

6 Conclusion

The aim of our study is to reveal the role of personality in work-life balance and life satisfaction. Our findings are as follows:

- A statistically significant relationship was found between all dimensions of personality and work-life balance except agreeableness.
- All dimensions of personality have a significant effect on life satisfaction except agreeableness.
- Work-life balance has a significant and positive effect on life satisfaction.
- Work-life balance has a mediator effect on the relationship between extraversion, conscientiousness, neuroticism, openness to experience, and life satisfaction.

In our study, no analysis was made on the effect of demographic variables. In future studies on this subject, a detailed analysis is recommended by including demographic variables in the model. Although professional differentiation was considered in our study, it is recommended to differentiate on a sectoral basis in future studies.

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Factors for the Future of Work and Their Impact on the European Economy and Labor Market

Monika Moraliyska

Abstract The aim of the present paper is to gain a deeper understanding of the essence of the "Future of work" by exploring simultaneously its major drivers and their impact on the job market and employment on European level in the long run. The data used are based on the research of numerous international organizations, European Union institutions, and bodies, as well as on analytical data and expertise of reputable business consulting companies. The methodology includes qualitative research, including data analysis, comparative analysis, inductive and deductive approach, and others. This type of research helps to explore how and why the phenomenon "Future of work" occurred, what it represents and what the prospects for its development are. The main drivers of this phenomenon are analyzed as follows: globalization, digitalization, and demographic change. The paper explores and summarizes the expected economic and social effects of these three factors on the labor market in the EU. The main findings conclude that the "Future of work" is an interdisciplinary phenomenon covering the current and expected trends on the world labor market, provoked by the dynamic technological development and penetration of artificial intelligence technologies in the economic and business practice, including job automation (job loss and job creation), rising skills and qualification requirements, a big change in employment occupations, and rising diversity in working arrangements. Legislative, business-oriented, and educational actions on all levels are urgently required to face these new challenges successfully.

Keywords Future of work · Digitalization · Globalization · Aging · Job loss · Job creation

M. Moraliyska (✉)
International Economic Relations & Business Department, University of National and World Economy, Sofia, Bulgaria

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1 The Future of Work

The Fourth industrial revolution and its technologies (robotics, artificial intelligence, the internet of things, 3-D printing, and others) affect and transform the world of work today. The rapid technological progress, combined with the globalization and demographic trends, provokes enormous changes in the nature and role of work. These changes have the potential to increase the economic growth and productivity, to further improve efficiency, costs optimization, and value creation, and to create new opportunities and professions, but they also cause a job loss, as digitalization and automatization put the routine-task jobs at risk. Another big challenge is the new flexible forms of employment that threaten workers' social protection and may lead to intensification of work and health problems.

"The Future of Work" has come to be a complex term, encompassing various themes, problems, and phenomena from the contemporary world. It is a result of the emergence and massive deployment of high digital technologies in combination with other specific social trends. It is to a high degree stemming from the enormous digital change, but not only. Digital change is not only about the future of work, because it concerns the future of national and world economy, society, and democracy. On the other hand, the future of work is not only about digital change neither, but also about the greening of the European economy, global value chains, demographic change, and others (Thyssen 2019).

One of the most significant evidence of the change in work is that work is increasingly being performed through online platforms, while robotics, artificial intelligence (AI), and digitization are deployed to replace the human workforce. This way, the technical progress, together with the economic changes, is restructuring the work environment, with new economic sectors growing while others are fading. These trends are raising many questions and challenges to employment. Among them is the growing need for digital skills, which become crucial in the new digital era.

The contribution of the present paper to the literature consists of its systematic and interdisciplinary approach to the theme "Future of work," which analyzes and systemizes different literature sources that concern the Future of work, defines the factors for its development, and projects their effects on the employment and jobs.

The main findings are the following: (1) The future of work is a broad interdisciplinary term covering numerous aspects of the current and expected trends on the world labor market, which are provoked by the dynamic technological development and penetration of artificial intelligence technologies in the economic and business practice; (2) The fourth industrial revolution is going to cause several important effects on the labor market—job automation (including job loss and job creation), rising skills and qualification requirements, a big change in employment occupations, and rising diversity in working arrangements; and (3) Legislative, business-oriented, and educational actions on global, regional (European), and national level are needed to face the big challenges but also big opportunities, which the fast

technological development and population aging as major factors will bring to the labor market and jobs.

The structure of the paper is as follows: (1) The factors for the Future of work are depicted and analyzed: Globalization, Digitalization, Demographic change. Simultaneously, the effects from these factors are explored and analyzed: (1) Effects from Globalization—offshoring and reshoring; (2) Effects from Digitalization—automation of Jobs, rising skills and qualification requirements, change in employment by occupation, and rising diversity in working arrangements; (3) Effects from Demographic change—need for training and retraining, potential for new industries and rising inequality. The paper concludes with recommendations for policies and measures regarding the future of work.

2 Factors for the Future of Work

2.1 Globalization

Globalization is an important factor for the significant changes in employment and jobs worldwide. No doubt it has contributed significantly to economic growth through enhancing international trade and has brought numerous benefits to the exporting companies and nations. The process of outsourcing has allowed companies to contract out their non-essential tasks and functions cutting their costs and focusing on their core competences. This became possible not only for the big companies, but also for the small and medium export-oriented European enterprises, which represent the biggest share of companies in the European Union.

This process has led to negative effects of globalization and concerns about the local labor force and environment in the receiving countries. Another argument against globalization is the expansion of trade with developing countries and emerging markets has led to imports of labor-intensive goods in Europe, which has decreased the local demand for labor, especially unskilled labor (FEPS 2019). This has resulted in lowering wages and, respectively, to a rising inequality in Europe. He also addresses the management of globalization, which he considers "bad" due to the lack of international tax cooperation to combat tax evasion, lax global enforcement of competition rules, and cross-border financial market liberalization, and criticizes the "pro-business political agenda," which worked in favor of the business at the expense of the workers (through lower wages, fewer labor protections, lower taxes, less welfare spending, and so on).

The economic globalization has evolved, however, in comparison with a decade ago, and it has a growing impact on the future of work in the EU. In the past it was represented mainly by the tangible flows of products of multinational companies from the developed economies and moving of their production from Europe to cheap-labor countries. Today, globalization more and more refers to intangible flows of services, and it is happening in both—developed and emerging economies, engaging an increasing number of smaller companies as well. This process has led

to, among other effects, "relocation" of production back in Europe and to new jobs being created in the service sector because of globalization (Servoz 2019).

This new trend is evident in the global production and trade, and it is the opposite of the process of offshoring that happened decades ago. Now, the automation and robotization of production and processes have made it profitable to keep production in the home country. The process of reshoring, which stands for the returning of production and manufacturing of goods back to the company's original country, is becoming more widespread in Europe. Examples include big companies as Adidas and Philips, which are bringing back production to Europe from Southeast Asia. In addition to keeping production close to the customer, the new facility allows for personalized products using customized digital designs. Similar reverse offshoring has been a notable trend in many European countries, especially in Northern and Western Europe. For example, the Norwegian company I. P. Huse, which is a global player in the production of machinery and equipment, in 2017 announced a full reshoring of its production facilities from Czech Republic, Poland, Russia, and Ukraine (European Reshoring Monitor 2018). In this case, the motivation for using robots was not to replace labor, but to produce faster and with higher quality, with automation and robotics cited as the main enablers for achieving this (McKinsey&Company 2017b).

The trend of reshoring (companies bringing back their activities) is helping to overcome the aging problem in the EU. This way, the countries with a declining and aging population will be able to maintain their living standards even with a reduced workforce. This will affect negatively the developing countries, as automation leads to growth in productivity and decrease in the cost of manufacturing. Economies where the cost of labor is the most relevant competitive factor will have to find new opportunities for growth (International Labor Organization 2017).

2.2 Digitalization

Digitalization is key driver of economic and societal change. Digitalization is defined as the application or increase in the use of digital technologies by an organization, industry, or country, while digital transformation stands for the pervasive adoption of digital technologies in production and consumption activities that exploit a significant dimension of data development and data analysis (European Commission 2019a).

Digitalization is tightly connected with other technological phenomena as AI, automation, robotization, and it is difficult to separate their individual effect on work, jobs, and employment. The deployment of automation technologies and AI is based on the digitalization of the economy, through mobile internet connections, widespread use of smartphones and laptops, and cloud computing. Thus, digitalization is an enabling factor for automation (as an intermediary stage with less disruptive effect on labor markets), while AI represents a potential game-changer for some

Fig. 1 Effects of digitalization on employment and jobs. Source: Author's own study

industries and occupations (Servoz 2019). The direct effects of these processes are depicted in Fig. 1.

2.2.1 Automation of Jobs

Automation of jobs relates mainly to the robotization of work. Advances in robotics, artificial intelligence, and machine learning bring new opportunities for automation. The expected benefits of automation are well acknowledged—lowering costs, improved quality and reliability, increased workers' safety and job satisfaction, and expected rise in the global productivity growth—by 0.8 to 1.4% annually (McKinsey&Company 2017a). It is stimulating economic growth and prosperity in times when the share of the working-age population in Europe is declining.

However, the potential negative effects are still not clear. Like in the previous industrial revolutions, the Fourth industrial revolution will certainly lead to job loss and significant changes in work and employment. However, the human work is still impossible to be replaced. From the five human functions (physical capabilities, sensory perception, cognitive capabilities, natural language processing, social and emotional capabilities), artificial intelligence could replace efficiently only the first three (McKinsey&Company 2017c). In a historical perspective, technologies and machines have replaced humans in countless activities and operations, but technological revolutions so far have shown that the resulting job losses were compensated over time by new activities and occupations.

In the coming decades, a share of 45 to 60% of the European workers could be replaced by machines in their workplaces. Countries such as Belgium, Germany, and Sweden are expected to suffer the most from substantial job losses, together with countries in the European periphery with a higher share of low-skilled work (Institute for Public Policy Research 2015). According to OECD (2019), 14% of jobs could be completely automated, and 32% of jobs are likely to change significantly in the medium term (Fig. 2).

High risk of automation affects 33.6% of the jobs in the Slovak Republic (and only 7.2% in Finland), while significant risk of change threatens 41.9% of the jobs in Lithuania (and only 26% of the jobs in the United Kingdom). The OECD average is 31.6% for high risk of automation and 14.0% for significant risk of change (OECD 2019). McKinsey suggests that up to 30% of the hours worked globally could be automated by 2030, depending on the speed of adoption. In that period, up to

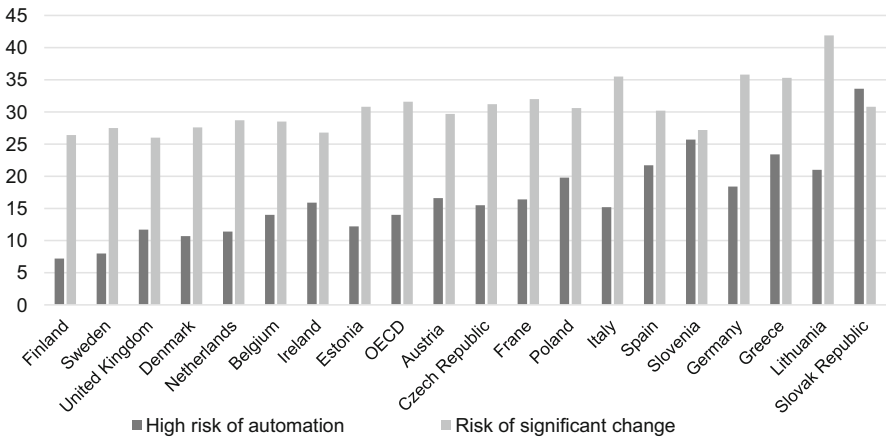

Fig. 2 Share of jobs at high risk of automation or at risk of significant change (%) in European countries and OECD average. Source: Author's own study based on OECD (2019). Note: Share of jobs at high risk of automation—when the likelihood of their job being automated is at least 70%. Jobs at risk of significant change—when the likelihood of their job being automated is between 50 and 70%

375 million workers globally (14% of world's workforce by 2030) may need to switch jobs and learn new skills—100 million of them from China, one-third of the workforce in the US and Germany, and nearly half of the workforce in Japan (McKinsey&Company 2017c).

The potential impact of automation on employment varies by occupation and sector. Physical, routine, and predictable tasks (manufacturing, craft and clerical occupations, operating machinery, preparing fast food, collecting and processing data) will most probably and successfully be replaced by machines. The automotive industry is where robotization is expected to accelerate fast further. For example, the German car manufacturers are introducing helper robots, as they are facing a big shortage of workers combined with an aging population. In addition, German carmakers hope that new types of robots will stimulate further their productivity growth and help them face the strong market competition by their Asian rivals (Euromonitor International 2016).

Automation is not expected to affect much the employment in spheres that include social interactions, creativity, expertise, and managing people such as childcare, care for the elderly, social work, mental health care, garden work, plumbing, etc. Despite all these projections, however, the share of job loss by 2030 will likely be lower, because of technical, economic, and social factors that affect adoption, and the trade-off between them. These factors are as follows: (1) Technical feasibility; (2) The cost of developing and deploying the hardware and the software for automation; (3) The cost of labor (in case there is an abundant labor supply, automation may not happen); (4) The benefits beyond labor substitution, including higher levels of output, better quality, and fewer errors (often considered as more important than the decreasing of labor costs); (5) Regulatory

and social-acceptance issues, such as the degree to which machines are acceptable to substitute workers (McKinsey and Company 2016). Another opinion is that automation does not necessarily lead to net employment losses, because the net job creation depends not only on changes in the demand and supply of labor resulting from digitalization, but also on the efficiency of the labor market institutions (European Commission 2019a).

Simultaneously with job loss, job creation is also expected. In the period from 2015 to 2025, more than 97 million jobs are expected to be opened in the EU, of which 7% will be in new occupations (the rest will be due to replacement demand, resulting from retirement, migration, shifts between occupations, or by workers temporarily leaving the workforce). It is certain that there will be a significant job creation in the IT sector, as the need for it has been increasing in the last decades. Digitalization has already led to massive job creation—over two million jobs in the EU were created in the last decade. According to the European Center for the Development of Vocational Training between 2016 and 2030, there will be over 750,000 job openings for ICT professionals (Cedefop 2019).

Similarly, McKinsey Global Institute (2017) presents an optimistic scenario that 8 to 9% of the labor demand in 2030 will be in new types of occupations that have not existed before. The preconditions for this to happen are sufficient economic growth, investment, innovation, and workers with the appropriate skills. There are several factors that determine the scale of the expected job creation. The first one is the wages, as the higher the wages, the bigger the incentives for automation. The second is the economic growth, as countries with stronger economic and productivity growth and innovation are more likely to meet the new labor demand. The demographic situation is also important—countries with a big share of young population are more likely to have a growing workforce and economic growth, which will lead to new jobs creation. The automation potential also depends on the mix of economic sectors and the mix of jobs within each sector in the different countries (McKinsey&Company 2017c).

2.2.2 Skills and Qualification Requirements

The studies of the labor markets' development in the past two decades show that in general, the demand for medium-skilled occupations and skills is falling, while the demand for both—high-skilled and low-skilled jobs is rising, which leads to the so called "jobs or skills polarization." In addition to that, the increasing demand for high qualification jobs will most likely outpace the supply in the next decades. Digitalization is certainly leading to job polarization, as it influences on employment and jobs in accordance to the required job skills—the low-skilled jobs survive because they cannot be automated, the middle-skilled jobs are replaced by machines, and the productivity of the most skilled jobs is rising (European Commission 2019a).

Cedefop (2018) estimates that by 2030, almost half (46%) of the total job openings will still require medium level of education, but as a whole their share is shrinking (the demand for medium-qualification jobs remains comparatively high

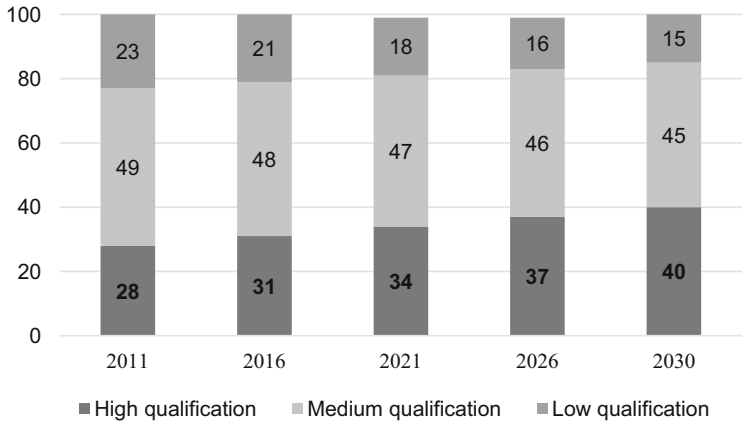

Fig. 3 Labor force by level of qualification in EU28, %, 2011–2030. Source: Cedefop (2018)

due to the big replacement need caused mainly by retirement). Meanwhile, the share of high qualification jobs will rise to 43%, and low-qualification jobs will decrease to 11% of all jobs. In line with the labor market needs, the share of Europeans with high qualifications is expected to continue increasing up to 2030 while those for medium and low levels of education will most probably suffer a small decline (Fig. 3).

There are variations by country, which is a proof that the specific policies, institutions, and labor measures influence the labor markets. Portugal, Germany, Austria, and Romania are the countries where the smallest number of total job openings requiring a high qualification is expected by 2030. The opposite case is projected for Poland, Ireland, and Cyprus, with more than 50% of job openings demand high qualifications. Around 11% of the total job openings that require low level of qualifications are expected in Portugal, Denmark, and Romania (Cedefop 2018).

Among the most important skills in the future will be the digital skills. There is a digital skills gap in the EU—44% of the Europeans do not have basic digital skills, and 37% of people in the labor force also lack enough digital skills, despite the increasing need for such skills in their job. Europe also lacks skilled ICT specialists to fill the growing number of job vacancies in all sectors of the economy (European Commission 2019c).

In order to overcome this skills gap, the educational systems in the EU should be adjust and integrate digital skills in the curriculum, so that they provide students with basic digital and ICT skills. The European Commission's Coalition for Digital Jobs has set several goals by 2020 in that direction: (1) to train one million young unemployed people for vacant digital jobs; (2) to support the upskilling and retraining of the European workforce, and (3) to modernize education and training so that all students and teachers have the opportunity to use digital tools and materials in their teaching and learning.

Table 1 Degree of (recent and anticipated) change in skill profiles across jobs, 2014, EU28[a]

	Top five occupational groups with rapidly changing skills profiles	Top five occupational groups with stable skills profiles
1	ICT professionals	Subsistence farmers, fishers or hunters
2	ICT associate professionals	Cleaners or helpers
3	Production or specialist services managers	Food preparation assistants
4	Health professionals	Personal services workers
5	Electronic and electronic trades workers/Science and engineering professionals	Personal care workers

[a]Ranking of occupations based on an index of Skill stability, derived as the share of EU adult employees who experienced changes to the technologies (machinery, ICT systems) they used in the past 5 years and expect that their skill has a high likelihood of becoming outdated in the next 5 years
Source: Cedefop (2014)

The future of work will be different for different level of qualifications. It will affect all—low-skilled, medium-skilled, and high-skilled work, but some of them will suffer more. The automation and robotization processes that will replace humans will lead to an overall decline in demand for workers with low qualifications. Some medium-level jobs are also expected to be lost, for example, in the sphere of sales. But in the medium and long run, technologies are expected to affect high-skilled jobs as well—in financial trade, transport, and others. Jobs that rely on physical or manual skills, numerical skills as well as customer service skills are the most threatened by automation, while the jobs characterized by high levels of cognitive skills, (advanced) digital skills, communication and planning skills are in low risk of replacement (Cedefop 2014).

Therefore, the future economies will increasingly be in need for workers with strong cognitive abilities (e.g., active learning, ICT literacy) as well as high levels of cross-functional skills (social skills, complex problem-solving, resource-management). Jobs that are not at risk of automation include social or creative skills—such as jobs in management, education, healthcare, science, or engineering. A growing demand for technical skills is also expected, as nearly half of all jobs in the EU will have a stable need for such skills in the coming years (Cedefop 2019). Among the most required technical skills, recently are cloud and distributed computing, statistical analysis and data mining, SEO/SEM Marketing, Mobile Development, Network and Information Security, Web Architecture, User Interface Design, Coding, Cloud technology, system integration, big data, and the Internet of Things. A big challenge is the fast-changing profile of the required skills in some jobs (Table 1).

The future of work will need both—technical and social skills. Creativity, social, and communication skills, as well as emotional intelligence and entrepreneurship skills, will most likely remain reserved for the humans and will be crucial for the economic growth in the future (Institute for Public Policy Research 2015).

2.2.3 Change in Employment by Occupation

The labor market on global scale is transforming—as a whole, the need for high-skill work is growing. The demand for low-skilled jobs has also increased, while the share of middle-skilled jobs has decreased. Between 1995 and 2015, employment in the manufacturing sector went down by 20%, while it rose by 27% in the service sector. The share of high-skilled jobs has increased by 25% over last two decades (but six out of ten adults do not have basic ICT skills or have no computer experience to fulfill the new requirements) (OECD 2019). Growth is demand is expected, for example, for new jobs as big data specialists, social media managers, cognitive computing engineers, blockchain experts, as well as for professionals in the sphere of legislation, management, and in the technical sector (Fig. 4).

Cedefop (2019) predicts that 29 million job openings will be opened in the EU in the period 2016–2030 for the occupational group of Professionals, of which more than 80% due to replacement demand. The occupations with the biggest number of total job openings (including both—net change and replacement needs) will be in the spheres of business and administration associate professionals. Most new jobs will be created for legal, social, cultural, and business & administration associate professionals, with four out of five new jobs requiring high skills. The low-skilled occupations related to primary sector, utilities, and manufacturing (for example, farmers, fishers, hunters, and assemblers) are estimated to be the most negatively affected. There will be, however, some low-skilled occupations, where the technological progress will have a positive impact and stimulate job demand, for example, for assemblers (Cedefop 2019).

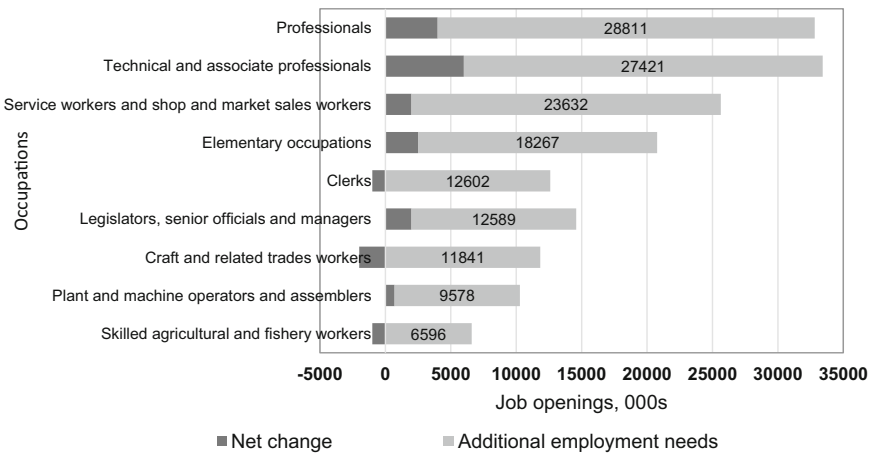

Fig. 4 Total job openings by broad occupational group in EU28 in 2016–2030. Source: Cedefop (2018). Note: The dark blue of each bar presents the net change; the light blue of the bar presents the additional employment needs that add to the total job openings once the net change has been considered

The diversification of jobs could have positive effects on the economies. High level of economic diversification can improve social welfare by providing a large range of alternatives to economic agents. A recent research, based on data for 20 European countries from 1996 to 2010, found evidence for positive welfare effects of economic diversification in Central and Eastern European Countries suggesting that diversification is especially important for social welfare in transition economies (Ali and Cantner 2020). As a whole, in the long run, overall variety improves social welfare while related variety reduces it.

2.2.4 Rising Diversity in Working Arrangements

The fourth technological revolution is going to bring large change to the business sector and the ways it functions. Technologies as Internet of things, augmented reality, additive manufacturing, and robots may provoke transformational changes, which could have substantial impact on the business functioning (Antonova 2017). At present, the advanced process of digitalization has led to a wide spreading of the telework (work from distance) and ICTM work (ICT-enabled mobile work).

Among the advantages of T/ ICTM work are the following: (1) People can choose to work where their labor and living costs are lower and their quality of life is higher; (2) Jobs in less developed regions can be created, contributing to greater economic and social cohesion of regions and countries; (3) It can be expected that labor costs will be reduced by locating online services where labor is cheap, which is a key factor for economic development; (4) This type of work allows an increase in the labor market participation of vulnerable groups (people with disabilities, women, looking after children/ adults); (5) Successful participation in a globalized economy will depend less on where people live and more on the speed and quality of their Internet connection and their skills. For example, online labor platforms are used by Western European technology firms to buy work from skilled software developers in Eastern Europe, or rural workers migrate virtually to the urban labor market (Braesemann et al. 2018); and (6) The greatest advantage lies in the flexibility of these forms of work, as they give workers greater autonomy, increasing their productivity and making a better work-life balance possible.

The spread of T/ICTM in the EU is directly related to technological developments in the various Member States, but also to the existing economic structures in the country and the adopted work culture. Among the countries with high T/ ICTM entry into the EU are Finland, the Netherlands, and Sweden, with the US and Japan leading the world. On average in the EU in 2017, around 17% of employees are engaged in T/ ICTM, with a larger share of them working this way from time to time, not regularly (Eurofound 2017).

Self-employment and non-standard forms of work represent a significant share of the EU labor market. In 2016, 14% of EU employees were self-employed, 8% were full-time, 4% were part-time, 13% were part-time, and 60% were hired full-time. The degree of use of non-standard forms of employment and self-employment varies across countries, regions, and sectors, as well as across generations—the proportion

of workers between the ages of 20 and 30 who work on temporary contractual arrangements, on another type of contract, or without a contract, is twice as high as other age groups (European Commission 2018).

The share of platform workers in the EU is increasing, with 2% of adults across 14 EU member states for whom it is the main source of income (Pesole et al. 2018). The main economic spheres in which work is platform-mediated are transport, delivery, care, as well as software development, translation, data entry, and other knowledge work (European Commission 2019a). Another important fact is the share of people in standard employment in the EU which has remained the same (approximately 40%) in the period from 2002 to 2018, which proves that the increase in non-standard work has not been at the expense of standard work, but rather reduced the unemployment.

The disadvantages of T/ICTM work are related to (1) People could work longer hours or more intensively; (2) Sometimes workers feel pressured to do more work in exchange for their flexibility, or because of excessive workload; (3) Workers at home often suffer from high stress, anxiety, sleep disorders, headaches, and eye strain (Eurofound 2017). Therefore, the European Commission is making proposals concerning the need for neutral social protection in the new forms of employment. On first place, it recommends the establishment of guilds covering sectors of the new economy, ensuring collective representation of non-standard workers. The second thing is to ensure that the benefits of workers are attached to the worker rather than the job. This could be done by a universal personal account, whose function would be to provide insurance against the main risks covered by social protection and to help prepare career transitions. This account could be financed by a generalized social contribution levied on all services provided through platforms, together with traditional social contributions.

ILO calls for a human-centered agenda for the future of work that protects workers. The organization appeals for a bigger investment in people's skills, education and training, and social protection, as well as for increased investment in the institutions of work. For the latter, ILO recommends the creation of a universal labor guarantee, as well as the reviving of the collective representation. It calls also for investments in human development and environment, in accordance with the UN 2030 Agenda goals (ILO 2019).

3 Demographic Change

The long-term projection of Eurostat indicates that the EU-28's population will increase by only 1.7% (8.5 million persons) between January 1, 2016, and January 1, 2080. The share of the working-age population in the EU28's total population is expected to decrease from 333.0 million persons in 2016 (65.3% of the total) to 288.4 million persons in 2080 (55.6%), representing a reduction in the working-age population during the next six and a half decades of 44.5 million persons. Even though these projections are based on constant assumptions for the whole period and

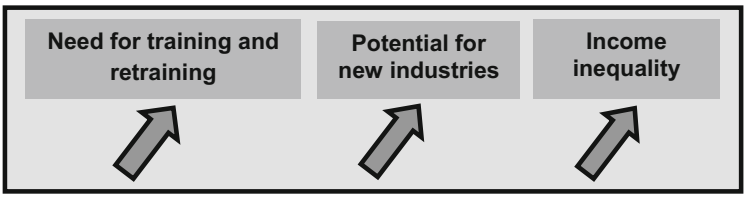

Fig. 5 Effects of demographic change in Europe on employment and jobs. Source: Author's own study

could not predict the future with certainty, they show several very important trends—the already low number of births is expected to preserve, the working-age population will fall significantly, which further increase the burden on it, and the European population will continue to age considerably. Figure 5 explores the effects of population change in the EU on its labor markets.

Due to the aging of the European population, resulting from declining fertility rates and rising life expectancy, the proportion of population aged 60 or over is likely to reach 30% of the whole population in 2050, making Europe one of the fastest aging regions in the world (UNDESA 2015). As a result of the population aging, the available labor force in the EU will decrease. However, the projections concerning the total employment rate in the EU are positive and estimate that it will increase from 71.1% in 2016 to 75.8% in 2070, due to improvements in the employment of the older people (+12.6 percentage points) and of women (+6.9 percentage points). As a result, the unemployment rate in the EU is assumed to decline by 2.2 percentage points—from 8.7% in 2016 to 6.5% in 2070 (European Commission 2017).

3.1 Need for Training and Retraining

Statistics show that in 2017, only 57% of the individuals in the EU had basic or above basic overall digital skills (European Commission 2019b), which means that a significant share of the Europeans does not have the necessary skills to adapt successfully to the digital era. The European skills and jobs survey estimates that about 85% of all jobs in the EU need at least basic digital skills (Cedefop 2014). Therefore, a growing need for basic and proficiency digital education in the EU is expected.

Other important missing skills for a big part of the Europeans are as follows: problem-solving, resilience, self-control, work in teams, social skills, economic and financial literacy, and entrepreneurship (Cedefop 2014). Lifelong learning is already a must for all, and especially for self-employed, vulnerable workers (workers at risk of automation, women in STEM, older, lower-educated, unemployed, or inactive people or under new forms of employment), who face more barriers to the labor market than the rest.

As a result, the need for education, training, and retraining throughout one's life is expected to become a must in the future. Supporting the Europeans with the right reskilling and training opportunities is expected to be very difficult for the member states. The European Commission has suggested the creation of Digital Skills Personal Learning Account, which would be an account, voucher, or credit card charged with a certain amount of money, which would represent one's personal right to attain training in digital skills. Once the individual decides to make use of the available amount, they should go through a guidance process where a first assessment of digital skills will be done to establish the baseline and initial record of digital qualification. Then training will be provided, which would be organized by public-private cross-country partnerships that ensure that the secured skills are those demanded by the market.

The role of career counseling and career guidance services for individuals in different stages of life is expected to increase in the future. It would be even more important for the big number of young people in the EU that do not have the proper information or awareness of all the training and career opportunities, as well as of their own competences, interests, and abilities.

Another challenge is to better understand why there is underinvestment in training. Underinvestment in on-the-job training is often explained by temporary misalignments between demand and supply, in large part driven by the business cycle. The increasing diversity in forms of work toward shorter contract durations (temporary help agency workers, on-call workers, contract workers, and independent contractors or freelancers) is also a factor for underinvestment in training, because there is no guarantee for the employer that it will reap the result of his investment. Therefore, policies involving third-party intermediaries that share in the costs and benefits of training are required to increase training and reduce skill gaps (European Commission 2019a).

3.2 Potential for New Industries

A positive effect of digitalization combined with the population aging in the EU is that together they may lead to the creation of new industries. On one hand, there are opportunities for new occupations as a result of the deployment of new technologies and the replacement needs of the labor market, generated by the retiring workers. On the other hand, the demand for labor is expected to increase in the sectors of social, personal, and general interest services. Big market opportunities are expected in the framework of the "silver economy" (providing products and services for the aging population) (International Labor Organization 2017).

3.3 Rising Inequality

As already mentioned above, the polarization of workforce between highly skilled, well-paid jobs and lower-paid, low-skilled ones has intensified (European Commission 2016). Digital technologies are mostly skill-biased, which makes the demand for high-skilled workers to rise, but because this rising demand is not accompanied by a similar rise in the supply of high-skilled workers, a wage premium develops for high-skilled labor relative to low-skilled labor. As a result, the wage inequality increases. Empirical evidence for job polarization process in Europe is provided by Goos et al. (2014).

The wage premium is a result of the high-skilled workers' higher productivity and their scarcity. The other end of the labor market includes low-qualified workers who do manual non-routine work. As the supply of the first group is insufficient, while the supply of the second group is abundant, the wages of the first are high and tend to rise, while the wages of the second are low and tend not to increase rapidly. The older workers are the most affected, as usually they lack the skills to reallocate into the emerging jobs that require new skills, in comparison with the young workers who can redirect their education and focus.

This trend will have further negative impact on the balance of the supply of labor, with younger workers, who are bearers of the new skills, becoming relatively scarcer. Meanwhile, the older workers with lower-skilled, low-paying occupations will increase disproportionately in coming years suggesting that the social inequality could increase further. The trends show that innovation will further polarize the workforce and increase the income and wealth inequalities. The main reason for that is that the productivity gains from technological innovation increasingly accrue to the owners of technology and the (relatively few) workers required to operate it, while the big majority of workers face stagnant real wages at best, unemployment at worst (Hilpert 2019).

In many advanced economies, including European countries, the process of job polarization has contributed to rising inequality (Acemoglu and Autor 2011). Certainly, the process of digitalization can lead to higher income quality, as the massive introduction of robots and high technologies weakens the negotiating power of workers and labor displacement threatens to push wages below the socially acceptable threshold, especially for unskilled workers (Sundararajan 2017).

Significant differences in the level and evolution of wage and income inequality between countries is evident and expected to grow. These differences partly reflect that country-specific institutions and policies that deal with the labor market consequences of digitalization (Fernández-Macías 2012). Significant factors that can prevent the creation of a low-wage sector are the existence of powerful unions, heavy payroll taxes, high minimum wages, and generous unemployment benefits. This is why, the low-wage sector grew to a bigger extent in countries where this sector is relatively unsheltered from market pressure (for example, in the United Kingdom), and less in countries with a more compressed wage distribution such as Germany, Spain, or Switzerland (European Commission 2019a).

The wide spreading of platform work is also a factor for decreasing wages and hence, to rising inequality, because jobs can be transferred among numerous independent and unprotected workers. The new forms of employment provide low workers' protection and negotiating power, as usually they are not represented in trade unions (International Labor Organization 2017). In some cases, the digital platforms allow firms to distribute working tasks among free-lance workers, who are poorly paid and unprotected.

4 Recommendations for Policies and Measures

The future of work has provoked numerous challenges to the national governments, member states, the business, and the European citizens. The further development of the digital infrastructure in the EU is very important, which makes the investment in it and R&D crucial. The second area of improvement is the sphere of education and training, where focus on STEM and lifelong learning should be put. Big efforts are needed also to develop models and policy for transitioning workers to new jobs and occupations. (2019) outlines 20 recommendations for a successful digital transition, summarizing them in five pillars: youth education, adult education, the EU's digital potential, work organization, and social support. In the sphere of youth education, the recommendations include the introduction of computer science in the secondary education; reviewing of the teaching methods with more soft skills and critical thinking and shifting to skill and competency acquisition; elimination of the delineation between general and technical education; and listing the required skills on the job market instead of degrees/diplomas in order to attract applications from a diverse skill set.

In the area of adult education, it is recommended that the universities reform their programs and shorten the initial training period so it would be easier for students to return regularly to update their skills during their on-the-job experience. There is a proposal for a system for mid-career education to be created for adults' training and retraining, as well as certification of skills learned on the job to be introduced. In addition to that, as the EU has started to lag behind, several AI hubs and super laboratories have also to be created, universities need to offer more computer science programs on AI and robotics, and a specific mobility program to attract international AI experts in the EU has to be developed.

The European Commission is making proposals concerning the need for a "new social contract upgrading the social fabric of our labor markets" (European Commission 2019a). It is particularly addressing the need for neutral social protection in the new forms of employment. On first place, it recommends the establishment of guilds covering sectors of the new economy, ensuring collective representation of non-standard workers. The second thing is to ensure that the benefits of workers are attached to the worker rather than the job. As mentioned earlier, this could be done by a universal personal account, whose function would be to provide insurance against the main risks covered by social protection and to help prepare career

transitions. This account could be financed by a generalized social contribution levied on all services provided through platforms, together with traditional social contributions.

The ILO proposal for universal labor guarantee includes the protection of the fundamental workers' rights, an adequate living wage, limits on hours of work and healthy workplaces, guaranteed social protection from birth to old age, and a universal commitment to lifelong learning that enables people to skill, reskill and upskill. It is also calling for new business incentives to encourage long-term investments and proposes the establishment of an international governance system for digital labor platforms (International Labor Organization 2019).

5 Conclusion

The future of work is not even future but present. As technological and demographic change is happening turbulently, massive advancements in technology and significant shifts in the demographics of the workforce bring new opportunities and challenges for the European economy and society. Some trends are already evident, while others are difficult to be predicted. The aim of this paper was to gain a deeper understanding of the dynamics of the future of work by exploring its major drivers—globalization, digitalization, and demographic change.

Globalization has turned from offshoring to reshoring, due to the technological progress that allows cheaper and closer to the customer industrial production. Digitalization is tightly connected with AI, automation, robotization, and leads to significant chances in the required skills and qualifications on the job market, change in jobs and occupations, and a greater diversity in the working environment. It also leads to a job loss for the low and middle-skilled workers.

Demographic change is strongly affecting the European population and leads to the need of constant training and retraining of the workforce. Together with digitalization, the population aging in the EU may lead to the creation of new industries, but they are also causing a rise in the wage and income inequality. The aim of this paper was to explore and summarize the expected economic and social effects of these three factors on the labor market in the EU, together with the leading international organizations' recommendations and proposals for action to address the challenges. Despite the different scenarios for the future of work, it is certain that in the long run, the European society needs to commit itself to excellence in education, from preschool education through high-quality secondary education to higher education, and this commitment must include not only the young, but also the adult people in the workforce, who will need to retrain and improve their skills throughout life.

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Part VII
Public Economics

Current Developments on the Economics of Happiness: Evidence from Turkey

Ayşe Özge Artekin

Abstract Happiness is a concept that changes according to individuals. However, in general terms, happiness can be expressed as an overall positive assessment of one's quality of life. The branch of economics makes happiness measurements by looking at happiness from an economic point of view and examines their relations with economic factors. Happiness economy, on the other hand, examines which factors increase or decrease the quality of welfare and life and makes inferences about this issue. The aim of this study is to examine work done related to the happiness economy and the change in happiness in detail in Turkey and is to interpret in detail the current data on this subject. For data on Turkey published regularly since 2003, "TSI Life Satisfaction Survey" results were used. The study also mentions the happiness measurement techniques and contents made today and gives the latest happiness researches of all countries in the world. Countries happiness data are compiled from the last publication of the "World Happiness Index." The study focuses on the relationship of happiness with variables such as income, employment, health, and social status, which are the determinants of happiness in the economy, and their effects on happiness.

Keywords Happiness economics · Individual welfare · Life satisfaction · Turkey

1 Introduction

The desire of happiness, which is one of the ultimate goals to be achieved in every period of life, is integrated with the search for economic prosperity and emerged as one of the developing fields in current economic researches. It is seen that the pursuit of happiness together with the economist researchers whose interest in this field has

A. Ö. Artekin (✉)
Department of Finance, Banking and Insurance, Yunak Vocational School, Selçuk University, Konya, Turkey
e-mail: aoartekin@selcuk.edu.tr

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increased recently has a close relationship with the economy rather than just being within the scope of psychology and sociology.

The happiness economy, which measures the share of economic values among the factors that cause the happiness of individuals, makes investigations on the policies that will increase the happiness of individuals. In this context, as the economy grew more rigorously and quantitatively, the more basic definitions of social welfare became valid. The happiness economy, which represents a new orientation, relies on a broader range of benefits and welfare concepts, including interconnected benefit functions, interactions between rational and nonrational effects in determining procedural benefit and economic behavior (Graham 2005).

The study consists of four sections: Introduction, Concept of Happiness and Factors Determining Happiness, Research on Happiness, Conclusion and Suggestions. In the study, recent developments in the study of the happiness economics field in the world and Turkey, literature summaries, happiness given basic information about the main determinants of happiness in economics and has been referred to the outstanding research on the subject.

It is stated that positive and negative changes in factors that determine happiness in the study (GDP-GNP, personal income, employment and inflation, sociodemographic factors, and democracy) affect the well-being of the individual. In addition, this study is the source of happiness that values in Turkey (health, love, money, success, work, power, and other factors) and people (himself, kids, mother/father, friend, nephew, grandchild, spouse, whole family, and others) contributes to the literature in terms of showing its effects with up-to-date and detailed numerical data.

2 The Concept of Happiness and Factors Determining Happiness

In general terms, happiness is the degree to which an individual judges the overall quality of his or her life as a whole in a positive way. In other words: It is the answer of "How much does a person love his life?" The term happiness is used only to describe status of the individual. Therefore, it cannot be said that a nation is collectively happy. At best, it is the case that most citizens of that country see themselves happy. Happiness includes subjectivity, it shows an individual's subjective appreciation of life. So there is no "objective" standard given for happiness. A person who thinks he's happy is happy even if he's really wrong (Veenhoven 2015).

Subjective well-being is the scientific term for happiness. It state to a relatively stable state, such as life satisfaction and emotional experiences. Therefore, subjective well-being comprises of three main components. These are the existence of positive emotions or high levels of positive effects, absence of negative emotions or low levels of negative effects, and life satisfaction. The presence of positive effects and absence of negative effects realize the affect balance and are affected by daily

events while life satisfaction express to long-term valuation of one's own life (Jain et al. 2019).

According to people who state that happiness occurs as a result of the combination of variables such as demographic, economic, physical environment, social environment, and the socioeconomic situation of the country in which they are living, there is a great affinity between happiness and satisfaction from life (Şeker 2009). However, in general, the terms "happiness," "welfare," and "life satisfaction" are used interchangeably in the literature (Frey 2008). An important mental feature that a healthy person should have is a sense of well-being, defined as: a positive and satisfying feeling involving the person and others. The happier the people are, the more confident they feel (Lee 2005).

Happiness depends on many determinants. Therefore, one of the most important tasks of happiness research is to isolate which conditions affect individual and social welfare and to what extent. It is important to emphasize that economic happiness research is not limited to the impact of economic factors on subjective well-being. In fact, one of the most important findings is that the intangible aspects of a person's life—especially the social relations between family members, friends, and neighbors—are important. Happiness research tries to quantitatively determine the relative importance of genetic, personality, sociodemographic, economic, cultural, and political factors. Genetic and personality factors that determine subjective well-being are largely outside the scope of economics. Nevertheless, it is important because the precision of the econometric estimates of the effects of other determinants is important because it depends on the possible confounding role of personality differences. However, it is important to remember that happiness has its own cultural definitions and that motivations and predictions of happiness may vary between cultures (Frey 2008). The factors determining happiness are summarized as follows.

2.1 GDP-GNP

It can be stated that the main purpose of the science of economics is to increase the well-being of individuals. Gross domestic product (GDP) and gross national product (GNP), which concern all segments of an economy, are directly related to the welfare levels of countries. The main criticism against the use of GDP, which is seen as a measure of the progress of societies, is that greater material prosperity will not always bring happiness to individuals (Uğur 2019). Deciding whether economic growth increases happiness is a personal choice and it is difficult to make concrete arguments. Economic growth has many benefits, such as increased consumption. Consumers benefit from consuming more goods and services. Consumption in the economy is related to service, so as more and more goods are consumed, it leads to higher services that provide greater prosperity. Furthermore, economic growth is normally associated with improved public services. Improved health services can improve quality of life by treating diseases and increasing life expectancy. Increased educational standards can provide the population with a wider range of skills and

literacy. In this sense, there will be more happiness in economies. Finally, in the event of unemployment and poverty reduction, economic growth helps reduce unemployment by creating jobs. This is important because unemployment is the main source of social problems such as crime and alienation, which in turn creates unhappiness (Whynes 2018).

2.2 Personal Income

Personal income refers to the total incomes of all individuals or households in a country. Personal income may consist of a number of sources, including salaries, wages, and bonuses received as employment or self-employment. Some of those are: dividends and distributions received from investments; rent income from real estate investments and profit sharing from enterprises (Mankiw 2014).

Economists have thoroughly analyzed the relationship between income and happiness. Income rises with roughly balancing effects on welfare. Individual income is closely related to professional status. Paid work is firmly linked to the lower level of stress and depression, as well as higher levels of satisfaction and self-esteem (Thoits 1986). With increasing income, people will have access to better health services, improve their human capital, or be able to spend on cultural activities. An income that meets the expectation level of the person will create an increase in happiness.

2.3 Employment and Inflation

The other two major economic variables, unemployment and inflation, have an impact on happiness (Frey and Stutzer 2000). A recent trend is to appear an increasing number of employers who at least start to invest in management practices and services that claim to care about the happiness of their employees and aim to create and maintain a happy workforce. One reason for this is the expectation that happy employees will be more productive in their jobs. However, it remains unclear whether this belief is based on solid empirical evidence or rather an example of "management mythology" (Bellet et al. 2020). In most studies, it is accepted that the study constitutes an important part of happiness. For some people, it is true that working increases their happiness through personal satisfaction; reduces their happiness by increasing stress and anxiety for others. The state of happiness will vary depending on a person's work situation, such as regular or unusual employment. However, the situation is not so simple, because the purpose of the study may vary between individuals. Treatment may vary between education and the way it works (regular and non-regular). In this sense, it is meaningful to investigate the status of happiness by focusing on the work situation (Frey 2008; Yılmaz 2018).

There are certain costs of unemployment. Individuals want to work for themselves because the value of the next best alternative time of use is lower than the value of their work, and therefore accepts it as the output of society as a whole. These are the economic or financial costs of unemployment. However, these costs are not the only costs of unemployment. The social or nonmoral costs stem from the fact that unemployment deprives individuals not only of wages, but also of the moral benefits of the work. Studies prove that work is a very important determinant for the well-being of people. The most evident evidence of this statement is the detrimental effects of individuals that lead to a negative loss of income when they become unemployed. Some of these nonpecuniary costs arise as external costs to other family members. The loss of one's identity, purpose in society, and the relationship with others is defined as the main reasons for this non-spiritual unemployment cost (Winkelmann and Winkelmann 1995).

Individuals also have a strong dissatisfaction with inflation and are ready to bear significant costs to avoid it. One percent of inflation corresponds to a welfare cost of about 2% of per capita income (Frey and Stutzer 2000). Therefore, since the decrease in inflation rates will increase the welfare level, it has a positive effect on the happiness level of individuals.

2.4 Sociodemographic Factors

There are many other factors that affect the well-being of the individual and the happiness of the individual and which attract the attention of the economists. This applies not only to economic variables such as income, employment, and inflation, but also to sociodemographic characteristics such as gender, educational level, age, marital status, and belief. For example; Botwin et al. (1997), in different studies, emphasized that unmarried people are happier than divorced ones and married people are happier than unmarried people.

The results of another sociodemographic factor, education level, indicate that happiness is not related to higher education level. Therefore, programs and expenditures that emphasize only to lead to an improved educational structure may not be very effective in conveying more happiness to the public (Anwar and Asif 2016). Eryılmaz and Ercan (2011) state that happiness increases with age and does not fall after a certain age in some studies. In some studies, it is concluded that the subjective well-being levels of individuals in adolescence and advanced adulthood age groups are higher than those in middle adulthood age groups. In other words, there is no clear situation regarding the relationship between happiness and age.

2.5 Democracy

Another factor of happiness is related to the institutional (or constitutional) conditions in which democracy and federalism are of paramount importance in an economy and society. As far as we know, the impact of the scope and design of democratic and federal institutions on subjective well-being is best described (Frey and Stutzer 2000). From the point of view of utilitarian tradition, the state is seen as a device that respects the happiness of individuals. With regard to the principle of "greatest happiness," the ultimate goal of any government should be to ensure the happiness of the greatest number in society. From the point of view of utilitarian thinking, democracy is seen as a valuable political process with its instrumental role in ensuring the happiness of individuals. According to John Stuart Mill, democracy is the system that provides the most favorable political environment for freedoms by preserving diversity and is also the most favorable system for individual and social interests and happiness (Bayram 2014).

3 Research on Happiness

As happiness begins to be measured, the course of happiness can be monitored over time. Particularly in early approaches, it was believed that people would not be able to fully know their level of happiness, even if they knew it. Today, however, it is believed that people have a healthy idea about their happiness and can express it correctly (Veenhoven and Dumludağ 2015). Extensive research has been made over the years and has been made by countless researchers, making great progress in measuring benefit. It is possible to measure individual benefits satisfactorily using representative surveys. With the help of a single question or several questions, it has become possible to determine the satisfaction or happiness assessments of individuals (Frey and Stutzer 2000). Table 1 gives brief information about the names of some happiness measurement techniques and their contents.

However, it is a problem to see the same country in various rankings in different studies conducted throughout the world or in the country. Achieving different results as a result of the studies carried out on behalf of the same country may be related to the declaration based measure. Another consequence of this kind of research is the social diversity of the criteria and requirements of being happy. Such values and criteria, which differ from individual to individual, are highly likely to differ between countries. In this context, the concept of happiness to be questioned with the same questions prevents reaching the right results everywhere. For this reason, significant differences emerge in the rankings described (Yılmaz 2018).

Table 1 Happiness measurement techniques

Happiness measurement techniques	Contents
The Oxford Happiness Questionnaire	This technique was designed in the late 1980s to measure individual happiness. Accordingly, happiness includes three main components: frequency of positive affect or joy, high level of life satisfaction experienced in a certain life process, and lack of negative emotions such as anger, anxiety, and fear.
Cantril Ladder	The scale takes values between 0 and 10. The number 10 represents the perfect life, while the number 0 represents the worst. The evaluation is based on the number 5.
General Health Questionnaire	The purpose of the survey is to determine the psychiatric problems and to determine the level of happiness. As a result of the questionnaire, individuals are categorized as Caseness points, which represent a score between 0 and 12. Individuals with a score of 0 are expressed as "almost stressful." Individuals with a score of 12 are defined as "very stressful."
World Values Survey	The aim is to reveal the transformation of the basic values of the people in developed industrial societies. Special areas such as the meaning of life, family life, and happiness are evaluated here. In individual face-to-face meetings, "are you generally happy these days?" and "how satisfied are you with your life in general when you consider all the possibilities?" questions are asked.
Satisfaction with Life Scale	This scale is designed to measure life satisfaction. The scale consists of five items and the scores that can be obtained from the scale vary between 5 and 35. It is requested that individuals evaluate the five different questions within the scope of this survey. Individuals score these five questions as "strongly agree" 7 and "strongly disagree" 1.
Eurobarometer Survey	The Eurobarometer Survey started in 1972 and carried out studies covering the European Union countries. Consequently, with the increase in the number of member states, it has conducted research on a wider scale. The answers of this questionnaire are 4-scale.
Happy Planet Index	The purpose of this index is to measure sustainable welfare for all. It explains the success of countries in achieving long, happy, and sustainable lives. The index is obtained by dividing the sum of welfare data, average life expectancy, and inequality percentages of a country by the ecological footprint expressed in global hectares per person.
World Happiness Report	In the report, which deals with the final happiness based on six factors: per capita GDP, healthy life expectancy, social support, trust, perceived freedom, and generosity are used.
Gross National Happiness	The first country in the world to develop alternative data instead of Gross National Product is the Kingdom of Bhutan. When calculating this measurement method; 9 parameters such as living standards, health, education, good governance, ecological difference and flexibility, time use, psychological well-being, cultural difference and flexibility, and social communication are used.

Source: Table has been compiled from Küçüksucu and Konya (2017)

3.1 Happiness Researches in the World

In the international literature, "happiness" studies can go back a long way, but from a long-term perspective, it can be said that interest in the issue has increased in the near term. The increasing interest of economists in the recent period has played a major role in this increase. Economists have also started to show interest in "happiness" which has been under the science of psychology for a long time, and this has caused a significant increase in happiness studies. According to the study by Veenhoven and Dumludağ (2015), the number of studies in this field in the 1970s was very small, but after that date there was a rapid increase and in 2010 approximately 300 publications appeared.

Contextually, the concept of happiness varies between cultures and therefore countries. In Western culture, individuals try to find happiness through an independent institution. However, in East Asia, culture defines happiness as a balance between self and others (Jain et al. 2019). However, since states and institutions determine happiness and satisfaction indicators according to certain scales and pay more attention, the report on this issue is accepted globally. Thus, satisfaction surveys are conducted worldwide. A state should aim to increase the satisfaction and happiness of its citizens. Therefore, it should measure how many people in the country are satisfied with the services provided and expand its focus to increase their level of satisfaction (Bulut 2020).

The distribution of happiness around the world can be evaluated in which regions the happy countries and the unhappy are concentrated. Accordingly, the between countries distribution of happiness based on the world happiness data set is shown in Table 2. In the table, the countries are listed between the numbers 1 and 156. Accordingly, values close to 1 indicate the highest happiness, while values approaching 156 indicate the lowest happiness level.

When the table is evaluated in general, among the highest happiness levels: Finland, Denmark, Norway, Iceland, Netherlands, Switzerland, Sweden, New Zealand, Canada, Austria, Australia, Costa Rica, Israel, Luxembourg, England, Ireland, Germany, Belgium, Czechia, United Arab Emirates, Malta, Mexico, France, and Taiwan. Countries in the African continent have significantly lower levels of happiness than other countries. The last ten countries with the lowest levels of happiness are: South Sudan, Central African Republic, Afghanistan, Tanzania, Rwanda, Yemen, Malawi, Syria, Botswana, and Haiti.

3.2 Happiness Researches in Turkey

Almost every time when people pursued, which aims to achieve a final "happiness" recently written in Turkey, it comes up frequently in the visual and social media. In particular, the results of the "Life Satisfaction Survey," which has been regularly conducted by TUIK since 2003, have been shared with the public, resulting in

Table 2 World happiness index (2019)

Countries	Rank[a]	WHI[b]	Countries	Rank	WHI	Countries	Rank	WHI
Finland	1	7.769	South Korea	54	5.895	Albania	107	4.719
Denmark	2	7.600	Estonia	55	5.893	Venezuela	108	4.707
Norway	3	7.554	Jamaica	56	5.890	Cambodia	109	4.700
Iceland	4	7.494	Mauritius	57	5.888	State of Palestine	110	4.696
Netherlands	5	7.488	Japan	58	5.886	Senegal	111	4.681
Switzerland	6	7.480	Honduras	59	5.860	Somalia	112	4.668
Sweden	7	7.343	Kazakhstan	60	5.809	Namibia	113	4.639
New Zealand	8	7.307	Bolivia	61	5.779	Niger	114	4.628
Canada	9	7.278	Hungary	62	5.758	Burkina Faso	115	4.587
Austria	10	7.246	Paraguay	63	5.743	Armenia	116	4.559
Australia	11	7.228	Peru	65	5.697	Iran	117	4.548
Costa Rica	12	7.167	Portugal	66	5.693	Guinea	118	4.534
Israel	13	7.139	Pakistan	67	5.653	Georgia	119	4.519
Luxembourg	14	7.090	Russia	68	5.648	The Gambia	120	4.516
United Kingdom	15	7.054	Philippines	69	5.631	Kenya	121	4.509
Ireland	16	7.021	Serbia	70	5.603	Mauritania	122	4.490
Germany	17	6.985	Moldova	71	5.529	Mozambique	123	4.466
Belgium	18	6.923	Libya	72	5.525	Tunisia	124	4.461
United States	19	6.892	Montenegro	73	5.523	Bangladesh	125	4.456
Czech Republic	20	6.852	Tajikistan	74	5.467	Iraq	126	4.437
United Arab Emirates	21	6.825	Croatia	75	5.432	DR Congo	127	4.418
Malta	22	6.726	Hong Kong	76	5.430	Mali	128	4.390
Mexico	23	6.595	Dominican Republic	77	5.425	Sierra Leone	129	4.374
France	24	6.592	Bosnia Herzegovina	78	5.386	Sri Lanka	130	4.366
Taiwan	25	6.446	Turkey	79	5.373	Burma–Myanmar	131	4.360
Chile	26	6.444	Malaysia	80	5.339	Chad	132	4.350
Guatemala	27	6.436	Belarus	81	5.323	Ukraine	133	4.332
Saudi Arabia	28	6.375	Greece	82	5.287	Ethiopia	134	4.286
Qatar	29	6.374	Mongolia	83	5.285	Swaziland	135	4.212
Spain	30	6.354	North Macedonia	84	5.274	Uganda	136	4.189
Panama	31	6.321	Nigeria	85	5.265	Egypt	137	4.166
Brazil	32	6.300	Kyrgyzstan	86	5.261	Zambia	138	4.107
Uruguay	33	6.293	Turkmenistan	87	5.247	Togo	139	4.085
Singapore	34	6.262	Algeria	88	5.211	India	140	4.015
El Salvador	35	6.253	Azerbaijan	90	5.208	Liberia	141	3.975
Italy	36	6.223	Morocco	89	5.208	Comoros	142	3.973

(continued)

Table 2 (continued)

Countries	Rank[a]	WHI[b]	Countries	Rank	WHI	Countries	Rank	WHI
Bahrain	37	6.199	Lebanon	91	5.197	Madagascar	143	3.933
Slovakia	38	6.198	Indonesia	92	5.192	Lesotho	144	3.802
Trinidad Tobago	39	6.192	China	93	5.191	Burundi	145	3.775
Poland	40	6.182	Vietnam	94	5.175	Zimbabwe	146	3.663
Uzbekistan	41	6.174	Bhutan	95	5.082	Haiti	147	3.597
Lithuania	42	6.149	Cameroon	96	5.044	Botswana	148	3.488
Colombia	43	6.125	Bulgaria	97	5.011	Syria	149	3.462
Slovenia	44	6.118	Ghana	98	4.996	Malawi	150	3.410
Nicaragua	45	6.105	Ivory Coast	99	4.944	Yemen	151	3.380
Argentina	47	6.086	Nepal	100	4.913	Rwanda	152	3.334
Romania	48	6.070	Jordan	101	4.906	Tanzania	153	3.231
Cyprus	49	6.046	Benin	102	4.883	Afghanistan	154	3.203
Ecuador	50	6.028	Republic of the Congo	103	4.812	Central African Republic	155	3.083
Kuwait	51	6.021	Gabon	104	4.799	South Sudan	156	2.853
Thailand	52	6.008	Laos	105	4.796			
Latvia	53	5.940	South Africa	106	4.722			

Source: Table has been compiled from WHI (2020)
[a]World Happiness Ranking, [b]World Happiness Index

increased interest in the findings and discussions about the data. Although not as much in the public interest, recently also seen a significant increase in happiness studies at the academic level in Turkey (Veenhoven and Dumludağ 2015). Table 3 shows the general level of happiness published between the years of 2003 and 2019 in Turkey.

TUIK Life Satisfaction Survey was conducted for the first time in 2013 at provincial level. Research by going to Turkey across the 125,720 households, age 18 and above made in face to face interviews with 196,203 members, has involved the services of all municipalities in the general municipal services and public services are under provincial boundaries. While the rate of those who stated the general happiness level as happy in 2003 was 59.6%, this rate continued almost the same in the following years but fell to the band of 53% according to the statistics published in 2009 and 2019 when the effects of the crisis were felt in two different years. However, while the rate of those who stated that general happiness level was unhappy was 7.3% in 2003, this ratio increased to 13.06% in 2019. Therefore, there is a 7.23 point negative increase between the first and last data of the very happy and happy ones in the general happiness level and a negative increase of 5.81 points in the total data of the unhappy and very unhappy ones. Table 2 general happiness levels in Turkey after analyzing the 2000 economic crisis, when viewed in a stepwise manner, provided the economic recovery can easily see that reflected positively on society. With the 2003 election, it can be said that the coalition periods ended and the

Table 3 Turkey general happiness level, 2003–2019 (%)

	Very happy	Happy	Moderate	Unhappy	Very unhappy
2003	12.01	47.57	33.17	5.6	1.65
2004	9.35	48.73	29.77	9.54	2.61
2005	9.14	48.49	29.52	9.92	2.94
2006	8.78	49.05	30.29	9.05	2.84
2007	8.71	51.48	28.75	8.84	2.22
2008	8.23	47.52	30.34	11.43	2.47
2009	7.67	46.62	31.11	11.5	3.1
2010	9.16	51.99	28.09	8.75	2.0
2011	8.53	53.57	28.02	7.99	1.89
2012	8.5	52.45	28.89	8.32	1.84
2013	9.57	49.45	30.23	8.17	2.58
2014	8.07	48.19	32.01	8.9	2.83
2015	7.95	48.65	32.02	8.83	2.56
2016	7.56	53.77	28.26	8.84	1.57
2017	7.23	50.81	30.91	8.94	2.11
2018	6.9	46.47	34.53	9.73	2.38
2019	6.61	45.74	34.58	9.93	3.13

Source: TUIK (2020)

confidence environment was reestablished with the government that continued alone.

In 2005, the development of large-scale real estate projects supported by publicly owned TOKI and Emlak GYO, the provision of longer-term loans by the public and private banks on the loan side, large public infrastructure investments, and the mortgage law system enacted in 2007 enabled the sector to drive the economy and an intensive construction work started throughout the country. When this situation caused a rapid rise in asset prices, shopping malls and consumption oriented structures were formed in each province. When the growth rates of the country increased, the expenditure level of the society increased and positive effects started to be seen in the happiness index in general.

The effects of the economic crisis in the United States have attracted developing countries around the world as low interest and monetary expansion. Low interest seems to have plenty of money to influence spending and contribute to the development of Turkey's real estate market. On the other hand, positive developments in the European integration process and extensive consultation period, to begin the opening of chapters, Turkey's insistence in the EU of dedication to the common society and perceived positive foreign investors, direct and indirect foreign investments in Turkey have rapidly increased.

On the political side, it can be said that the solution processes for terrorism problem, which started in 2005 and continued until 2009, also created satisfaction and expectation in the positive sense of society. While the improvements towards economic and social problems were felt in the happiness index, the Ergenekon cases

that started in 2007 after the so-called e-memorandum were the developments that worried the country's agenda. Very happy level declined to happy level in future years. There was an increase in the unhappy population. With the beginning of the arrests in 2009, it can be said that the decrease in the happiness index had a relative effect.

Happiness indices peaked in 2012 despite all kinds of economic and political agendas and developments. "Happy" approaching 53% and "Very unhappy" (1.84%), which reached its lowest point, decreased despite the optimistic developments in the first half of 2013. The political and military agendas followed by periodic attacks in the happiness indices point to deterioration in general.

Turkey's general happiness level, the overall level of happiness after evaluating the latest figures and developments have been published on this subject is necessary to examine the differences by gender. Table 4 shows the levels of happiness divided by gender.

The proportions shown in Table 4 show that more than half of the men and women are generally happy. It is seen that men are relatively unhappy in Turkish society compared to women. The reason for this situation: women's low level of participation in business life and women's share of distressed situations more easily. It is a known fact that in Turkish society traditionally women share more problems with each other. In terms of males, the low level of education and the more rigid model of behavior imposed on the family by men can be considered as factors that may increase unhappiness relatively. There are some values that make individuals happy. These values may include health, love, money, success, work, power, or other. Table 5 shows the values that Turkey sees as the source of happiness of individuals.

In Table 5, it is not difficult to say that the result is very suitable for human nature. Health represents the most important contribution to individual happiness. Those without health reported a significant reduction in life satisfaction. This is especially the case of disability which seriously reduces the welfare of the individual (Eyunni 2011). It can be thought that it is very important to stay healthy in the rapidly changing economic, military, and political environments and to receive health services with unstable and surprise developments. The fact that the sum of health and love values is at the level of 90% indicates that the society's financial expectations are not very high. Other values may be considered to be sufficient to have a certain level.

Although the value of money given in Table 4 is low among other factors, it is important that individuals are satisfied with the income levels entering their homes to spend. In Table 6, the level of satisfaction of individuals from monthly household income is given as a percentage.

Table 6 shows that dissatisfaction in income distribution is high and does not change chronically proportionally. It can be said that social conflict and disruption will accelerate if the ratio increases in the dissatisfied and very dissatisfied column. In Table 4, we examined the values that are the source of happiness. In Table 7 percentage as a ratio of happiness resource persons of individuals in Turkey it is shown.

Table 4 Turkey separation of general happiness levels by gender, 2003–2019 (%)

	Very happy		Happy		Moderate		Unhappy		Very unhappy	
	Woman	Man	Woman	Man	Woman	Man	Woman	Man	Woman	Man
2003	11.6	12.42	49.42	45.72	32.19	34.15	4.97	6.22	1.82	1.49
2004	10.22	8.45	51.24	46.17	27.64	31.95	8.4	10.71	2.5	2.72
2005	10.27	7.99	50.19	46.75	28.13	30.94	8.58	11.28	2.84	3.03
2006	9.93	7.6	50.52	47.56	28.53	32.09	7.89	10.23	3.14	2.52
2007	9.78	7.61	52.32	50.62	27.26	30.27	8.42	9.27	2.22	2.22
2008	9.07	7.35	48.7	46.29	29.99	30.7	9.39	13.56	2.84	2.09
2009	8.88	6.38	49.23	43.85	29.63	32.68	9.48	13.65	2.79	3.44
2010	9.68	8.62	53	50.95	27.31	28.91	7.62	9.93	2.39	1.59
2011	9.21	7.81	55.36	51.7	26.16	29.96	7.25	8.77	2.02	1.76
2012	9.11	7.87	53.68	51.17	28.15	29.65	7.18	9.51	1.88	1.8
2013	10.06	9.05	51.8	47.03	28.5	32.01	7.27	9.1	2.36	2.8
2014	8.53	7.61	51.91	44.35	29.19	34.91	7.61	10.22	2.75	2.92
2015	8.9	6.96	51.27	45.94	29.79	34.31	7.59	10.11	2.45	2.67
2016	8.2	6.9	56.32	51.16	26.35	30.22	7.52	10.2	1.61	1.52
2017	8.35	6.08	54	47.54	28.06	33.83	7.77	10.14	1.82	2.41
2018	7.97	5.8	49.06	43.81	32.73	36.38	8.13	11.36	2.11	2.65
2019	7.13	6.07	49.88	41.48	32.18	37.06	8.36	11.54	2.44	3.84

Source: TUIK (2020)

Table 5 Resource happiness of individuals in Turkey the values, 2004–2019 (%)

	Health		Love		Money		Success		Work		Power		Others	
	Woman	Man	Woman	Man	Woman	Man	Woman	Man	Woman	Man	Woman	Man	Woman	Man
2004	72.43	61.61	16.61	12.51	4.21	8.11	3.39	8.78	1.97	6.71	0.79	1.24	0.6	1.04
2005	74.43	63.9	13.14	10.58	4.05	7.83	3.25	7.69	3.17	6.84	0.93	1.79	1.03	1.39
2006	76.08	67.98	13.04	9.36	3.49	5.86	4.12	8.61	1.9	5.95	0.79	1.04	0.59	1.2
2007	72.48	64.76	15.88	11.04	4.53	8.27	4.04	8.71	1.59	4.23	1.21	2.11	0.26	0.86
2008	75.89	66.12	12.46	11.1	4.23	7.23	3.55	7.26	2.4	5.35	0.88	1.56	0.59	1.37
2009	76.02	64.92	14.25	12.09	3.72	6.83	3.97	9.35	1.32	5.91	–	–	0.71	0.89
2010	76.15	66.03	14.27	11.57	3.65	5.67	3.71	10.12	1.58	5.47	–	–	0.65	1.14
2011	77.44	67.92	13.11	13.04	3.26	5.34	4.43	9.37	1.08	3.7	–	–	0.67	0.63
2012	74.17	67.26	15.65	11.8	3.62	6.6	4.28	9.12	1.67	4.62	–	–	0.62	0.6
2013	72.19	63.71	16.35	13.96	3.03	5.29	5.72	11.52	1.31	3.35	–	–	1.39	2.18
2014	73.45	63.91	16.84	13.89	2.76	5.76	4.96	12.21	1.45	2.91	–	–	0.55	1.32
2015	72.54	64.85	17.21	14.28	2.75	5.04	5.62	11.59	1.26	2.82	–	–	0.63	1.42
2016	75.15	69.04	15.98	13.17	2.18	4.18	4.95	9.09	1.15	3.48	–	–	0.59	1.05
2017	71.82	64.12	17.89	15.21	2.51	5.34	6	12.02	1.34	2.47	–	–	0.44	0.84
2018	73.28	64.59	16.51	14.54	2.85	5.58	5.73	11.99	1.47	3.03	–	–	0.15	0.27
2019	73.29	66.34	15.16	13.45	3.2	5.15	6.73	11.69	1.34	2.95	–	–	0.28	0.42

Source: TUIK (2020)

Table 6 Monthly household income level from satisfaction in Turkey, 2003–2019 (%)

	Very satisfied	Satisfied	Moderate	Dissatisfied	Very dissatisfied
2003	1.44	18.27	42.02	25.08	13.19
2004	1.98	29.18	26.38	31.8	10.67
2005	1.95	28.14	25.51	31.57	12.83
2006	1.7	31.63	24.56	31.04	11.08
2007	2.22	34.58	23.91	30.12	9.17
2008	1.63	30.48	26.26	31.53	10.1
2009	2.44	29.02	25.78	32.92	9.85
2010	2.15	35.64	25.24	30.72	6.25
2011	2.58	34.91	26.57	29.7	6.24
2012	1.9	36.57	25.52	29.71	6.3
2013	1.95	42	20.07	28.96	7.02
2014	1.64	39.27	20.78	30.02	8.29
2015	1.66	39.01	22.84	30.12	6.38
2016	1.69	44.38	21.85	27.46	4.61
2017	1.62	43.73	20.5	29	5.14
2018	1.97	37.83	22.91	30.38	6.9
2019	2.28	37.88	22.53	29.73	7.58

Source: TUIK (2020)

In Table 7, it is possible to understand the importance of having families and children in Turkish society as a source of happiness. Although it changes proportionally in all societies, the concept of family is a very important structure that makes people happy. In the table, the rate of individuals' happiness towards their spouses started to decrease rapidly in 14 years. This situation suggests that the relationship between men and women in society has started to deteriorate and expectations have changed. This can be confirmed by the average number of divorces going up to 140 thousand annually and continuing to increase each year. Starting from the industrial revolution, the increasing trend in divorce understanding with the increase of participation of women in working life, the scale of Turkey seems to have accelerated after 2000. It is also possible to confirm this situation from the structure of the construction sector which produces smaller houses. It can be thought that since the mid-1900s, the self-centered understanding of life, which started in western societies, the mass media, the Internet, and the spread of various mystical concepts began to influence Turkish society since the 2000s.

4 Conclusion and Suggestions

Happiness reflects people's satisfaction with life. Happiness research allowed us to investigate problems using numerical data. We cannot solve the problem without knowing it. Therefore, happiness research has given us concrete data and in this way,

Table 7 Source of happiness individuals in Turkey persons, 2004–2019 (%)

	Himself	Kids	Mother/father	Friend (s)	Nephew(s)	Grandchildren	Spouse	Whole family	Others
2004	2.02	13.2	3.14	1.16	0.26	1.77	8.15	69.51	0.79
2005	1.72	13.86	3.11	1.38	0.22	1.66	9.31	68.15	0.6
2006	1.52	13.96	3.79	1.58	0.3	1.49	9.37	67.3	0.69
2007	2.16	12.03	3.61	0.9	0.26	1.62	9.32	69.54	0.54
2008	1.99	14.04	3.08	1.3	0.33	1.65	7.19	70.08	0.33
2009	2.42	12.69	3.15	1.13	0.24	1.45	6.87	71.17	0.89
2010	1.89	13.24	3.11	1.12	0.35	1.19	7.48	70.87	0.76
2011	1.79	12.16	2.86	0.94	0.29	1.4	6.17	73.79	0.61
2012	2.22	13.91	3.45	0.97	0.14	1.99	7.03	69.6	0.7
2013	2.5	12.86	2.88	0.79	0.23	1.66	5.19	73.03	0.86
2014	1.87	13.35	3.08	1.12	0.24	1.42	4.95	73.26	0.69
2015	2.75	13.13	2.76	0.83	0.25	1.88	5.31	72.28	0.82
2016	2.71	15.07	3.64	0.96	0.28	1.92	4.73	70.22	0.46
2017	3.42	14.31	3.19	0.75	0.26	1.89	5.35	70.59	0.23
2018	3.33	12.9	2.73	0.77	0.39	1.82	3.62	74.17	0.27
2019	3.77	12.85	2.46	0.75	0.28	1.59	3.69	74.1	0.5

Source: TUIK (2020)

we have obtained visible and available data. Determinants of happiness are: income, employment, inflation, sociodemographic characteristics (such as gender, age, education, marital status, belief), and democracy. Positive or negative changes in these factors affect individual welfare.

When we look at the distribution of happiness in the world, it is seen that the happiness value scissors among countries is quite clear. Accordingly, the between countries distribution of happiness based on the world happiness data set is shown in Table 2. In the table, the countries are listed between the numbers 1 and 156. Accordingly, values close to 1 indicate the highest happiness, while values approaching 156 indicate the lowest happiness level. When the table is evaluated in general, among the highest happiness levels: Finland, Denmark, Norway, Iceland, Netherlands, Switzerland, Sweden, New Zealand, Canada, Austria, Australia, Costa Rica, Israel, Luxembourg, England, Ireland, Germany, Belgium, Czechia, United Arab Emirates, Malta, Mexico, France, and Taiwan. Countries in the African continent have significantly lower levels of happiness than other countries. The last ten countries with the lowest levels of happiness are; South Sudan, Central African Republic, Afghanistan, Tanzania, Rwanda, Yemen, Malawi, Syria, Botswana, and Haiti. In addition, in the table, it is seen that small countries such as Finland, Denmark, and Norway are happier than big countries. In some countries with low levels of happiness, stresses such as economic, political, social, and war are observed like Syria and Afghanistan.

When we look at Turkey's general happiness it arises figures some results. In the happiness index in Table 3, it can be considered that the rate of benefiting from Gross National Product is very high. Considering that the 17-year process in the Very Happy group generally ranges between 7% and 9.5%, it would be more accurate to evaluate 2003 by excluding 2003 (12%) for a realistic analysis. The fluctuation of 2.5 points appears to be proportionally high in the 16-year period, which ranges from 7% to 9.5%. It is possible to think that in the very happy segments there can be a rapid recovery and deterioration against the economic and political developments, where the capital moves rapidly and the period fashion is creating new rich and very happy segments.

In Table 3, the Happy and the Middle Happy can be considered to represent the broader strata of the society and reflect the happiness index of the middle class. The apparent index here is the range of proportional variation, varying with an average of 6.5% and 7%. Here, it can be thought that the society accepts that any situation experienced is a part of life and that it continues to live by adapting to the change in life with the effect of belief system. This situation is directly related to the history, cultural life, traditions, life perception, and belief system of Turkish society.

In the measurements mentioned in Table 3 as Unhappy and Very Unhappy, it is seen that between 9% and 13% of the population has problems due to various reasons and this rate does not change much. Although the rate of change is between 1.5% and 3.5%, it is understood that around 10% of the population is unhappy during the period examined. It would not be surprising to think that those who have low levels of education and who do not get what they desire from sociocultural and social life are gathered in this section.

Considering the sources causing the happiness of individuals in Turkey shows that; the total value of health and love at almost 90%. This ratio means that the society's financial expectations are not very high and it can be considered that the values such as money, success, and work are sufficient to be at a certain level unless they threaten the health and happiness of the people. When we look at the individuals who see persons as a source of happiness, it is possible to understand the importance of having families and children in Turkish society. Although it changes proportionally in all societies, the concept of family is a very important structure that makes you happy.

As a result, it is thought that Turkish society is happy in general and eliminates negativity in life by expecting good things from life. In addition, when we examine the statistical deviations related to happiness and satisfaction, it is possible to see that the society can react delayed. It is also believed that the resulting economic, political, and military agenda and developments are reflected in the daily life of the members of the society. The fact that a society with high social solidarity reacts only to the negativities affecting itself can be explained by the inadequacy of that society's educational infrastructure. This is a wide area that can be a separate research topic.

On the other hand, when we look at the impact of macroeconomic factors on happiness, it is seen that happiness is affected by income, employment status, and inflation. Therefore, considering the assumption that happiness is related to a strong economy, the economy of the country needs to be strengthened and the income spread to the base. We cannot say that individuals having more income have a direct effect on the increase in happiness. Therefore, more comprehensive studies can be conducted on the relationship between income and happiness based on one's working environment and other factors.

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Circular Economy: New Opportunities for Growth

Nikolay Sterev and Vania Ivanova

Abstract Circular economy's approach attracts a lot of followers nowadays. It mobilizes not just public authorities, but the social responsible business as well. Although circular economy (CE) was established as strategy for clean environment, it overpassed the need of recycling and waste management mechanisms. It covers new business models that generate added value through optimizing the resource's and energy's inputs not by single company but by the whole added value chain. Transition to a circular economy is based on reducing not just the waste but the primary recourses as well as increasing of waste reuses. Circular economy actions are closely linked to key EU priorities, including jobs, growth, climate, and energy. The goal of the paper is to explore the opportunities from application of the circular economy principles for forcing up not just economic growth but improving quality of life. The used methods are as follows: descriptive, quantitative, and qualitative analysis of main indicators of circular economy, statistical analysis of the business model: production level—resources productivity—waste generation—circularity rate—investments in circular economy subsectors. As the analysis shows heterogeneity among EU countries in application of the circular economy approach, there is different speed of transferring economic growth from linear to circular subsectors. There is proved that some of the EU economies are fully linear and they delay real shift between linear and circular business models. Bulgaria needs as soon as possible to enforce the acceptance of newer CE strategy that covers the road from LE to CE. The main conclusion is to set new institutional measures for those EU economies that had to shift between linear and circular business models.

Keywords Circular economy · Resource productivity · Waste management · Economic growth · Bulgaria · EU

N. Sterev
Industrial Business Department, UNWE-Sofia, Sofia, Bulgaria

V. Ivanova (✉)
Economics Department, UNWE-Sofia, Sofia, Bulgaria

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1 Introduction

The awareness of the consequences of the industrial development of the world economy in the last 150 years and the effects of applying a linear model of development (yield-production-consumption-waste) has led to the imperative need for transformation of the model. The increasing consumption of resources and the environmental consequences it causes require a change in the economic model. The concept of a circular economy (CE) is part of this change. It mobilizes the efforts not only of public authorities involved in sustainable development, but also of companies aiming at better economic, social, and environmental development. A CE refers to the ability of an economy to grow while the use of resources is decreasing. The switch to a circular model aims to achieve "dematerialization"—an absolute or relative reduction in the amount of materials used and in the amount of waste.

Most of the business practices applied so far are about achieving more with less expense. In contrast, the CE relies on its reuse. At the base of this concept is the effort to maximize the benefit of an already created product throughout its entire life cycle.

The analyses from the Ellen MacArthur Foundation (EMF), as well as from the McKinsey Centre for Business and Environment (EMF and McKinsey 2015), estimate that by 2030, consumption of new materials may decline by 32% and by 2050 by 53%. Primary raw materials can be replaced by secondary ones in a number of industries—construction, automotive, chemical fertilizers, synthetic materials, fuels, and energy from non-renewable sources, etc. According to the UN Environment Program (UNEP 2011), the transition to a CE can eliminate up to 100 million tons of waste worldwide by 2020.

Among many of the definitions of the concept and various aspects of considering it, this paper adopts the definition given by ADEME (2014) that "a circular economy is an economic system of exchange and production in which at every stage of the life cycle of the product (good or service) is intended to increase resource efficiency and reduce environmental impact while ensuring the well-being of individuals" (p. 4). This definition puts an emphasis on the economic aspect of the CE. The ambition is to move toward a model that includes not only recycling, but overall better use of resources, by changing production and consumption patterns, extending product lifecycle, imposing eco-design as a reuse concept and recycling.

The core of the idea of circularity is the question of resources, the optimization of production methods, and the change in the pattern of consumption. Various studies in the scientific literature indicate that the CE is economically justified (Liu and Bai 2014) and is certainly a model combining sustainability and profit (Ivanova and Slavova 2019). In addition to the purely economic benefits, adopting this new model also brings additional benefits related to the challenges of biodiversity, combating urban air pollution or soil pollution (Boring 2019), as well as improving the quality of life.

Growth based on extracting more and more resources and discarding them thereafter is doomed. In its development, the current linear model objectively places

Table 1 Linear economy versus circular economy

Linear economy (LE)	Circular economy (CE)
Excessive consumption	Sustainable consumption
Inefficient waste management	Aiming for zero waste
Resource depletion	Resource optimization
Environmental imbalances	Ecological balance

Source: Author's systematization

limits on economic growth opportunities. In an exhaustive world with scarce resources, this growth could not take place without affecting its very base—the natural capital (Constanza et al. 2012). This inevitably requires a reversal of perspective (Constanza 1991), changing the model with a new one, and adopting the principle of systematic and connectivity of different systems. This idea formed the basis of industrial ecology as early as the 1980s (Erkman 1998; Billen et al. 1983). The need for transformation and transition to an industrial ecosystem, with optimized consumption of resources and energy, replicating biological ecosystems by analogy (Frosch and Gallopoulos 1989), becomes an inevitable imperative of the future economic model. The search for new, sustainable business practices (Graedel and Allenby 1994) implies a gradual and consistent transition from a linear to a circular economy. Table 1 outlines the main features of the two models.

The idea of closing the loop on the use of resources and on turning waste into a resource has been institutionalized at European level in a number of documents. Starting from EU Communication (EC 2014a, b) and ending with the Circular Economy Action Plan adopted in 2015 and complementing it later with the Circular economy package (EC 2018) and Monitoring Framework on progress toward a circular economy.

All these documents are not about giving up the idea of growth. The debate is about the type of growth and the achievement of certain quantitative indicators related to the utilization of primary resources, the use of secondary resources and energy, and the minimization of waste. The perception of the model in its totality and as a system encompasses three main areas of activity—production, consumption, and waste, interconnected so that each stage "feeds" the next (Europesworld 2014). The CE comprises seven pillars (Fig. 1) and covers the entire product life cycle.

Along with the implementation of new industrial practices, saving primary resources, and changing the eco-design of products, the CE model also requires a change in consumer behavior and the adoption of practices that prolong the use of products (as well as their reuse). There is still a widespread perception that the CE is a production concept. This is an important aspect and progress in this direction must lead to the greening of the economy. But it is equally important to develop new levers to facilitate the transition to sustainable territorial development (Marichova 2018) and the construction of a new type of ecosystem. A shared economy, a functional economy, dematerialization, and the promotion of the use of services are vectors of an economic model adapted to the needs of the future.

One of the biggest challenges at the moment is how to break away from dominated of the pursuit of growth model, in order to meet the social needs of

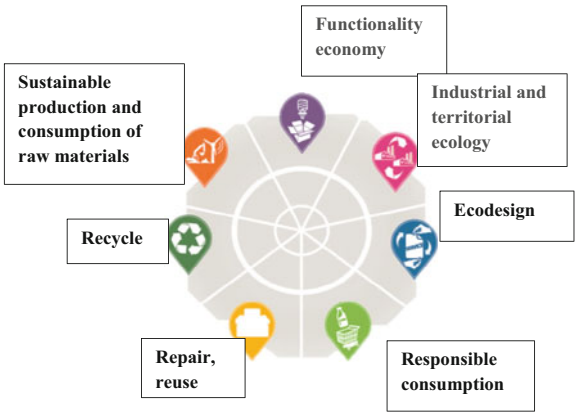

Fig. 1 Fundamental pillars of the circular economy. Source: Adapted from ADEME (2014)

society and how to replace the current predatory exploitation of natural resources with new, more effective, resource-efficient, and ecologically responsible model. The CE provides the basic guidance on what needs to be done to significantly reduce the long-term dependence of the economy and to go forward to overcoming the scarcity of non-renewable natural resources. It offers important solutions, especially for manufacturing and design skills, new business models, cycle building skills, and cross-industry collaboration.

2 Research Methodology

The purpose of the paper is to explore the opportunities from application of the circular economy principles for forcing up not just economic growth but improving quality of life. The dataset is from Eurostat for the period 2008–2016. The Key Performance Indicators (KPIs) of the CE refer to metric measurement of the reference CE policy and its performance significance. The definition of CE is not unified. Similar for the KPIs for the circularity of the economy. So, there is no single KPI set to metric the CE performance.

As the main understanding of CE is "refuse-rethink-reduce," the main circular KPIs are given as a set of the Global goals (UNDP 2016) that includes as follows: Sustainable Consumption and Production, Sustainable Management and Use of Natural Resources, Responsible Management of Chemicals and Waste, Substantially Reduce Waste Generation, and etc. The CE goal is based on management the gap between environmental changes goals and economic growth goal. The goal means: less resources per production unit and less environmental harm of resource usage (Fig. 2).

Nevertheless, it looks like easy to present the metrics of CE, but basically there are no single indices that express the level of the circularity of the economy system neither any of its levels: nano-, micro-, mezzo-, or macro-level. Saidani et al. (2019)

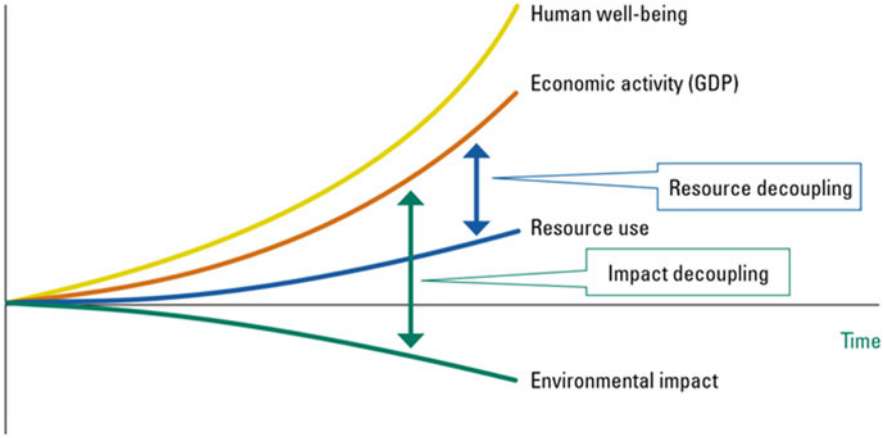

Fig. 2 Long-term sustainability of production and consumption patterns. Source: UNEP (2011, p. xiii)

Table 2 CE KPIs sets

Indicator set	Advocated by	Characteristic/data source	Number of indicators
Sustainable development indicators	UNEP	Major global environmental issues	10
Sustainable development goals	UNDP	End poverty, fight inequality and injustice, and tackle climate change	17
Little green data book	World Bank	Environment and sustainability	50
Green growth indicators	OECD	Environment, resources, economic and policy response	25–30
Economy-wide material flow	Eurostat	Focused on material flows	6
Resource efficiency	Eurostat	EU resource efficiency scoreboard	32
Circular economy indicator	Ellen MacArthur foundation (EMF)	Indicators currently available	7

Source: EASAC (2016)

make a try to explore different CE indicators but there is open space for discussion about their efficiency at usage. From the practical point of view, there are at least 8 different sets of CE KPIs that are used by different institutions (World Bank (2016), OECD (2014), EC (2015) (Table 2).

Moraga et al. (2019) make comparison of different indices for metric the circularity of the micro-level by summary of different authors indices (Table 3).

In summary, according to different KPIs sets we could summarize some of the most common field of CE metrics:

- Environmental and resource productivity (incl. resource usage at different Life Cycle Thinking (LCT) (see WBCSD 2018)

Table 3 Micro-level CE KPIs indicators

	Physical properties from the technological cycles	Physical properties from the technological cycles with LCT approach (EMF 2015a, b)	Cause-and-effect modeling with/ without LCT
Refuse, rethink, reduce			
Reuse, refurbish, remanufacture products		Total restored products Material circularity Indicator	Sustainable circular index
Reuse, repurpose components		Total restored products	Sustainable circular index
Recycle, down cycle materials	Recycling process efficiency rate Recycling input rate	Material circularity Indicator	Circular economy index Sustainable circular index
Energy recovery		Material circularity Indicator	Sustainable circular index
Waste generation		Longevity Material circularity Indicator	Sustainable circular index

Source: Moraga et al. (2019)

- Social and environmental sustainability and health
- Natural resource flows (biodiversity, Energy and green gas emissions, Water and sanitation)
- Waste generation

One of the metric sets of CE indices includes 10 indicators based on LCT concept accordingly to the goal of the European Commission for sustaining European economy (Eurostat 2015). Among them we found:

- EU self-sufficiency for raw material (% key materials used in EU that are produced within EU)
- Waste generation (waste generation per capita/per GDP unit)
- Overall recycling rate (% municipal waste)
- Contribution of recycled materials to raw materials demand (% secondary raw material on overall raw material demand)
- Trade in recyclable raw materials (imports and exports of selected recyclable raw materials) and etc.

The indices that are included in the EC CE KPI set cover economic activity inside CE sectors: recycling sector, repair and reuse sector, and rental and leasing sector. The main CE indices that are researched include:

- The CE economic model indices (code: cei_cie010). Their definition is according the Structural Business Statistics (SBS) framework and cover:
  - Value added at factor costs.
  - Production value;

  - Gross Domestic Product (GDP) (code: tipsau10)

- The CE waste and eco-efficiency (code: cei_pc031): The indicator measures the waste collected by or on behalf of municipal authorities and disposed of through the waste management system. It consists to a large extent of waste generated by households, though similar wastes from sources such as commerce, offices, and public institutions may be included.
- The CE Recycle Rate (code: cei_wm011): The indicator measures the share of recycled municipal waste in the total municipal waste generation. Recycling includes material recycling, composting, and anaerobic digestion. The ratio is expressed in percent (%) as both terms are measured in the same unit, namely tonnes.
- The CE recyclable waste trade (code: cei_srm020): measures the quantities of selected waste categories and by-products that are shipped between the EU Members States (intra-EU) and across the EU borders (extra-EU). The indicator includes the following variables—Intra EU trade of recyclable raw materials (measured as the Imports from EU countries) and Imports from non-EU countries and exports to non-EU countries of recyclable raw materials (as regards extra-EU trade).

2.1 The Econometric Approach

The analysis of circular economy contribution to the economic growth is based on the classical approach summarized by Foster et al. (1998), Aw et al. (1997), Haas et al. (2015) and Griliches and Regev (1995), Baily et al. (1992), and others (see Kopeva et al. 2012, 2013). Traditionally, the industrial growth is covered by the national induce of Total factor productivity (TFP) or labor productivity (LP). The classic approach of growth states that TFP growth is result of the impact of different production factors as it is given by Cobb-Douglas, respectively:

$$\text{TFP} = Y = A \cdot K^{\alpha} \cdot L^{\beta}, \text{ where } (\alpha + \beta = 1), \tag{1}$$

where Y—Output

A—measures economic growth (Technology effect, innovations, knowledge, development of economy, level of democracy, etc.), basically measured by Hicks' index.

K—Capital input

L—Labor input

α, β—measures (output elasticity) of capital/labor; and $0 < \alpha < 1$; $0 < \beta < 1$

Solow (1956) and Swan (1956) enriched the Cobb-Douglas's model as adding two new elements inputs and additional factors. According to this contribution, the TFP production function explains the classical Schumpeter's entrepreneurial

approach as the entrepreneurial business is not limited in exchanging different independent variables to the production process as "labor," capital, goods and materials, new technologies, and etc.

$$\mathrm{TFP} = Y = A \cdot K \cdot L \cdot R \cdot M, \tag{2}$$

where R—Inputs
M—additional factors,
So, analysis of the growth model of the recycling sectors is based on next indices:

- Dependent value: TFP of circular sectors—GDP or Production value of circular sectors (PV);
- Independent variable: Labor force of circular economy—Number of persons employed in circular economy;
- Independent variable: Capital inputs into circular economy—Gross investment in tangible goods in circular economy;
- Independent variable: Material and goods inputs into circular economy—Value added at factor costs in circular economy.

Secondly, the growth of circular economy could by additionally developed if the first derivative is used to analyze the additional factor of circular economy. Then, the change of Production of circular sectors will be dependant by the different factors of the circular economy (see KPIs if Table 3).

$$\Delta\mathrm{TFP} = \Delta Y = B \cdot \sum M_i, \tag{3}$$

where B—measures change of productivity factors
M_i—set of i additional circular factors,
The statistical expectation of the change of TFP could be presented as logarithmic function as follows:

$$\ln\mathrm{TFP} = \ln Y = b_0 + b_1 \ln M_1 + b_2 \ln M_2 + \ldots + b_k \ln M_k + \varepsilon. \tag{4}$$

And the single impact of any i additional variables to the growth could be explained as:

$$\ln\mathrm{TFP} = \ln Y = B_i + b_i \ln M_i + \varepsilon_i. \tag{5}$$

Based on the EUROSTAT Resource efficiency scoreboard (see Table 2), three main additional circular factors are found:

M_1—Generation of municipal waste,
M_2—Recycling rate of municipal waste,
M_3—Trade in recyclable raw materials.

Defining the dependence coefficient (resp. b_i in Formula 5), the evolution of Circular Economy Application could be found in accordance to the model that is

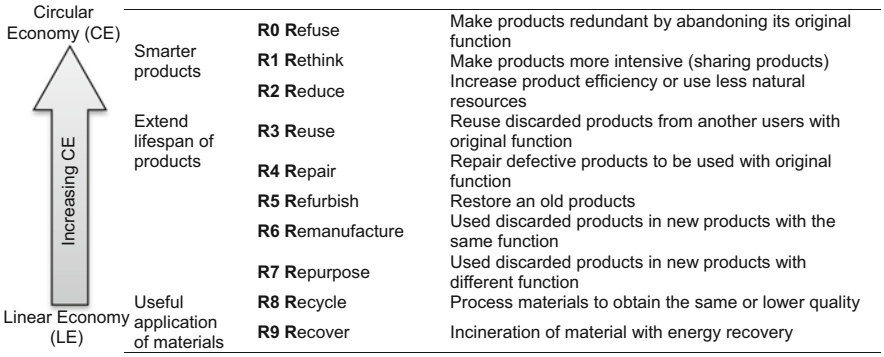

Fig. 3 9R CE business model framework. Source: Adaptation of Potting et al. (2017, p. 5)

proposed by Potting et al. (2017, p. 5) and developed by Kirchherr et al. (2017) (Fig. 3).

2.2 The Dataset and Hypotheses

Data analysis covers Bulgarian economy for the period 2008–2016. The comparative analysis is done by comparison CE KPI indices between Bulgaria (new member state and first Cluster group) and EU member states: United Kingdom, Denmark, Spain, Italy, Austria (old member states and third Cluster group), Poland, Romania (new member states and second Cluster group), Finland, and Sweden (old member states and second Cluster group)[1] (see Ivanova and Chipeva 2019).

The main Figures for Bulgaria are presented at Table 4.

According to the data table, we could define two main hypotheses about CE KPIs change and dependence for the Bulgarian case:

H1: The economic growth at national level (resp. Growth of GDP and PV) is fully dependent of the growth of the CE sectors: recycling sector, repair and reuse sector, and rental and leasing sector (resp. VA, GITG and Emp of the sectors).

H2: The economic growth at national level (resp. Growth of GDP and PV) is fully dependent of the change of the CE activities: Waste collection (MuW), Recycle Rate (RR), and Recycle trade (TrRRM).

[1]Based on the outcomes for both years under study (2014–2016), three clusters are drawn with different number of countries within each one, corresponding to three models of transition to circular economy. Cluster 1 includes Bulgaria and Estonia, Cluster 2 includes 12 countries which, with few exceptions, are the majority of the new Member States, and Cluster 3, comprising 14 countries, covers mainly old Member States and three new Member States that joined EU after 2004.

Table 4 Macro-level CE KPIs indicators for Bulgaria (2008–2016)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Value added at factor cost (Mio euro)—*VA*	501.6	352.4	441.4	452.8	459.2	440.7	486.7	520.9	539.1
Gross investment in tangible goods (Mio euro)—*GITG*			110.5				105.5	80.5	86.9
Number of persons employed—*Emp*	60,612	60,407	62,184	63,235	62,956	62,394	60,097	59,173	60,952
Production value (million euro)—*PV*	30091.7	24196.1	26717.8	31065.7	32,660	32740.6	32439.6	33813.9	34187.1
Gross domestic product (*GDP*) at market prices—annual data euro	37199.5	37317.1	38229.96	41291.42	41946.59	41857.47	42823.76	45287.78	48127.9
Generation of municipal waste per capita (*MuW*)	599	598	554	508	460	432	442	419	404
Recycling rate of municipal waste (*RR*)	19.4	19.9	24.5	26.2	25	28.5	23.1	29.4	31.8
Trade in recyclable raw materials (*TrRRM*)	44,635	33,775	55,489	77,928	77,645	69,688	78,582	87,442	101,140

Source: Eurostat (2019)

Table 5 Correlation indices for macro-level CE KPIs indicators for Bulgaria (2008–2016)

	GDP	Prod	RR	MuW	TrRRM	Year
VA	0.688 (0.040)	0.809** (0.008)	0.534 (0.138)	−0.582 (0.100)	0.725* (0.027)	0.606 (0.083)
GITG	0.423 (0.257)	0.165 (0.672)	0.333 (0.382)	−0.364 (0.336)	0.408 (0.275)	0.515 (0.156)
Emp	−0.181 (0.641)	−0.029 (0.941)	0.097 (0.803)	0.053 (0.893)	0.027 (0.945)	−0.239 (0.536)
GDP	1	0.824** (0.006)	0.876** (0.002)	−0.923** (0.000)	0.952** (0.000)	0.966** (0.000)
Prod		1	0.706* (0.033)	−0.869** (0.002)	0.876** (0.002)	0.789* (0.012)
RR			1	−0.852** (0.004)	0.864** (0.003)	0.848** (0.004)
MuW				1	−0.919** (0.000)	−0.963** (0.000)
TrRRM					1	0.910** (0.001)

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
(0.138)—*p*-value of the correlation coefficients
Source: Eurostat (2019) and our calculation

3 Results and Discussion

According to defined hypothesis, the verification of *H1* needs to find out confirmation of high correlation between Growth of GDP and Production Value (PV) as dependent variables and their structural independent elements: Value added at factor cost (VA), Gross investment in tangible goods (GITG), and Number of persons employed (Emp) and respectively, additional factors as Generation of municipal waste per capita (MuW) and Trade in recyclable raw materials (TrRRM)—formula 2.

According to defined hypothesis, the verification of *H2* needs to find out confirmation of high correlation between Growth of GDP, Production Value (PV), and Recycling rate of municipal waste (RR) as dependent variables and their structural elements: Generation of municipal waste per capita (MuW) and Trade in recyclable raw materials (TrRRM)—Formula 5

Based on the given figures for main circular economy's variables (Table 4), the found two hypotheses could be verified (H1 in light gray and H2 in dark gray) by correlation analysis by using Formula 4 and Formula 5. Main figures of the correlation indices are presented at Table 5.

The data analysis shows that there not enough sufficient evidences to confirm the *H1*, but the *H2* is verified. According to the *H1*, just Value added of CE sectors grows significantly with the growth of GDP or PV. Gross Investments in CE sectors either the Number of CE employees forms the growth of Bulgarian GDP or Production value (Fig. 4). The R^2 is over 0.70 that explain above 70% of cases.

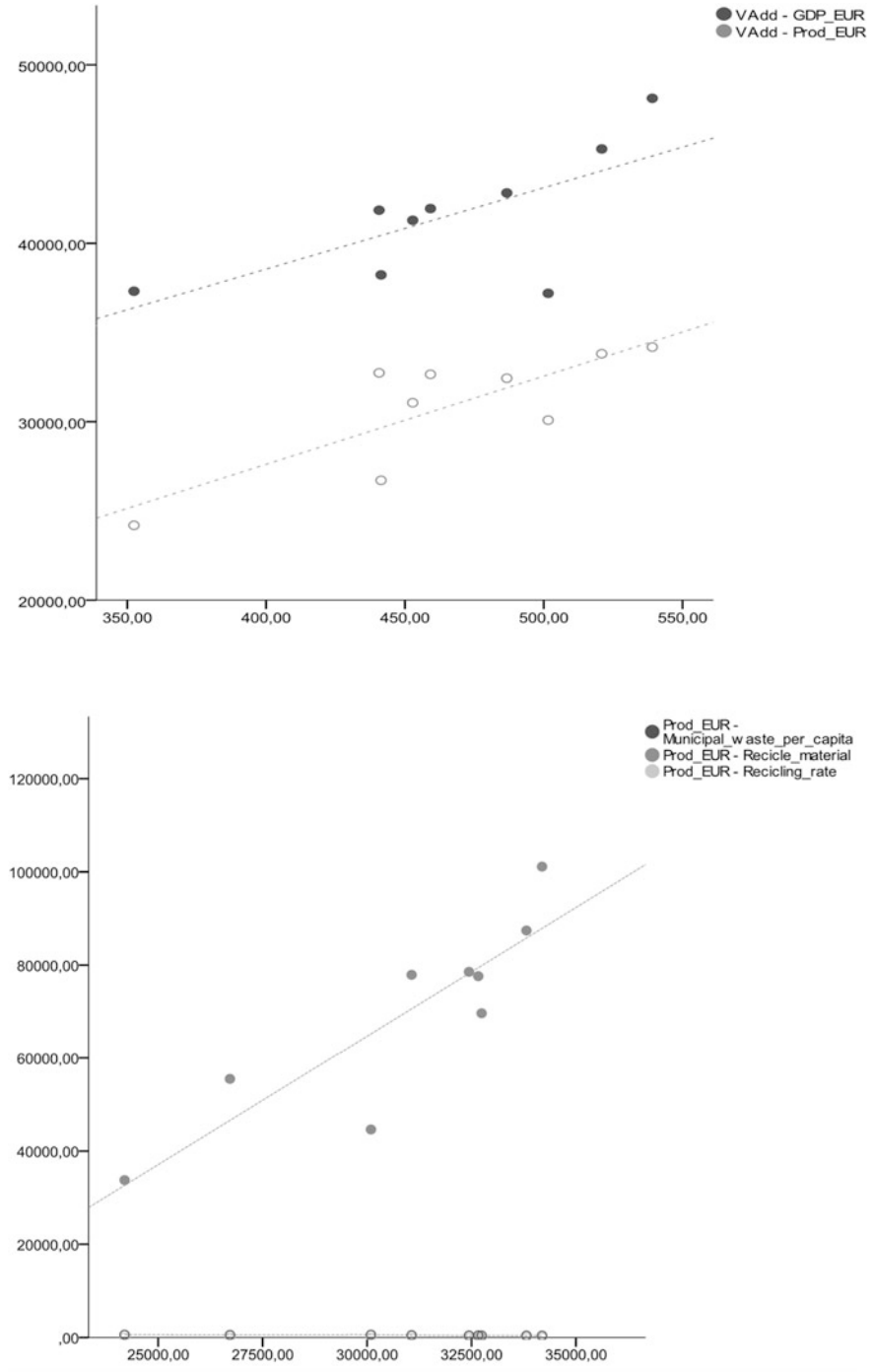

Fig. 4 Dependence ratio of H1 (top) and H2 (bottom) verification. Source: Eurostat (2019) and our calculation

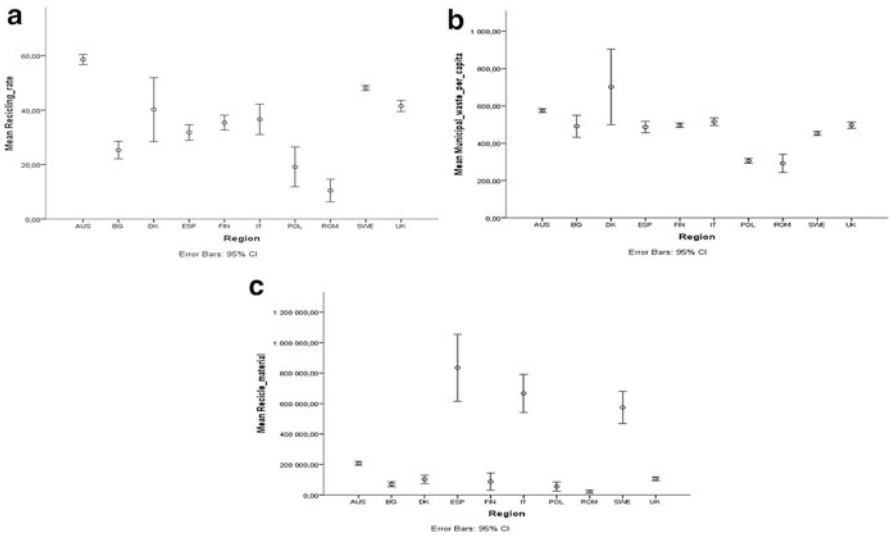

Fig. 5 (**a**) Change of CE KPIs (recycling rate) for EU member states. (**b**) Change of CE KPIs (municipal waste) for EU member states. (**c**) Change of CE KPIs (recycle materials) for EU member states. Source: Eurostat (2019) and our calculation

The figures (Fig. 4, top) show that 0.768 of change of Production Value of Bulgarian Economy as well as 0.463 of change of GDP are based on the change of Added Value of the CE sectors. The figures of dependence ratio are less than 1, so we could summarize that Bulgaria economy is not enough circular, as well as the added value of the CE sectors are not enough sufficient to enforce the growth of GDP on national level in Bulgaria.

Checking the *H2* (Fig. 4, bottom), the 0.478 of change of Production value of Bulgarian economy is result of Recycling Rate as well as −0.648 is result of Municipality Waste and 0.295 is result of Trade with recyclable materials. Although the small change of recycling in Bulgaria is provided with the growth of economy, the rate of Municipality rate by capita decreases as the packaging is less waste producing one. The Bulgarian figures could be better but it's more important where the country is placed with other EU member states (Fig. 5).

The figures show that Bulgaria is at the bottom of CE KPIs in comparison with the other EU member states. This conclusion is based on the big difference and staying behind the Austria, Denmark, Italy, and Spain in all three KPIs. Although the Bulgarian figures are better than Poland and Romanian ones, the CE level is close to Finland and UK (except Recycling rate) ones. The difference between EU regions is obvious as the Fig. 6 shows.

The best countries with the better impact of CE KPIs change on the growth of Production value are as follows: Italy, UK, and Spain; at the middle are as follows: Finland, Austria, and Poland; and at the bottom is just Bulgaria! Further proves for *H2* is made by CARTREG analysis. The analysis is done by 90 cases (74 valid cases)

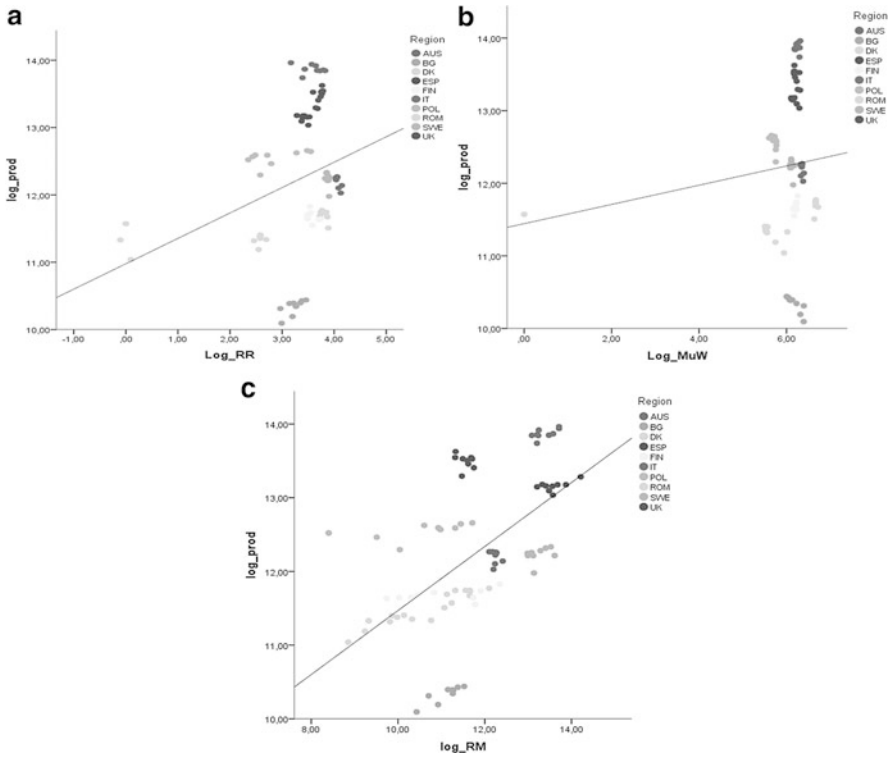

Fig. 6 (**a**) Dependence of production growth by CE KPIs (recycling rate) for EU member states. (**b**) Dependence of Production growth by CE KPIs (municipal waste) for EU member states. (**c**) Dependence of Production growth by CE KPIs (recycle materials) for EU member states. Source: Eurostat (2019) and our calculation

with verification of the model: $r^2(74) = 0.961$, $p = 0.039 < 0.05$. The statistical results are given the next:

- There was a significant main effect for treatment, $F(8, 89) = 11.904$, $p = 0.000$.
- Recycled rate significantly predicted depression scores to Production Value, $\beta = 0.538$, $F(8, 89) = 8.122$, $p = 0.000 < 0.001$.
- Municipality Waste also significantly predicted depression scores to Production Value, $\beta = -0.538$, $F(8, 89) = 8.111$, $p = 0.001$.
- Recycled Materials also significantly predicted depression scores to Production Value, $\beta = 0.560$, $F(8, 89) = 35.089$, $p = 0.000 < 0.001$.

Comparison with the Bulgarian dependence coefficient, the EU members' states are much better as the importance of the CE KPIs is almost one and the same.

In summary, there is a significant dependence between industry production growth and change of the CE KPIs. Thus, the EU economies are following the EU

strategy for CE with some slight exceptions. Unfortunately, Bulgaria is falling upon those exceptions as:

- The lowest dependence rate between growth indices and CE KPIs;
- Totally independent development of different measures to better CE KPIs as the waste management is one of the best managed one;
- Recycling rates as well as trade of recyclable raw materials are not enough sufficient to enforce the Value Added of Recycling sectors (much more than 1.00 for EU and less than 1.00 for Bulgaria).

4 Conclusion and Recommendations

The different progress in the process of transition once again confirms the rationale behind forming separate groups of countries achieving integration with each other at a different speed. Some progress is noticeable toward more circular trends in production, such as in waste generation. There is, however, considerable potential for reducing the differences of performance across Member States and types of materials. Waste generation as a whole indicates a positive development, but still with much room for improvement and dissimilarities both among Member States, and across waste flows.

The lesson learned from successful experiences is that the transition toward CE comes from the involvement of all actors of the society and their capacity to link and create suitable collaboration and exchange patterns. The transition toward a CE requires fundamental changes to production and consumption systems, going well beyond resource efficiency and recycling waste. Current actions to stimulate and monitor the transition, however, primarily focus on materials, which is not surprising, as the circular economy vision has evolved as a solution to the waste problem, and current policy and business tools focus on waste or materials. The shift from product-based to service-based business models is another promising development. Well-tailored governance and finance mechanisms, including innovation incentives, will be required to turn these niche activities into mainstream economic models.

Bulgarian case shows that the shift from LE to CE is on the first to stages of application of materials: Recover and Recycle. But nevertheless the growth of Recycled materials, the share of recycled waste is 2 times below the average European level. At the same time, the trade of recycled material, as a result of Reuse and Rethink, is more than 7 times less. The real business model change from LE to CE approaches could be more easily done in Bulgaria with promotion of the lessons learnt by the developed countries. And the best practices, that could be multiplied in Bulgaria, covers 3 main CE business strategies models: 1. Regenerate, Exchange, and Loop; 2. Optimize and Loop, and 3. Share (Product life extension).

Thus, Bulgaria needs as soon as possible to enforce the acceptance of newer CE strategy that covers the road from LE to CE.

There is a need for a new, more global and integrated vision, in which the role of the state is to promote the change of behavior of business entities, risk management, and the introduction of new rules and regulators. Only this way, the conditions for a genuinely successful model an environmentally friendly economy would be created. Realizing this is a new challenge both for the implementation of the circular economy model and for the need for another type of macroeconomic policy and regulation.

In order to build and succeed with such a model, several successive steps are needed:

- Developing a strategy and long-term goals. It should be more complex and comprehensive and go beyond the now-developed National Waste Management Plan (2014–2020).
- Launching and enforcing the idea of eco-design. In this direction, the promotion of good practices will mobilize businesses and promote a more radical change in production models. Industry organizations, BCC, and professional organizations would be very important here.
- Encourage (including with economic incentives) projects related to technological process innovation, new products, and materials leading to "greening" of industrial productions and prolonging the product lifecycle.
- Creating a favorable environment for increasing the interest in separate waste collection by both consumers and producers. This facilitates the input of quality material into recycling plants and significantly improves the efficiency of the process.

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Comparative Portfolio Analysis of Selected Sovereign Wealth Funds and Case of Turkey

Ayse Akdam Peker

Abstract After World War II, the number of SWF increased due to higher number of countries with foreign trade surplus by precious mines and energy exports. The countries with goods and service exports and foreign trade surplus used SWF to spread these organizations. Turkey has started to parlay the financial assets of the state by establishing Turkey Wealth Fund Management in 2016, although there is no reasonable resource to establish the asset fund. Since there is no economic surplus, public institutions operating on the market have been transferred to the Turkish Asset Fund for financing. Turkey Wealth Fund's financial sources consist of only noncommodity (public companies' surplus—some of which have negative profit) assets. From this aspect, this paper aims to compare and analyze the funding and investment methods of selected sovereign wealth funds. To clarify the question, top 10 wealth funds in the world and Turkey Wealth Fund are compared in terms of asset size and transparency index. Also, Temasek of Singapore is used as specific example for Turkey Wealth Fund due to its resemblance. Conclusions are that in order to be successful wealth fund, Turkey Wealth Fund needs better transparency, credibility, and auditability. At current situation and structure, Turkey Wealth Fund does not meet the specific conditions like counterparts around the world.

Keywords Sovereign Wealth Funds · Turkey Wealth Fund · Noncommodity funds · International investment

1 Introduction

Sovereign wealth funds (SWFs) are in operation all around the World, especially in countries with current account surplus. Monetary resources of those SWFs have various economical surpluses. An economy with budget surplus may decide to

A. Akdam Peker (✉)
Department of Land and Registry, College of Land and Registry, Ankara Haci Bayram Veli University, Ankara, Turkey
e-mail: ayse.akdam@hbv.edu.tr

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transfer this surplus to SWF in order to finance savings and investments rather than allocating to consumption. Similarly, an economy with current account surplus may choose to accumulate the surplus rather than injecting to economy. The importance of SWFs can be seen better, especially during economic crisis and other financial fluctuations. Decreased consumption—and income for sure—during economic crisis, can be compensated by sources of SWFs. The functions of SWFs may not be seen unless required. SWFs can be classified into two categories: (1) commodity and (2) noncommodity. Commodity-oriented income generally means crude oil and natural gas export that creates current account surplus. Noncommodity-oriented income can be privatization income of SOE (State-owned enterprises), saving funds, exchange reserves, and foreign trade surplus.

As a new initiative, questions raised with the establishment of Turkey Wealth Fund. We will try to answer the question of "which fund is this wealth fund is going to manage?" by finding examples of the same kind of wealth funds. To reach a conclusion, we will simply explain the wealth funds and their purposes. Then, we will give necessary information on Turkey Wealth Fund, emphasize the inadequacies, and compare with a successful example.

2 Sovereign Wealth Funds

Wealth funds are specialized investment funds, which are owned by state with growth in terms of both number and portfolio size. The history of SWFs can be dated back to the 1950s. The first practice of SWFs is Kuwait Investment Institute Wealth Fund, founded in 1953. Progressively, the importance of SWFs is increased and spread to global economy (Quadrio and Miceli 2010). National Wealth Fund (NWF) concept is defined by Sovereign Wealth Fund Institute (SWFI) as "State-owned investment fund or entity that is commonly established from balance of payments surpluses, official foreign currency operations, the proceeds of privatizations, governmental transfer payments, fiscal surpluses, and/or receipts resulting from resource exports" (Sovereign Wealth Fund Institute 2014: 4). In accordance with definition, the scope of NWF is diversified by source of capital (Sovereign Wealth Fund Institute 2014). The source of capital is diversified according to the way of creation of economic surplus.

SWFs can be classified into two categories: (1) commodity and (2) noncommodity. Commodity-oriented income generally means crude oil and natural gas export that creates current account surplus. Noncommodity-oriented income can be privatization income of SOE (State-owned enterprises), saving funds, exchange reserves, and foreign trade surplus. Economies like Saudi Arabia, Kuwait, UAE, Qatar, Norway, and Russia are example for commodity-based funds, whereas China, Hong Kong, and Singapore are example for enormous foreign trade surplus-oriented funds (SETA 2016).

3 Purposes of Wealth Funds and Operation Fields

Wealth funds may have different functions depending on the purposes of the government, which is the governor of the fund. Each state may have different needs, targets, and fund management strategies in accordance with fund source (Akbulak and Akbulak 2008). In terms of accumulating long-term investment capacity, the relationship between capital accumulation and economic growth can make a difference especially for developing and undeveloped countries. Also, wealth funds may function like central banks against internal or external financial shocks. Major and strategic investment projects are also within the operation field of wealth funds. It can be concluded that wealth funds are operating in the intersection set of monetary and fiscal policy.

Table 1 shows the economic and special targets of wealth funds. One of the properties of the economies of those wealth funds that draws attention is the development level of the countries. In short terms, basic targets of the wealth funds are (1) valuating the savings effectively and (2) compensating the consumption during economic crisis, decreasing the imbalances in the economy, endorsing

Table 1 Targets and operation fields of wealth funds

Economic target	Special target	Description	Country
Saving Growth and sustaining the national wealth	Balancing intergeneration wealth	Transforming nonrenewable resources to various financial assets and endorsing to future generations	Norway Kuwait
	Financing the future liabilities	Sustaining and raising the value of the capital	Australia New Zealand
	Reserve investments	Valuating excess reserves in high yielding financial assets and avoiding capital cost	China South Korea
Stability Macroeconomic policies and sustaining economic stability	Fiscal stabilization	Compensating the effects of internal and external shocks and stabilizing price level	Chile
	Stabilizing interest rates	Using fund reserves against hot money flux	Russia
		Easing the fluctuations of interest rate in long-term	Mexico
Economic development Financing investments to increase the long-term productivity	Infrastructure investments	Energy, communication, transportation, and water investments	Nigeria
	Enhancing social structure	Augmenting human capital and institutions and investing in health, education, and socioeconomic projects	UAE
	Industrial policies	Creating economic diversity and increasing productivity in strategic industries	Singapore France

Source: SETA (2016)

Table 2 Largest sovereign wealth fund rankings by total assets

Ranking	Country	Fund	Foundation	Total assets ($ billion)	Transparency Index
1.	Norway	Norway Government Pension Fund Global	1990	1,108.17	10
2.	China	China Investment Corporation	2007	941.41	7
3.	United Arab Emirates	Abu Dhabi Investment Authority	1976	696.66	6
4.	Kuwait	Kuwait Investment Authority	1953	592.00	6
5.	China	Hong Kong Monetary Authority Investment Portfolio	1935	509.35	8
6.	Singapore	GIC Private Limited	1981	440.00	7
7.	China	National Council for Social Security Fund	2000	437.90	5
8.	China	SAFE Investment Company	1997	417.84	4
9.	Singapore	Temasek Holdings	1974	375.38	10
10.	Saudi Arabia	Public Investment Fund	1971	320	7
28.	*Turkey*	*Turkey Wealth Fund*	*2016*	*40*	*N/A*

Source: Sovereign Wealth Fund Institute (2019a, b)

the present prosperity to future generations, and increasing the international influence of the state (Guzel et al. 2017).

Considering not only economically but also ethically, the financial sources of wealth funds create income at present. However, the progress cannot be guaranteed, especially the economies that mostly rely on natural resources. In these kinds of nonrenewable resource-based societies, future generations cannot benefit from the natural resources. But fortunately, thanks to wealth funds, the income from nonrenewable natural resources can be endorsed to future generations. Thus, event societies cannot keep the psychical sustainability of natural resources can do for economic sustainability. Table 2 shows the top 10 wealth funds according to asset size and Turkey Wealth Fund (TWF).

As seen from Table 2, the wealth funds with largest assets are from economies with external surplus—except Hong Kong Monetary Authority Investment Portfolio. TWF is 28th largest wealth fund with $40bn. In the order of asset value, the sum of 82 SWF is approximately $8.32tn and top 10 SWF comprises 73%.

4 Turkey Wealth Fund

When compared to other countries' wealth funds, a basic difference draws attention. In fact, there is a discrepancy with status quo. Wealth funds are institutions that are established to endorse the present wealth of natural resources and external/internal surpluses. Turkey is a country with neither external nor internal surplus. In that case, there is a question waiting for an answer: "What is the financial source of this fund?". Concerned law regulates everything and provides an answer. A company, owned by a no economic surplus state's operation fields, whether it is going to compete in free market conditions.

To be clearer, some details about Turkey Wealth Fund should be presented. Turkey Wealth fund is established in 2016 to enhance the development and economic stability in Turkey by efficient and productive management of public funds. The objectives of the fund are sorted as contributing growth, supporting development, deepening capital markets, and attracting investors. Another important aspect is the sources of the fund. The sources are the institutions and assets in privatization process and surpluses (Turkey Wealth Fund 2019).

One can see that the sources of Turkey Wealth Fund are different from the ones of conventional wealth funds. This is quite understandable for Turkey since there is no internal or external surplus. According to law, those financial sources normally belong to the budget. From this point of view, there is no change in Turkey's internal balance. Former budget revenues now belong to Turkey Wealth Fund. This law tells that Turkey Wealth Fund is a noncommodity one.

5 Selected Sovereign Wealth Funds and Temasek Holdings

Asset size and number of wealth funds are rising year by year. Table 3 shows the change in the size of the assets of wealth funds between December 2008 and March 2018 with commodity and noncommodity classification. We see that noncommodity fund size is getting larger faster than commodity funds (Table 4).

Hydrocarbon funds increased 90%, other commodity funds increased 50%, while noncommodity funds increased 250% by March 2018 (Fig. 1).

In March 2018, the commodity funds comprise 52%, whereas noncommodity's share is 48%.

As mentioned above, TWF differs from conventional wealth funds in two terms: It is a noncommodity fund and also not financed by external surplus. Temasek Holdings is the most similar one to TWF in terms of noncommodity portfolio (Kerkez 2019). If the development of Temasek Holdings can be analyzed well, a success path can be created for generally criticized TWF.

According to September data of SWFI, there are a total of 116 SWF from 7 regions (Sovereign Wealth Fund Institute 2019b). Temasek Holdings was established in 1974 as a noncommodity wealth fund. Its aim was to assist its sole

Table 3 Aggregate sovereign wealth fund assets under management and rate of change, 2008–2018

	Hydrocarbon	Increase/decrease percentage	NonCommodity	Increase/decrease percentage	Other commodity	Increase/decrease percentage	Total assets under management
December 08	2.02		1.01		0.04		3.07
December 09	1.94	−0.04	1.24	0.23	0.04	0.03	3.22
December 10	2.01	0.04	1.54	0.24	0.03	−0.18	3.59
December 11	2.12	0.05	1.79	0.16	0.04	0.12	3.95
December 12	2.43	0.15	2.15	0.20	0.04	0.17	4.62
December 13	2.80	0.16	2.52	0.17	0.06	0.31	5.38
March 15	3.44	0.23	2.74	0.09	0.13	1.26	6.31
March 16	3.43	0.00	3.03	0.10	0.05	−0.62	6.51
March 17	3.49	0.02	3.04	0.00	0.06	0.11	6.59
March 18	3.82	0.09	3.57	0.17	0.06	0.10	7.45

Source: PREQIN (2018a, b)

Table 4 Aggregate sovereign wealth fund assets under management, 2008–2018

	Commodity	NonCommodity
December 08	0.67	0.33
December 09	0.61	0.39
December 10	0.57	0.43
December 11	0.55	0.45
December 12	0.53	0.47
December 13	0.53	0.47
March 15	0.57	0.43
March 16	0.53	0.46
March 17	0.54	0.46
March 18	0.52	0.48

Source: Author's own calculation

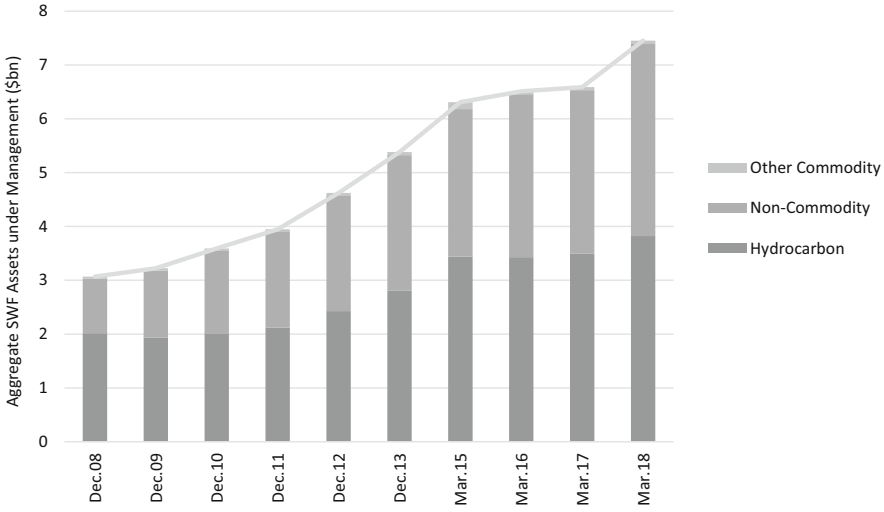

Fig. 1 Aggregate sovereign wealth fund assets under management, 2008–2018. Source: PREQIN (2018a, b)

owner, the Ministry of Finance, in managing and maximizing returns of MOF's initial portfolio, which included mainly strategic government-linked 15 companies (Stitsart 2014). Temasek's established mission was to contribute to Singapore's economic development, industrialization, and financial variety by nurturing effective and commercially driven strategic investments in and around Singapore (Temasek Holdings 2019).

There may be uncertainty concerns about the investment objectives of state-owned SWFs under government. It is often questioned if the SWF really acts for economic objectives or there are military, political, and technological agendas. In this context, transparent and auditable governance is expected to be strongly correlated with success of a SWF (Aggarwal and Goodell 2018). The funds of Temasek Holdings are a success story for countries without natural resources in terms of both

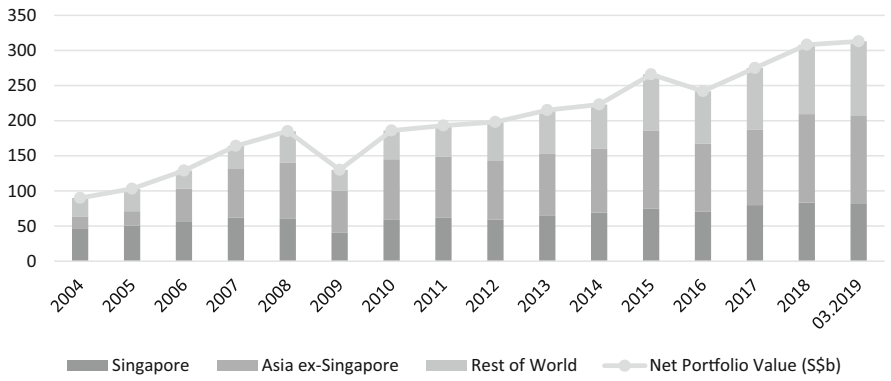

Fig. 2 Temasek portfolio value (2004–2019). Source: TEMASEK (2019)

fund size and management (Quadrio and Miceli 2010). Despite the day-by-day increase in the number of wealth funds, audit function is not sufficient for the most. According to Linaburg–Maduell Transparency Index, the rating of Singapore Temasek Holdings is 10, which means it is perfectly performing audit operations. Temasek Holdings was established with noncommodity portfolio and is very close to the portfolio of TWF (Uysal 2018). Temasek publishes a detailed memorandum on its financials, investments, governance structure, and risk management strategies in its annual report, which has been available to the public on its website since 2004 (Quadrio and Miceli 2010).

In Fig. 2, 16-year change of portfolio value is given. As seen from the figure, except few years, S$313 billion was reached in March 2019 incrementally. In 2004, a 52% share of the funds was of Singapore, but as time passed, share of international investments increased.

Considering the portfolio, governance, and purpose of establishment, Temasek Holdings can be a benchmark for TWF (Durdu 2018). Actually, both funds can be classified as "development funds". As seen from Fig. 3, Temasek Holdings invests in telecommunication companies, financial institutions, reality, etc. just like TWF. Especially, a large share of the portfolio consists of financial services, telecommunications, media & technology, consumer real estate, and transportation and industrials.

6 Conclusion

Wealth Funds are institutions that are established to endorse the present economic surplus to future. The most important function of the wealth funds is to provide benefit to future generations from present wealth. Especially, the countries with high resource income facilitate wealth funds to restrict the uncontrolled exchange inflow to the economy (Dutch Disease). Turkey, despite lacking both internal/external

Sector	2019	2018	2017	2016	2015
Financial Services	25	26	25	23	28
Telecommunications, Media and Technology	20	21	23	25	24
Consumer & Real Estate	17	16	17	17	15
Transportation & Industrials	16	16	17	18	17
Life Sciences & Agribusiness	7	6	4	4	3
Energy & Resources	3	3	3	3	5
Multi-sector Funds	8	8	8	7	5
Others (including Credit)	4	4	3	3	3

Single Name	2019	2018	2017	2016	2015
Singapore Telecommunications Limited	8	9	12	13	13
DBS Group Holdings Ltd	6	7	5	5	6
Mapletree Investments Pte Ltd	5	*	*	*	*
Rest of Portfolio	81	84	83	82	81

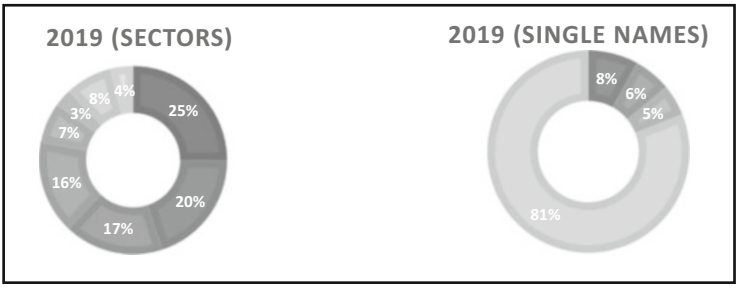

Fig. 3 Temasek portfolio (2015–2019) by single name and sector. Source: TEMASEK (2019)

surplus and any kind of resource revenue, established Turkey Wealth Fund in 2016. Thus, TWF, as a state-owned company, chose different kinds of financial sources for operations. Simply, some kinds of budget revenues were directed to TWF. The success of TWF depends on if the return of investments is above the average market return or not. Otherwise, it will face an unsustainable structure like Ponzi Scheme.

The most transparent SWF of the world, Temasek Holdings' both institutional audit structure and operations, can be a pathway for TWF for future. Although TWF's structure allows independent audit, the release of the audit report is subjected to approval of the board. This process arises concerns about the transparency of TWF.

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Environmental Taxation in Portugal: A Contribution to Sustainability

Sara Sousa

Abstract Environmental taxation represents a key tool in a country's sustainable development strategy, being an important factor of conciliation between environmental protection and economic growth. As a result of high population growth, intense industrialization and fossil fuels' overuse, the world deals with serious environmental problems, namely unacceptable values of greenhouse gas emissions and severe climate changes. Its mitigation and resolution depend on the adoption of a set of concrete measures and policies to combat pollution and promote deep changes in polluters' behavior and, in this context, we highlight the key role of the environmental taxation policy. Some years after one of the most important reforms, this research proposes to analyze and interpret some of the main statistics on the environmental taxation in Portugal. The final aim is to provide policy makers with more information, allowing them to consolidate an efficient strategy regarding the promotion of a more sustainable development, through the application of an efficient environmental taxation.

Keywords Sustainable development · Environmental protection · Environmental taxation · Portugal

1 Introduction

The twentieth century witnessed considerable increases in global population, industrialization, and fossil fuels consumption. Despite its unquestionable importance in some key economic areas, such as power generation and transport, the overuse of fossil resources, such as natural gas, coal, and oil, raises serious environmental sustainability issues. In addition to being nonrenewable and therefore finite resources, the use of fossil fuels is responsible for high levels of greenhouse gas

S. Sousa (✉)
Coimbra Business School/ISCAC and CERNAS, Polytechnic Institute of Coimbra, Coimbra, Portugal
e-mail: ssousa@iscac.pt

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(GHG) emissions, namely carbon dioxide (CO_2), with harmful consequences on the global warming of Planet Earth. According to the Intergovernmental Panel on Climate Change (IPCC 2018), GHG emissions released by human activities are estimated to have caused approximately 1.0 °C of global warming above preindustrial levels (i.e., since the start of the Industrial Revolution), with a likely range of 0.8–1.2 °C. If these emissions continue to increase at the current rate, global warming is likely to reach 1.5 °C between 2030 and 2052—an additional warming of 0.5 °C from today's level. The world's future global warming evolution strongly depends on global annual decarbonization rates.

There are some solutions to address these environmental problems and promote a sustainable development strategy, namely through a significant investment in more efficient use of resources, adoption of carbon capture and sequestration technologies, and increased use of non/less polluting and renewable energy sources (RES) (Silva et al. 2019). Regarding the renewables, despite not being impact-free (e.g. Botelho et al. 2016, 2018), its increasing use, as an alternative to fossil fuels, represents an exceptional opportunity for mitigation of GHG emissions and reducing global warming (Panwar et al. 2011; Borenstein 2012), namely by allowing to satisfy, in a more sustainable way, a growing world energy demand which is expected to increase by 30% until 2040 (IEA 2016).

These environmental issues have been the subject of intense debate in the European Union (EU), which is strongly committed to undertaking ambitious environmental protection policies, particularly with regard to combating climate change, having ratified the Paris Climate Agreement on 5 October 2016. Under the framework of this international agreement, all parties are pledged to undertake considerable efforts to reduce GHG emissions by 20% by 2020 and by at least 40% by 2030, compared to 1990, with the purpose of controlling and containing the rise in global temperature. This goal requires that all economies adopt a deep decarbonization strategy in order to achieve a global carbon neutral balance (UN 2015; EC 2019). In line with this strategy, Portugal must reduce its CO_2 emissions in the near future, which requires the adoption of some key public policies to lower the national carbon footprint, namely an effective environmental taxation policy—a key tool in the promotion of a sustainable development, representing a crucial link between environmental protection and economic development.

The remainder of this paper is organized as follows. Section 2 provides an overview of the key concept of sustainable development, essential for understanding the relations between economy, society, and environment. In Sect. 3, we present some of the main arguments for a country levying environmental taxes as an essential tool for promoting sustainable development, making a serious commitment to present and future generations to respect and protect the environment. Following, in Sect. 4, after a brief presentation of the national context regarding GHG emissions, we analyze some of the key statistics on environmental taxation in Portugal, allowing a better knowledge of the national Government's strategy in the pursuit of a sustainable development. Finally, the main conclusions are presented.

2 The Concept of Sustainable Development

A more detailed analysis of the literature allows us to realize that the concept of sustainable development is a very rich and broad concept, for which there are different interpretations and definitions according to the authors' approaches. Different organizations participated in the creation of the notion of sustainable development, but the most significant is the United Nations (UN), founded in 1945, with currently more than 190 Member States. The UN has several goals and one of them is to promote sustainable development. Since its establishment, UN has been very proactive, being responsible for the organization of numerous conferences, actions, and publications in order to achieve and promote a sustainable development and the Millennium Development Goals (MDGs) (Klarin 2018).

Despite not being the first publication or meeting organized by the UN, we can say that the concept of sustainable development was firstly introduced in its true sense and gained international relevance with the publication "Our Common Future" of 1987, also known as "Brundtland Report," according to which, "sustainable development is one that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, p. 43).

Many other UN meetings and publications followed, contributing to further consolidate the concept of sustainable development. We highlight the following. In 1992, the importance for all nations to achieve a sustainable development was strengthened in the UN Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil. In the preamble of its final report—"Agenda 21"—it is stated: "Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can—in a global partnership for sustainable development" (CNUMAD 1997, p. 9). Some years later, in 1997, the UN publishes the document "Agenda for Development" and, in its first paragraph, it is referred that: "Development is one of the main priorities of the United Nations. Development is a multidimensional undertaking to achieve a higher quality of life for all people. Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development" (UN 1997, p. 1).

Since then, the discussion about sustainable development has been intensely developed and today we find in the literature different interpretations, which complement and prove how rich and comprehensive the concept is. According to Costa (1999, p. 62): "sustainable development is a huge umbrella, capable of harbouring a wide range of innovative, progressive proposals/approaches, or at least moving

towards greater justice improvement of the population's quality of life, more dignified and healthier environments and commitment to the future."

From all the definitions and considerations presented, it is easily understood that debating sustainable development involves the cross-fertilization between distinct disciplines (Hui 1997). In its evolution, the concept of sustainable development has been popularized as a concept based on three main pillars or dimensions of sustainability settled in balance: economic, environmental, and social. Hopwood et al. (2005, p. 39) states that "The concept of sustainable development is the result of the growing awareness of the global links between mounting environmental problems, socio-economic issues to do with poverty and inequality and concerns about a healthy future for humanity. It strongly links environmental and socio-economic issues."

It is also important to underline that the concept of sustainable development is closely related with the notion of justice regarding the ecosystems' use and conservation: justice between different people of the current generation—intragenerational justice; and justice between people of different generations—intergenerational justice (Aragão 2012; Emas 2015; Mendes 2016). As stressed by Spijkers (2018), Planet Earth can be seen as a valuable and irreplaceable resource, used by past generations, currently being used by current generations and it is expected to be used by future generations. The main challenge is to find a balance between intragenerational equity—all people, rich and poor, of the current generation and intergenerational equity—present and future people. Particularly attention must, however, be given to those of the upcoming generations since they have no voice. In sum, "sustainable development requires the integration of economic, environmental, and social objectives across sectors, territories, and generations" (Emas 2015, p. 3).

3 Environmental Taxation

The world is facing a host of complex environmental problems such as GHG emissions from fossil fuels combustion, deforestation, air, soil, and water pollution, inefficient resource management, and climate change. All these environmental aggressions have become particularly evident in the second half of the past century worldwide. While some are confined to local areas and may be the result of a few polluters, others occur at the global level and are brought about by millions of different actors. It is also observed that as economies grow richer and become more industrialized, the awareness about environmental problems increases and the desire and ability to confront these challenges growth as well (OECD 2011a, b, c). The relation between environmental degradation and national income is well documented in the Environmental Kuznets Curve literature (Grossman and Krueger 1993).

It is observed that, while poor countries value further income more than environmental quality, rich countries are willing to forgo further industrialization in favor of more environmental protection (Dorsch 2011).

In order to achieve environmental protection and sustainable development, governments have a range of tools at their disposal, such as regulations, information programmes, innovation policies, environmental subsidies and taxes. Environmental taxation is a key part of this toolkit and widely accepted as a powerful instrument for combating complex environmental problems worldwide (e.g., Cottrell and Falcão 2018; Aidt 2010; Bachus et al. 2019; Gago et al. 2007; OECD 2011a, b, c).

We present some of the main reasons for using environmental taxes as follows:

(i) Internalization of external environmental costs: one of the main arguments for using environmental taxes is to bring the costs of pollution and other environmental aggressions into the prices of the goods and services. Such environmental costs—negative externalities—are not included in the prices paid by the involved agents, which creates significant market distortions, since it encourages activities that are costly to society even if there are considerable private benefits. The application of an environmental tax allows to bring these external costs to prices, so that social and private costs are as similar as possible. This internalization of the negative externalities will lead to a reallocation of resources of an economy according to "fair and efficient" prices by redistributing the costs (EEA 1996, 2016; EC 1992, 1995).

(ii) Implementation of the polluter pays principle (PPP): environmental taxes implement the PPP, since they confront polluters with the costs caused by their harmful behavior. Moreover, the application of taxes on the polluting activities incentivizes other alternative environmentally sustainable options, namely: cleaner production processes; measures to capture and neutralize harmful emissions before they enter the environment; and development of less polluting products. In the cases where it is difficult to tax directly the polluting activity, close intermediate goods or activities can provide a good tax base. For instance, it would be very difficult and expensive to tax directly the CO_2 emissions from individual motor vehicles, but, since the release of these emissions is highly correlated with fuel use, taxing fuels is an efficient alternative. Thus, the most efficient method to combat environmental degradation is direct taxation at the polluting source (good or service, behavior or activity). However, when this is not possible, close intermediate goods, services, or activities should be taxed so that the source of environmental pollution is not unpunished (OECD 2011a, b). Regarding the PPP, we highlight the research developed by Aragão (2014) in which the author deepens in detail the importance of this principle in environmental policy.

(iii) Creation of incentives: an environmental tax provides an incentive for producers to use, or generate, less of the polluting substance being taxed. On the other side, with the raise of prices, consumers are also incentivized to buy less of the taxed products. Environmental taxes may be targeted directly on consumers or on producers, but in all cases they end to affect all agents by changing relative prices and therefore behaviors (EEA 1996, 2016).

But the incentive effect is not exhausted in the processes just described. Environmental taxes provide an ongoing incentive for innovation, as firms and

consumers seek cleaner solutions in response to the price put on pollution. To further reduce their tax burden, firms are incentivized to invest in research and development (R&D) towards new production technologies generating lower levels of pollution and, consequently, with a lighter environmental footprint. If these R&D activities are successful, the same level of production can be realized with lower pollution. Thus, the new production technology results both in substantial tax savings as in lower environmental damages. The wider context is also determinant for the innovation outcomes of environmental taxes: the regime of intellectual property rights, the higher education system, and cultural norms towards innovation are just some examples of key tools to a country promote its innovation capacity (Fullerton et al. 2008; OECD 2011a, b; Vollebergh 2012).

(iv) Double dividend: a potential double dividend from environmental taxes was initially suggested by authors such as Pearce (1991) and Oates (1991). According to the double dividend argument, applying taxes on polluting products and behaviors provides two different benefits: (i) on the one hand, there is an environmental gain because the environmental behaviors of both consumers and producers have become more responsible; (ii) on the other hand, with the application of environmental taxes, an additional tax revenue is generated, which allow governments to reduce the tax burden on, for example, the labor, resulting in an increase in employment, which represents an economic gain (Borrego 2016). In this case, taxes on "bads" such as polluting products and behaviors create additional revenues that can replace the revenue raised by taxes on "goods" such as labor, thereby shifting the tax burden from the "goods" to the "bads" (EEA 2000).

However, it should be stressed that if there are no doubts regarding the first dividend, the same cannot be said about the second one. The double dividend literature can be divided in two strands. On the one hand, some authors, particularly the Europeans, focus on the impact that environmental taxation revenues can have on the macroeconomic variable employment. Thus, this specific form of double dividend, where both emissions and unemployment are reduced by the environmental taxation, is usually named "employment double dividend." On the other hand, we have another group of contributions, most from the United States (US), focusing upon the distortions of the tax system, before and after an environmental tax. According to this approach, the second gain results from the reduction of the negative impact of the tax system on the economy: by reducing taxation on capital, income and other taxes, which have a distortion effect on the economy, then the economy becomes more efficient and competitive (Bosello et al. 1998; Alves and Roseta-Palma 2004).

Regarding the first dividend, there is no doubt about the concept, despite the difficulty in knowing the exact values of the environmental gains from green taxation. With regard to the second dividend, in addition to different interpretations regarding the concept, there is also some controversy regarding the sign of this dividend on the economy: if some authors argue that environmental taxation

provides positive effects on the economy (e.g., Goulder 1995; Parry and Bento 2000; Labandeira et al. 2004; Glomm et al. 2008; Stavickiene and Ciuleviciene 2014), others consider the existence of a second dividend, but with a negative impact on the economy (e.g., Bovemberg and Mooij 1994, 1995; Bohm 1996; Bosquet 2000; Chiroleu-Assouline 2001).

4 The Case of Portugal

Before addressing some of the key environmental tax statistics in Portugal, it is important to evaluate the degree of pollution in the country. To this end, we present below a portrait of Portugal regarding GHG emissions, one of the main threats to the Planet's sustainability.

4.1 National GHG Inventory

The greenhouse effect is considerably influenced by human activity, mainly by the use of fossil fuels, which increases the amount of carbon dioxide (CO_2) in the atmosphere. There are others harmful gases such as methane (CH_4) and nitrous oxide (N_2O), which are mainly emitted by agricultural activities. The emission of GHG is responsible for temperature rise, which leads to climate changes, affecting severely life conditions on the planet. This is why reducing GHG emissions is probably the most important global environmental challenge of the present generation (Castanheira et al. 2008).

According to the Portuguese National Inventory Report on Greenhouse Gases (see APA 2019), in 2017, total Portuguese GHG emissions, without land use, land-use change, and forestry (LULUCF), were estimated at about 70.7 million tonnes (Mt) CO_{2e}, representing an increase of 19.5% compared to 1990 levels and an increase of 7.0% compared to the previous year, 2016.

The Portuguese GHG emissions over the last three decades reflect largely the evolution of the national economy. During the 1990s, the unprecedented rise in energy demand and mobility resulted in a steady increase of the emissions. Then, in the early 2000s, the growth of emissions has been more moderate and started to stagnate, mainly due to a large investment in RES and an increased efficiency in energy use. Thereafter, in particular after 2005, the emissions registered a decrease as a result of the later economic recession and, after a slight decline in 2016, total emissions in 2017 increased significantly by 7.0% compared to the previous year, which raise serious concerns (APA 2017, 2019).

Through a detailed sectoral analysis, we conclude that the energy sector, including transport, remains the main responsible for GHG emissions, with 72.6% of total national emissions in 2017. In this sector, energy production and transport are the main polluters, accounting for around 29.5% and 24.3% of national emissions,

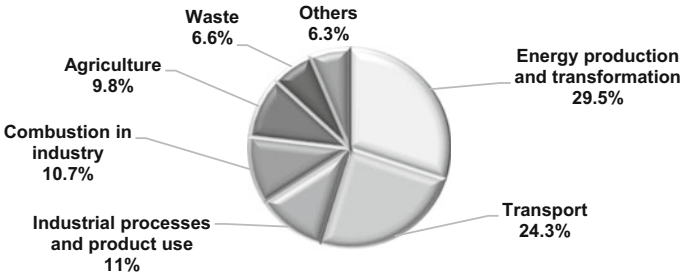

Fig. 1 Sectoral GHG emissions in Portugal, 2017 (LULUCF excluded). Source: APA (2019)

respectively, reflecting the country's high dependence on fossil fuels for electricity generation and transports (Fig. 1). With considerable lower levels of pollution, industrial processes and product use, agriculture and waste sectors have approximate weights, representing 11.0%, 9.8%, and 6.6%, respectively. It is also important to highlight the role of LULUCF (land use, land-use change, and forests) sector, being a net emitter or a carbon sink depending on the occurrence of forest fires in Portugal. In 2017, this sector returned to being a net emitter, with a total of 7.2 $MtCO_{2e}$, representing 9% of the country's total emissions as a consequence of the exceptional and tragic year in terms of forest wildfires, associated to an exceptional dry year, high temperatures and unusual strong winds, phenomenon that can be related to climate change (APA 2017, 2019).

In 2016, the Portuguese government pledged to achieve carbon neutrality by 2050, through the adoption of a strategy of intense decarbonization of all sectors of the national economy, in accordance with the Paris Agreement. This commitment implies achieving a balance between GHG emissions and carbon sequestration, which is only possible through substantial decreases in emissions and/or substantial increases in carbon sinks are required. In this national strategy, all economic sectors, with particular attention to the energy and transport, must reduce their emissions and adopt more sustainable production methods (MATE 2019).

This is a path that can no longer be delayed and requires the participation and action of all individuals, both producers and consumers, whose behavior must change in favor of environmental protection and the survival of present and future generations. Governments have a toolkit to promote and encourage individuals' environmentally benign and sustainable behaviors.

Following, we deepen environmental taxation in Portugal, one of the most effective tools in promoting a sustainable development.

4.2 Environmental Taxation in Portugal

In September 2014, a Commission for Environmental Tax Reform, appointed by the Portuguese government, submitted a report containing a proposal designed to guide Portugal to a triple dividend in the long run: (i) to protect the environment and to reduce external energy dependence; (ii) to promote growth and employment; (iii) to contribute to fiscal responsibility and to reduce external imbalances (CRFV 2014). That same year, in 31 December 2014, the Portuguese parliament approved the Law n.° 82-D/2014, the piece of legislation that implements key changes in the national environmental tax norms regarding several issues such as energy and emissions, transport, water, waste, land use, forests, and biodiversity (Diário da República 2014; MAOTE 2015).

The Green Tax Reform came into force on the first day of 2015, with the introduction of a set of key green tax measures, including:

(i) Creation of a carbon tax on non-emissions trading scheme uses (non-EU-ETS), with a rate indexed to the price of the carbon in the EU-ETS sector.
(ii) Incentives to electric mobility as well as increases of vehicle tax according to CO_2 emissions.
(iii) Introduction of a tax on plastic bags by 8 cents/bag plus VAT.
(iv) Rebates for the replacement of end of life vehicles were reintroduced.
(v) Introduction of benefits for car sharing and bike sharing.

A few years after this reform, it is important to analyze and interpret some of the main statistics on environmental taxation in Portugal.

In 2017, environmental tax revenues reached about 5 billion euros, which represents an increase of 4.8% over the previous year. This was the fifth consecutive year with revenue increases for this type of tax, as shown in Fig. 2.

An analysis by tax category allows to observe that, in 2017, oil and energy taxes represented 72.1% of total environmental tax revenues. Transport taxes (single road tax and vehicles tax) accounted for 27.2%. Resources and pollution taxes, on the other hand, had an insignificant expression in the structure of environmental taxes (0.4% and 0.3%, respectively) (INE 2018). Figure 3 presents green taxes by category in Portugal for the year of 2017.

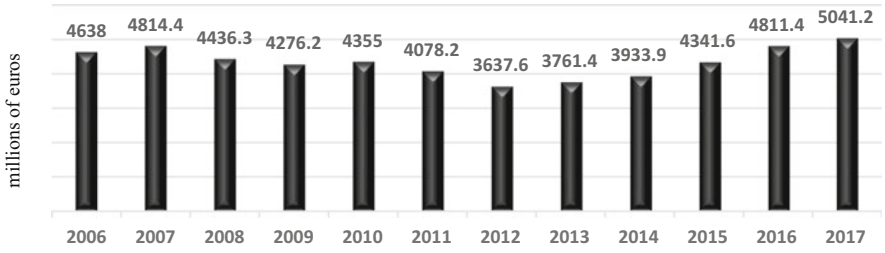

Fig. 2 Environmental tax revenues in Portugal, 2006–2017. Source: INE (2018)

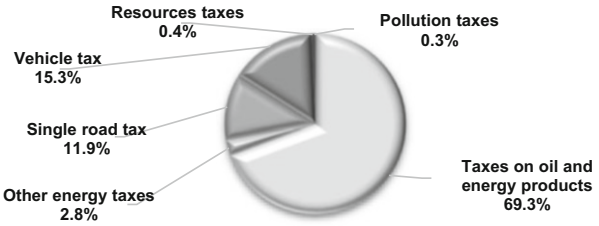

Fig. 3 Environmental tax categories in Portugal, in 2017. Source: INE (2018)

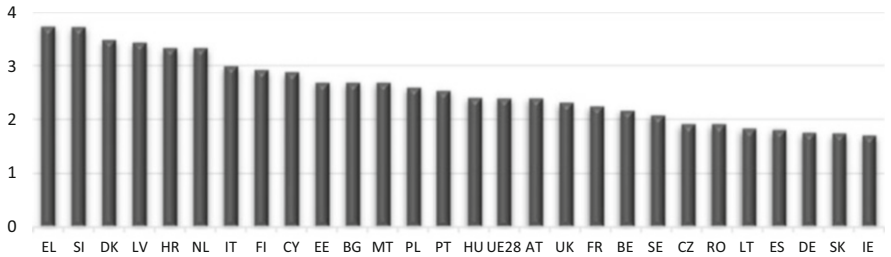

Fig. 4 Environmental tax revenues in % of GDP, 2017. Source: Eurostat (2019)

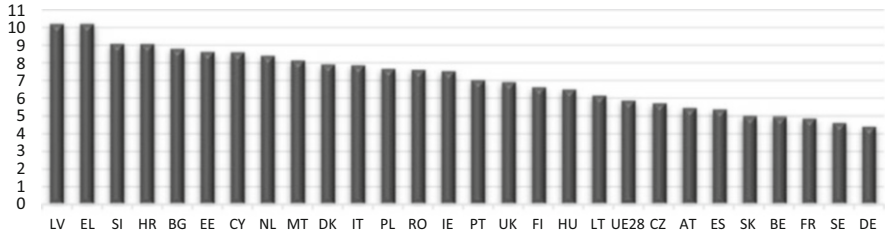

Fig. 5 Environmental tax revenues in % of total revenues from taxes and social security contributions. Source: Eurostat (2019)

In comparison with the other EU countries, in 2017, the share of environmental tax revenues in the national Gross Domestic Product (GDP) amounted to 2.59%, a value slightly above the EU-28 average of 2.40% (EC 2019; Eurostat 2019). Figure 4 presents the share of environmental tax revenues in the GDP of each EU-28 Member State.

In the same year, environmental taxation in Portugal contributed 7.02% of total revenues from taxes and social security contributions. Although this figure is above the Community average (5.86%), we consider that there is still some scope for, for example, transferring labor taxes to environmental taxes (EC 2019; Eurostat 2019). Figure 5 shows the importance of environmental tax revenues in total tax revenues and social security contributions in EU-28.

5 Conclusion and Discussion

Since at least the 1980s, the world has been well aware of the seriousness of environmental problems, namely the high level of GHG emissions, responsible for considerable negative impacts on human health and endangering the survival of both present and future generations. These environmental concerns have been at the center of intense debates in EU institutions, which, over the past decades, have been strongly committed to finding efficient strategies to combat pollution and change individuals' behaviors.

As an EU State Member, Portugal ratified the Paris Climate Agreement in 2016 and pledged to achieve neutrality of its emissions by the end of 2050, outlining a strategy to promote an intense decarbonization of the national economy. Focused in reducing the national carbon footprint, over the last years the Portuguese government has been adopting and reforming some important public policies, namely environmental taxation—a key tool in the promotion of the country's sustainable development, representing a crucial link between environmental protection and economic development.

Published in 31 December 2014, the Green Tax Reform in Portugal implemented key changes in national environmental tax norms regarding several issues such as energy and emissions, transport, water, waste, land use, forests, and biodiversity. These changes were decisive for the consolidation of the national environmental protection strategy and promotion of the country's sustainable development.

The analysis of some environmental statics reveals that: in the last 5 years, environmental tax revenues have consecutively been increasing, reaching 5 billion euros in 2017; the majority of these taxes are collected on oil and energy products (72.1%); the environmental tax revenues represent 2.59% of the national GDP, a value above the EU-28 average (2.40%); the environmental taxation represents 7.02% of total revenues from taxes and social security contributions represent a value above the EU-28 average (5.86%). Although national values are above the EU-28 averages, there is still some scope for transferring labor taxes to environmental taxes.

The final aim of this research study is to provide policy makers with more information on environmental taxation in Portugal, allowing them to consolidate a more efficient strategy for the country regarding the promotion of environmental protection and sustainable development.

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Globally Emergent Behavioral Patterns, as a Result of Local Interactions in Strongly Interrelated Individuals

Christos Manolopoulos, Yannis C. Stamatiou, and Rozina Eustathiadou

Abstract In this paper, we study how local interactions in suitably structured social networks give rise to globally emergent states and observable patterns. An example of such states and patterns is the emergence of Panopticon-like structures that possess global surveillance properties. Our methodology is based on elements of game theory and innovation diffusion graph processes modeling social network local interactions. We provide an example of a simple social network structure in which collective actions induce the emergence of specific behaviors due to the effects of the local dynamics inherent in strongly interconnected individuals. Our work provides a framework for studying and explaining how specific social interaction patterns produce already observable global social patterns.

Keywords Social networks · Privacy · Surveillance · Game theory · Graph theory · Outerplanar graphs

1 Introduction

The diffusion of ideas and beliefs in society, such as technology preferences, beliefs, habits, and dispositions, has attracted the attention of a number of researchers from diverse disciplines ranging from sociology and psychology to economics, mathematics, and statistical physics. As evidenced by real-world cases, behavioral patterns and views (e.g., views held by a local majority of individuals) can be seldom

C. Manolopoulos (✉) · R. Eustathiadou
Computer Technology Institute and Press – "Diophantus", Patras, Greece
e-mail: manolop@cti.gr; efroz@cti.gr

Y. C. Stamatiou
Computer Technology Institute and Press – "Diophantus", Patras, Greece

Business Administration Department, University of Patras and Computer Technology and Press – "Diophantus", Patras, Greece
e-mail: stamatiu@ceid.upatras.gr

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imposed, globally, on large populations only through outside interventions or enforcement (e.g., by legislation or a totalitarian state). For example, evidence from general campaign-based approaches, such as, for instance, efforts to introduce abruptly e-Government innovations into governance, by law, or approaches to diffuse privacy/security awareness to young people through paternalistic campaign messages about cybercrime incidents acting as deterrents, often fails to reach their goals. It appears that people are, rarely, convinced to adopt a particular habit or way of thinking, e.g., to be privacy aware, by force or simple campaign-based strategies. We believe that one of the main reasons for the inefficiency of enforcement or campaign-based diffusion approaches is that people tend to be more prone to follow the, perhaps risky, behaviors and habits of their peers during their everyday life rather than the ones imposed by privacy/security awareness campaigns and news about privacy breaches.

On the other hand, the unprecedented advances in information technologies, along with advances in more specialized areas such as Artificial Intelligence, affect drastically the structure and stability of the social fabric. More specifically, these advances induce transformations that significantly impact the *state of surveillance* (and, consequently, breach of privacy) of individuals, the creation of multiple digital identities, and the behavioral habits through which an individual can be known to others, as well as the way individuals perceive the society. Bauman (2007), on the other hand, investigates processes that caused the transformation of the citizens' identity into individualization under certain circumstances that materialized, gradually, since 1990. Also, Bauman (2007) discusses the processes that transformed collective action and certain forms of social structure into this new form of individualization.

One such example of the transformation of the individuals so as to adopt a collective behavior, even when it is risky to do so, is the case of global surveillance based on *Information and Communication* (ICT) systems or *ICT Panopticons*. The term *Panopticon*, originally proposed by the philosopher Jeremy Bentham (1791) in a series of letters, as an architecture for circular prisons, is synonymous to *never ending surveillance or discipline*. Later, Foucault (1995) and other philosophers proposed the concept of Panopticism as a metaphor for political systems of social control as well as the dualistic relationship between knowledge (through surveillance) and power (discipline and control). Today, through ICTs, our digital identities and dispersion of digital information about ourselves offer unprecedented possibilities for information collection and massive surveillance, substituting the physical Panopticon with a global intertwined complex of data collection organizations and services. What is more, which is of central importance to our approach, is that this state of surveillance is often *acceptable* by individuals, as an emergent behavior starting from small groups who, first, accept it and, subsequently, affect their social media connections to follow them. Thus, the situation evolves toward a global state of affairs in which individuals accept the trade of privacy with some free to use services, such as social media and data sharing facilities. Without loss of generality, we may focus on social networks rather than daily physical interactions of individuals because of the widespread penetration of social networks in people's lives as

well as the fact that social networks allow people to interact with many of their contacts instantly and frequently, while they are, also, in a restful mood.

Our motivation for this paper was to cast these views, observations, and facts into a more concrete, foundational, framework relying on precise mathematical models of behavior diffusion processes. To this end, our approach, in contrast to the current literature from sociology or political sciences, is more theoretical and quantitative in nature, drawing, of course, on the important results from these disciplines as guiding directions for designing and evaluating the proposed models. Our anchor point is that ideas, beliefs, and behavioral patterns (such as giving up or compromising, voluntarily, and privacy) appear to start diffusing over larger populations from an initial "seed" adoption by a, possibly small, set of devoted individuals or behavior adopters, e.g., fans of a particular social medium, who disregard their privacy in order to gain the benefits of social networking or other free services. These individuals, through their interactions with other individuals, may succeed in propagating the adoption of the innovations to increasingly larger sets of individuals until the behavior is globally accepted by the total population or, at least, the vast majority of individuals.

Based on these observations and the innovation diffusion theory of Young (2006), we propose, in this paper, an organizational structure of a set of individuals into a network structure that appears to lead the long-term evolution of the social networks toward a specific global state, e.g., tolerance to Panopticism or, in the other extreme, total privacy awareness and rejection of Panopticism.

Our initial findings indicate the following: if a certain subset of individuals who are organized in the proposed network structure follow a specific behavior or support certain views (e.g., with respect to privacy awareness), then, after a finite amount of time, they will succeed in diffusing their beliefs to *all* individuals. The social network structure we propose is that of the *outerplanar graphs*, which is a well-known class of graphs in Graph Theory. We show that this class of graphs has a certain "coherence" mathematical property (they are *close-knit*, as defined by Young (2006)), and thus, according to Young's theory, a sufficiently large set of initial behavior adopters can diffuse this behavior, whether right or wrong, throughout the whole social network based on local social interactions. We believe that the advantage of this approach lies in the fact that it proposes a simple (but not totally unrealistic) social network structure, based on outerplanar graphs, which can help model and explain *behavior diffusion processes*, as observed in sociology or political sciences, using a *concrete mathematical framework*.

The rest of this paper is organized as follows. In Sect. 2, we discuss *individualization* and how it is connected with the digital evolution and the emergence of surveillance structures, such as Panopticons. In Sect. 3, we present some basic concepts from game theory and show how it can model pairwise interactions in societies through which globally emergent social behaviors emerge. In Sect. 4, we briefly review Young's innovation diffusion theory and the concept of close-knit social structures, which facilitated the emergence of global social patterns. In Sect. 5, we define a close-knit family of social structures that can give rise to global patterns

through local social interactions. Finally, we discuss our findings and give directions for further research in Sect. 6.

2 Individualization, Digital Technologies, and Surveillance

2.1 Individualization

ICTs and their specialized areas, such as Artificial Intelligence, drastically affect the structure of social organization and its stability. The relevant advances, also, enhance the possibilities for surveillance of individuals, and they change the way in which individuals view their identity, also impacting and determining individuals' comprehension and realization of social frameworks and social constructs. Therefore, they adopt changes which according to Bauman (2007) either have, already, occurred or are identified in a state or process of formation. Concerning the core of these processes and changes, Bauman underlines the transition from a *constant* to a *liquid* form of modernity, the disunion between dominion and control on the one hand, state and politics on the other hand, the reduction of state aid to socially weak members of society, as well as state protection or support against personal failure. But the deep core of these transitions is identified in the field of relocation of the responsibility to individuals, namely, for new dilemmas derived from unstable and changing circumstances. Therefore, citizens are now fully charged with the consequences of their personal choices, even in the case that they are not able to avoid such choices, according to Bauman (2007).

Bauman's argument is relevant in some dimensions, with the theories that were expressed in the 1950s by Arendt (1951) and Kornhauser (2008). These theories criticized the emergence of mass society phenomena and indicated that mass society and totalitarianism were the effect of the collapse of a system based upon class relations, social ties, and intermediate class unions developed since the nineteenth century forming the, so called, *citizens' society*. As a result of this collapse, a new form of individual behavior emerged, which was termed in "mass society" theory as *atomization*, which, in turn, led to the emergence of a mass society phenomenon. People classified under the term "atomization" are socially disconnected, replacing previous horizontal social or class connections with a concrete and unique vertical connection with the state, the state leader, or "a remote object" according to terminology specified by Blumer (1946, 1986).

Bauman, on the other hand, investigates processes that caused the transformation of the citizen's identity into individualization, under certain circumstances formed gradually since 1990. He also defined the exact content of the term. Bauman (2000) cites the process that caused the transformation of the procapitalistic standards of "estates" to "classes", which correspond to industrial capitalism ones. He also defined certain processes that transformed collective action into the new form of individualization. Common issues in both theories are the terms *atomization*, according to Arendt (1951), and *individualization*, according to Bauman (2000),

despite that they were formalized under quite different circumstances, while differing, both, in meaning and content. What is, in fact, common is the specific emergence of an individual profile of actions and behaviors, as well as the consequent social behavior due to the dissolution dynamics concerning concrete class ties, certain social entities, and solidarity practices.

In the case of the argument in Arendt (1951), about the formation of a "mass society" and "totalitarianism", the key issue concerns individuals whose interests have nothing in common except the experience of seclusion as well as negative solidarity conditions, caused by the extended disappointment about the political system and the political parties. On the other hand, the crucial factor toward individualization is the process of gradual *mutation* from the entity of citizen into that of a *consumer*, which led to a decline of certain forms of social and political organizations. These changes impact the individualization and postmodernity conditions.

Szahaj (1996) names several characteristics of postmodernity (see, also, Batco (2017)):

- A change of focus from the production paradigm to the consumption paradigm. Consumerists are characterized by impatience and a desire for immediate satisfaction of their consumption needs.
- A difference in lifestyles and a subjectivism of beliefs, evident in religion's postulates about tolerant and ecumenical behaviors.
- An *aestheticization* of life, i.e., the treatment of one's life and self in terms of experiences.
- An increasingly important role and impact of mass media, which, instead of presenting reality as it is, they create it, themselves, according to their own views and goals.
- A dispersion due to lack of an axiological center, in other words, a *mosaic* and internal *incoherence* landscape throughout the Western culture. In this *liquid modernity* state of affairs, surveillance becomes liquid too. Surveillance processes, including tracking, controlling, and constant observation (even remotely), have become an integral part of our daily lives, and thus, we can, no longer, detect their presence.

Important and interesting issues of these processes are concerned changes in the behavior of individuals, which, in turn, built new social ethics and standards. Louise and Charles Tilly (1981) have shown that *structural* or *technological changes* affect collective action indirectly through concrete changes in the forms of expression and interactions among individuals in everyday life. From this perspective, for instance, the effect of the Internet and, especially, Facebook on forms of interaction could be perceived as the technological parameter impacting the transformation of collective action and, therefore, leading to individualization.

As a result, previous forms of social structure are transformed into a *social network*, losing, along the way, the social qualities of the previous stages. This is common in atomization and individualization. In the first case (atomization), the constructed network relies upon vertical relationships of individuals with state and

discipline, while in the second (individualization), we, also, wave horizontal relationships with individuals and private agencies or organizations. As a by-product of both processes, we have the *emergence of global surveillance*, which takes different forms in each case.

2.2 Surveillance and Commercialization of the Individual's Identity

Surveillance represents a constant characteristic of human history, impacting every form of social and political organization. What distinguishes our days from the past, however, is the *extent* of surveillance, the *range* of personal data collected, the technological methods of collecting and managing the data, the profile of the stakeholders who collect and use data, and, most importantly, the reaction of individuals toward these data collection activities.

According to Schmidt and Cohen (2014), the anchor points of surveillance are *Internet filtering* and the "cloud". Concerning state surveillance, they detect three distinct models, depending on the state regime established in each country (democratic or authoritarian). In the case of authoritarian regimes, a set of technologically advanced tools and methods collects huge volumes of personal data, including biometric ones. Very recently, a report prepared by experts in the field advises EU authorities to apply rules, which should guarantee that Artificial Intelligence tools will not harm the rights of EU citizens.

In a theoretical perspective, Foucault (1995) analyzes surveillance based on the Panopticon, a model of an ideal prison proposed in the eighteenth century in Bentham (1791). This model describes the architectural design of a prison that enables a single prison guard to watch all the inmates continuously, while the latter can never know whether they are, currently, watched or not. From this departure point, Foucault (1995) developed the concept of *panopticism* by which he analyzed the mechanism of control.

Bauman, in turn, extended the concept to *postpanopticon* forms, analyzing the phenomenon of surveillance mechanisms on a global scale. There is a fundamental difference between panopticism and the postpanopticon. According to Batco (2017), Foucault's concept of an architectural rendition of constant surveillance, augmented with an observer existing within the system, allows panopticons that can be easily detected and examined from *outside* of the system. This can be accomplished, for instance, by an independent examiner or inspector who represents targeted individuals. Thus, in general, the panopticon will, eventually, become a transparent establishment whose actions and operations will not be secret, but open to all society.

On the other hand, in the postpanopticon framework, both data accumulation and algorithmic manipulation are conducted by *invisible* and, possibly, *undetectable* anonymous and unknown overseers (machines) in a way that precludes democratic control. The advantages of AI achievements are profound, in this context, but, at the

same time, risks and challenges of these achievements have, also, been identified. Some of them refer to industrial and technical unemployment, to the accumulation and use of huge amounts of personal data, to the transformation of concrete processes to algorithmic treatment (such as personal scores and individual scored reputation), as well as the redistribution of power, etc. This condition is defined by Pascuale (2015) as the "knowledge problem."

Regarding the concentration and algorithmic processing of personal data, we have to distinguish *state* from *private* spheres. The arguments in Pascuale (2015) concern, mainly, the first case (credit scores, etc.), but the second form is also crucial. In this case, individuals permit access to their personal data, which are collected and manipulated by huge private firms, such as Google and Facebook, pursuing concrete benefits and services as consumers. This process follows two stages. During the first stage, the individuals are not aware of the consequences of their decision. During the second stage, although the individual is aware of possible algorithmic intervention to the released personal data, he/she is not able to infer whether this intervention should be perceived as a commodity exchanged with free of charge services. This is more important especially for young people.

In what follows, we cast and analyze this transformation leading to individualization using special types of social network graphs and game theory-based mathematical models for behavior diffusion processes in these graphs. The analysis shows that social clusters can be, gradually, transformed into social networks within which interactions among individuals, machines, and agents spread, fast and on a global scale, the newly perceived forms of individual behavior.

3 Game Theory

A *game* G is composed of a finite number of n *players*, $n \geq 2$. Player i has available a finite set S_i of at least two *pure strategies*. The elements of the set $S = S_1 \times \cdots \times S_k$ are called the *pure strategy profiles*. Component i of an element in S denotes the choice of player i from within his set S_i of pure strategies. In addition, in order to quantify value of the players' decisions, given any pure strategy profile in S, the game's description needs to specify real-valued *utilities* or *payoffs* for each player that ensue from this pure strategy profile. By u_s^i, we denote the payoff to player i that results from choosing $s \in S$.

In informal term, a *Nash equilibrium* characterizes a set of strategies, one for each player, such that none of the players has an incentive to deviate, i.e., plays some alternative strategy. In general, Nash equilibria do not exist for pure strategies. It is often necessary to allow the players to randomize over pure strategies. We will not go into further details but, rather, direct the interested reader to classical texts such as Fudenberg and Tirole (1991). We will, instead, focus on a specific family of games in order to present our ideas with the generic payoff matrix shown in Table 1, with two pure strategies, A and B, available to each of the two players:

Table 1 The generic form of a payoff matrix

	A	**B**
A	(*a*, *a*)	(*c*, *d*)
B	(*d*, *c*)	(*b*, *b*)

Source: Authors' own work

Table 2 The payoff matrix of the GDPR compliance game

	Compliant	**Noncompliant**
Compliant	$(p_cC_b - C_g, p_cC_b - Cg)$	$(p_cC_b - C_g - p_nC_b, C_g - p_nC_b)$
Noncompliant	$(C_g - p_nC_b, p_cC_b - C_g - p_nC_b)$	$(C_g - p_nC_b, C_g - p_nC_b)$

Source: authors' own work

In Table 2, we provide the payoff matrix of a game that pertains to two interacting and collaborating, e.g., through customer data or order sharing, organizations (players) that have two choices (strategies): (i) Spend effort to become and stay GDPR Compliant and (ii) Remain NonCompliant. In the table, we see the payoffs.

In this table, the symbols are as follows:

- p_c: the probability of a successful attack on a *compliant* organization (it is assumed to be constant across all organizations).
- p_n: the probability of a successful attack on a *noncompliant* organization (it is assumed to be constant across all organizations).
- C_b: the costs of a successful attack on the organization.
- C_g: the costs for an organization to become and stay GDPR compliant.

Then, the payoffs are as follows:

- $a = p_cC_b - C_g$ represents the payoff when both collaborating organizations become and stay GDPR compliant. It is defined as the *average* cost of a successful breach, p_cC_b, minus the expenses for GDPR compliance.
- $b = C_g - p_nC_b$ represents the payoff when both collaborating organizations decide to stay noncompliant. Actually, the companies gain the cost C_g for compliance, but if a cybersecurity breach incident occurs affecting both, since they share data, damage of expected value p_nC_b is incurred on both of them.
- $d = C_g - p_nC_b$ represents the payoff of an organization that decides to stay noncompliant, while the other collaborating organization decides to become compliant. It is the same as b.
- $c = p_cC_b - C_g - pC_b$ represents the payoff of an organization that decides to stay compliant, while the other collaborating organization decides to become noncompliant. The compliant organization gains the expected average costs of a successful attack, while it is compliant, i.e., p_cC_b minus the costs for compliance C_g minus the expected average losses due to a successful attack on the collaborating organization, which is noncompliant. This expected cost is p_nC_b.

We would like to stress the fact that we do not claim that the payoff choices above are realistic or the approach we used to derive them is unique. The payoffs, for such a game, are not uniquely definable and depend on people's views, experiences, and

background. We believe that the realistic definition of the payoffs in the diffusion game necessitates a deeper, practical analysis of what are the factors that make users choose strategy A or strategy B. We view the strategy adoption process as a highly social process in which users affect other, and get affected by others, during their daily interactions.

Now, the conditions that need to hold (increasing returns for player conformity) are as follows:

- $a > d$:

$$p_c C_b - C_g > C_g - p_n C_b \Leftrightarrow (p_c + p_n) C_b > 2C_g \tag{1}$$

- $b > c$:

$$C_g - p_n C_b > p_c C_b - C_g - p_n C_b \Leftrightarrow 2C_g > p_c C_b. \tag{2}$$

Inequalities (1) and (2) imply that $p_c C_b < 2C_g < (p_c + p_n) C_b$. The condition that decides risk dominance is, then, based on the following difference:

$$\begin{aligned} D &= (a-d) - (b-c) = (p_c + p_n) C_b - 2C_g - \left(2C_g - p_c C_b\right) \\ &= (2p_c + p_n) C_b - 4C_g. \end{aligned} \tag{3}$$

If $D > 0$, i.e., when the cybersecurity costs are sufficiently larger than the compliance costs, the theory predicts that the two organizations will choose to become GDPR Compliant. Otherwise, if $D < 0$, i.e., when the compliance costs are sufficiently larger than the cybersecurity costs, then the two organizations will choose to stay GDPR NonCompliant. The new GDPR, with the decision to impose extensive fines on noncompliant organizations that fall victims of cybercriminals, points to the "both compliant" equilibrium.

Generalizing the above discussion to any two types of (usually contrasting) behaviors, A and B, we can make the link with *mass society* phenomena and the, eventual, domination of mass surveillance or Panopticons. Individuals are confronted with adopting either of the two behaviors, A or B. Usually, one of them is chosen according to satisfy some personal needs or gaining personal benefits (e.g., giving away some personal information items in exchange of free Internet services—the "individualization" phenomenon), while the other one also has some benefits for the society (i.e., being privacy aware and cautious with personal data, also persuading other individuals to follow this behavior). Modeling this situation with the game discussed above, we can describe conditions that can lead to a "liquid society" like negative (for society itself) behavior or not. This behavior can be, for instance, tolerance or indifference to Panopticons or mass surveillance. In the next section, we will focus on modeling this situation using diffusion processes on special categories of social network graphs.

4 Social Interaction Patterns and Diffusion Processes

In this section, we discuss the important, in our opinion, role that everyday social interactions can play in diffusing ideas and beliefs when they viewed innovations or individualization behaviors diffused over all members of a population.

Our main idea is that we can start with a few individuals who follow a belief A or B and then take advantage of their social relationships with other individuals who may have the opposite belief with eventual goal being the gradual diffusion of the initially held belief by the few individuals to all individuals based, on their pairwise interactions. The intuition behind this approach is that even a small group of convinced individuals can convince a larger group if they have close connections to each other.

This intuitive statement can be founded on an important mathematical result of Young (2006) related to *innovation diffusion*. Young's result studies innovation diffusion processes over populations whose social structure has certain "closeness" properties when the interaction between pairs of individuals is described by and "innovation acceptance" game similar to the ones discussed earlier. Young showed that if a social network has these "closeness" properties while innovation acceptance is defined by a risk dominant Nash equilibrium of the involved game, then, eventually, all members of the population will adopt the innovation. Moreover, the "time," as measured by the number of pairwise game interactions, is *independent* of the size of the population. The importance of Young's theory is in the fact that it offers a theoretical framework for investigating how attitudes diffuse over large populations, as a function of two key characteristics of the population: (i) the strength of pairwise interactions among members of subsets of the population (called close-knit social graphs) and (ii) the result of these interactions (the game describing the interaction as well as its payoffs). Based on these two key elements, Young's theory provides a formal framework for studying the conditions that lead the population to adopt the attitude under consideration. We next discuss briefly Young's result and show its relationship to the problem of affecting widespread diffusion of ideas and beliefs.

Young (2006) defined a parameter of social networks or groups of individuals, when their interactions are modeled by graphs, which measures their "closeness" as well as their "immunity" outsiders' opposing views. A group of individuals S is called *close-knit* if the following condition holds for every set $S' \subseteq S$:

$$\min_{S' \subseteq S} \frac{d(S', S)}{\sum_{i \in S'} d_i} \geq r, \tag{4}$$

with $d(S', S)$ being the number of links or connections between the individuals in S' and S and d_i the total number of links of individual i. In other words, the intuition here is that in order to have such a large ratio in a subset of individuals, we must have many internal connections and only a few external connections. A graph is called (r, k)-close-knit if every node belongs to a group S of size at most k which is r-close-

knit, according to Inequality (4). Finally, a *class* of graphs is called *close-knit* if for every $0 < r < 1/2$, there corresponds an integer k, possibly dependent on the value of r, such that all graphs in the class are (r, k)-close-knit.

In addition to the above structural property, the individuals of the population interact through a *two person, repetitive, game*. According to the game, each time two individuals play the game, they, independently, choose to either adopt or reject the innovation or behavior, judging from the payoffs resulting from each choice. We assume that the game has a *risk-dominant Nash equilibrium* according to which *both* players adopt the innovation or behavior. Using these model elements, Young showed that for close-knit social graph families, all community members will, in the long run, adopt the innovation, as defined by the risk-dominant Nash equilibrium, in "time" (i.e., number of game interactions), which is *bound* and *independent* of the size of the interaction graph, i.e., the population of the community. In essence, what Young showed is that if all the subsets of the community members have strong internal pairwise links and, at the same time, they are weakly connected to outsiders, then a group of initiators who adopt an innovation or behavior will, eventually, manage, to convince all population members to adopt the innovation or behavior too.

Thus, this mathematical result suggests a plan that can help diffuse a certain idea or behavior over a social network or group of individuals. We can view an idea or behavior as an *innovation* to be diffused. The idea is to introduce this innovation in a slow, stepwise manner, which involves increasingly larger close-knit subsets of a population, as potential initiators. It, then, follows that in order to convince them to adopt the innovation, we should carefully design the adoption strategy and the communication infrastructure so as to avoid inducing negative attitudes toward the innovation. To this effect, it is preferable to diffuse the innovation in the least risky way. For example, we can use rather simple diffusion strategies, avoiding critical or complex situations that may result in intimidation or raise unjustifiable suspicions toward the innovation. This approach can, also, help achieve a quick, in-depth, test of an innovation since it is used by a small, controllable, number of people. As the innovation testing proceeds, the next innovation diffusion phase can be initiated to a larger number of individuals, using more sophisticated diffusion strategies.

5 Outerplanar Close-Knit Social Networks

In this section, we describe a close-knit graph family with good information diffusion properties, which can realize the diffusion processes described in Sect. 4. The class is that of *outerplanar* graphs. We define, below, the general class of *k-outerplanar graphs* as well as some notation that will be used in what follows.

Definition 1 ((Planar) Embedding) *An embedding is a drawing of a graph in the plane. An embedding is called planar if no edge crosses another edge.*

Definition 2 (k-Outerplanar Graph) *Let $G = (V, E)$ be a graph. G is* planar*, if there exists a planar embedding of G. An embedding of a graph G is called*

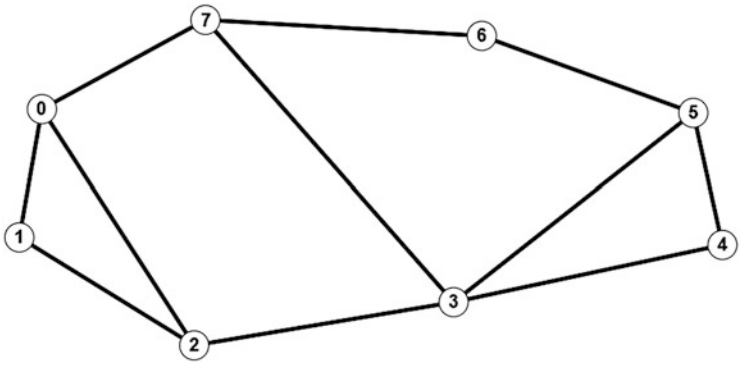

Fig. 1 An example of an outerplanar social network. Source: Developed by the authors

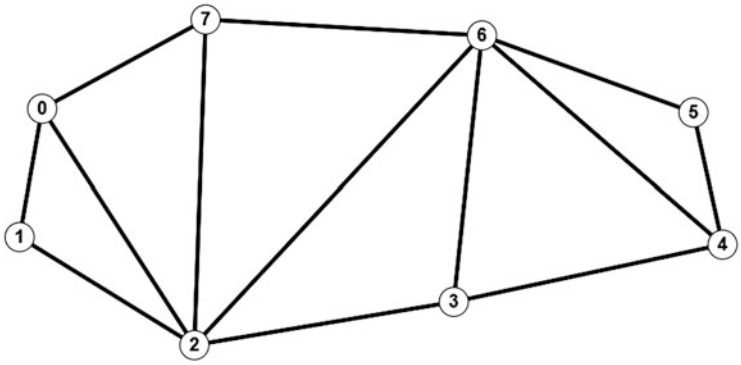

Fig. 2 An example of a maximal outerplanar social network. Source: Developed by the authors

1-outerplanar*, if it is planar and all the graph's vertices lie on the exterior face of the embedding. For* $k \geq 2$*, an embedding of a graph G is called* k-outerplanar*, if it is planar and when all vertices on the outer face are deleted, then what remains forms a* $(k-1)$*-outerplanar embedding. If G admits an embedding which is a k-outerplanar, then it is called a* k-outerplanar graph.

In Fig. 1, we show an outerplanar graph with 8 vertices.

In Fig. 2, we show a maximal outerplanar graph.

In Fig. 3, we see a zig-zag maximal outerplanar graph, which is the model we adopt for our targeted social networks.

With respect to properties, observe that in MOPs, the maximum degree of the network's vertices is constant, equal to 4, regardless of the network's size, while in nonzig-zag MOPs, the maximum degree is, generally, unbound. This condition helps satisfying Inequality (4). Intuitively, having too many vertices with large degrees exposes a group of individuals to much external interference. This affects negatively the close-knit property. We shall now prove the following:

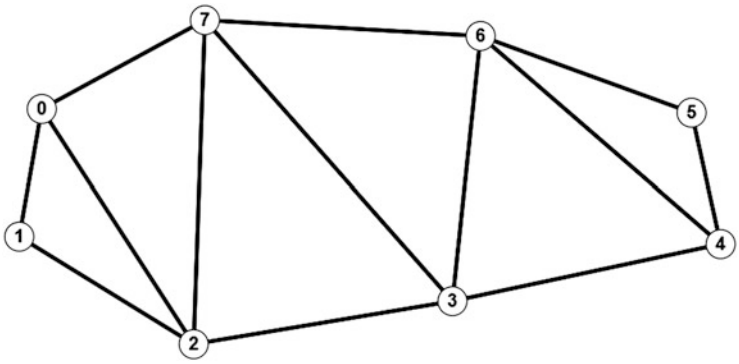

Fig. 3 An example of a zig-zag maximal outerplanar social network. Source: Developed by the authors

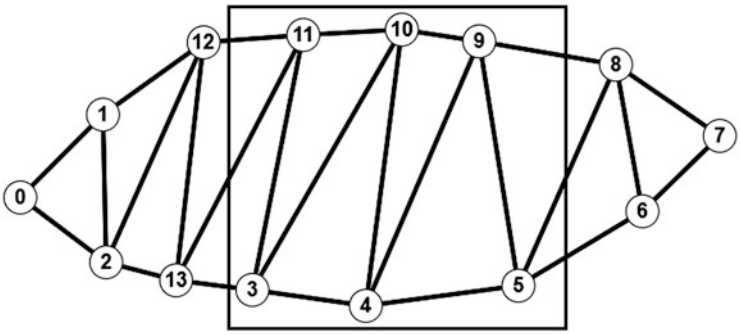

Fig. 4 An example of a zig-zag maximal outerplanar social network. Source: Developed by the authors

Theorem 2 *The family of outerplanar graphs is close-knit.*

Proof. Consider the following subset of vertices, S_k, for $k = 2l$, which we call a *k-central zone* in any outerplanar graph of n vertices: l vertices of degree 4 in one of the ear separated parts and l vertices in the other such that all vertices are connected only to vertices within set S_k except four vertices, two in the one ear-separated part and one on the other, that are also connected to vertices outside S_k.

For example, in Fig. 4, we see such a set S_k for $k = 6$ and $l = 3$. The four vertices that are also connected to vertices outside S_k are the vertices with numbers 3, 5, 9, and 11.

Let S be a k-central zone, such as the one in Fig. 5, composed of two rows of l vertices each.

Then,

$$\frac{d(S,S)}{\sum_{i\in S} d_i} = \frac{2k-3}{4k} = \frac{1}{2} - \frac{3}{4k}\ . \tag{5}$$

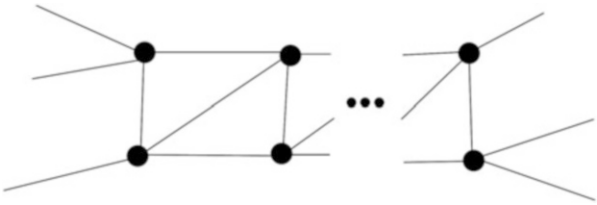

Fig. 5 A generic k-central zone, with $k = 2\ l$, of a maximal outerplanar social network. Source: Developed by the authors

Let $S' \subseteq S$ be a nonempty subset of S with t vertices. We will estimate the quantity,

$$\frac{d(S', S)}{\sum_{i \in S'} d_i}. \tag{6}$$

For the denominator, we have $\sum_{i \in S'} d_i = 4t$. With respect to the numerator, the maximum number of edges between S' and S is attained when the t vertices of S' form an independent set, i.e., they are not neigbours in S' in which case the quantity in Eq. (6) is 1. When some or all of the vertices in S' are adjacent, then fewer edges occur between S' and S since we cannot count an edge twice, as an edge of two neighboring vertices. The worst case, i.e., the case in which the numerator in Eq. (6) is minimum, is when all t vertices in S' are adjacent among them, i.e., they form a connected graph. This graph is still an outerplanar graph as a subgraph of our initial outerplanar graph. According to a well-known result in graph theory, an outerplanar graph of t vertices can have at most $2t - 3$ edges. Thus, between S' and S, there are at least $4t - (2t - 3) = 2t + 3$ edges. Therefore,

$$\frac{d(S', S)}{\sum_{i \in S'} d_i} \geq \frac{2k + 3}{4k} = \frac{1}{2} + \frac{3}{4k}. \tag{7}$$

From Eqs. (5) and (7), it follows that, for any value of r,

$$\frac{d(S', S)}{\sum_{i \in S'} d_i} \geq \frac{d(S, S)}{\sum_{i \in S} d_i} \geq r. \tag{8}$$

From the above discussion it follows that a k-central zone is r-close knit, for any $r < 1$. Since for any such value of r, there exists a value of k such as the class of all outerplanar graphs that are (r, k)-close-knit, we conclude that the class of outerplanar graphs is a close-knit graph family.

6 Conclusions

In this paper, we discussed a general approach for diffusing ideas and beliefs into large populations of individuals taking advantage of the social connections among them. This approach is based on our view that an idea or belief can emerge, gradually, over a large population of individuals as a result of their everyday, social interactions rather than being enforced by external interventions. The reason behind our belief is that people appear to be affected more by their peers' attitudes in making innovation adoption decisions than product advertisements or attempts of enforcement. Based on this belief, we described a simple social connectivity pattern based on outerplanar graphs coupled with a game between pairs of individuals, which, according to a mathematical result of Young (2006), are sufficient to diffuse an idea or belief to all individuals within a finite time span independent of the number of targeted individuals. In this way, we can interpret, mathematically, the emergence of "individualization" behaviors such as, for instance, the tendency of people to give away personal information, thereby breaching themselves their own privacy, in return for some free (or useful, to them) Internet services or membership to social media networking platforms.

However, there are two limitations in our approach. The first is related to the payoff definitions. Our first attempt was to simply define them as differences between protection benefits and effort expenses. We admit that this definition needs further justification with respect to how realistic it is. It was only a first attempt toward demonstrating the feasibility of our approach. On the other hand, as it frequently happens for payoff definitions in real-life games, choosing the payoffs in a realistic way is, often, a very difficult task. Thus, admittedly, there is a need to investigate more realistic ways to determine the payoffs for the game, possibly based on real data on how people interact in different settings.

The second limitation is the class of close-knit graphs, i.e., the outerplanar graphs, we employed. Although this class can model special types of social interactions, it may not be readily applicable to more realistic social networks. It would be interesting to investigate whether other more realistic social networks are close-knit and, thus, may lead to the discussed phenomena through the local interactions of the society members.

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Part VIII
Regional Studies

Problematic Issues of Youth Unemployment in Central and Eastern European Countries

Rasa Daugėlienė and Algis Junevičius

Abstract Although most European economies show fragile signs of recovery after the financial crisis of the twenty-first century, youth unemployment remains not only one of the biggest concerns for European countries but also one of the most serious challenges. This fact leads to another problem called social exclusion. The novelty of this research manifests in the complexed standpoint to the youth unemployment situation analysis as well as a systemization of programs, which are used to help young people integrate into the labor market in selected EEC countries. The aim of this research is to highlight the main problematic issues of youth unemployment in the CEE countries. Main findings of the scientific and empirical research: the indicators for the context analysis of youth unemployment situation were suggested; youth employment policy specificity in the EU was highlighted, and the challenges of youth employment policy in CEE countries were systemized. Methods of this research are documents' content analysis, qualitative analysis of states' cases, comparative analysis, statistical data interpretation, and prognostic method.

Keywords Youth unemployment · Central and Eastern European Countries (EEC countries) · Employment · European Union

1 Introduction

In recent years, the youth unemployment issue has been described as one of the most serious macroeconomic and social problems that contemporary economies are facing. North European, Continental European, the Anglo-Saxon, the South European Systems' (Pastore 2015), as well as Central and Eastern European (CEE) countries face the problems of youth integration into the labor market. After the economic crisis in 2008, many economies of the EU Member States

R. Daugėlienė (✉) · A. Junevičius
Faculty of Social Sciences, Arts and Humanities, Kaunas University of Technology, Kaunas, Lithuania
e-mail: rasa.daugeliene@ktu.lt; algis.junevicius@ktu.lt

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shrunk, which resulted in many Europeans losing their jobs. Although most European economies show fragile signs of recovery, youth unemployment remains not only one of the biggest concerns for all Member States but also one of the most serious challenges of the twenty-first century as well. Especially, there is a need to highlight the importance of specific competencies of the twenty-first century that need to be developed to be successful in the labor market. A significant decrease of youth employment in the labor markets in CEE countries creates a need to search for ways to facilitate young people's transition from education to the labor market (from school to work) (Pastore 2015) and to improve conditions that young people would be able to find a job as soon as possible. Increased emigration, especially, youth emigration to Ireland, later Germany and Scandinavian countries after the accession to the EU, is not a good prognosis for the future economic recovery of CEE Countries. Despite the situation, the EU implements various strategies, projects, and programs to improve youth employment policy in the Member States. Projects such as strategy Europe 2020 or the Youth in Action program and many others help to define the way the EU is going to lead its youth employment policy and emphasize key points to increase the youth employment rate in the EU. Many studies analyzed youth unemployment issue from various points of view stressing factors that influence youth unemployment as well as indicating the consequences of such unemployment. Gocer and Erdal (2015) analyzed the relationship between youth unemployment and economic growth in CEE Countries. Brzinsky-Fay (2011) and Marginean (2014) emphasized that one of the main problems regarding youth unemployment is the smooth transition from school to work, which is not possible without gaining job experience while studying. Moreover, Cinalli et al. (2013), Gontkovičová et al. (2015), and Gorry (2013) indicated that youth unemployment is a global issue. Repečkienė et al. (2012) and O'Reilly et al. (2015) examined that factors such as level of education, professional training, or the youth experience gap, active labor market, and social policies as well as labor market flexibility, youth migration, and family legacy of long-term unemployment influence youth unemployment rate (YUR). Grabowska and Getka (2014) analyzed issues that affect youth employment policies in CEE Countries. The role of the EU while implementing youth employment policy has been stressed in the works of Lahusen et al. (2013), Grinevica (2014), and Pastore (2015). Kvedaraitė et al. (2012) explored programs that help young people to be successfully integrated into the labor market. It is a key to stress that labor supply issues in the context of migration were analyzed in the study of Berulava (2019) (Georgia case). The impact on family members was explored, but the youth problems were not highlighted. The relationship between technology and employment or "technological unemployment" was analyzed by Vivarelli (2013). The contrasting effects of labor market rigidity on economic efficiency were examined in Grimalda (2016) research. This allows us to state that the youth unemployment problem is very important and analyzed just fragmentarily.

The novelty of this research manifests in the complexed standpoint to the youth unemployment situation as well as a systemization of measures/programs, which are used to help young people integrate into the labor market in selected EEC countries. The limitation of this research could be related to the selected youth of 14–24 years

old excluding the older ones. The problems analyzed in the article are**:** what are the EU's political actions regarding youth unemployment issues? What are the actions of selected CEE countries regarding youth inclusion in the labor market? The aim of this research is to highlight the main problematic issues of youth unemployment in the CEE countries. The tasks to be solved are: to suggest the indicators for the context analysis of youth unemployment situation in CEE countries; to highlight youth employment policy specificity in the EU; and to systemize the features of youth employment policy in CEE countries.

The structure of this paper: This paper consists of seven chapters. First chapter represents the introduction. The second chapter is devoted to the classification of indicators that could serve as instrument for the context analysis of youth unemployment situation in every country (theoretical background). Interpretation of indicators regarding youth unemployment in CEE countries is presented in the third chapter (context analysis). The fourth chapter analyzes youth unemployment policy specificity in the EU. The fifth and the sixth chapters accordingly are devoted to the youth employment policy feature analysis in Central European Countries and Eastern Central Countries. The last chapter represents the conclusions.

2 Indicators for the Context Analysis of Youth Unemployment Situation

The analysis is concentrated on youth unemployment problematic issues in CEE countries by invoking various indicators and is based on the comparative analysis of statistical data, systematic approach to analyzed data, and content analysis of official documents of the European Commission.

The countries in Table 1 were chosen for this research using the following criteria: first, all the above-mentioned countries joined the EU in 2004, which is by far the biggest enlargement in the history of the EU. The accession was a huge opportunity for CEE countries to become western-style economies. They were obliged to overcome challenges regarding economic and political modernization. Moreover, CEE countries had to perform tremendous reforms regarding economic, educational, and social policies and adapt many regulations and rules of the EU to their national laws to fit into the standards of the EU. Consequently, it is useful to compare the progress that CEE countries reached and analyze the problems that prevented them from doing better. Second, CEE countries are similar to one another

Table 1 Central and Eastern European countries

Central	Eastern
Czech Republic	Estonia
Hungary	Latvia
Slovakia	Lithuania
Slovenia	Poland

Source: Prepared by authors'

Table 2 Indicators used to identify youth unemployment trends in CEE countries

Demographic		
Share of young people aged 15–24 years and share of people aged 65 or more in CEE countries in 2017		
Economic		
GDP per capita €		
Minimum gross wage €		
Self-employment		
Youth unemployment in comparison with the total unemployment level of the country		
Educational		
Educational attainment	Less than primary, primary, and lower secondary	Upper secondary and postsecondary nontertiary
Social		
Gender	Female	Male
Time-related		
Term	Long-term youth unemployment	
	Short-term youth unemployment	
Seasonality	Seasonally adjusted youth unemployment	
	Seasonally unadjusted youth unemployment	
	Youth unemployment by month	
Type of contract	Full-time youth employment	
	Part-time youth employment	

Source: Prepared by authors'

by many aspects, such as economic (in some countries, same currency—Euro, similar GDP rate), geographical (neighboring countries), cultural, historical, or political aspects (the Visegrad Group—all four Central European countries, break from the Soviet Era). CEE countries are compared not only to one another but as well to the average percentage of particular indicators to the average percentage in the EU and that country of the EU that had the best score of the particular indicator. The average percentage in 28 countries of the EU and particular country with the best percentage of one or another indicator is taken as the starting point evaluating one or another indicator's performance in CEE countries. The indicators used while analyzing youth unemployment in CEE countries are presented in Table 2 and were collected from the official publications of the European Commission.

The collected data allowed us to compare different European Countries and regions and to evaluate their performance implementing youth policy and, especially, improving youth unemployment situation. The correlation between youth unemployment and indicators used is indicated in Table 3.

Table 3 Correlation between indicators and youth unemployment

Indicator	Correlation to youth unemployment
Share of young people aged 15–24 years and share of people aged 65 or more in CEE countries in 2014	Shows importance of young people in the society as a cornerstone aspect of future stable economic situation in the country (the less the percentage of young people in the country is, the less the workforce will be in the future, meaning that there will be less money coming in from taxes, while more money is needed on social benefits such as pensions or healthcare provision)
GDP per capita €	Youth unemployment rates are lower in the countries with a higher GDP per capita rate
Minimum gross wage €	A young, inexperienced worker at the beginning of a working career is forced to work for the minimum wage to gain work experience and receive a higher wage
Share of self-employed youth in the country	Contributes to the goals of the EU of more growth and better jobs, since self-employment is deeply encouraged and gains more and more attention and importance within the EU
Youth unemployment in percentage of total number of working population	Be able to compare young and older workers' unemployment percentage in the labor market
Educational attainment	Education is the critical factor that determines young people's chances to be employed
Gender	The main distinguishing feature of the unemployed
Long-term unemployment Short-term unemployment	Long-term unemployment might be very harmful to the country's economy
Seasonally adjusted	Shows influence of seasonality to the youth unemployment situation
Seasonally unadjusted	
Youth unemployment by month	
Full-time employment Part-time employment	One of the most popular employment types among young people. Full-time employment is mostly assigned to those, who finished studies, while part-time employment is more convenient for young people who are still studying and are looking for a temporary job

Source: Prepared by authors'

3 Interpretation of Indicators Regarding Youth Unemployment in CEE Countries

Indicators showed the main problems that caused high youth unemployment in CEE countries in 2017 and indicated what measures adopted by the governments of CEE countries gave the biggest positive effect reducing youth unemployment. The analysis enabled us to highlight two possible options of actions in order to improve youth unemployment situation in CEE countries. The first is to strengthen the

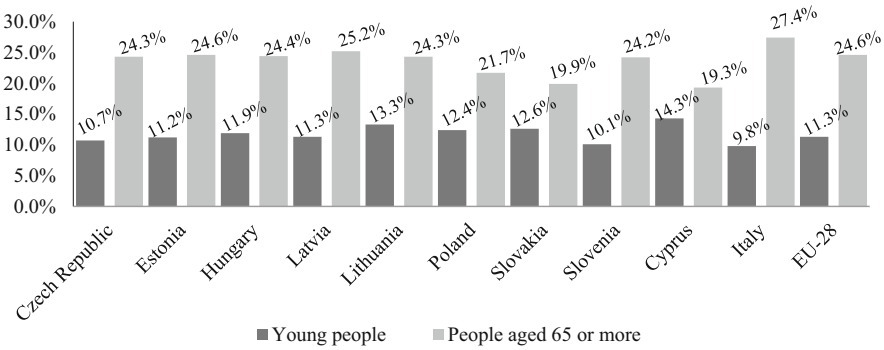

Fig. 1 Share of young people aged 15–24 years and share of people aged 65 or more in CEE countries in 2017. Source: Eurostat (2019)

creation of family-friendly environment and policies (such as the creation of favorable conditions for young people to start a family by having opportunity to achieve the balance between work and family); the second plan of actions could be related to efforts to improve education system, and so it would meet labor market requirements and promote economic growth. The issue of high youth unemployment is detectable across all CEE Countries, and so the economic and social effects of youth unemployment should be carefully considered to understand the gravity of the issue. Early unemployment has a negative effect not only on the future employability of young people but also on their self-esteem and their role in society and can represent a serious economic burden on state finances (Nedeljkovic 2014). Youth unemployment may be particularly harmful for a young person and economy as it may lead to long-term unemployment, which leads to multiple social, economic, and psychological problems.

Kofalt and Čepar (2015) stated that aging of a whole population is a reversible social process that depends on the structure of the age of a population, which can change in any direction. Moreover, population aging is usually measured by the percent of people aged 65 (60) years and over. Following these ideas, it can be stated that the process of aging population is perceived as a growing increase in the number of people aged 65 or more and a growing decrease in the number of young people (see Fig. 1). However, the process of population aging when adopting the right measures can be halted, but this is not possible without an increase in young people's population, meaning improvement of living conditions for young people to have more children.

One of the best ways to illustrate and understand the seriousness of youth unemployment and perceive it as a threat to the future of the EU is the comparison of youth and adult unemployment levels (see Fig. 2).

The comparison of youth and adult unemployment levels in CEE countries allows us both to go deeply into the analysis of the roots for high youth unemployment and to search for possible ways to decrease it. The youth will be those whose taxes will have to cover the expenses of future social and other benefits (e.g., paying pensions

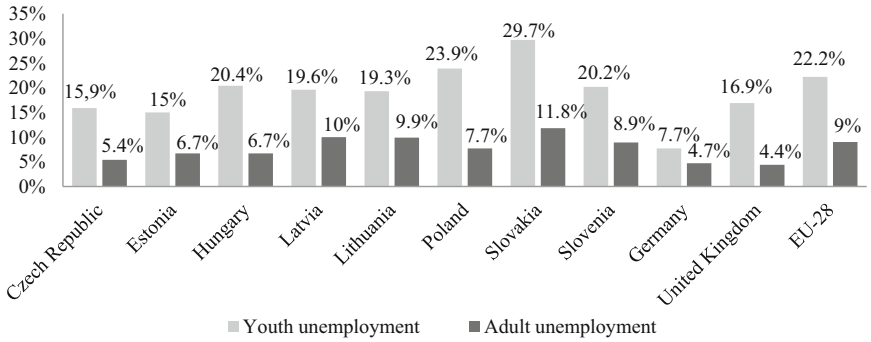

Fig. 2 The comparison of youth aged 15–24 years and adult aged 25–64 years unemployment in CEE Countries in 2017. Source: Eurostat (2019)

or providing healthcare for aging society, etc.) in the future. Therefore, it is of primary importance to prevent the increase of youth unemployment levels and search for solutions on how to integrate young people into the labor market.

4 Formation of Youth Employment Policy in the European Union

Formation of Youth Employment Policy in the EU Started at the End of the twentieth century. Since then, youth employment policy was changed, complemented, developed, and reformed without number. Knowing that not only the number of Member States of the EU constantly grew but as well different opinions about how youth employment policy in the EU should be implemented emerged, the vision of common youth employment policy seemed hardly achievable in some ways. First, each Member State had its vision and suggestions on how to improve youth employment policy that not necessarily matched other Member States' visions. Second, the adoption of certain programs, strategies, or laws regarding youth employment policy was differently implemented in the Member States as some countries successfully implemented them, while the others had serious issues and disagreements whether it is the best way to improve youth employment policy in the country

As emphasized by Lahusen et al. (2013), employability, activation, and labor market mobility are the primary objectives recommended by institutions of the EU to reduce the problem of youth unemployment, guarantee general participation of the youth in society, and regulate the access to the social security system. Main initiatives of the European Commission and their most important aspects tackling youth unemployment are given below (see Table 4).

All programs related to youth employment policy in the EU are used to test ideas, evaluate them, and then apply the best ones across the Member States. The prime

Table 4 Initiatives of the European Commission fighting youth unemployment

White Paper in 2001	Shaped youth policy focusing on its improvement.
European Youth Pact in 2005	One of the main instruments helping to achieve the objectives of the Lisbon Strategy.
Youth on the move in 2010	Encourages young people to study or train in another country and gain experience for future jobs.
Youth Guarantee in 2013	Young people up to age 25 received a quality offer of a job, continued education, an apprenticeship, or a traineeship within 4 months of leaving formal education.
Youth Employment Initiative in period of 2014–2020	Support young people in regions where youth unemployment is higher than 25%.

Source: Prepared by authors'

similarity between the mentioned programs is that they all define youth unemployment as a sensitive subject but at the same time very important key to fighting social exclusion and poverty. Mentioned initiatives include versatile development of the labor market, that is, encouraging labor mobility between youth by promoting young people to train abroad to gain experience or promoting traineeships for young employees. All in all, the bright future of the EU depends not on how many youth employment programs are adopted but on how successfully they are agreed on and implemented.

5 Main Features of Youth Employment Policy in Central European Countries

5.1 Czech Republic Case

Janíčko (2012) stated that youth unemployment became a visible problem in the labor market that is already at the beginning of the economic crisis. It is apparent that resolving this problem requires more than a few specific measures aimed at this population group, but concerns the overall state of the labor market, the management of economic policy, and the overall conception of social policy. Concerning young people specifically, another significant obstacle to improving their situation is the chaotic approach to the development of the education system, resulting in a marked skill mismatch. This is due to an underestimation of the need to develop technical and vocational training (Janíčko 2012). The author supposes that economic, social, and education systems are the main areas where youth employment problematic issues in the Czech Republic lie. Without proper management of economic policy, the correct perception of social policy, and, nonetheless, important systematic attitude to the education system, youth employment is self-defeating. The absence of targeted policy and coordination between these three closely related policies build the gap for youth unemployment to thrive. Although the Czech Republic ranks among those EU countries where the question of unemployment among young

people is not so acute, still measures have to be taken for the future stability (Social Dialogue Committee 2015). Evaluating situation, several national programs have been launched for the increase of youth employment in the Czech Republic.

- "Pospolu" ("Together") 2012–2015 fostered cooperation between schools and companies with a focus on vocational education and training in practice, identifying the possibilities and limits of cooperation between schools and employers.
- One of the biggest programs is "Activation Measures to Address the Adverse Situation on the Labor Market" 2014–2017, which focuses on standing the employment and labor market issues to the center of government activities.
- "Year of Industry and Technical Education" in 2015 aims to promote the general interest in technical education and to provide highly skilled workers for the labor market.
- "Your Way—Young Business" in 2015 and "Pulling for Crafts" in 2014 foster creativity, entrepreneurship, and mobility in education and training. It emphasizes the recognition of skills and qualifications acquired through nonformal and informal learning, strengthening key competences for young people to be knowledgeable in their careers, and increasing their activity and employability (Framework of Actions on Youth Employment: Final evaluation report 2017).

As can be seen, all programs in large part focus their attention on education. When a young person acquires skills and competencies that are suitable for a labor market, he or she will have more chances to be employed. The education system must be more adapted to labor market requirements as possible. The last, but not least aspect raised in one of the programs is that youth employment has to be a focal point shaping the government's created policy regarding youth employment.

5.2 Hungarian Case

Various measures to fight youth unemployment are taken in Hungary by different institutions. These measures cover financial support for employers, young entrepreneurs, and young persons who are engaged to get professional knowledge before starting the career. In more details, it would be:

- The financial grand could be proposed as a new opportunity for young people to become self-employed. The main idea of this project is to stimulate an entrepreneurial activity for those who are unable to find a job for more than three months. European Union structural funds and Hungarian resources are directed to manage this program. Another innovative project is suggested for jobseekers. Those who are registered for more than 3 months at the specific work finding institutions are provided by housing benefits if they find a job away from their home.
- There is provided a 10-point workplace protection action plan. The main idea of it is to implement half portion of employers' contribution for workers under

25 years starting from 2013. The aim of these measures is to encourage employers to employ young people under the age of 25.
- It is proposed that "The Apprentice Support Program" has to support young people at the beginning of their careers to obtain professional work experience. Employers can receive financial support for six months if they employ skilled unemployed people at the start of their careers.
- The progress is made in the vocational education system. The main aim of this project is to provide knowledge and skills for young people at the end of their education and training. It is assumed that newly obtained knowledge would be utilized immediately in the labor market (Elmmagazine.eu 2013).

It is important to emphasize that all of the above-mentioned programs to fight youth unemployment in Hungary are not possible without cooperation between government and business.

5.3 Slovakia Case

It could be stressed that the main problem of youth unemployment in Slovakia is a skill mismatch in the labor market. Schools and universities produce large numbers of graduates with skills lack of demand. Slovakia's education system produces graduates with encyclopedic knowledge, few practical skills, and limited potential for creation of innovations. Besides, it can be said that education is named as the crucial part of successful youth employment policy in the country and is primarily the area to be reformed. Accordingly, the supply of young specialists is immense but does not fit into present-day Slovakia's labor market demand, which needs young specialists with not only good theoretical knowledge but practical knowledge as well. However, new tools to fight youth unemployment were outlined in the new programming period of 2014–2020 in Slovakia. Measures such as "Work Experience for Future Employment," "Graduate Practice Starts up Employment," and "My Chance in the Labor Market" were invoked to facilitate the gaining of practical experience by creating a temporarily subsidized job with an employer and attaining practical skills in the given field and supported self-employment. Their implementation was initiated in the second half of 2015 (Liptáková 2012). On the whole, from the above statements, current youth unemployment problematic issues in Slovakia are associated mostly with the education system, which are not adapted to the current labor market needs. Those needs are related to a graduate who has a not only strong theoretical background but also practical skills to use theory in practice, thereby, be flexible, innovative, and able to adapt to constantly changing situation in the labor market.

5.4 Slovenia Case

According to Ignjatović (2010), Slovenian youths, especially unemployed young people, are included in the majority of Slovenian Active Labor Market Policies (ALMPs) as one of the groups at risk. However, there are a very small number of measures aimed specifically at young unemployed people aged 15–24; all are divided into four groups:

- Counseling and job search assistance advises and assists young people about career opportunities and provides occupational and employment information, guidance, and motivation, thus developing new forms of assistance and representation. Workshop "After studies into employment" intended to help young graduates' transition to the labor market.
- Training and Education measure aims to increase the employability and competitiveness of employed and unemployed people in the labor market by acquiring new knowledge, skills, and abilities and by raising their educational level. Program "Graduate—Activate yourself and get the job!" was meant to improve the employment opportunities for young graduates keeping a record of registered students and connect them with employers who are looking for new graduates. Education program "Learning for Young Adults" was designed to help young people who have no qualifications, occupation, or employment, to overcome social isolation and encourage them to continue schooling and, where this is not possible, to promote the acquisition of skills that make the transition to work easier.
- Promoting employment and self-employment aims to promote new employment and self-employment opportunities and subsidizing self-employment through the program "Employ.me," which aims to develop the skills, knowledge, and social security of unemployed persons by subsidizing jobs.
- Programs to increase social inclusion aim at promoting social integration and employment, development of social entrepreneurship, social inclusion, and employment. The adopted new Labor Market Regulation Act is widening the access to unemployment benefits to people who were employed for at least nine out of the last 24 months.

To sum up, to overcome challenges regarding youth unemployment, Central European countries will need a united approach involving different levels of government, i.e., regional, national, and NonGovernmental organizations (NGOs) to set targets and evaluate impacts while developing youth employment policy.

6 Main Features of Youth Employment Policy in Eastern European Countries

6.1 Estonian Case

Estonia is the first Eastern European country in which measures to tackle youth unemployment are outlined. As pointed out by Eamets and Humal (2015), only in 2015, the first youth-specific measure "My first job" was launched, which provides wage support to the employer so-called employment subsidy, hiring a young person with no or little work experience. Subsidies for employers include 50% of wages being paid by the government for up to 12 months. Other measures created to tackle youth unemployment include:

- Career counseling and career information rooms across the country provide all the information about working or studying or general advice from career specialists. This is available for young people who have not registered as unemployed in the Estonian Unemployment Insurance Fund (UIF).
- Work clubs are group meetings to get information about the labor market through activities such as introducing the labor market situation, developing communication and social skills, learning to perform at a job interview, and composing a CV and a cover letter.
- Labor market pieces of training that can last from one day to one year can be provided to acquire or enhance one's occupational skills that facilitate finding a job. Jobseeker who participates in such pieces of training, work practice, internship, or volunteer work can receive a scholarship and remuneration of travel costs (Eamets and Humal 2015).

6.2 Latvian Case

Latvia also implemented a range of measures to fight youth unemployment. Organization for Economic Co-operation and Development (OECD) indicated the main measures launched by the State Employment Agency (SEA) that started to be brought into effect in 2011:

- Youth workshops are dedicated to young people with a low level of education or without any work experience to raise awareness of educational needs and options linked to existing job opportunities.
- Support for youth volunteer work is created for young unemployed aged 18–24 years working in associations and foundations also known as "First work experience in NGOs". This type of program is usually not associated with strong employment outcomes in the private sector but can be useful in times of weak job creation as participants receive an allowance for up to six months.

- Subsidized first experience jobs or "First work experience at employers" for 18–29-year-old who have been either unemployed for the last six months, those without secondary education or professional qualification, as well as single parents, disabled, or belonging to an ethnic minority. Hiring a person matching one of those criteria might bring a subsidy for an employer for up to 12 months.
- Support to self-employment or entrepreneurship provides help in writing a business plan preparation and enables an entrepreneur to receive a grant to start a business, counseling during the first year of business, and a subsidy equivalent to the minimum wage for the first six months of the project.

6.3 Lithuanian Case

Lithuania implemented several measures to fight youth unemployment as well. 2014 was one of the most active years in doing so. Kvedaraitė et al. (2012) stated that youth employment and development of successful integration into the labor market are given special attention by creating programs of youth consulting and information and employment and unemployment mitigation, thus encouraging young people to strive for personal improvement and search for opportunities to earn a living or even start a business themselves instead of being the beneficiaries of social benefits or aid. Main programs meant to boost youth employment in Lithuanian are implemented by Labor Market Exchange under European Social Fund projects:

- Project "Trust in Yourself" helps to prepare for employment in the labor market for young people aged 16–25 who are not in employment nor education, nor engaged in any active labor market policy measure.
- Project "Employment Support" targeted at young people under 29 years to engage in two measures: subsidized employment and supporting the acquisition of job skills.
- Project "Stay in the Labor Market" helps young people under 29 years to engage either in subsidized employment, acquisition of job skills, or rotation.
- Project "Youth Voluntary Service" encourages young people under 29 to take part in volunteering for at least 20 h/week up to 3 or 6 months.

6.4 Poland Case

Poland is the last Eastern European country in which measures to reduce youth employment will be discussed. Poland's efforts to combat youth unemployment are based on three pillars: (1) public employment services, (2) encouragement of greater worker mobility, and (3) promotion of entrepreneurship. Accordingly, the actions taken are (it is a key to stress that these measures are very similar to those applied in Hungary):

- Young people are provided for a support to find jobs as well as employers eager to take on the unemployed were financially supported. Vocational training is proposed for unemployed persons.
- As Poland's regions are very divergent in field of unemployment level, greater worker mobility within the country is supported.
- Attractive loans for young entrepreneurs and support for start-ups by pupils still at school were proposed in order to foster to create entrepreneurial business. Pupils at schools had an opportunity to prepare their business projects as coursework's. Financial support for start-up projects that were interpreted as highly innovative was proposed (European Economic and Social Committee 2015).

It could be noted that Poland undertook wide actions to fight youth unemployment. Such measures included subsidies for employers, general worker mobility within the country as well as the encouragement of entrepreneurship. Moreover, according to Polakowski (2012), one of the widely known programs to reduce youth unemployment in Poland is "Young People in the Labor Market" launched in 2012 aiming to increase the employability of young Poles by providing them with additional training and mobility instruments such as vouchers for training (both infirm and those offered by vocational schools) and mobility allowances. Also, it is worth mentioning that more and more programs are implemented in Poland grappling with youth unemployment problematic issues in creating as better conditions as possible so that more young people would be employed.

In conclusion, it can be stated that it is probably unsurprising that measures adapted by CEE countries to fight youth unemployment are quite similar. Although each country has its specifics that have to be taken into consideration while creating and developing youth employment policy or adapting EU's laws, strategies, or initiatives, all countries pay attention to such aspects fighting youth unemployment as education that meets labor market requirements, providing all career counseling information, youth mobility, entrepreneurship, self-employment, subsidies for employees hiring young people, and pieces of training to gain occupational skills or volunteering to gain experience. Several differences were noted as well while analyzing youth employment policy measures. Only Estonia implemented measures such as Labor market pieces of training that provide an opportunity to young people to acquire or enhance occupational skills that facilitate job search during which young person not only gain occupational skills but as well can receive a scholarship and remuneration of travel costs. The Czech Republic promoted interest in technical education to provide highly skilled workers for the labor market. Hungary provides housing benefits for jobseekers who cannot find a job for more than 3 months if they find a job away from their home. However, despite an advance in improving youth employment, CEE countries still have a great amount of work ahead regarding the improvement of youth employment policies. Among to do tasks are: the creation of new employment opportunities for young people, promoting youth mobility, apprenticeship, or a traineeship, and opportunities to retrain so that a young person would be able to find a new job and encourage close cooperation between government and business sector. However, one of the biggest challenges is reforming the education

system, and so it can adapt to the latest labor market requirements. It is possible to induce that youth policy in CEE countries is recognized as a common policy toward young people and emerging from their needs. Fighting youth unemployment requires a range of early interventions—from hiring subsidies to certain training opportunities. These interventions need to be appropriately targeted at those who will benefit most from them. The essence of youth policy in mentioned countries is the creation of appropriate living conditions for young people, enabling them to participate in public, social, cultural, and political life equally with other social groups.

7 Conclusions

Several groups of indicators regarding youth unemployment in CEE countries were invoked. Indicators such as demographic, economic, educational, social, and time-related helped to analyze trends and distinguish main factors that influence youth unemployment in CEE countries the most. Demographic indicator revealed that societies in CEE countries are aging, while economic indicators portrayed the relation between such indicators as GDP, minimum wage, self-employment, comparison of youth and adult unemployment levels, and youth unemployment rate. The educational indicators showed the importance of education for a young person to be employed, while social indicators revealed the differences in gender unemployment among youth. Time-related indicators revealed the relation between youth unemployment and time, seasonality, and type of contract.

Throughout the time, the EU has created many initiatives, programs, and strategies tackling youth unemployment and shaping youth policy within the Union. Initiatives such as White Paper, European Youth Pact, Youth on the Move, Youth Guarantee, and Youth Employment Strategy involve various measures on how to reduce youth unemployment and create favorable living conditions for young people. Moreover, these initiatives indicated areas to be improved such as education system, the balance between work and personal life, youth mobility, traineeship system, wage subsidies for employers hiring young people, and many others to help young people to find a job as soon as possible and do not stay in unemployment for a long period.

Youth employment policies in CEE countries are quite similar and highlight the same aspects on how to improve youth unemployment. All countries distinguished the need to provide young people with all the information related to work, labor market, and employment opportunities at the beginning of their career. One of the most discussed areas is the improvement of the education system as a young educated person without job experience faces difficulties to find a job. This is supported by the idea that traineeships are a very important part of a young person's life to receive practical skills needed in the labor market. Youth mobility is also encouraged as it allows young people to either study or work abroad and gain experience as well. Much attention is given to self-employment and opportunities

it might provide. Finally, all countries acknowledge that to increase youth employment, employers hiring young persons have to be subsidized and provide incentives to employ young people.

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Insular Region Policy in Greece

Vasiliki Delitheou, Eleftherios Podimatas, and Evanthia Michalaki

Abstract Due to the large number of islands that are located in its territory, Greece strongly encountered the phenomenon of insularity. The main aim of this article is to propose the strategic objectives that need to be carried out to achieve the necessary modification of the pursued policy. In this way, the insular regions will be led to their development. The purpose of this article is to highlight the problems that insular regions in Greece face and present their development strategy. In order to conclude the above proposals, the presentation of the characteristics of each Greek insular region was required and the current policies that shaped the regional development of the islands are mentioned. So as to achieve the best study of the current situation and the prospects for further development of the insular areas, it was deemed necessary to analyze their internal and external environment, in relation to the peculiarities of the Greek insular area. The research method on which this paper is based is mainly bibliographic research, and the data gathered from the literature are based on primary and secondary data. The secondary data were drawn from books, articles, as well as material from public authorities that fill the need for study and scientific approach and documentation of issues concerning the Local Government, such as the Hellenic Statistical Authority and the Institute of Local Administration. The primary data were derived by the Institute of Local Administration, in the context of the implementation of the study "Technical Assistance in the Financial and Administrative Management of small Island and Mountain Municipalities". This is why it was deemed necessary to carry out a SWOT analysis, which will reflect the common points of the strategic planning of the Greek regions.

Keywords Island policy · Insularity · Greece

V. Delitheou · E. Podimatas · E. Michalaki (✉)
Department of Economics and Regional Development, Panteion University of Social and Political Sciences, Athens, Greece
e-mail: v.delitheou@panteion.gr

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1 Introduction

Insularity is a lasting phenomenon of geographical discontinuity, and it escalated inversely proportional to the size of the island and proportional to its distance from the mainland. Factors affecting the escalation of insularity are the isolation that may be internal and external, the size of the island, and the distance from the main continental development pole (Konsolas 2016).

The term "Double Insularity" refers to the large, combined, intensity of internal and external isolation, the size of the island, and the distance from the main continental development pole, which is mentioned even within the island area itself, due to the small (regarding area and population) size of the islands, the difficulty of intraisland communication, and the distance not only from land but also from the larger islands in the area. This phenomenon creates further problems for development and spatial cohesion (Konsolas 2016). Dual Insularity is a key feature of the South Aegean Region because it combines the above factors to a great extent.

The interaction between the geographical discontinuities observed in the island area causes considerable problems. This paper examines the most important of these, such us accessibility to and from them, access to health and education services, seasonality, environmental problems, and the inability to develop external economies. It has also been noticed that in policy design, the only criterion for measuring growth is GDP per capita, which by itself cannot capture the level of development of a region. This is due to its inability to capture the problems faced by the islands, and it is influenced by seasonality.

The aim of this article is to highlight the problems that insular regions in Greece faced and present their development strategy. This paper will serve as an important tool for evaluating the insular policy, which should be taken into account in development planning for them, and the same development policy applied for the mainland should not be applied.

The first part of this paper presents some important issues that are being faced by islands, due to insular policy. The second part analyzes the internal environment analysis of insular regions. The physiognomy of the Greek island areas along with the external analysis of the environment of island areas and the EU's insular policy is also presented. In order to verify the impact of the bibliographic research, this paper first attempts a theoretical analysis of the factors that determine which insular policy is going to be adopted according to economic, social, and structural features. The ultimate target is to attract investment, followed by an improvement over the living environment. In this manner, this paper will crystallize the understanding of the insular policy over Greece and EU, by extension.

2 The Issue of Insularity

Insularity creates barriers to transport because it restricts access to the islands. There are also problems with access to Services (Public Administration, Health, and Education), external economies cannot be developed, Demand and Employment seasonality is observed, and access to specialized Human Resources is limited. Other major impacts are adverse demographic factors, environmental problems, and limited natural resources.

A multi-island municipality defines the island municipality to consist of island community municipalities, in Greece, the phenomenon of multi-islands occurs in the Municipalities of Thira, Naxos and Small Cyclades, Corfu, and Lefkada (Konsolas 2016).

Some quantitative indicators are taken into account when measuring insularity intensity. Some of them are the number of islands, their size, the length of their coasts, their agricultural land, their population, employment by sector, tourists, GDP, per capita GDP, gross value added (GVA), and imports and exports of products (Delitheou 2018).

Application of quantitative indicators in the Greek islands cannot be done as the necessary quantitative data are not available and the indicators between them are not calculated at the same NUTS statistical level.

Indicators regarding land area, population, population density, and coastal length are available at island level. Data on GDP, per capita GDP, and GDP are available at NUTS 3 level. Still employment by production sector, number of unemployed, and imports and exports are at NUTS 2 level.

Indicators regarding land area, population, population density, and coastal length are available at island level. Data on GDP, GDP, and GVA are available at NUTS 3 level. Additionally, employment by production sector, number of unemployed, and imports and exports are data found at NUTS 2 level (Konsolas 2016).

3 Internal Environment Analysis of Insular Regions: Structural Features and the Physiognomy of the Greek Island Area

Greece is the European country with the most inhabited islands, which are 222, based on the last census (Petrakos and Psicharis 2016). Greek Islands and island clusters cover 18.8% of the country's territory, and they consist of 9837 island lands belonging to the categories of islands, small islands, rock islands, and desert islands (Papadaskalopoulos et al. 2015).

It should be noted that from the 13 regions of the country, the twelve (12) include in their territories islands, with the exception of the Region of Western Macedonia. In addition, there are four (4) Island Regions in Greece, which are the Region of Crete, North Aegean, South Aegean, and Ionian Islands (Delitheou and Michalaki

Table 1 Participation of Greek Islands in National Population and Territory

Region	Population 2015 (inhabitants)	Participation in national population (%)	Area (km^2)	Participation in national territory (%)
Northern Aegean	199,231	1.84	3836	2.91
Southern Aegean	309,015	2.86	5286	4.01
Ionian Islands	207,855	1.92	2307	1.75
Crete	623,065	5.76	8336	6.32
Greece	10,816,286	100	131,957	100

Source: Institute of Local Administration (2017)

Table 2 The extent of the Greek Mountainous Area by Island Region

Region	Mountain area (km^2)	Percentage of mountainous area of the region	Percentage of the mountainous area throughout the total area of the country
Crete	4116	49.40%	7.40%
Northern Aegean	1313	34.20%	2.40%
Southern Aegean	1494	28.30%	2.70%
Ionian Islands	548	23.70%	1.00%
Greece	55,795	42.30%	100%

Source: Papadaskalopoulos and Christofakis (2016)

2016). Regarding the size of Greece, it is 131,957 km^2. From these, the area of Crete covers 6.32%, followed by the South Aegean Region with 4.01%. The smallest island region in the country is the Ionian Island Region, which covers 1.75% of the country, while the Northern Aegean Region covers 2.91% of the national area (Table 1) (Konsolas 2016).

Greece, apart from being an island country, is one of the most mountainous countries of Europe (Petrakos and Psicharis 2016). This characteristic is also evident in the Island Regions. From the island regions of the country, in the Region of Crete, the participation of the mountainous area in the total area of the Region is 49.4%, while it covers 7.4% of the total mountainous area of the country. The island region that has the smallest percentage of the mountainous area in its total area is the Region of Ionian Islands, with a percentage of 23.7%, while the Region's participation in the country's mountainous area is only 1.01% of Greece's mountainous area (Table 2).

The third ranked Region of Greece, whose mountainous percentage is higher than the national percentage, is mountainous Crete (Papadaskalopoulos and Christofakis 2016). Table 3 presents the total number of airports and ports per Island Region, serving arrivals of passengers/tourists, both domestic and foreign, to and from the Regions, for the current period.

Table 3 Airport classification

Region	State international airports	State domestic airports	Municipal airports	Number of airports
Northern Aegean	Mitilini airport "Od. Elitis"; Limnos airport "Ifestos"; and Samos airport "Aristarchos"	Ikaria airport "Ikaros"; Chios airport "Omiros"	–	5
Southern Aegean	Kos "Ippokratis" and Rhodes "Diagoras"	Santorini, Milos; Mykonos; Naxos; Syros; "Dimitrios Vikelas"; Astypalaia; Kalymnos; and Karpathos	Kasos; Leros; and Megisti	14
Ionian Islands	Zakynthos "D. Solomos"; Corfu "I. Kapodistrias"; and Kefalonia	–	–	3
Crete	Heraklion "Nikos Kazantzakis"; and Chania "Ioannis Daskalogiannis"	–	Sitia "Vintsentzos Kornaros"	3
Insular regions	10	11	4	25

Source: Developed by the Authors Based on Civil Aviation Authority (2019)

Regarding airports, Greek Island Regions have totally 25 airports, ten (10) of which belong to the category "State International Airports" and eleven (11) to the category "State Domestic Airports", while four (4) of them are in the category of Municipal Airports. The region with the most airports is the South Aegean Region (14 airports). On the other hand, the regions with the least are the Regions of the Ionian Islands and Crete, which have three (3) airports each. Taking into account the particularities of the geographical area and the statistical data of the total annual volume of freight traffic (in tons) and of passengers in ports, four (4) categories of ports were created. These categories are Ports of International Interest, Ports of National Importance, Ports of Major Interest, and Ports of Local Importance. Greek Island Regions have seven (7) Ports of International Interest, nine (9) Ports of National Importance, and nine (9) Ports of Major Interest. However, it is particularly important to note that all islands in the Greek Insular Region have ports (Ministry of Shipping and the Aegean 2013). Ports of islands not shown in Table 4 belong to the category of Local Ports.

Regarding the manufacturing sector that attracted most workers in 2018, it is observed that in all four (4) Island Regions, the largest proportion is in the Tertiary Production Sector (Petrakos and Psicharis 2015). The Region with the highest percentage of employees in the tertiary sector is the Region of South Aegean (82.24%), while the region with the lowest percentage of employees in that sector is Crete with 69.87% (Table 5).

The Tertiary Sector is followed by the Secondary Sector in the Southern Aegean and Ionian Islands, while in the Northern Aegean and Crete Regions, the Primary

Table 4 Port classification

Region	Ports of international interest	Ports of national importance	Ports of major interest
Northern Aegean	Mytilini	Vathi (Samos) and Chios	Ag. Kirikos (Ikaria) and Mirina (Limnos)
Southern Aegean	Mykonos and Rhodes	Thira, Kos, Paros, and Syros	Tinos, Naxos, and Patmos
Ionian Islands	Corfu	Argostoli and Zakynthos	Lefkada and Poros
Crete	Heraklion, Souda, and Chania	Rethymno	Ag. Nikolaos (Lasithi) and Sitia

Source: Ministry of Shipping and the Aegean (2013)

Table 5 Percentage of employees by economic activity sector (2018)

Region	Primary sector (%)	Secondary sector (%)	Tertiary sector (%)
Northern Aegean	17.73	11.56	70.70
Southern Aegean	4.28	13.48	82.24
Ionian Islands	9.07	9.76	81.16
Crete	18.06	12.05	69.87
Greece	12.26	15.24	72.48

Source: Developed by the authors based on Hellenic Statistical Authority (2019)

Table 6 Labor force in the Greek insular regions

Year	Northern Aegean	Southern Aegean	Ionian Islands	Crete	Greece
2008	74.3	148.9	95.6	289.0	4998.3
2009	75.8	156.0	97.0	295.5	5040.7
2010	79.1	153.9	96.2	296.1	5029.1
2011	78.8	154.2	94.7	294.8	4936.2
2012	84.7	154.8	94.5	288.0	4890.1
2013	84.2	156.0	91.8	286.0	4843.5
2014	80.2	154.9	90.5	279.2	4810.6
2015	79.2	155.5	90.1	276.0	4807.7
2016	82.5	157.2	90.2	284.8	4804.5
2017	89.5	152.1	91.0	285.2	4779.7
2018	91.3	158.3	93.1	285.4	4743.0

Source: Developed by the Authors Based on Hellenic Statistical Authority (2019)

Sector is the one that follows. However, it is found that the percentages of workers are very different from those of the Tertiary Sector.

Table 6 shows the workforce of each Island Region. The Region with the largest labor force was the Region of Crete and was followed by the South Aegean Region by a large margin during the period 2008–2018. The Region with the lowest number of labor force was the Region of North Aegean.

Table 7 Economically active population in the Greek insular regions

Year	Northern Aegean	Southern Aegean	Ionian Islands	Crete	Greece
2008	70.9	131.6	78.3	247.3	3828.0
2009	69.4	127.7	73.2	234.8	3752.7
2010	67.4	129.8	75.8	220.5	3673.6
2011	65.0	132.3	73.0	209.1	3610.7
2012	62.3	123.8	71.1	212.2	3536.2
2013	65.6	122.8	75.2	214.8	3513.2
2014	66.2	131.0	80.6	223.9	3695.0
2015	67.0	130.7	81.3	248.3	4054.3
2016	71.6	131.4	82.2	260.7	4389.8
2017	70.8	136.8	87.8	268.7	4556.0
2018	70.8	136.5	87.6	270.4	4610.5

Source: Developed by the authors based on Hellenic Statistical Authority (2019)

Table 8 Economically inactive population in the Greek insular regions

Year	Northern Aegean	Southern Aegean	Ionian Islands	Crete	Greece
2008	20.3	26.7	14.8	38.1	915.0
2009	20.1	24.4	17.9	50.4	1027.0
2010	15.1	27.4	14.4	64.3	1130.9
2011	14.2	23.1	17.1	66.9	1197.0
2012	17.9	31.1	19.4	66.9	1274.4
2013	18.5	33.2	16.6	71.2	1330.3
2014	18.5	23.8	13.9	64.1	1195.1
2015	11.8	23.4	13.3	46.5	881.8
2016	7.5	22.4	14.0	35.4	639.4
2017	5.0	19.2	9.2	26.7	484.7
2018	3.5	12.4	8.0	18.6	387.9

Source: Developed by the authors based on Hellenic Statistical Authority (2019)

Table 7 shows the number of people employed per Insular Region. The Region with the largest number of employees in the period 2008–2018 was the Region of Crete, followed by the Southern Aegean Region. The Region with the lowest number of employees was the North Aegean Region.

According to data obtained by Hellenic Statistical Authority on unemployment in the Greek Insular Regions, it is evident that the Region of Crete and the Region of South Aegean have the largest number of unemployed in the period 2008–2018 (Table 8).

The Active Population Employment Index reflects the percentage of the economically active population. The Insular region with the largest Employment Index in the last 5 years is the South Aegean Region, while the region with the lowest Employment Index is the North Aegean Region (Fig. 1).

The Unemployment Index reflects the percentage of unemployed toward the economically active population. According to Fig. 2, it is observed that from 2008

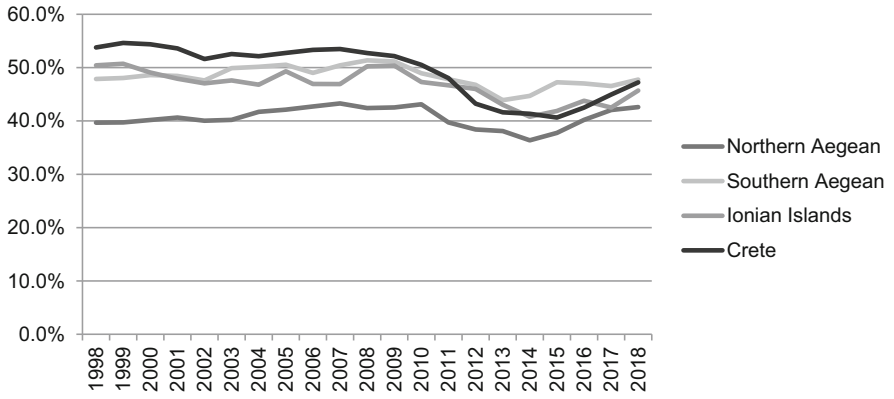

Fig. 1 Employment Index in the Greek Insular Regions. Source: Developed by the authors based on Hellenic Statistical Authority (2019)

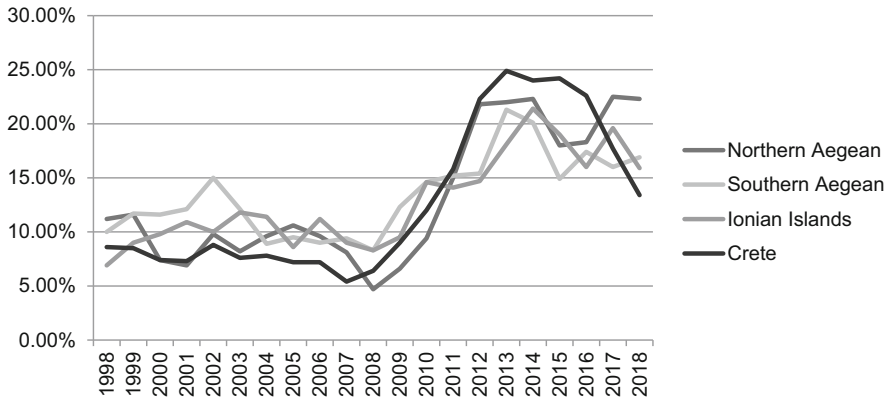

Fig. 2 Unemployment Index in the Greek Insular Regions. Source: Developed by the authors based on Hellenic Statistical Authority (2019)

to 2013 in all Island Areas, the Unemployment Index is increasing. Then, its values begin to decline but continue to remain high. The Greek islands are based on the economic activities of the Tertiary Sector and more specifically on the tourism industry. The model of tourism development in recent decades has been Mass Tourism. This means that there is an over-concentration of tourists in certain areas and at specific times (seasonality of demand). Visitors to the islands, who wish to spend their holidays on this island, want to pay a little money and enjoy a lot (Tsartas 2010).

The development of Industrialized Mass Organized Tourism in Hotels is preferred by tourists, mainly because packages are offered, which do not require tourists to engage in holiday planning (Tsartas 2010). Although this standard is very strong, there are some tendencies to reduce its intensity. Also, an evolution of the

industrialized organized mass tourism in hotels is the "all inclusive" system. This one has been particularly developed because it reduces the cost of holidays as much as possible, as it offers free of charge all hotel services. Islands that greatly developed this type of mass tourism are Corfu, Rhodes, Crete, and Kos (Tsartas 2010). At the international level, however, there is a tendency for self-reliance on tourists, something that is enforced by the use of the Internet.

An increasing trend is also observed in the model of mass (autonomous or mixed) organized tourism, which is an evolution of industrialized mass organized tourism in hotels. The key differentiation is that it enables the tourist to gain more autonomy (Tsartas 2010). Although this standard is a qualitative upgrade of the industrialized standard, it still has a negative impact on some islands. Some of the Greek islands that have developed the Model of Mass Organized Tourism are Samos, Lesvos, Limnos, Lefkada, Zakynthos, Kefalonia, Skiathos, and Thassos.

However, taking into account various socioeconomic, ecological, and cultural consequences caused by a significant concentration of tourists, concerns have arisen regarding the sustainability of mass tourism (Bakogiannis, et al. 2020). The aim is to implement an environmentally friendly development policy without reducing the islands' economic revenue. This can be achieved through sustainable tourism development, which includes planning, which aims to create and enhance the balance between social justice, economic efficiency, and environmental protection (Kokkosis and Tsartas 2019). In the islands, alternative tourism should be promoted by relying on one form or combining the development of more of these forms, in order to cover a wider range of their tourism potential.

Cultural Tourism is a form of alternative tourism that can be developed in the Greek islands, as it aims to promote, exploit, and preserve their cultural heritage (Venetsanopoulou 2006). It is also combined with and co-exists with mass tourism or other alternative forms of tourism. Additionally, Maritime Tourism is a form of alternative tourism especially important for the Greek islands (Milonopoulos and Mira 2005), due to the long length of their coastline. Maritime tourism is defined as any tourism activity taking place in the maritime area (seas and coasts) of a country (Igoumenakis and Igoumenakis 2013), that is, the whole range of tourist activities, recreational, sports, or sea tours with pleasure boats or cruises.

4 Island Policy in the EU

European Union has not shown its interest in strengthening the Island Regions and removing the problems caused by insularity, such as Economic, Social, and Environmental Inequalities. Island Regions can be financed by the European Maritime and Fisheries Fund, which provides higher aid ceilings for the outermost regions and remote Greek islands, which are at a disadvantage due to distance (Konsolas 2016). In addition, the European Agricultural Fund for Rural Development (EAFRD) helps for the reduction of specific constraints and structural problems in agriculture and

Table 9 European islands' classification according to their population

Category	Population size	Number of islands
Large islands	More than 50,000 permanent inhabitants	15 islands of which 5 have more than 500,000 inhabitants (Sicilia, Sardegna, Mallorca, Cyprus, and Crete)
Medium-sized islands	Between 5000 and 50,000 permanent inhabitants	44 islands
Small islands	Between 50 and 5000 permanent inhabitants	303 islands
Very small islands	Less than 50 permanent inhabitants	228 islands

Source: ESPON (2013)

forestry and enhances the added value of agricultural and forestry products resulting from the distance of the island (Konsolas 2016).

Islands are very different between each other. In order to make better and easier the comparison between the islands of the European area, ESPON 2006 created two kinds of classification. The first concerned the creation of categories according to the size of the islands and the second according to their population. Taking as criterion the size of the islands, the category "Very Large Islands" includes islands that their area exceeds 5000 km^2, while "Intermediate" islands are between 100 km^2 and 1000 km^2. In the category, "Small Islands" belong to those that range from 25 km^2 to 100 km^2, and the last category of "Very Small Islands" includes those that do not exceed 25 km^2 (Konsolas 2016).

Based on the ESPON 2006 classification, Crete belongs to the category "Very Large Islands", based on the area of the island, which is more than 5000 km^2. In addition to the category of "Big Islands" are two (2) islands, Lesvos and Rhodes (Konsolas 2016). Regarding the population of Greece in 2015, there were 10,858,801 inhabitants of which 207,059 lived in the Ionian Island Region and 197,695 in the North Aegean Region. The population of the South Aegean Region was 334,865 and of the Region of Crete had 631,513 inhabitants (Konsolas 2016).

According to the European Island classification based on ESPON 2013, according to population, four grades were created. The islands with population more than 50,000 permanent inhabitants belong to the category "Large islands". "Medium-sized islands" are those with a population of 5000 to 50,000, while "Small islands" are those with population of 50 to 5000. The islands with less than 50 permanent inhabitants belong to the category of "Very Small islands" (Table 9).

EU Cohesion Policy and regional aid policy are ineffective because using per capita GDP as a method of classifying Regions, they do not favor islands, as problems arising from the discontinuity of space are not always taken into account during Regional Planning processes. Thus, although the Cohesion Policy and the Common Agricultural Policy recognize the problems posed by insularity, they do not treat island regions differently during regional planning. Island Regional Policy can be supported by Cross-border, Transnational, and Interregional Cooperation

Programs. One of these programs is the "Adriatic-Ionian", which promotes European Integration between Partner States. The program provides support to achieve economic, social, and territorial cohesion in the areas applied. It also aims to provide sufficient transnational cooperation between the Adriatic and Ionian countries in order to create the basis for Sustainable Economic Development, which will ensure the maintenance and restoration of ecosystems in the application area. It should be noted that the Mediterranean program is also aimed at co-operation between the Mediterranean regions including its islands, as it supports the development of its regions. Through the implementation of innovative ideas and policies, the sustainable use of resources is encouraged and the transnational governance of the Mediterranean is promoted.

5 External Environment of Island Areas: Policies for the Greek Island Area

According to the National Strategic Reference Framework (NSRF) 2007–2013, the urban centers of Heraklion—Chania and Rhodes are defined as development poles of island regions. (Papadaskalopoulos and Christofakis 2016). The criteria that led to their selection are their population size and population dynamics, the location of the center according to the existing development poles, their administrative importance, availability of research and health infrastructures, structures and dynamics of the productive model, and the existence of networking elements with neighboring urban centers (Papadaskalopoulos 2008).

While the polar standard according to the National Spatial Framework identifies the Heraklion—Chania dipole as Primary National Poles, Corfu, Rhodes, Hermoupolis, Mytilene, and Chios are included in the Secondary National Poles (Papadaskalopoulos 2008). The Multipolar Development net of North and South Aegean includes the areas of Syros—Paros—Naxos, Lesvos—Chios, Samos—Ikaria, and Rhodes—Kos—Kalymnos (Konsolas 2016). Finally, at the International and Interregional Entrance Gates, Corfu, Rhodes, and Heraklion along with Souda are key ports, while the Development Axis includes the Sitia-Kastelli Kissamos North Road in Crete (Papadaskalopoulos 2008). The NSRF 2014–2020 program sets out the policy to be followed based on a number of thematic objectives that determine their investment priorities. The eligible thematic objectives are the same for all Regions of Greece, whether continental or island. Concerning funding from the NSRF 2014–2020, there will be a reduction in the absolute amounts of aid in the least developed regions, while there will be increase in the transition regions and the more developed regions.

Greece has three (3) Island Transition Regions (Ionian Islands, North Aegean, and Crete), that is, with per capita GDP between 75% and 90% of the EU-25 European average. The South Aegean Region is the only Greek Island Region with more than 90% of the EU average EU-25 and it is considered more developed,

while there is no Island Region that is less developed (Delitheou 2018). The classification of the Greek Islands in the above categories was done according to the statistics of the per capita GDP of the Regions in the period 2007–2009 (Delitheou et al. 2018). By the end of 2009, the country had not suffered the effects of the economic downturn, and as a result, the level of development of the country and the regions was comparatively increased (Kourtesi and Avdikos 2013). Additionally, during 2008–2010, the country's GDP was marginally above 90% of the EU 27 average. Therefore, Greece should not have been financed by the Cohesion Fund, but eventually, the country received aid because it was in a transitional situation (Kourtesi and Avdikos 2013).Thus, compared to the 2007–2013 programming period, the aid granted will be lower due to the above allocation. However, according to GDP statistics for 2016, all the Island Regions had less than 75% of the EU-25 European average (Stavropoulos 2019). Therefore, there will be a reduction in the absolute amounts of aid. This reduction in the Greek Regions, and in particular in the Islands, will act as a hindrance to the development of the islands, as there will not be the necessary funding to reduce the problems they face, such as relative isolation, inadequate access to the market and the public services, and limited availability of productive resources and transport problems.

6 SWOT Analysis

In the context of the implementation of the study, "Technical Assistance in the Financial and Administrative Management of small Island and Mountain Municipalities" by the Institute of Local Administration (2017), a survey was conducted.

In order to identify the characteristics of the internal environment of municipalities in the study area, a survey using a questionnaire in 31 mountainous and 37 small island municipalities was conducted. The aim of the questions was to identify the most important problems and to formulate proposals in relation to the organization, the staffing, the computerization, the equipment, the systems, and the procedures that the Municipality implements. In more detail, the questionnaire included the following thematic sections:

- Evaluation of service operation.
- Ability to meet responsibilities.
- Identify and evaluate problems.
- Required characteristics of executives.
- Support for functions and external partners.
- Computer systems.

A total of 45 municipalities, 23 mountainous, and 22 small island municipalities (66% of the sample) responded to the questionnaire.

The following SWOT analysis emerged after proper processing of the questionnaires and corresponding cooperation with the local island regions (Table 10).

Table 10 SWOT analysis over the Greek internal environment of municipalities

Strengths	**Weaknesses**
▪ Existence of airports, in almost every island, which receive a large number of passengers annually. ▪ Existence of heliports on islands without airports. ▪ Existence of ports on every region. ▪ Significantly improved accessibility from the mainland. ▪ Existence of natural environment of exceptional condition and particular importance both at national and European levels. ▪ Existence of many regulated natural protected areas as well as remarkable flora and fauna. ▪ High readability of the area as one of the most popular and internationally known tourist destinations in the Mediterranean. ▪ Concentration of high-quality cultural elements.	▪ Lack of personnel in departments of regional units. ▪ Conditions of reduced/limited accessibility and inadequate intraregional transports due to double insularity (large and small islands). ▪ Restriction on the utilization of alternative renewable energy sources due to reduced energy transfer capacity. ▪ Lack of land use plans in nonresidential spaces. ▪ Lack of basic infrastructure (water supply, sewerage, etc.). ▪ Problems during the tourist season due to high water consumption. ▪ Water quality problems. ▪ High dependence on travel agents, especially overseas who promote the 'tourist package.' ▪ Nonrecognition of local products. ▪ Intraregional disparities between the economies of the islands.
Opportunities	**Threats**
▪ Utilization of NSRF resources and other financial instruments. ▪ Utilization of the high growth rates of domestic and international tourism moving by ferry, cruise, and yacht. ▪ Utilization of alternative renewable energy sources. ▪ Utilization of national and EU resources for the implementation of environmental management systems. ▪ Holding of graduates of high educational level in the region in order to develop new activities combined with the productive web. ▪ Enrichment, promotion, and integration of the tourism product through exploitation and the cultural reserve (with information, publicity, and awareness for the historical, cultural, musical, artistic, architectural, and religious heritage). ▪ Development of special forms of tourism (cultural, conference, sailing, diving, health, etc.). ▪ Development of primary and secondary sectors in synergy with tourism. ▪ Utilization of recognizable local products, using organic production methods. ▪ Distribution of local agricultural products to visitors in order to exploit the territorial productive resources and at the same time to	▪ Transfer of responsibilities to the region while there is lack of resources and inability to provide electronic services to citizens and businesses. ▪ Lack of personnel in several departments that are confronted with parallel assignment of duties. ▪ Risk of deterioration of environmental resources and the status of the ecosystems of the area, due to the inappropriate implementation of the institutional environmental framework. ▪ Delay in establishing integrated waste management infrastructure. ▪ Delayed implementation of community environmental legislation in the fields of agriculture and livestock, management of water resources, liquid and solid waste, protected areas, etc. ▪ Delay in the implementation of environmental protection projects. ▪ Increased competition from other Mediterranean ports of tourist interest.

(continued)

Table 10 (continued)

promote the local identity of the tourist product. ▪ Utilization of the possibilities for developing intermunicipal cooperation and understanding.	

Source: Developed by the authors based on Institute of Local Administration (2017)

7 Strategic Goals of Insular Regions: Implementation Means

7.1 Transport Sector

For the improvement of transports, it is necessary to redesign the transport system by encouraging combined transport. For that, an Island Transport Regulatory Authority should be created to monitor and optimize the combined transport system. Additionally, it is of major importance that European resources will be utilized for the purchase and/or upgrading of transport means (especially for unprofitable air and sea lines) and of infrastructures to improve accessibility through networks, green ships, etc. For the development of Insular Regions, rules set by Services of general economic interest should be applied regarding the transport network of the islands using European legislation and practice. Finally, a strategic goal related to the insular sector, which is of particular importance, is the reduction of transportation costs for residents and businesses: increase of tax-free threshold or deduction from tax due on ferry tickets for households and waybills for businesses.

7.2 Education, Training, and Lifelong Learning: Employment Sector

Education, training, and lifelong learning and employment sector are of particular importance in the strategic planning for insular regions. More specifically, utilization of distance education techniques to improve access for entrepreneurs, employees, and young people who live on smaller islands to new knowledge is very important. Additionally, it is necessary that support will be provided to municipalities and regions for the effective functioning of the Training and Lifelong Learning Centers. This could be achieved through a specific program for the insular regions that take into account development planning and social needs. During the last few years, more public sector services, services of training, information, entertainment, and culture are provided through internet. Special care must be taken to prevent e-illiteracy of insular regions in order to avoid their social exclusion. Also, the institutional framework of the Social Economy must be activated and it should be implemented by the existing development structures of self-government and with technical support from the competent ministry.

7.3 Health and Welfare Sector

The municipalities provide primary health and welfare services. Over time, this was done without planning and to a different degree among municipalities, accordingly each time with the Central State and Local Government's current institutional framework.

The municipalities are expected to take over the Primary Health Care (Health Centers, Clinics, etc.) as well as all the responsibilities currently performed by the Public Health and Social Welfare Directorates of the former Prefectural Local Authorities, which were abolished and converted. The responsibilities of the abolished "Health Directorates" of the prefectures will be transferred and exercised by a corresponding directorate set up by the largest local authorities.

Additionally, welfare sector is of particular importance in the strategic planning for insular regions. Specific provision such as "Community Centers" should be created to provide social services to meet the needs of medium and small islands.

The main goal is the creation of cooperation networks between the municipalities to improve the physical, cultural, and social environment and the level of well-being of citizens living within the wider boundaries of the municipalities.

7.4 Telecommunication Sector

In order to minimize isolation of Insular Regions, Telecommunication sector should have major priority in strategic planning. Since isolation of insulars must be limited, it is necessity to complete infrastructure for broadband networks to enable development of applications and upgrading of structures (Centers of Citizens' Service) in order to provide businesses and citizens with public services and services of public interest, so that they will not have to move outside of the island.

7.5 Local Administration Sector

Even in local administration sector, there should be modification of the legislative framework for the functioning of local government in order to take into account the particularities of the insular regions. This could be achieved through the enhancement of the executive powers of the first level local authorities in social policy, quality of life, and the planning competences of the second level local authorities given the lack of regional and intraregional projects concerning the islands. Also, the strengthening self-government support structures (especially first level) for the proper functioning of key infrastructures (e.g., water supply and sewage management) should not be neglected. Nevertheless it is necessary to provide incentives to attract qualified staff to cover critical island services as well as to take measures for

the possibility of existence of multipower staff especially in small islands in order to eliminate movement of citizens for their public administration affairs.

8 Conclusions and Suggestions

It is found that since Greece is primarily an island country, it is confronted with its characteristic geographical discontinuity, which is inversely proportional to the size of the island and proportional to the distance from the continental shores. In addition, the existence of insularity is one of the main problems, which is found, relative isolation is observed, and incomplete market access, relatively limited availability of productive resources, and extremely large seasonal fluctuations in the islands' human resources and economic activities are observed.

For the implementation of Regional Development Policy in the Island Regions, their particular characteristics and the problems existing in the islands should be taken into account. It is also suggested that per capita GDP should not be the only classification criterion for regions since it only measures the level of economic development of the Region in one year and excludes the standard of living, health system, education and individual physical and quality characteristics of the regions. Additionally, seasonality, which is found in some Regions and its intensity, is not estimated. With the sole criterion of calculating GDP growth, the problems faced by the island regions cannot be captured. In addition, the per capita GDP of the Islands has increased, due to the large participation of the tourism industry in economic activities.

It will also be useful to differentiate the eligible thematic objectives of the Regional Operational Programs of the continent from the island part of the country, as they will have to be adapted to their particular characteristics (Konsolas 2016). It is noted that in the Regional Operational Programs prepared, only the eligible investment priorities are modified according to the specificities of the Regions. In addition, for the implementation of the NSRF 2014–2020 thematic objectives, an Integrated Development Strategy for the Greek Island Area should be formulated. This will work in a complementary way to properly utilize the cofinanced programs in order to achieve the final development objectives, to alleviate the problems they face, as areas with particular characteristics such as insularity, double insularity, and multi-insularity are found in Greece. Finally, Local Agencies and, in particular, residents should be the leaders in the development of the Regions and Municipalities. They can make an active contribution to development policy, as they are the only ones who know their real needs.

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Informatization Construction and Urban Total Factor Productivity: Empirical Analysis Based on China's Smart City Pilot Policy

Qian Yuan, Lihua Wu, and Ping Zhang

Abstract In theory, informatization construction can optimize resource allocation and improve total factor productivity through changing urban organizational structure and production mode. Based on the quasinatural experiment of smart city pilot policy, this paper employs kernel propensity score matching and difference-in-difference (KPSM-DID) method to test whether it improves the urban total factor productivity with data of China's 171 cities during 2006–2016 period. The results show that: (1) On average, the smart city pilot policy plays a significant role in promoting the city's technical change (TC), and the impact on efficiency change (EC) is positive but not significant. Their coupling effect promotes the growth of urban total factor productivity. (2) Government financial expenditure has significant negative influence on total factor productivity, while industrial structure and infrastructure have significant positive effects on total factor productivity. (3) Heterogeneity research shows that the smart city pilot policy is more conducive to promoting the growth of total factor productivity in eastern cities and high-innovation cities, but it is difficult to improve the level of total factor productivity in western cities and low-innovation cities. (4) From the various forms of robustness tests, it can be seen that the smart city pilot policy has significantly promoted the growth of urban total factor productivity in both statistical and economic sense.

Keywords Urban informatization · Total factor productivity · Smart city · DEA-Malmquist model · KPSM-DID method

Q. Yuan (✉) · L. Wu
School of Economic and Management, Southeast University, Nanjing, China

P. Zhang
School of Computer Science, Nanjing University of Posts and Telecommunications, Nanjing, China
e-mail: zhgp@njupt.edu.cn

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1 Introduction

China's economic development has entered a new normal stage. The economic acceleration in the industrialization stage is shifting to the economic deceleration in the urbanization stage. The traditional extensive mode driven solely by factors cannot be sustained. China's economic growth not only depends on the growth rate but also attaches importance to the quality of growth. The core content of economic growth quality is efficiency. Therefore, the only way to develop China's economy under the background of the new normal is to maintain medium-high economic growth, achieve sustainable economic development, and improve total factor productivity.

A total factor productivity (TFP) is not just the influence of the labor and capital on economic growth, but is the common result of the influence of many factors on economic growth (Solow 1956, 1957). TFP can be utilized to measure the allocative efficiency of factor inputs in economic growth, and it is an important way to analyze the economic development quality of a country or a region and the source of sustainable economic growth (Miller and Upadhyay 2000; Baier et al. 2006). Since the Solow model is set up, especially the endogenous growth model, the research on total factor productivity has made great progress. From the perspective of research methods, production frontier analysis can effectively decompose the growth of total factor productivity (Zhang and Wang 2012). A large number of literatures using production frontier methods to study total factor productivity have emerged in our country and abroad. The commonly used production frontier methods are mainly divided into two categories: one is the parametric method based on the stochastic frontier function method (Lin and Yang 2014); another is the nonparametric method based on the Data Envelopment Analysis (DEA) method (Sahoo and Acharya 2012). Compared with the parameter method, the DEA method does not need to set the specific form of production function in advance, and it is easy to deal with the situation that the decision-making unit is multi-output. Therefore, this paper adopts the DEA method to estimate the total factor productivity of a city.

The annual contribution rate of China's total factor productivity to economic growth reached 20.83% from 2013 to 2017, and the impact of total factor productivity is sustained and significant and effectively promotes the growth of China's economy. Therefore, it is of great significance to study the factors of total factor productivity to find new drivers of China's economic growth under the new normal. As a new core production factor and strategic resource for economic development, informatization has become one of the most critical factors among the existing researches on the factors of total factor productivity (Sung 2007; Jorgenson et al. 2008; Lee et al. 2011). As early as in October 2000, the Fifth Plenary Session of the 15th Central Committee put forward the idea of using informatization to drive industrialization, giving play to the advantages of latecomers, and realizing the leap-forward development of social productive forces and began to explore the informatization construction. There are numerous literatures on the relationship

between informatization and economic development. The following is a review of the literature on the relationship between informatization and productivity and the impact of informatization construction on urban economic growth, which is closely related to this paper.

The research on the relationship between informatization and productivity has gone through a process from holding the information technology productivity paradox at the early stage to agreeing on the promotion effect of informatization on productivity (Weill 1992). In terms of foreign countries, Nordhaus (2002) found that the productivity increase caused by informatization in the United States was between 1.2% and 2.1% from 1996 to 1998. Park et al. (2007) found that informatization greatly increases the total factor productivity in the United States, while also has a significant spillover effect. Similarly, Vemuri and Siddiqi (2009) and Hamdan and Kasper (2010) studied the EU and developed countries, which will not be repeated here. Domestically, Sun et al. (2012) found that informatization did not significantly promote the improvement of total factor productivity in the industry through the quantitative analysis of informatization and economic growth. The contribution of informatization to total factor productivity was still lagging behind to some extent. Zhang and Ma (2013) used the provincial panel data to show that informatization has significant positive effects on China's regional economic growth and industrial structure adjustment of agriculture and industry.

With the increasing influence of informatization on urban economic development, the academic community was also concerned about the problem of informatization construction to the urban economic growth. Informatization construction is a continuous deepening process. Information technology is of great significance to the development of urban economy (Malecki 1997). Different cities present different characteristics of information development. Yigitcanlar and Velibeyoglu (2008) and Van Den Berg and Van Winden (2017) explored the impact of the application of new technologies on urban development in Brisbane, Australia, Eindhoven, Helsinki, Manchester, Marseille, the Hague, and other European cities. In domestic researches, most literatures still affirmed the promotion effect of informatization construction on urban economic growth based on theoretical principles. Since the beginning of this century, urban informatization construction has entered a new stage of smart city development. Zhang and Zhang (2014) believed that smart city covers multiple subsystems and can promote sustainable economic development through economic activity system. Shi et al. (2018) took 197 prefecture-level cities in China as research samples and found that smart city construction improved urban innovation level, reduced resource mismatch, and promoted the upgrading of industrial structure.

In general, domestic and foreign scholars have conducted a lot of researches on informatization, productivity, and urban economic growth. However, due to the large number of factors involved in total factor productivity, there is still a lack of in-depth and systematic researches on informatization from the macropolicy level. Based on this, this paper takes the pilot policy of the first batch of smart city construction in 2012 as the representative of current informatization construction and regards it as a quasinatural experiment. The possible marginal contributions

have the following three points: First, it pays attention to the impact of smart city pilot policy on urban total factor productivity and enriches the research on the impact of existing informatization construction on total factor productivity. Second, the DEA-Malmquist model is used to calculate the total factor productivity, technical change index, and efficiency change index of each city, and then the KPSM-DID method is used to analyze the influence of smart city construction on these three indexes, which makes the research conclusion more accurate in terms of data and methods. Third, the urban samples are split based on the differences of some factors in the process of informatization construction. This paper tests the regional characteristics of the impact of smart city pilot policies on urban total factor productivity and the heterogeneity of innovation.

2 Empirical Design and Variable Description

2.1 Empirical Design

Smart city can be regarded as a policy experiment of informatization construction toward high-end development. The economic effect of smart city pilot can be summarized into two parts: "time effect" and "policy processing effect". Therefore, this paper uses KPSM-DID to estimate the policy. The policy evaluation of traditional difference-in-difference (DID) model implies the premise of "the same time effect". If the premise hypothesis is not satisfied, there will be systematic differences between the treatment group and the control group, and the regression results of multiple difference analysis are likely to be biased. However, the characteristics of smart cities and other cities are heterogeneous before the pilot policies, and so it is not easy to find matching cities with completely similar characteristics to the pilot smart cities to overcome the sample selection bias. Therefore, it is better to match the samples before applying the DID method, so that the treatment group and the control group are very similar in other characteristics except the difference of "participating in the smart city pilot policy". The kernel matching DID method combines the kernel function's propensity score matching with the traditional DID method, which is helpful to improve the sample selection bias of prefecture-level cities, and basically satisfies the assumption that the DID method has the same time effect.

There are two main steps in the tendency score matching: First, given the matching variable $X_{i,\,t\,-\,1}$ (The match period is before the implementation of policy) if a prefecture-level city participates in the construction of the smart city as the treatment group, the value is 1; otherwise, if it is the control group, the value is 0. The Logit regression model is used to estimate the Chinese cities to participate in the pilot wisdom city policy of conditional probability P,

$$P = \Pr\{DZ_t = 1\} = \Phi\{X_{i,t-1}\}. \tag{1}$$

Second, propensity score matching was performed. Common propensity score matching methods include K-nearest matching, radius matching, kernel matching, etc. However, since $P(X_i)$ is a continuous variable, only a few cities other than smart cities can meet the matching criteria of the control group by using K-nearest matching or radius matching methods. Since the kernel matching method takes the average weight of other cities other than all smart cities as the control group for each smart city to establish a matching, this paper adopts the kernel matching method to solve the problem of urban sample matching.

After the kernel matching is completed, the average processing effect ATT can be further calculated,

$$\mathrm{ATT}^k = \frac{1}{N^T}\sum\nolimits_{i\in T}\left\{Y_i^T - \frac{\sum_{j\in C} Y_j^C G\left(\left(p_j - p_i\right)/h_n\right)}{\sum_{k\in C} G\left(\left(p_k - p_i\right)/h_n\right)}\right\}. \tag{2}$$

The average processing effect ATT is to differentiate the difference between the two elements of the total factor productivity gap in the two groups. By comparing whether the difference in the average processing effect ATT is significant, it is judged whether the pilot policy has produced an effect. T and C are the collections of the smart city's treatment group and the control group outside the smart city, N^T is the number of all smart cities in the treatment group, and Y_i^T and Y_j^C are the true total factor productivity levels. $G(\cdot)$ is a kernel function; p is the propensity score value, and h_n is the bandwidth. The last item in braces Y_{0i} is the consistent estimator. Of course, the ATT obtained in Eq. (2) is only the average difference in total factor productivity between the treatment group and its control group after matching, but not the net treatment effect brought by the smart city pilot policy. Therefore, on the basis of nuclear matching, it is necessary to use the DID method to estimate the net effect of policies according to the weight generated by the propensity score, which is the real total factor productivity difference caused by the improvement of informatization construction level,

$$\mathrm{ATT}^{\mathrm{KPSM-DID}} = \frac{1}{N^*}\sum_{i\in\{1_T\cap S^*\}}\left[\left(Y_{i,T}^1 - \sum_{j\in\{0_T\cap S^*\}}\omega_{ij}Y_{j,T}^0\right) - \left(\sum_{j\in\{1_C\cap S^*\}}\omega_{ij}Y_{j,C}^1 - \sum_{j\in\{0_C\cap S^*\}}\omega_{ij}Y_{j,C}^0\right)\right]. \tag{3}$$

The KPSM-DID in formula (3) represents the kernel matching DID method, T represents the set of the treatment group, C represents the set of the control city, 0 represents the control base period, 1 represents the smart city pilot policy effect inspection period, indicating the common support area, which is the number of cities entering the common support area in the treatment group of smart cities, and Y is the

total factor productivity level of the city, indicating the weight of the control city matching the treatment group smart city.

In order to accurately analyze, the KPSM-DID measurement model based on kernel matching is set as

$$Z_{it}^{\mathrm{KPSM}} = \alpha_0 + \alpha_1 \mathrm{City}_{it} \times \mathrm{Year}_{it} + \sum\nolimits_{i=1}^{N} b_i X_{it} + \varepsilon_{it}. \tag{4}$$

The explanatory variables are regressed by the total factor productivity (TFP), the technical change (TC), and the efficiency change (EC), which are related to the total factor productivity level obtained by the DEA-Malmquist model. City_{it} is the urban dummy variable, which reflects whether city i is a smart city of policy pilot. If so, it is 1 and 0 vice versa. Year_{it} is the year dummy variable, which reflects whether the country implements the smart city pilot policy in the year t. The year before the implementation takes the value of 0, and the year after the implementation takes the value of 1. The interaction term is the core explanatory variable in this paper, and its coefficient measures the net effect of the smart city pilot policy on the impact of urban total factor productivity. X_{it} is a series of control variables that affect the total factor productivity of cities, including human capital, foreign direct investment, government financial expenditure, industrial structure, and infrastructure. ε_{it} represents random error term.

2.2 Data Source and Variable Description

Taking into account the availability of prefecture-level city data, this paper excludes prefecture-level cities located in the western region and selects only 28 pilot smart cities established in 2012 as treatment groups, and other 143 nonpilot cities are defined as the control group, i.e., 171 cities selected balance panel data from 2006 to 2016. The data are mainly derived from the *Chinese Cities Statistical Yearbook* over the years. The smart city pilot was conducted in 2012. So far, the policy has been in effect for a short time, and the impact informatization construction represented by smart cities on urban total factor productivity is a short-term effect.

This paper focuses on whether informatization construction can improve urban total factor productivity. Therefore, this paper takes the total factor productivity as the explained variable and uses the DEA-Malmquist model to estimate. The DEA-Malmquist model reflects the trend of total factor productivity by measuring the relationship between total factor productivity and 1. Technical change (TC) and efficiency change (EC) can be obtained by further decomposing the measured total factor productivity (TFP). Among them, the total output is measured by the GDP of each city. Meanwhile, in order to eliminate the price difference between different years, this paper takes 2007 as the base period and reduces the city's historical GDP according to the GDP deflator of the provinces in each city. As for capital input, this paper uses the method of perpetual inventory to calculate the base capital stock,

depreciation rate, and fixed asset investment price index involved referring to the practice of Zhang et al. (2004). For labor inputs, this paper selects the total population of each city at the end of the year to measure. The total factor productivity (TFP) and its decomposition indexes, technical change (TC) and efficiency change (EC), from period t to period t+1 can be expressed as

$$\mathrm{TFP}(X_{t+1}, Y_{t+1}, X_t, Y_t) = \left[\frac{D^t(X_{t+1}, Y_{t+1})}{D^t(X_t, Y_t)} \times \frac{D^{t+1}(X_{t+1}, Y_{t+1})}{D^{t+1}(X_t, Y_t)}\right]^{1/2}, \tag{5}$$

$$\mathrm{TC}(X_{t+1}, Y_{t+1}, X_t, Y_t) = \left[\frac{D^t(X_{t+1}, Y_{t+1})}{D^{t+1}(X_{t+1}, Y_{t+1})} \times \frac{D^t(X_t, Y_t)}{D^{t+1}(X_t, Y_t)}\right]^{1/2}, \tag{6}$$

$$\mathrm{EC}(X_{t+1}, Y_{t+1}, X_t, Y_t) = \frac{D^{t+1}(X_{t+1}, Y_{t+1})}{D^t(X_t, Y_t)}. \tag{7}$$

(X_{t+1}, Y_{t+1}) and (X_t, Y_t) represent the input and output in $t + 1$ period and t periods, respectively; D^t and D^{t+1} represent the distance functions of the $t + 1$ and t periods with the technology of the t period as the reference, respectively.

The core explanatory variable of this paper is the dummy variable (interaction item $\mathrm{City}_{it} \times \mathrm{Year}_{it}$) reflecting whether each city is a smart city pilot in the process of informatization construction. As mentioned above, at the beginning of the smart city pilot policy in 2012, there were 90 prefecture-level and county-level cities, while the prefecture-level cities in the west lacked data in some years, and the index data of county-level cities were limited, all of which were excluded in the selection of urban samples in this paper. Finally, the urban sample covers 171 cities at the prefectural level and above.

For the control variables in this paper, we refer to economic theories and existing literatures and control the following variables:

Human capital (Hk). Human capital can play a direct role in economic growth or indirectly promote economic growth through technological innovation and technological imitation (Du et al. 2014). This paper uses the number of students in ordinary colleges and universities as the proxy variable of human capital.

Foreign direct investment (Fdi). Appropriate opening up can stimulate total factor productivity through technology spillovers, capital formation, and spatial agglomeration, but improper opening to the outside world may produce "crowding out" effect on regional economy, which results in the loss of total factor productivity. This paper uses the proportion of foreign direct investment in GDP as its proxy variable. Among them, the foreign direct investment is converted by the central parity of RMB-exchange rate against the US dollar in the current year, and taking into account the impact of price fluctuations, the GDP deflator in 2007 is further used to deflate the foreign direct investment.

Government financial expenditure (Gov). Government financial expenditure plays a very important role in China's economic growth. Therefore, this paper takes the

Table 1 Descriptive statistics of variables

Variables	Mean	Standard deviation	Minimum	Maximum
TFP	1.024	0.093	0.726	1.401
TC	1.056	0.053	0.902	1.151
EC	0.969	0.069	0.780	1.293
Hk	62,476.320	110,137.200	610.847	966,438.000
Fdi	0.026	0.021	0.000	0.150
Gov	0.187	0.086	0.029	1.725
Sec	50.105	9.241	14.950	76.530
Inf	11.939	6.942	1.430	73.040

Source: Author's calculations based on the *Chinese Cities Statistical Yearbook* over the years. In the actual regression, in order to eliminate the multicollinearity problem, the above variables are treated with logarithm

variable of financial expenditure into consideration and measures it by the proportion of government financial expenditure in GDP.

Industrial structure (Sec). One of the important sources of the improvement of total factor productivity is the resource allocation effect among different industrial sectors, and so the industrial structure will also have an important impact on total factor productivity. This paper adopts the proportion of the output value of the secondary industry in GDP to measure, reflecting the contribution of the development of the secondary industry to economic growth among the three major industries.

Infrastructure (Inf). The improvement of infrastructure can effectively promote the spread of knowledge, information, and technology in cities, accelerate the formation of urban scale economy, and thus promote the improvement of total factor productivity. In view of the availability of data, this paper draws on the practice of Yang et al. (2018) to use the per capita urban road area as the agent.

Descriptive statistics of the above variables are shown in Table 1.

3 Empirical Analysis

3.1 Matching Balance Test

In order to make the empirical results more robust and exclude the influence of other factors, this paper uses the estimated propensity score to match the urban samples and then carries out the balance test of the matching results. Table 2 reports the results of the nuclear matching balance test.

As shown in Table 2, the standard deviation of each matching variable of the treatment group and the control group is significantly reduced after matching, and the absolute value of standard deviation is less than 5%. The matching effect is reliable. From the perspective of t concomitant probability, each matching variable is

Table 2 Results of the matching balance test

Variables	Treated	Mean		Standard deviation (%)	Standard deviation reduction (%)	*T* statistics
		Treatment group	Control group			
LnHk	Before	11.119	10.227	80.1	96.3	12.73***
	After	11.087	11.053	3.0		0.36
LnFdi	Before	−3.6408	−4.0659	48.1	99.2	7.04***
	After	−3.6432	−3.6467	0.4		0.05
LnGov	Before	−1.9639	−1.7248	−63.1	99.2	−9.04***
	After	−1.9587	−1.9607	0.5		0.06
LnSec	Before	3.9851	3.8771	57.8	99.7	8.18***
	After	3.9839	3.9842	−0.2		−0.02
LnInf	Before	2.5976	2.2953	59.3	98.4	9.12***
	After	2.5995	2.5946	1.0		0.12

Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

significant at the 1% significance level before matching. Through matching, the associated probability is significantly greater than 0.1, and the matching variables no longer have significant systematic differences. The significantly reduced standard deviation and insignificant t concomitant probability indicate that the matching variables in this paper are selected appropriately and the matching method is selected properly, and so the regression analysis of multiple difference method can be performed.

3.2 Basic Estimation Results

According to the score of propensity value kernel matching above, this paper excludes the urban observations that do not meet the matching conditions. On this basis, the DID method is adopted to carry out regression for all samples of cities that meet the matching conditions, so as to test the direct impact of smart city pilot policy on urban total factor productivity. The basic estimation results are shown in Table 3.

In Table 3, columns (1), (3), and (5) are the estimated results when no control variables are added, while columns (2), (4), and (6) are the results when control variables are added. It can be found that the regression coefficient $\text{City}_{it} \times \text{Year}_{it}$ does not change significantly when total factor productivity, technical change, and efficiency change are taken as explanatory variables, no matter whether control variables are added or not. When other explanatory variables are controlled, smart city pilot policy can increase urban total factor productivity by 3.8%, and this effect is significant at the level of 1%, indicating that smart city pilot policy has significantly promoted the growth of urban total factor productivity. The results of the total factor productivity decomposition index show that the coefficient estimates are significantly positive with technical change as the explained variable in the model,

Table 3 Basic estimation results

	LnTFP		LnTC		LnEC	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$City_{it} \times Year_{it}$	0.033*** (3.880)	0.038*** (4.391)	0.022*** (6.350)	0.025*** (5.952)	0.011 (1.362)	0.013 (1.595)
LnHk		−0.003 (−0.284)		0.008 (1.299)		−0.011 (−1.037)
LnFdi		−0.002 (−0.752)		−0.002 (−1.200)		−0.000 (−0.029)
LnGov		−0.029** (−2.552)		0.057*** (5.548)		−0.086*** (−5.726)
LnSec		0.118*** (5.151)		0.043*** (3.053)		0.075*** (2.681)
LnInf		0.017** (2.056)		0.015** (2.484)		0.002 (0.262)
Constant	−0.057*** (−33.066)	−0.596*** (−3.851)	−0.025*** (−24.804)	−0.211** (−2.079)	−0.031*** (−16.475)	−0.385** (−2.170)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Samples	1549	1549	1549	1549	1549	1549
R^2	0.101	0.133	0.026	0.130	0.050	0.131

The values in brackets are robust standard errors
Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

but not with efficiency change as the explanatory variable, indicating that the promotion of smart city pilot policy to urban total factor productivity is mainly achieved by promoting technical change and has not played a significant role in promoting efficiency change. Just as the new economic growth theory holds that technical change is the core of growth and the driving force of economic growth difference, the technology of smart city in the new stage of informatization development is updated rapidly. The application of modern new technology promotes the continuous progress of the industry and the continuous innovation and upgrading of informatization, which ultimately brings about a significant increase in urban total factor productivity. However, compared with developed countries, the history of China's informatization construction is not long, the accumulation of smart technology and advanced management mode is not mature enough, and the integration of information resources is not easy to carry out, resulting in the imbalance of resource input and output ratio. There is still a large lifting space of efficiency change. In general, although limited to the uncertainty caused by the smart city pilot policy, the improvement of efficiency change is not obvious, but smart city highly integrates the wisdom technology based on modern information and communication technology and accelerates the process of new technology innovation and application. Its promotion of urban total factor productivity is worthy of recognition.

According to the observation of control variables, the regression coefficient of human capital is not significant in different regression models, which to some extent indicates that China's current R&D and innovation relying on human capital are insufficient to drive the sustainable economic development. In the process of informatization construction, more human capital does not necessarily represent higher resource utilization efficiency. It may violate the factor endowment conditions and produce the dislocation allocation of human capital, which results in the insignificant impact of human capital on total factor productivity. Although the regression coefficient of foreign direct investment in each model is negative but not significant, it is difficult to improve total factor productivity by introducing foreign capital and expanding the scale of foreign direct investment at present. Due to the existence of transportation costs and trade barriers, the effect of foreign direct investment on the improvement of urban total factor productivity may be more manifested as a long-term trend process. Government financial expenditure has a negative impact on total factor productivity and efficiency change, while has a positive impact on technical change, and the estimated coefficients are all significant at the level of 1%. This means that the financial expenditure of our government has promoted technical change, but the scale of expenditure is too large and has exceeded the critical value. It has exceeded the state of output inefficiency. The efficiency change has lowered the promotion effect of technical change, thus hindering the growth of total factor productivity. In contrast, the industrial structure has become an important factor to promote the growth of total factor productivity. The coefficients in each regression model are significantly positive at the level of 1%. With the advancement of industrialization and the optimization of industrial structure, the flow of production factors among different industries becomes more and more frequently flowed. More and more advanced production technologies and

management methods are directly applied to the development of secondary industry. As the most important support of the national economy, the technological competitiveness of the secondary industry will be greatly enhanced, and the corresponding urban total factor productivity will also increase accordingly. The coefficient of infrastructure is also significantly positive at the level of 1% in the regression model of total factor productivity and technical change, indicating that the improvement of infrastructure significantly improves urban total factor productivity. Generally speaking, the more complete the infrastructure, the better it will be to improve timeliness, reduce transaction costs, and promote technical change, so as to achieve the growth of urban total factor productivity. The regression coefficients of the above control variables are mostly consistent with the expectations of general economic theory.

3.3 Heterogeneous Regression Analysis

From the results of Table 3, the whole sample estimation, we speculate that the different pilot cities in the role of the informatization construction policy efforts may exist difference. Therefore, based on the above-mentioned kernel matching, this paper splits sample cities from the urban area and innovation level perspectives in order to further explore the cross-sectional differences of smart city pilot policy under different conditions.

3.3.1 Urban Regional Heterogeneity

In this paper, the samples are divided into eastern and central regions according to the traditional method, so as to investigate whether the impact of smart city pilot

Table 4 Regression results of urban regional heterogeneity

	Eastern region			Central region		
	LnTFP	LnTC	LnEC	LnTFP	LnTC	LnEC
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$City_{it} \times Year_{it}$	0.053*** (4.483)	0.019*** (3.620)	0.034*** (3.321)	0.011 (0.990)	0.028*** (4.836)	−0.009 (−0.762)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.147 (−0.537)	−0.149 (−1.089)	0.000 (0.000)	−0.954*** (−5.248)	−0.385** (−2.619)	−0.506** (−2.357)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Samples	755	755	755	794	794	794
R^2	0.229	0.146	0.281	0.068	0.170	0.058

The values in brackets are robust standard errors
Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

policy is different in the two regions. The results of regional regression are shown in Table 4.

The comparison between models (1)–(3) and models (4)–(6) in Table 4 shows that the pilot policy of smart cities in eastern and central regions does have obvious differences in their influences on total factor productivity, technical change, and efficiency change. From the regression analysis results of technical change, the regression coefficients of the cross term $City_{it} \times Year_{it}$ are significantly positive in both eastern and central cities, that is, the level of technical change affected by the smart city pilot policy is significantly improved. In the regression analysis of technical efficiency, the smart city pilot policy has a positive impact on the technical efficiency in the eastern region, but the impact in the central region has a negative impact instead of promoting. In general, the coupling effect of technical change and efficiency change affects the change of total factor productivity. Observing the estimation of total factor productivity mode, it can be found that the influence of the pilot policy in the eastern and central regions presents the "Matthew effect." The eastern cities with absolute advantages have the greatest spillover effect, while the policy has limited the impact on urban total factor productivity in the central cities.

In the process of smart city construction, eastern cities have more resources to complete the pilot work. It can be said that the construction of smart cities in eastern region is supported by the whole social and economic environment. As mentioned above, perfect infrastructure can significantly accelerate the construction progress of smart cities. Smart cities in the eastern region are mainly concentrated in the three economic regions of Bohai Rim, Yangtze River Delta, and Pearl River Delta. With strong economic strength, a large amount of information infrastructure needs for the construction of smart cities can be developed. Meanwhile, eastern cities attach great importance to information technology and have obvious advantages in talent introduction and independent innovation, as well as strong ability in intelligent technology development and achievement transformation. In addition, the superior geographical environment is also conducive to the innovation and diffusion of intelligent technology, which is in a leading position in the country. Central cities promote technical change through economic agglomeration, but they are limited by their own economic strength and lack of the foundation for information technology development, and the efficiency utilization rate is not high. It is difficult to play the demonstration role of pilot cities in the short-term, and the contribution of smart cities to total factor productivity is very limited.

3.3.2 Urban Innovation Heterogeneity

Since the twenty-first century, the world economic competition is increasingly intensified and urban innovation plays an increasingly important role in the sustainable development of the economy. It has become a key factor in whether a city can continuously improve its productivity. If smart cities provide hardware conditions for urban development, then innovation provides a city's software environment. Whether the smart city pilot policy will play a positive role in the total factor

Table 5 Regression results of urban innovation heterogeneity

	High-innovation			Low-innovation		
	LnTFP	LnTC	LnEC	LnTFP	LnTC	LnEC
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$City_{it} \times Year_{it}$	0.051*** (3.279)	0.032*** (4.520)	0.028* (1.979)	0.010 (1.076)	0.012*** (2.806)	0.009 (0.952)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−1.064*** (−4.343)	−0.548*** (−3.692)	−0.043* (−1.701)	−0.045 (−0.448)	−0.127*** (−2.974)	−0.347 (−1.603)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Samples	666	666	666	883	883	883
R^2	0.191	0.181	0.155	0.076	0.043	0.115

The values in brackets are robust standard errors
Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

productivity of high-innovation cities is also one of the important issues concerned by this paper. In the specific empirical process, this paper utilizes the innovation index to represent the innovation level of smart cities. The data come from the *Report on Chinese Cities and Industrial Innovation* published by Fudan University Industrial Development Center. Based on the average value of innovation index, this paper divides the sample cities into high-innovation cities and low-innovation cities and conducts regression, respectively. Table 5 shows the regression results of high-innovation cities and low-innovation cities.

According to models (1)–(3), smart city pilot policy has a significant positive impact on technical change and efficiency change in high-innovation cities. Among them, the regression coefficient of the cross-term $City_{it} \times Year_{it}$ based on technical change is 0.032 and is significant at the level of 1%, and the coefficient of the cross-term $City_{it} \times Year_{it}$ based on efficiency change is 0.028 and is significant at the level of 10%. Under the combined effect of technical change and efficiency change, the smart city pilot policy promotes the growth of total factor productivity in high-innovation cities, which means that high-innovation has a strong support for the smart city pilot policy. This result is not difficult to understand. Smart cities put forward high demands on the development of high technology and related industries, while high technology and related industries, especially information technology, computers, high-end equipment manufacturing, etc., are highly dependent on innovation. When the level of innovation in cities is high, it is easier to develop these industries in the short-term to achieve independent innovation in the core areas. High-innovation cities provide a good R&D environment for the development of smart cities and are often more capable of improving total factor productivity. Models (4)–(6) show that, for low-innovation cities, although the smart city pilot policy has significantly promoted the advancement of technology, the main source of economic growth still depends on cheap labor and capital investment as the low-innovation urban development system is immature. The construction of smart cities has a series of problems such as waste of resources and backward management

mode. The improvement of efficiency change level is not obvious enough, and to some extent, it has weakened the contribution of technical change to the growth of total factor productivity. Compared with high-innovation cities, low-innovation cities adapt to the new stage of informatization construction—the smart city stage still has some difficulty, and relying solely on technical change is not enough to drive the growth of its total factor productivity level.

3.4 Robustness Test

The above uses the more advanced kernel matching DID method to obtain accurate estimation results as far as possible. In order to verify the robustness of the basic estimation results, the following robustness test is carried out.

3.4.1 Change the Test of Efficiency Measurement Method

In order to avoid different measurement methods of urban total factor productivity affecting the empirical results, this paper changes the use of DEA-Malmquist model to calculate total factor productivity. By referring to approximate total factor productivity calculation method introduced by Sun and Guo (2013), we recalculated the total factor productivity of cities and tested the robustness of the whole sample cities, eastern cities, western cities, high-innovation cities, and low-innovation cities. Specifically, the calculation formula is

$$atfp = \ln(y/l) - \theta \ln(k/l). \tag{8}$$

Among them, y is the total output, l is the labor input, k is the capital input, and θ is the output elasticity of capital in the production function. This method is close to the Solow residual method in essence, fully considering the relationship between input and output of various factors, and is also widely used in assessing urban economic growth. The final estimated results are shown in Table 6.

In Table 6, the promotion of the smart city pilot policy to the total factor productivity of all cities is still significant. The regression results of the subsamples show that the cross-terms $\text{City}_{it} \times \text{Year}_{it}$ have positive effects in the eastern regions and high-innovation cities, which is obviously consistent with the above results.

3.4.2 Counterfactual Test

By changing the implementation time of the policy, this paper brings forward the pilot time of smart cities in the treatment group to 2009 and 2010 and investigates the effect of dummy variable $\text{City}_{it} \times \text{Year}_{it}$ on total factor productivity when the pilot policy of smart cities is not implemented. If the dummy variable does not have a

Table 6 Test results of changing efficiency measurement method

	Ln(atfp)				
	All samples	Eastern region	Central region	High innovation	Low innovation
Variables	(1)	(2)	(3)	(4)	(5)
$City_{it} \times Year_{it}$	0.034*** (9.179)	0.029*** (4.846)	0.008 (1.454)	0.032*** (6.792)	−0.001 (−0.208)
Control	Yes	Yes	Yes	Yes	Yes
Constant	1.357*** (35.923)	1.300*** (17.367)	1.571*** (24.302)	1.293*** (28.925)	1.706*** (22.256)
Fixed effects	Yes	Yes	Yes	Yes	Yes
Samples	1549	755	794	666	883
R^2	0.470	0.047	0.354	0.024	0.420

The values in brackets are robust standard errors
Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

significant impact on the total factor productivity of the city, it indicates that there is no correlation between other policies or random factors and the total factor productivity of the city before the smart city pilot policy. The basic estimation results are credible. The basic estimation results are not credible. The specific test results are shown in Table 7.

According to the results of pilot time for smart cities in advance to 2009 and 2010 in columns (1)–(6) in Table 7, the regression coefficients of dummy variables $City_{it} \times Year_{it}$ _ 2009 and $City_{it} \times Year_{it}$ _ 2010 are small and insignificant, indicating that there are no other factors lead to any change in urban total factor productivity.

3.4.3 Replace the Test of the Treatment Group

This paper also uses the smart cities piloted in 2013 to replace the smart cities in the original treatment group in 2012 and constructs a new treatment group. Moreover, the KPSM-DID method is used again to test the robustness of the smart city pilot policy (see Table 8).

As can be seen from Table 8, the coefficients of dummy variable $City_{it} \times Year_{it}$ in 2013 are basically smaller than those of dummy variable $City_{it} \times Year_{it}$ in 2012, indicating that the implementation of smart city pilot in 2013 is relatively close to now, and the policy effect has not been fully exerted. It is found that there is no significant difference, comparing all symbolic and significant findings of the dummy variable $City_{it} \times Year_{it}$. From the perspective of total factor productivity, the smart city pilot policy has significantly promoted the improvement of urban total factor productivity. After decomposing total factor productivity into technical change and

Table 7 Counterfactual test results

	LnTFP	LnTC	LnEC	LnTFP	LnTC	LnEC
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$City_{it} \times Year_{it}$ _ 2009	0.004 (0.442)	−0.004 (−0.950)	0.008 (0.818)			
$City_{it} \times Year_{it}$ _ 2010				0.013 (1.525)	0.006 (1.436)	0.007 (0.746)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.584*** (−3.473)	−0.182** (−2.120)	−0.403** (−2.483)	−0.636*** (−3.867)	−0.230** (−2.579)	−0.406** (−2.536)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Samples	1549	1549	1549	1549	1549	1549
R^2	0.098	0.101	0.156	0.106	0.043	0.148

The values in brackets are robust standard errors
Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

Table 8 Test results of replacing the treatment group

	LnTFP		LnTC		LnEC	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$City_{it} \times Year_{it}$	0.021** (2.507)	0.025*** (3.076)	0.013*** (3.242)	0.008*** (3.985)	−0.000 (−0.046)	0.003 (0.431)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.188*** (−5.268)	−0.523*** (−2.563)	−0.029*** (−16.048)	−0.140*** (−4.413)	0.017** (2.568)	0.165* (1.747)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Samples	1118	1118	1118	1118	1118	1118
R^2	0.105	0.098	0.010	0.043	0.155	0.166

The values in brackets are robust standard errors
Source: Author's own elaboration
*, **, and *** are significant at the levels of 10%, 5%, and 1%, respectively

efficiency change, it is found that the smart city pilot policy only plays a positive role in technical change, but has no significant impact on efficiency change.

4 Conclusions

Since this century, information technology has developed rapidly, and the world economic development has entered a new era of informatization. Faced with the tide of informatization competition in the world, the Chinese government has reviewed the situation and attached increasing importance to informatization. The pace of informatization construction is obviously accelerated. Smart city is the latest stage of current informatization development. The pilot policy of smart city has injected a new energy into the sustainable growth of urban economy and has had an extremely important impact on improving the level of urban economic development. This paper regards the smart city pilot policy as a quasinatural experiment. Based on the data of China's 171 cities during 2006–2016 period, the DEA-Malmquist model is used to estimate the total factor productivity of each city and to decompose two factors of technical change and efficiency change. In turn, the KPSM-DID method is utilized to test whether it improves the total factor productivity level.

The results show that: (1) The smart city pilot policy plays a significant role in promoting the city's technical change, and the impact on efficiency change is positive but not significant. Their coupling effect promotes the growth of urban total factor productivity. (2) Heterogeneity research shows that the smart city pilot policy is more conducive to promoting the growth of total factor productivity in eastern cities and high-innovation cities, but it is difficult to improve the level of total factor productivity in western cities and low-innovation cities. (3) From the above various forms of robustness tests, it can be seen that the smart city pilot policy has significantly promoted the growth of urban total factor productivity in both statistical and economic sense.

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