Contributions to Economics

Adam Śliwiński
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Economic Development and Financial Markets

Latest Research and Policy Insights from Central and Southeastern Europe

Springer

Contributions to Economics

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ISSN 1431-1933 ISSN 2197-7178 (electronic)
Contributions to Economics
ISBN 978-3-030-32425-4 ISBN 978-3-030-32426-1 (eBook)
https://doi.org/10.1007/978-3-030-32426-1

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

About This Book

Central and Southeastern Europe has, in the past quarter of a century, been the scene of the many interesting processes and deep reforms in different areas, including the fields of economics and financial markets (containing insurance). Most of the countries in this region have almost completed transition from the communist model of society and centrally planned economy to the model of democratic society and free market economy. The countries under consideration are also united into larger systems like the European Union. One of the main goals of European integration is cohesion among member states. However, there are still significant differences among them. The paths they followed during transformation period and the results they achieved have been very different. Nevertheless that makes things even more challenging and interesting to be researched and studied. Development of the economy and financial markets of Central and Southeastern Europe countries also differs among each other and in comparison to all EU members states. Some of the countries like Turkey are in close relation to EU. The relations were established in 1959, and the institutional framework was formalized with the 1963 Ankara Agreement. Turkey is one of the EU's main partners in the Middle East, and both are members of the European Union—Turkey Customs Union. The EU and Turkey have a common land border through the EU member states, Bulgaria and Greece. That is one of many reasons why the country like Turkey is worth to study from economic development perspectives.

All that certainly gives opportunity and encouragement to scientists and professional researchers to investigate, analyze, and develop new ideas and new knowledge. As a part of the development and changes that Central and Southeastern Europe has undergone over the past 25–30 years, we have witnessed a significant development in the area of academic and scientific work. Development and restructuring of old universities, new universities and scientific institutes, journals, and conferences have been flourishing in the region. The part of Europe has become not only an interesting area for scientific research but the region where new knowledge and insights are being created and from where new knowledge is delivered and disseminated to the world.

The international conference "**The Economies of the Balkans and the Eastern European countries in the changing world** (EBEEC)", through its ten previous editions, has become the forum where the knowledge and experiences of the economics and business in the region of Central and Southeastern Europe are exchanged, discussed, and checked. Not only are they discussed and verified, but they are disseminated—new knowledge and ideas created in this area are made available to others—all over the world. Through its various publications, EBEEC is trying to make available new knowledge and ideas developed by scientists from Central and Southeastern Europe to scientists and practitioners around the world. Big help and contribution in that sense are found in cooperation with renowned publishers such as Springer.

The 10th International Conference "**The Economies of the Balkan and the Eastern European Countries in the changing world**" was organized jointly by the TEI of Eastern Macedonia and Thrace, Department of Accounting and Finance (Kavala, Greece), Warsaw School of Economics (Poland), Department of Risk and Insurance, Poznan University of Economics (Poland), Department of Insurance, on May 11–13, 2018. The conference, which aimed to present scientific papers and researches of theoretical and empirical character about the economies and businesses in this region, brought together more than 120 papers prepared by more than 150 authors from 25 countries from the region and all over the world.

A broad range of issues—from international political economy, macroeconomics and economic policy, monetary economics, finance, banking and insurance, globalization, regional integration with special reference to the EU, economic growth, development and sustainability, labor markets and immigration, management and marketing, entrepreneurship, to corporate governance—have been discussed at the conference and in the resulting papers.

This volume, as one of the publications resulting from the 10th International Conference "**The Economies of the Balkan and the Eastern European Countries in the changing world**," is trying to make available worldwide works and knowledge created under the auspices of EBEEC conference in a specific area of development of the economy and finance. It contains ten selected works from the field of economy development and finance, prepared and presented to the 10th EBEEC conference in Warsaw. These papers, peer-reviewed and carefully edited, are certainly making a significant contribution to the broader field of economy. They are a concrete indication that the region of Central and Southeastern Europe is developing new knowledge and ideas even in this field. That is undoubtedly the result of two related, abovementioned trends: dynamic development of new ideas and experiences in the economies of the region of Central and Southeastern Europe and the considerable progress in quality of the scientific potential and work in the region of Central and Southeastern Europe.

Countries from Central and Southeastern Europe have evidently experienced in recent decades very interesting developments and practices in the field of economy and finance, some of which have served the authors represented in this book as the objects for very interesting analyses and grounds for quality work. The papers presented in this volume cover the spectrum from macroeconomic competitiveness

and embeddedness, monetary policy, and financial integration through financial and insurance market development. Since presented papers are independent and not directly related, their order of appearance in the volume is purely editorial, intended just to present a spectrum of topics in the field of economy and finance that attract the attention of contemporary authors from Central and Southeastern Europe. The book contains two parts.

Macroeconomics and Monetary Policy in Chosen EU Countries

The book opens with the first paper written by Yannis Psycharis from Panteion University of Social and Political Sciences, Greece, and Dimitris Kallioras and Panayotis Pantazis from University of Thessaly, Greece. The paper refers to regional inequality. The main goal of the paper is to provide empirically supported evidence regarding regional inequalities in the European Union. The specific attention is placed to the Balkan and Eastern European countries. Regional inequalities are mainly shaped by the process of European integration and the recent economic crisis. Those factors are among the prominent drivers that have shaped the inequalities. The process of European integration has impacted on the growth potential of regions across Europe. However, there has been no single development trajectories. In addition, the economic crisis has been another factor that influenced development prospects and regional inequalities. The Authors in the paper present and analyzed a set of factors that affects the inequalities. Trends in GDP growth and convergence, the role of metropolitan areas as drivers of growth and inequality, the changes in the sectoral mix of the regions, and the role of trade, competitiveness, and exports are among the most significant. The paper provides a statistical and cartographical analysis of regional inequalities in Balkan and Eastern European countries. The analysis is done by using statistical data that correspond economic, demographic, and trade aspects. The paper ends with a discussion regarding policy responses for redressing inequalities and achieving a more balanced development in the European Union.

The second paper in the part is written by Marija Džunić, Nataša Golubović, and Jelena J. Stanković from Faculty of Economics, University of Niš, Serbia. The paper refers to the process of building democracy among CEE countries. During the last couple of decades, considerable progress has been made in building democracy in the countries of Central and Eastern Europe. However, building liberal democracies is a complex process, implying not only the procedural conditions for electoral democracy, but also the institutionalization of vertical and horizontal accountability mechanisms and embedding the democratic values in the patterns of citizen's behavior and attitudes. In the absence of such mechanisms, democracies remain in the state of hybrid regimes, captured in the gray zone between democracy and autocracy, without guarantees of reaching the final stage of democratic

consolidation. In some cases, such hybrid regimes may revert into autocracy. More than two decades after the beginning of political transition, the European post-socialist countries vary significantly in terms of consolidation levels of their democratic regimes, ranging from consolidated democracies to semi-authoritarian regimes. Taking this into account, the paper attempts and explore the potential causes and available resources for consolidation. The authors have used the recent data from internationally comparable surveys and ratings. Based on Wolfgang Merkel's concept of embedded democracy, the analysis focuses on the importance of consolidating forces in the external environment, encompassing the socioeconomic context, the strength of civil society, and the influence of external political conditionality. The level of democratic consolidation is tested estimating a multiple linear regression model. The model implies the relevance of social and economic inequalities, civil society, and international integration as predictors of democratic consolidation.

The next paper prepared by Gyorgy Andor from Eotvos Lorand University, Institution of Business Economics, Budapest, contributes to the empirical examination of income inequality. In the paper, the author examined the evolution of income inequality in five Central and Eastern European (CEE) post-socialist countries, members of the European Union (EU)—the Czech Republic, Hungary, Poland, Slovakia, and Slovenia. The author assumed that the similarities of political and economic changes in these countries allow an integrated analysis of their income inequality developments. Moreover, the paper also contributes to the debate on inequality in countries at different levels of economic development. Chosen countries represent a unique group around the border between high-income and upper-middle-income states. The paper focuses on several relating and often contradictory theories and empirical evidence from the past few years. The author offer a comprehensive picture of the progress of inequality in this region. The paper starts with introduction. After a short introduction, the theories about the relationship between inequality and growth are summarized. In the main body of the paper, the empirical evidence about income inequality in CEE countries is presented and compared with EU-wide data.

The fourth paper written by Alexandra Horobet and Oana Popovici from Bucharest University of Economic Studies and Lucian Belascu from University of Sibiu, Romania, builds on the importance of high-tech manufacturing and knowledge intensive services as significant competitiveness and economic growth drivers in the European Union. The paper offers a fresh approach of the study on the competitiveness of secondary and tertiary high-tech industries across EU member states. The analysis covers the 2008–2015 period and includes 12 old and new EU members. To investigate the competitiveness of high-technology industries in the EU with the aim of uncovering the nature of the main explanatory factors of their performance, the authors opt for a balanced panel data approach in a least squares framework and ARIMA. The main findings show that the number of persons employed and the investment rate are both determinants of labor productivity and business profitability, while turnover and personnel costs have a specific influence on productivity and profitability, respectively. The GDP level and the percentage of

population with tertiary education are the most significant location-related factors of influence for high-tech industries' competitiveness. Overall, industry-related factors are more important for explaining the competitiveness of high-tech sectors compared to location-related factors, while external factors have a marginal impact on high-tech industries' performance.

The first part of proposed book is ended with the paper written by Magdalena Szyszko from WSB University in Poznan, Institute of Social and Economic Sciences, Poland, and Aleksandra Rutkowska Poznan University of Economics and Business, Department of Applied Mathematics, Poland. The paper is based on the main idea that inflation expectations cannot be fully explained by inflation itself. Therefore, the search for factors affecting expectations is up to date. The main aim of the paper is an attempt of the authors to detect such factors. To meet the goal, cointegration analysis is applied. The authors hypothesized that the changes and long-run development of expectations are explained by the development of other economic variables (1) and that the drivers of expectations are heterogeneous across countries (2). The study covers countries like Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Sweden, and the UK. The data used concerns the period between 2001 and 2016. It is important to notice that sample countries are the EU member states, but they still have not adopted euro. After the study, six monetary, financial, and real sphere factors that could affect expectations are distinguished. Authors elaborate on VECMs for each country respectively to analyze short- and long-run dependence of variables. The paper ends with the conclusion that long-run relations do exist between variables as well as—in certain cases—short-run relations. However, the number of variables and the lags suggested by the information criteria lead to relatively complex models. The models are difficult to interpret directly. As a result, authors propose further research with respect to the same dataset.

Development of Financial Markets and Insurance in Central and Eastern Europe

The second part concerns the development of financial markets and insurance in Central and Eastern Europe. The part includes five following papers. The subject of the papers ranges from analysis of financial integration through entrepreneurship development and insurance markets.

The first paper prepared by Özcan Karahan, Metehan Yılgör, and Hakan Öndes from Bandırma Onyedi Eylül University, Turkey touches the subject of financial integration. The aim of the study described in the paper is to measure the degree of financial integration by exploring the saving–investment nexus in Eastern European countries. The relationship between domestic saving and investment delivers important understandings for the integration of national financial markets into the world capital market. In case of perfect financial integration, it is generally assumed

that there should be no close relationship between national saving and investment. Authors employ panel cointegration and causality tests for the annual time series. The analysis covers the period of 2000–2016. Empirical findings show that there is a strong connection between domestic saving and investment rate. That indicates the low degree of financial integration of the Eastern European countries into the world capital market. The finding also suggests that Eastern European countries are not attracting enough foreign resources that could stimulate domestic investment as well as economic growth.

The second paper in the part is written by Valentina Diana Rusu and Angela Roman from Alexandru Ioan Cuza University of Iasi, Romania. The main objective of the paper is to investigate how the access to finance affects the creation of new business in European Union member countries. The question is answered by identifying the relationship between several indicators, measuring the access to finance and the specifics of business environment, and the dynamics of new business creation. The analysis provided by the authors includes ten indicators. It covers the period from 2007 to 2016. In order to realize the empirical analysis, authors apply a fixed effects model approach on a panel data for a period of 10 years and 18 European Union member countries (Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, and UK). The results of the study highlight that starting new business in European Union countries is significantly linked to easy access to finance. Thus, the creation of new business is encouraged when it is easier to obtain different financial resources to sustain the beginning of the activity. The characteristics of business environment are indirectly affecting the creation of new business (if the costs, time, and procedures needed are high, then the new business start-up is discouraged). The study contributes to completing the literature in the field by providing empirical evidence of the extent to which access to finance encourages or hampers the start of new business in the European Union member countries.

Jacek Lisowski and Aleksandra Hecka from Poznan University of Economics, Department of Insurance, Poland, analyze surety bonds in chosen CEE countries. The paper aims at description of an environmental surety bond as a financial instrument which gives a guarantee from an insurance company ensuring the liabilities of an operator, arising from ELD. It has been 8 years since the Environmental Liability Directive 2004/35/CE (ELD) was fully implemented. New regime based on the "polluter-pays" principle has increased environmental liability with regard to prevention and remedying of environmental damage. From year to year, the surety bonds (insurance guarantees) are becoming a more and more popular form of securing receivables of business entities, which is caused by many economic and legal factors. On the one hand, it provides the necessary funds to the local authorities when operator defaults on its obligations, and on the other hand, creates incentives for the companies to promote environmental safeguards. The paper includes short synthesis of the European Union's regulatory framework referring to the environmental liability with regard to the prevention and remedying of environmental damage. The scale of environmental damages in the EU is also

described. The authors explore the development and use of environmental surety bonds, with their strengths and weaknesses, as an alternative tool to control environmental damages in different member states with special regard to the Polish insurance market.

Next paper written by Adam Śliwiński and Lukasz Kurylowicz from Warsaw School of Economics, Department of Risk and Insurance, Poland, contributes to the application of insurance market equilibrium model. The paper shows the possibility of introducing the Usage-Based Insurance (UBI) for the sake of the individualization of Compulsory Motor Third-Party Liability Insurance premiums. The main aim of implementing UBI is to achieve the stability in Central and Eastern European markets and bring them closer to the state of equilibrium. The paper presents both the historical perspective of UBI development and the summary of the research carried out over the last decade. It is concerned with the advancement of UBI tariffs and the successful modification of the applicable pricing schemes as well as points to issues that may hinder the market launch of UBI. Finally, the paper shows that thanks to the Usage-Based Insurance, the industry can minimize the negative effect information asymmetry has on the motor insurance market.

The last paper in the second part paper prepared by N. Aydan Sat and Cigdem Varol from Gazi University, Department of City and Regional Planning, Turkey, shows the research on the relationship between locational preferences of banking sector and socioeconomic structures of cities in Turkey. The world's studies show that the development of banking sector in a region may highly be correlated with the socioeconomic capacity of the region. From this point of view, the aim of the paper is to investigate the relationship between locational preferences of banking sector and socioeconomic structure of cities in Turkey case. The paper consists an empirical analysis based on market data. The data on the locational preferences and characteristics of publicly held and actively traded banking has been obtained from Banking Regulation and Supervision Agency. The database identifies a bank's location and its total assets. On the other hand, the data on the socioeconomic characteristics of cities has been obtained from "Well-Being Index for Provinces" prepared by TurkStat in 2015. The study implies the data concerning statistical information about housing, working life, health, education, environment, safety, civic engagement, access to infrastructure services, social life, and life satisfaction of provinces. By using the datasets, Pearson's correlation and OLS multiple regression analyses have been realized to clarify the relationship between the socioeconomic characteristics of cities and the locational preferences of banks. The results of the statistical and spatial analyses are discussed. The main findings show that banks mostly prefer more developed provinces to use the advantages of agglomeration economies. Having powerful communication technologies and transportation infrastructure is also very critical in the investment decision of banking sectors.

Hoping again that this selection of papers from a combination of young and experienced scholars and researchers from Central and Southeastern Europe will confirm the initial statement that this region is producing new, genuine knowledge and ideas in the field of economy development, we are leaving it to the readers to finally assess their quality and use and disseminate ideas, questions, and solutions offered by these authors and their papers.

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Macroeconomics and Monetary Policy in Chosen EU Countries

Regional Inequalities in Central and Eastern European Countries: The Role of Capital Regions and Metropolitan Areas

Yannis Psycharis, Dimitris Kallioras and Panayotis Pantazis

Abstract The aim of this chapter is to provide empirically supported evidence regarding regional development and inequalities in the European Union by focusing specifically on the Central and Eastern European countries. The process of European integration has impacted on the growth potential of all regions across Europe. However, there have been very diverse development trajectories in different groups of countries. After their accession to the EU, the Central and Eastern EU countries have followed a relatively common development path. However, the geography of development in these countries provides a more detailed analysis of this trend. The analysis covers the period 2000–2016, starting from the years just before the enlargement until the years after the economic crisis. Statistical analyses of trends in GDP and convergence and the role of metropolitan areas are presented with thematic cartography maps. Results are relevant to regional analysis and policy as well as to the challenges of the European Union for the next programming period 2021–2027.

Keywords Regional inequalities · European regional policy · Central and East EU Countries

JEL Classification D72 · H54 · P25 · R53 · R58

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*, Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_1

1 Introduction

The process of European integration has created different geographies of development across Europe. There is a flourishing debate regarding the dynamics of growth and convergence and the underlying factors that determine the growth path and the dynamics of convergence and divergence between countries, and among regions within countries, in the EU. However, especially for the Central and East EU Countries (CEC's), specific attention has been placed on the role of Capital cities and large urban agglomerations. This chapter makes an attempt to study the evolution of regional development and inequalities in the CEC focusing on the role of Capital regions and Metropolitan areas.

The importance of metropolization and urbanization in shaping regional disparities in the CEC has been studied extensively in the literature (Petrakos 2001; Bourdeau-Lepage 2004; Gorzelak and Smetkowski 2010; Smętkowski 2013; Monastiriotis 2014). The urbanization trends and the large cities serving as hubs in the global flows of capital, people and information have been strengthened (Castells 1998). Urbanization is progressing faster than ever before in history (OECD 2015). The European Commission underlines the concentration of people and economic activities in cities as one of the key factors for uneven development across space (EC 2017). The magnitude of the urbanization phenomenon and the consensus on the relevance of cities within the social and economic landscape has stimulated the need for a much stronger research effort devoted to the analysis of the determinants of their economic performance. It has been increasingly suggested that, within the new globalized economy, the urban dimension more than the country dimension is the most relevant geographical scale of analysis (McCann and Acs 2011). As a result, in order to approach the new dynamics of geographical inequality in economic wealth, it is necessary to highlight the role of cities and large urban agglomerations. This is not even more evident than in the CEE countries, where urbanization plays a catalytic role in the regional inequalities within these countries.

The awareness that metropolization and urbanization play a critical role in shaping regional imbalances in economic wealth has impacted on the policy priorities. Urban policy within cohesion policy in the European Union seems to have gained a salient position (McCann 2015). Regional policy today tends to incorporate urban policy as a fundamental and integral part of cohesion policy. The upgrading of urban policy has been reflected in the planning of the new programming period and the allocation of financial resources for cohesion policy in the new programming period. Furthermore, statistical data have improved, which is something that has fostered a flourishing surge of research concentrating on cities and urban agglomerations in the analysis of the regional imbalances in wealth across Europe.

The analysis that is presented in this paper is based on statistical data which have been retrieved from the EURECO database of Eurostat. The novelty of this analysis is that these data provide information about functional urban areas and metropolitan areas. As a result, analysis can be more focused on metropolitan areas and large agglomerations. The basic division of statistical data is into metro regions and the

rest. Metro regions are subdivided between capital metro regions and remaining metro regions. The capital region is usually a metropolitan region. However, there are also other metropolitan regions beyond the capital region. This classification goes beyond the NUTS classification in the European Union. In some cases, metropolitan regions do not fit into one NUTS II or NUTS III classification. A metropolitan region could incorporate all or parts of the NUTS II or the NUTS III classifications. This makes the approach to analysing dynamics in space different from the ones that have been based on NUTS II and NUTS III classifications.

However, apart from the classification based on metropolitan and non-metropolitan regions, this research analyses the regional profiles based on the NUTS II and the NUTS III statistical classification. The combined use of statistical classifications in metropolitan/non-metropolitan and NUTS II and NUTS III is a novelty that enriches the analysis and provides a better understanding of growth dynamics in space in the EEC.

The analysis is based on data regarding economic and demographic variables such as population, GDP and GDP per capita in PPS. Standard indicators such as GDP per capita and the coefficient of variation have been used for the measurement of economic development and regional inequalities, respectively. In addition to the statistical analysis, this study makes use of thematic cartography in order to provide a concise visualization of the findings that affect the NUTS II, NUTS III and metropolitan geographical levels. The specific focus of this research on the role of capital cities and metropolitan areas in CEC and the combined examination of metro/non-metro regions vis-à-vis NUTS II and NUTS III regions provides some new insights on regional imbalances in the European Union.

2 Literature Survey

The market-based process of EU economic integration has long been considered in the literature as strictly welfare-enhancing (Gács 2003; Matkowski and Próchniak 2007; Rapacki and Próchniak 2009)—be it through the promotion of Europeanism (Grabbe 2006), through agglomeration and market access benefits (Ascani et al. 2012), through technology importation (Crescenzi et al. 2014), or through a more efficient allocation of capital (Monastiriotis 2016). Yet, the situation is less clear-cut at the regional (i.e. the sub-national) level. Theoretically, economic integration can have significantly differentiated effects at the regional level, as the trade diversion and market size effects that it entails can significantly alter existing (regional) comparative advantages and create new productivity or agglomeration advantages that may be distributed unevenly across space (Rodríguez-Pose 2006; Monastiriotis et al. 2017). Indeed, closed borders distort market size (Niebuhr and Stiller 2002), whereas the abolition of economic barriers generates (releases) spatial dynamics that promote imperfect competition and, as such, due to the inability of market to create conditions of optimum economic space (Starrett 1978), are deemed to result in an uneven distribution of the benefits of economic integration (Brülhart et al. 2004; Kallioras

et al. 2009; Brülhart 2011; Rodríguez-Pose 2012). Such types of arguments are at variance with the neoclassical understanding of the operation of the spatial economy (Solow 1956; Swan 1956, inter alia) and contribute to an ongoing discussion among academics and politicians concerning the impact of European economic integration on the growth potential of the EU regions, and in particular, of the less advanced ones.

The collapse of communism in the late 1980s brought about an unprecedented wave of trade liberalization and many economic integration agreements between the EU and countries belonging to the so-called Eastern Bloc. The pre-accession process towards the EU membership concluded in 2004, 2007 and 2013 and presented the EU with a significant challenge—as well as an opportunity—to integrate the former communist countries, thus securing the irreversibility of the transition process and matching, to a great extent, the political to the geographical boundaries of the European Continent (Wallace and Wallace 1996; Pond 1999). The EU new member-states (NMS) provide a quasi-laboratory, a natural, somewhat experimental, environment for the examination of the spatial impact of the EU economic integration process. The experience of the EU CEC is a unique situation, where relatively closed economic systems opened, almost at once, to the world economy and, at the same time, market mechanisms replaced central planning (Kallioras 2010; Kallioras and Petrakos 2010). Given that the EU CEC are still characterized as lagging behind and structurally weak (Petrakos et al. 2011; Kallioras et al. 2018)—compared to the EU core countries—such an examination may provide valuable insight for both theory and policy. This is especially so at a time when the European project is facing a number of challenges (Hartleb 2012) and European Cohesion Policy is under scrutiny (Karanika and Kallioras 2018).

The vast majority of the empirical literature (Downes 1996; Petrakos 1996, 2000; Resmini and Traistaru 2003; Römisch 2003; Petrakos et al. 2005a, b; Ezcurra and Rapún 2007; Ezcurra et al. 2007; Artelaris et al. 2010; Monastiriotis 2014, inter alia) indicates that the market-based process of EU economic integration has been accompanied by a significant upward trend of regional inequalities in the EU Central and Eastern European (CEE) countries. This means that the increasing trend of regional inequalities in the CEE, which was evident already from the early pre-accession (to the EU) period, has continued to prevail in the late 1990s and the early 2000s (at least until the outbreak of the economic crisis) at an undiminished pace. Recessionary shock impacted on all countries. However, the resilience of countries and regions as well as recovery reveals large differences between countries and regions. In particular, the weaker CEE regions typically lost the greatest part of their industrial base which, being in capital-intensive sectors, was more exposed to international competition. This, however, was not a universal experience in the CEE as a number of CEE regions, especially capital and western regions, have done relatively well in terms of performance and structural adjustment, benefiting from agglomeration economies, market size and proximity to western European markets.

Indeed, to date evidence brings into doubt, the ability of the market to generate self-correcting mechanisms for regional imbalances, and necessitates state (and EU) intervention in achieving balanced regional growth. Should disparities not continue

to decrease, the CEE may force a shift in the focus of public policy towards more effective regional policies. Thus, the assessment of the evolution of regional inequalities in the CEE for the more recent years, and with the post-2020 period at the doorstep, is an extremely salient issue.

3 The Evolution of Economic Development in the EU

3.1 The Evolution of GDP in Central and East European Countries

Access to the European Union has markedly affected the growth potential and development of the Central Eastern European (CEE) countries of the European Union. The new environment has shaped the economic conditions and has affected their transition to the market economy immensely. Following their accession to the European Union, these countries demonstrated/followed a relatively similar growth path. Figures 1 and 2 portray the development path that these countries followed during the period 2000–2016. Figure 1 shows the evolution of GDP per capita of the CEE

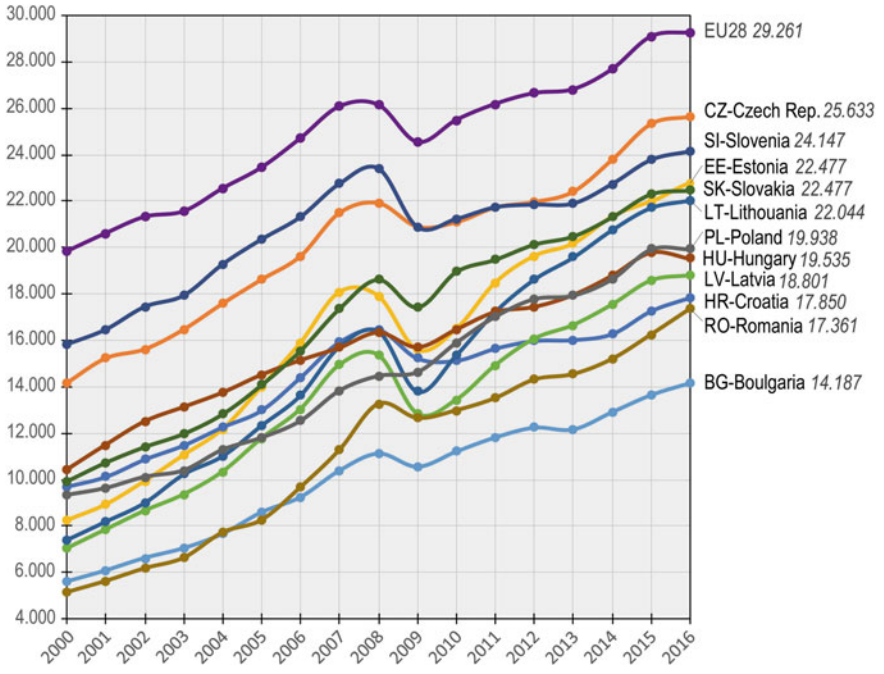

Fig. 1 Evolution of GDP/pc of the CEE countries 2000–2016. *Source* Eurostat, authors' elaborations

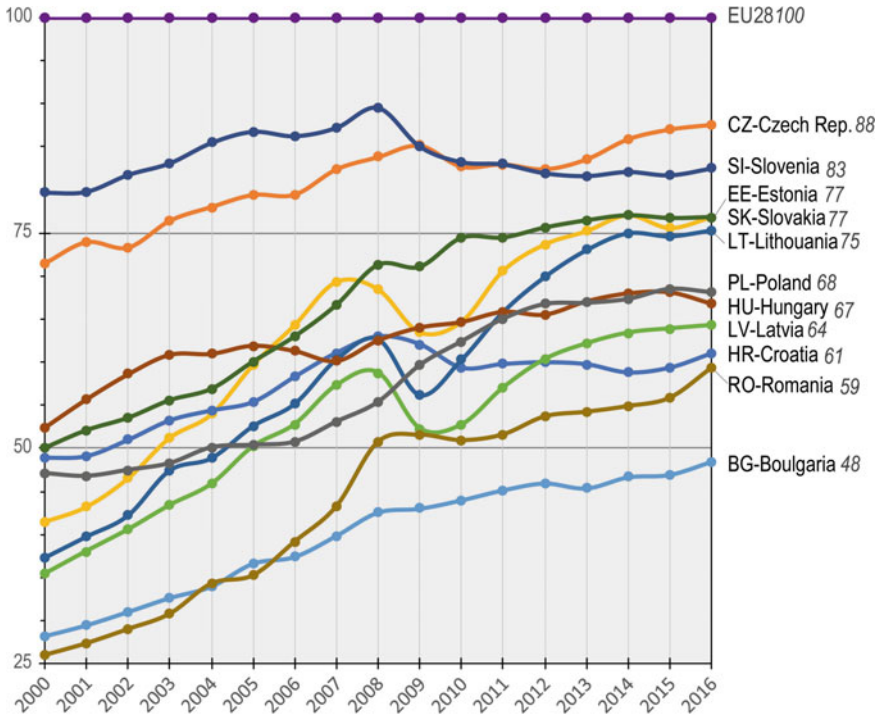

Fig. 2 Evolution of GDP/pc of CEE countries as % of EU28 2000–2016 (EU = 100). *Source* Eurostat, authors' elaborations

countries over the period 2010–2016, and Fig. 2 shows the GDP per capita of the CEE countries compared to the average EU level of economic development. According to these figures, three observations can be made.

First, during the course of the period under investigation, the CEE countries seem to have followed a relatively common development path. All these countries have experienced a rising trend in the level of economic development. As a result, the level of economic development in 2016 is much higher than the level of development in these countries in the time of accession to the EU in 2004 and 2007.

Second, despite the upward trend and the convergence process, the level of economic development for all the CEE countries still remains below the EU average. As shown in Fig. 2, the majority of these countries have a level of economic development between 50 and 75% of the EU average. Compared to the accession years when the level of economic development of the majority of these countries was between 25 and 50% of the European average.

Third, the economic crisis has impacted on the growth rate of all the CEE countries. However, the recessionary shock had different impacts on different countries. This observation calls for further investigation in the related literature. In addition, recovery from the economic crisis is far from homogeneous. Recovery has followed

differentiated paths. Some countries have regained their pre-crisis level of economic development faster than others, while some others still have not reached the pre-crisis level of economic development. The recessionary shock, along with the recovery trajectory, constitutes research areas that require special attention and analyses.

3.2 The Evolution of Regional Development

The upward trend of economic development has affected all the regions across the CEE countries. However, the trend of regional growth and development shows important differences among regions within these countries. Figure 3 shows the evolution of regional GDP per capita for the CEE countries compared to the EU average. This concise presentation illustrates the variations in regional development across the CEE countries and provides some very interesting findings.

First, while previous analyses have shown that the level of economic development of the CEE countries is lagging behind when compared to the EU average, there are important variations regarding the relative position each region holds in the development map of the European Union.

Second, analysis has shown that in most countries such as in Czech Republic, Poland, Hungary, Bulgaria, Romania and Slovakia, some regions as emerge as outliers regarding the level of economic development. These regions, which enjoy the level of economic development well above the country average, also have a level of economic development above the EU average. These are principally the capital regions in each country.

Third, the development gap between the capital and metropolitan regions and the rest of the country is widening over time. As a result, regional inequalities are marked by significant development gaps between capital regions and the other regions in each country.

3.3 The Evolution of Regional Inequalities

The evolution of regional inequalities constitutes an important issue that has attracted the attention of regional analysis. Regional inequalities within countries are an important issue for policy since it is related with the primary concern of cohesion policy for lagging regions to catch up and reduce the development gap with the more advanced regions within the countries.

In this section, we employ the coefficient of variation as well as the coefficient of variation weighted by population in order to estimate the level of regional inequalities and their evolution over time during the period 2000–2016. The results are presented in Figs. 4 and 5. These figures provide some interesting findings. These findings demonstrate that regional inequalities in the CEE countries are high and show a much diversified pattern. The main findings could be summarized as follows.

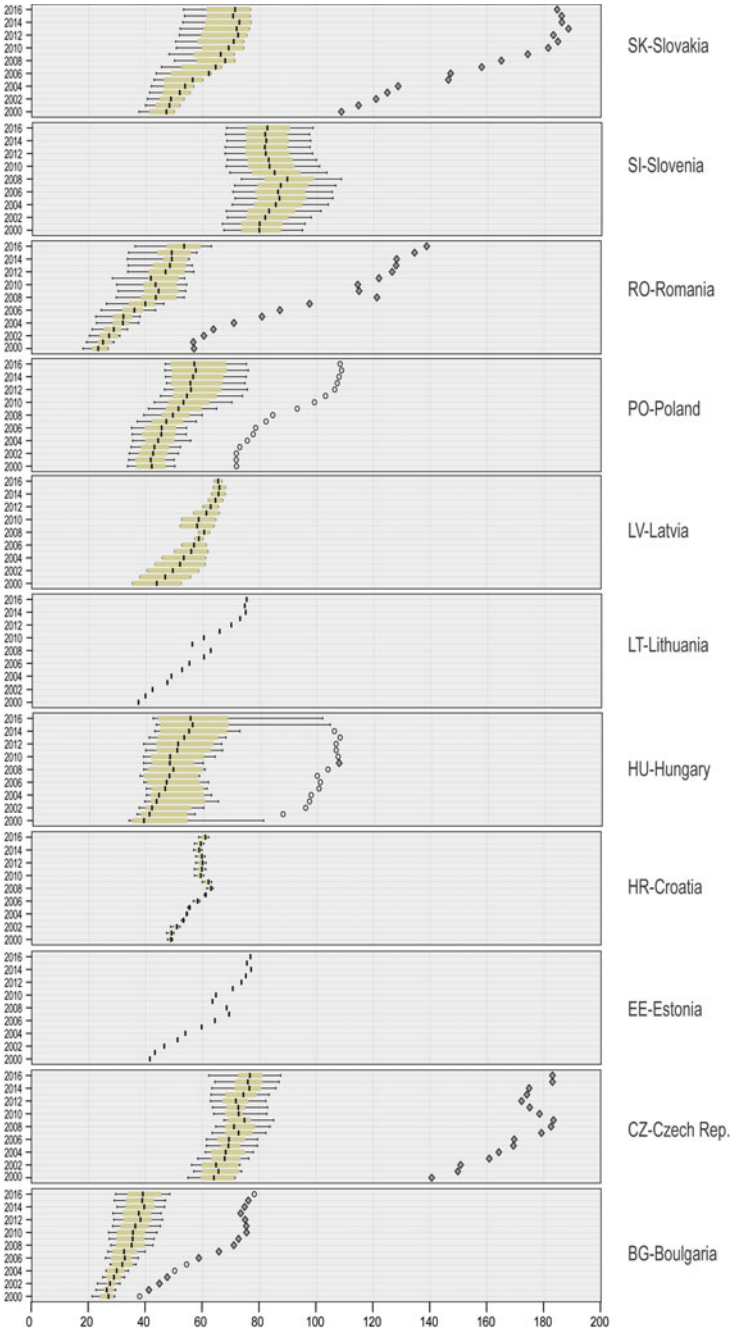

Fig. 3 Regional development in CEE countries 2000–2016. *Source* Eurostat, authors' elaborations

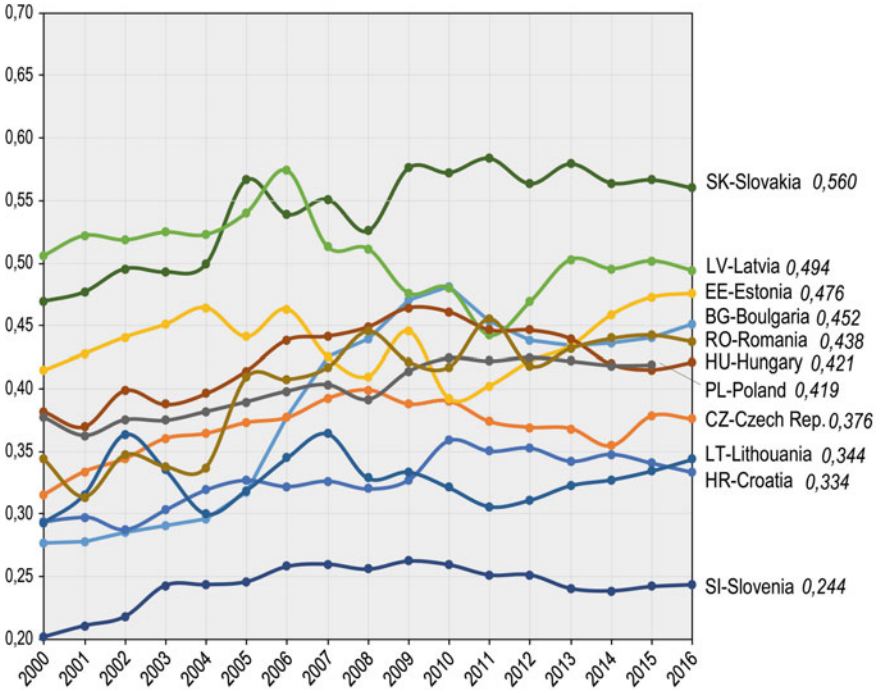

Fig. 4 Evolution of regional inequalities in CEE countries 2000–2016 (CV). *Source* Eurostat, authors' elaborations

First, the level of regional inequalities in the CEE countries is very high. CEE countries were among those EU member states with the widest regional disparities in the EU in terms of economic development (Smętkowski 2013: 1535).

Second, there are important differences in the level of regional inequalities and their evolution over time. A slower upward trend is observed in the majority of countries. Bulgaria and Romania are among the countries with high increase in regional inequalities.

Third, the measurement of inequality with the simple CV weighted by population demonstrates a different pattern of inequality within countries.

In sum, regional inequalities in the ECC countries are high and persistent. Regional inequalities have been influenced by the concentration and polarization of economic activity in capital cities and large urban agglomeration that took place during the course of European integration of the CEE countries. However, the growth and polarization dynamics are not the same for all countries. Economic specialization and sectoral mix, urban hierarchy and spatial scattering of population as well as geography play a critical role in shaping the structure and spatial dispersion of economic activity and agglomeration in each specific case.

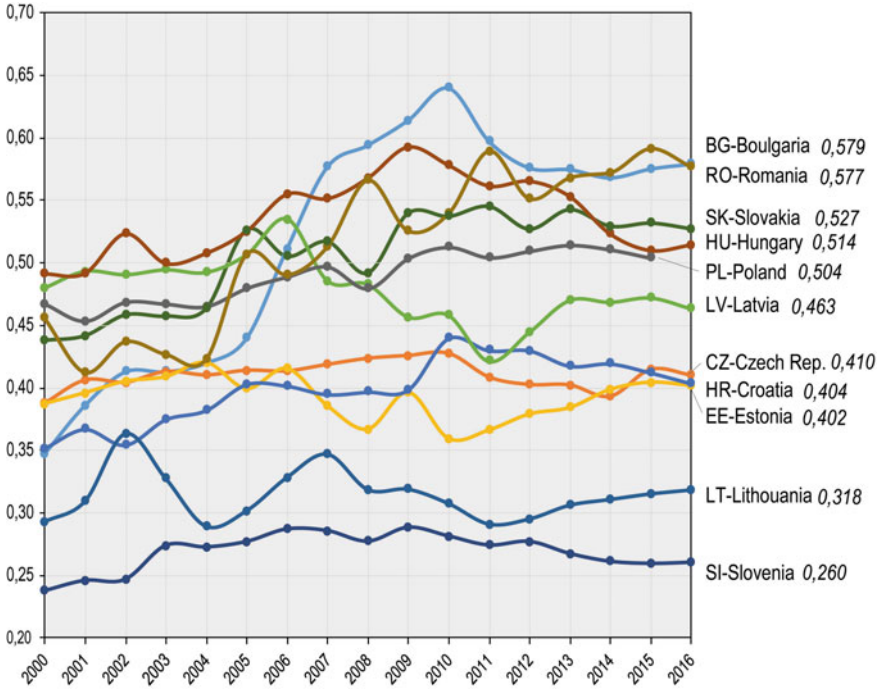

Fig. 5 Evolution of regional inequalities in CEE countries 2000–2016 (CV weighted). *Source* Eurostat, authors' elaborations

3.4 The Impact of Metropolitan Areas

Previous analysis has demonstrated that there are significant development gaps between the capital regions and the other regions within each country. In this section, specific attention will be placed on the relative value of Capital and Metropolitan regions in the regional inequalities in the CEE countries. The analysis is based on statistical data retrieved from the Eurostat *metropolitan regions* database.

Metropolitan areas in the EU are the regions with the highest level of economic development. Labour pooling, the concentration of highly skilled individuals and the technologically advanced environment make these regions the most competitive and productivity-enhancing regions in the EU (Puga, 2002; Glaeser et al. 1992). This trend has a catalytic role that shapes the type of regional inequalities in the CEE countries. After years of cohesion policy in support of the less well-off regions in the EU, the regional development map has remained largely unaffected and in some cases has deteriorated further. However, the concentration of people and economic activities in large metropolitan areas creates different types of problems which call for different types of policy interventions.

Figure 6 shows the evolution of metropolitan capital regions, the rest of the

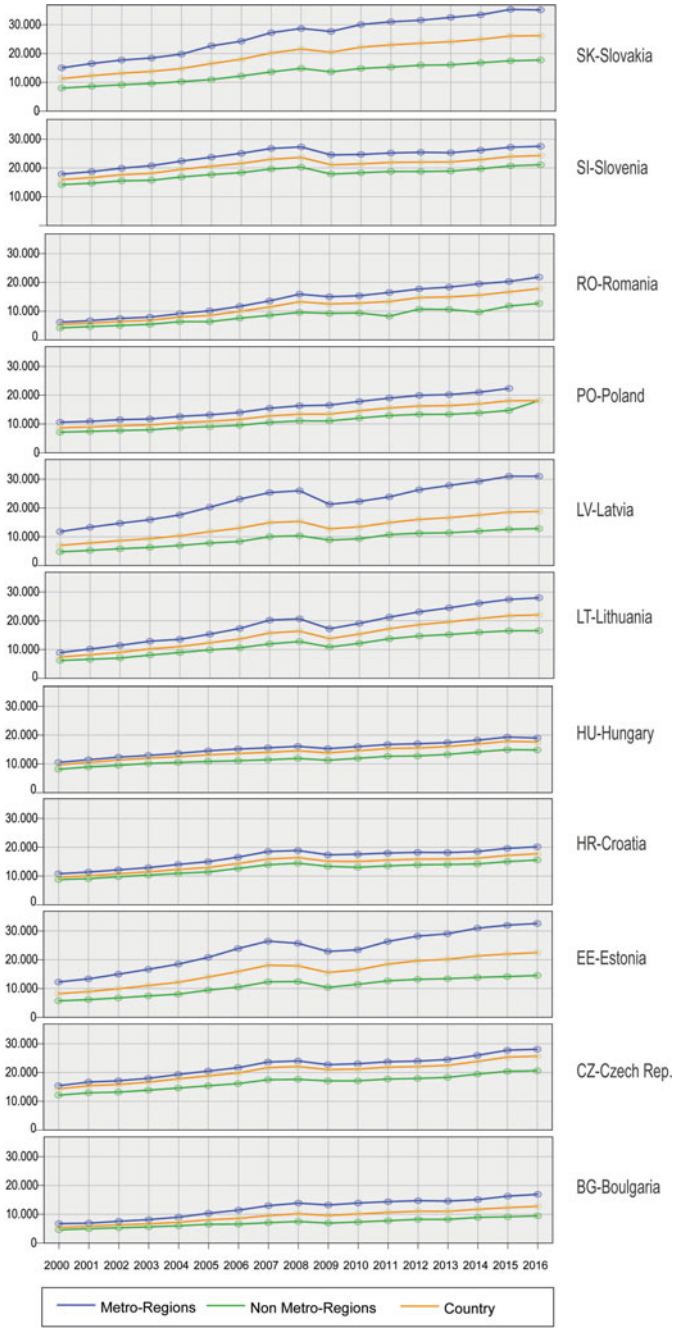

Fig. 6 Metropolitan development in the East European Countries 2000–2016. *Source* Eurostat, authors' elaborations

metropolitan regions and total regions in the ECC countries over the period 2000–2016. This analysis demonstrates some interesting results.

First, the Capital/Metropolitan regions represent the regions with the highest level of economic development in CEE countries.

Second, the rest of the metropolitan regions enjoy a higher level of economic development relative to the total number of regions. Baltic countries experience a high rate of economic development after 2010.

Third, the development gap between the Capital/Metropolitan regions and the total regions of the CEE countries is widening over time. As a result, there are immense differences in the level of economic prosperity between the metropolitan regions and the other regions in the country. These differences determine the new pattern of regional inequality and call for new approaches to regional policy means and objectives.

4 Portraying Geographical Aspect of Economic Development in Central and East European Countries

In this section of this chapter, we provide a visualization of the regional inequality in CEE countries. Figure 7 shows the level of regional economic development in the CEE countries in 2016 as a percentage of the EU average. Analysis is based on NUTS III regions. In addition, it provides information regarding the capital metro regions and other metro regions and demonstrates the level of economic development of metro regions. However, metro regions are identified in lower than NUTS III geographical levels. In order to identify the metro regions, analysis goes deeper and includes NUTS III regions as well. This map provides some interesting findings.

First, there are important gaps in the development map of the CEE countries. The majority of NUTS II regions show a level of economic development well below the EU average.

Second, contrary to this general trend, metro regions and especially capital metro regions enjoy a level of economic development above the EU average.

Third, excluding metro regions there is not any region with a level of economic development above the country average.

This evidence calls for careful interpretations of geographical inequalities in CEE countries and calls for tailored regional development policy in order to tackle inequalities and promote balanced growth and development.

Furthermore, Fig. 8 demonstrates the percentage of regional GDP to the GDP of each CEE the country. This analysis includes NUTS III regions and metro regions in the country. From these figures, it is evident that metro regions contribute 40% and above in national GDP. This fact demonstrates the importance of metro regions in the production activity within a country. The largest part of GDP is generated in metro areas in the countries. The high concentration of economic activity in specific urban centres and the differences in the levels of economic development between the

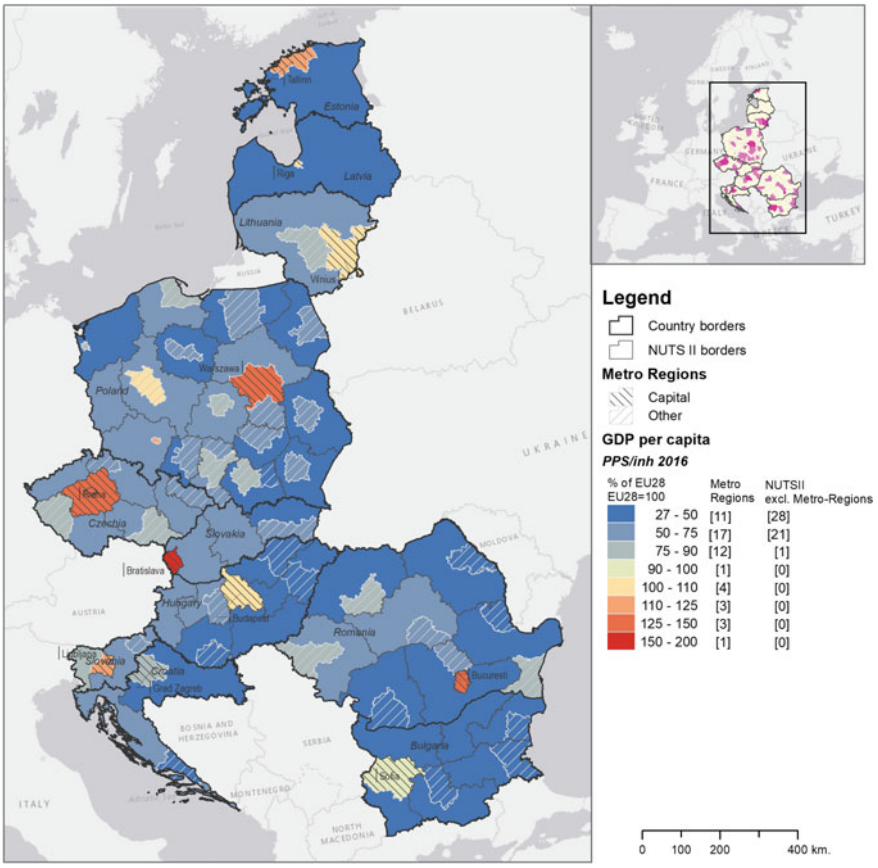

Fig. 7 GDP per capita in the CEE countries at regional and metropolitan levels (2016). *Source* Eurostat, authors' elaborations

most advanced regions and the less well-off ones are a matter that requires careful consideration for the formulation and implementation of appropriate policies for a territorially balanced development in the European Union.

Finally, Fig. 9 shows the contribution of metro regions in the GDP of the country. Although there is an important variation between countries, there are cases where in metro regions is generated the 60% of country's GDP. In most cases, metro regions contribute to more than 50% in the GDP of specific countries. This concentration of wealth and production in specific metro areas calls for careful interpretations and adjustments of regional policy.

Increases in the share of metropolitan regions can be observed in most CEE countries with possible exception of Hungary and Poland.

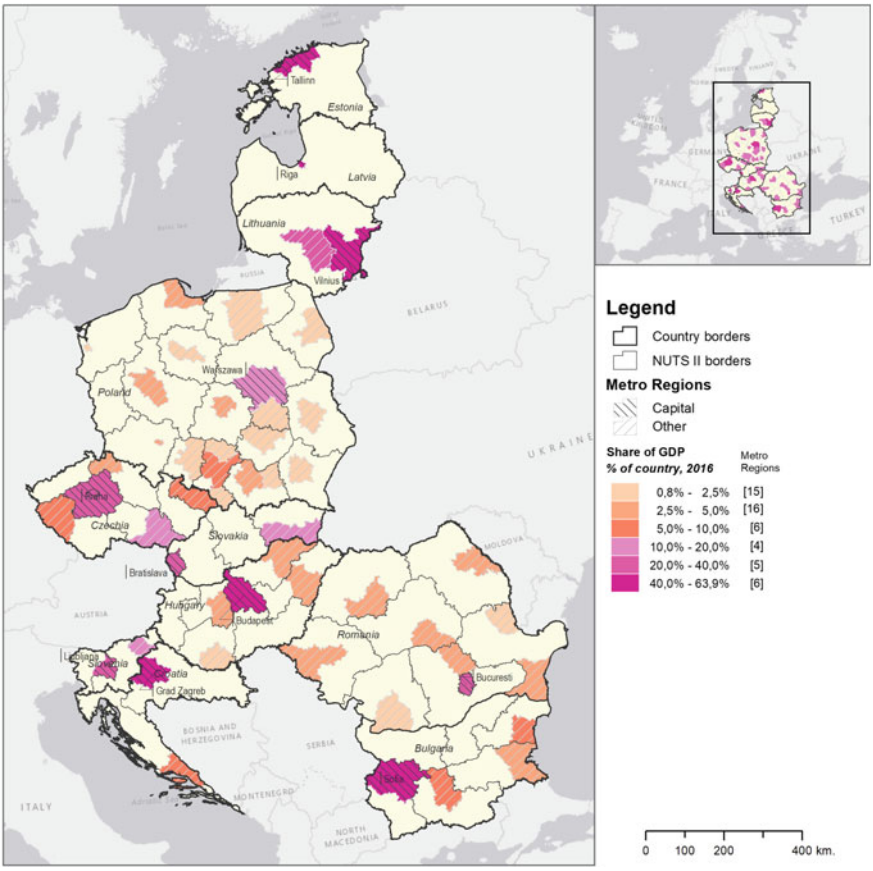

Fig. 8 GDP at metro regions as share (%) of national GDP (2016). *Source* Eurostat, authors' elaborations

5 Conclusions and Discussion

This chapter has made an attempt to present the level and the evolution of regional development in the CEE countries of the EU during the period 2000–2016, focusing on the role of metropolitan regions. This attempt has been supported by new data retrieved from Eurostat which allow the identification metro EU regions and the measurement of wealth according to GDP data. The analysis has provided some interesting results.

First, the CEE countries are lagging behind in terms of economic development compared with the EU average; however, there is an important trend towards convergence.

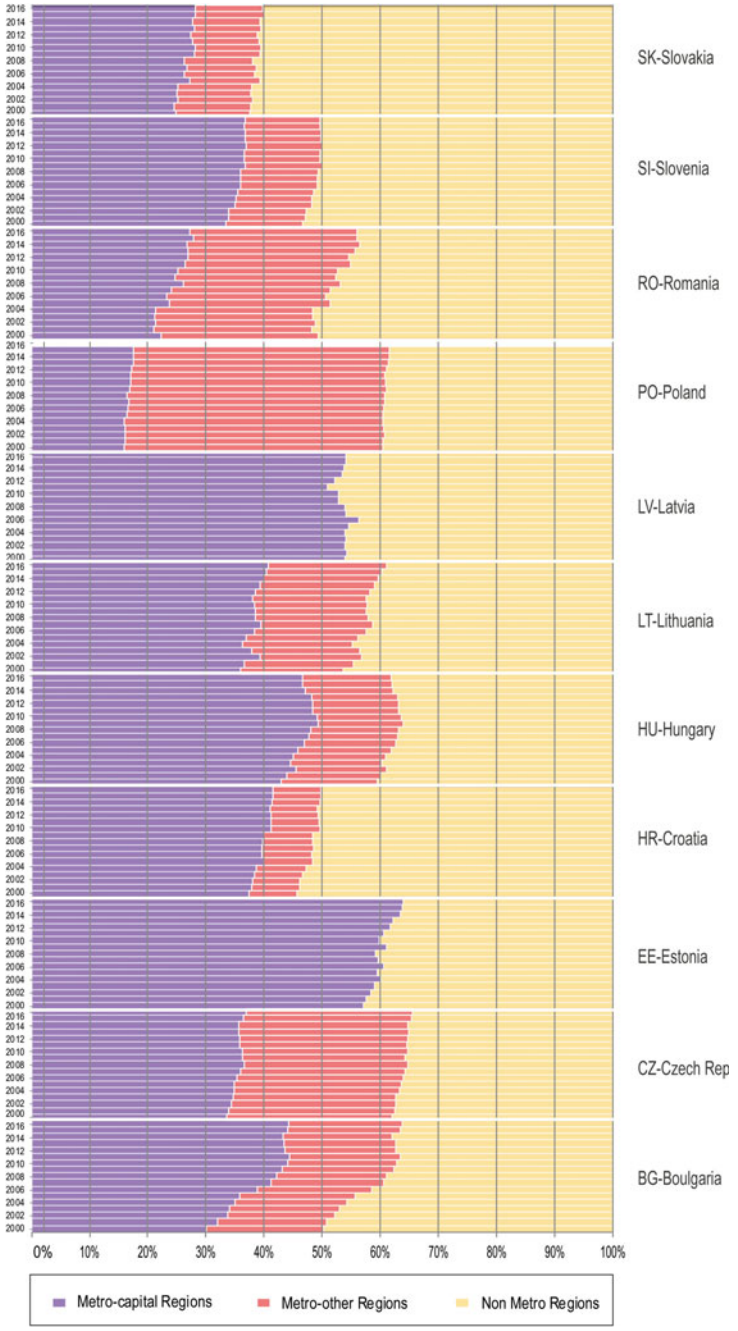

Fig. 9 Shares of metro regions in national GDP (2016). *Source* Eurostat, authors' elaborations

Second, regional inequalities in the CEE countries are high and persistent. This fact should be taken into consideration in the design and implementation of cohesion policy.

Third, metropolitan regions seem to be the outliers in the level of economic development since they enjoy levels of economic development above the EU average.

These trends reflect the changing landscape of regional inequality in the development map of the European Union. These changes call for the differentiation of regional policies. The new programming period calls for careful analysis and implementation of policies that will redress the geographical imbalances and gaps between the more densely populated areas and the peripheral regions in the European Union. The CEE countries require well-tailored policies in order to achieved balanced development between regions, urban areas and the other regions in each country. Summing up it could be stated that this new form of inequality requires different methods of analysis and adjustments to policy.

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Democracy in CEE: The Social and Economic Embeddedness

Marija Džunić, Nataša Golubović and Jelena J. Stanković

Abstract During the last decades, considerable progress has been made in building democracy in the countries of Central and Eastern Europe. However, building liberal democracies is a complex process, implying not only the procedural conditions for electoral democracy, but also the institutionalization of accountability mechanisms and embedding the democratic values in the patterns of citizen's behavior and attitudes. In the absence of such mechanisms, democracies remain in the state of hybrid regimes, captured in the gray zone between democracy and autocracy, without guarantees of reaching the final stage of democratic consolidation. The European post- countries vary significantly in terms of consolidation levels of their democratic regimes, ranging from consolidated democracies to semi-authoritarian regimes. The paper attempts to explore the potential causes and available resources for consolidation, using the recent data from internationally comparable surveys and ratings. Based on Wolfgang Merkel's concept of embedded democracy, the analysis focuses on the importance of consolidating forces in the external environment, encompassing the socio-economic context, the strength of civil society and the influence of external political conditionality. Estimating a multiple linear regression model, we test the relevance of social and economic inequalities, civil society, and international integration as predictors of the level of democratic consolidation.

Keywords Democratic consolidation · Institutional change · Inequality · Civil society · CEE

JEL Classification E02 · P30

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*,
Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_2

1 Introduction

A distinct feature of political changes in Central and Eastern Europe (CEE) is the diversity of political regimes. On the one hand, there are transitional economies that are considered to be more or less consolidated, liberal democracies. However, a number of countries are characterized by the development of the so-called *mixed* regimes that have experienced a formal transition to democracy, but still failed to consolidate the emerging democratic structures. After decades of political and economic reforms, these countries are still in a state of prolonged democratic transition, with uncertain prospects for the full consolidation of democratic institutions.

Previous theoretical and empirical research on democracy in transition countries suggests that the assessment of democratic consolidation cannot be based solely on the minimum requirements for the existence of democracy, but on the elements that provide democratic stability. In this sense, the concept of embeddedness appears as an appropriate analytical framework. This concept implies that stable democracies are internally and externally embedded, enabling the identification of obstacles which impede further consolidation. Internal embeddedness is based on the simultaneous interdependence and independence of the partial regimes of democracy, while the elements that constitute external embeddedness determine the probability of democracy survival. According to this view, many Central and Eastern European countries could be defined as semi-consolidated democracies, because the rings of external embeddedness (social and economic prerequisites of democracy) still show significant deficiencies. The unfavorable social and economic conditions are emphasized as the factors that have hindered the process of democratic stabilization in the region. Following previous studies, this paper contributes to the literature on the relevance of the external context for the outcomes of democratic consolidation in CEE countries. Drawing upon the theoretical model of external embeddedness of democracy, we identify a number of potential determinants and test their impact on the democracy scores assigned to transitional political regimes in CEE.

The paper is structured in the following way: after introductory notes, Sect. 2 presents a comprehensive review of the literature on consolidation of democracy and its determinants. Section 3 describes the data sources and elaborates on the choice of variables, followed by the specification of an econometric model in Sect. 4. After the presentation and the discussion of the results in Sect. 5, the paper offers concluding remarks and some policy implications.

2 The Role of Social and Economic Factors in the Consolidation of Democracy—Literature Review

In the former socialist economies, development of democracy began with the crash of the old regime and implementation of the first free elections (di Cortona 1991). The transition to democracy was expected to soon be followed by *consolidation* or

stabilization, in the course of which democratic practices would be accepted by the most relevant actors (O'Donnell and Schmitter 1986; Linz and Stepan 1996). From the perspective of developing democracies, the consolidation phase is crucial, but also the most demanding for the survival of the democratic regime. Some of the transition countries of Central and Eastern Europe did not follow the linear path of democratization after the initial phase of democratic transition. Instead, they faced stagnation, even a retrogression, or return to some forms of authoritarian regime. These countries have not transformed themselves into consolidated democracies, but have developed hybrid regimes that represent a mixture of democratic and non-democratic institutions. In such settings, the formal democratic political institutions, such as multi-party elections, conceal authoritarian elements, and informal practice (Diamond 2002, 2005; Reich 2002). In practice, these democracies were reduced to a set of formal democratic institutions, without a real democratic substance (Levitsky and Way 2005). While the core of the debate about democratization at the beginning of transition was the introduction of formal institutions of democracy, in the second phase, a far more complex analysis of democracy prevailed. Numerous social and political indicators were introduced in order to identify the relevant criteria for the consolidation of democracy or to provide basis for the identification of a democracy's defects. Instead of focusing on whether formal rules have been established, the emphasis is on analyzing the way institutions function, and to what extent this functionality deviates from democratic standards. It is the starting point for differentiation between embedded democracies, on the one hand, and half-authoritarian regimes or defective democracies, on the other (Merkel 2004).

In academic literature, the consolidation of democracy generally involves either eliminating the danger of the breakdown of democracy and/or moving toward higher levels of democratic performance. Consolidated democracy means a democracy that is resistant to crises and/or high-quality democracy. From the standpoint of elements and procedures taken as necessary prerequisites for democracy, we can distinguish between minimalist and maximalist approaches. Some definitions of democratic consolidation are focused on a minimum of necessary conditions (Schumpeter 1942; Przeworski 1991), while others imply that democracy is not sustainable without the fulfillment of additional requirements that ensure the constitutional equality of all citizens (Huntington 1991; Linz and Stepan 1996). Minimalist definition of democracy, based on electoral democracy, free elections and some basic human rights corps, allows certain political regimes to be qualified as democratic, although elections in such regimes are defective and certain groups are socially and politically excluded. The analytical usability of such definitions is limited, especially in empirical research.

Dahl (1971) emphasizes two dimensions—participation and contestation (competition)—as the most important for the dynamics of democracies. According to Linz and Stepan (1996), consolidation is necessary in five areas: civil society, political society, rule of law, state apparatus, and economic sphere. In each of these areas, it

is necessary to fulfill certain conditions for a democracy to be considered as consolidated. Similarly, Diamond and Morlino (2004) stress "eight dimensions of democratic quality": (1) *rule of law* (2) *participation*; (3) *competition*; (4) *vertical accountability* (5) *horizontal accountability*; (6) *freedom;* (7) *equality*; and (8) *responsiveness*. In his analysis of democracy and the quality of democracy, O'Donnell considers two elements: human development and human rights (2004), where human development addresses the social and economic contexts, while human rights include political rights, civil rights, and social rights. The social dimension provides necessary ground for the transformation of formal rights into real freedoms. Without human development, the human rights are more rights and not so much freedoms. Following a broader conceptual understanding of democracy, Campbell (2008) points out two broad groups of elements important for the assessment of the quality of democracy: those that determine the quality of politics and elements that determine the quality of society. Acknowledging the key role that the political system has in democracy, the remaining non-political dimensions that affect the quality of democracy are: gender, economy, knowledge, health, and the environment. The quality of politics cannot be assessed without considering the quality of society.

Although political processes are crucial for the consolidation of new democratic regimes, non-political factors also influence political processes in many ways. Among these factors, beside traditional interest for the impact of economic development, there is a rising interest for international influence and prior democratic experience, civic society, historical factors, etc. Empirical analysis of Sibinescu (2012) points out that the main source of weakness in Central and Eastern European countries lies in the sphere of external embeddedness, while internal embeddedness appears as quite solid. Political processes that directly affect consolidation or breakdown of democracy are embedded in social and economic context that are shaped by many factors, which influence the character and outcomes of these processes and thus indirectly affect the likelihood of democratic consolidation (Gasiorowski and Power 1998). This line of reasoning is followed by Merkel and Puhle. Merkel's concept of embedded democracy implies that stable democracies are internally and externally embedded. Internal embeddedness is based on the simultaneous interdependence and independence of the partial regimes of democracy: the democratic electoral regime, the right to political participation, civil rights, horizontal accountability, and the effective right to govern in the hands of democratically elected representatives. It is precisely the embeddedness of the institutions of democracy in the network of institutionalized partial regimes that increases the resilience of democracy (Merkel 2004). External embeddedness refers to factors that protect democracy from internal shocks and destabilizing tendencies. The most important among these factors are socio-economic context, civil society, and international integration. These elements are not defining components of the democratic regime, but could affect the quality of democracy. Puhle (2005) lists eleven consolidation criteria classified into five groups: the electoral regime, political liberties, the effective power to govern, horizontal accountability, and the rule of law. *Stateness* (a relatively independent and autonomous state) is added as a fundamental prerequisite for any political regime, followed by the civil society and the socio-economic (including the international)

context. In contrast to the partial regimes of democracy, whose non-existence or malfunctioning points out to the non-consolidated democracy, elements that constitute the external ring of embeddedness affect the probability of democracy survival (Puhle 2005).

It is considered that long-term economic development provides additional support for the survival and stability of democracy. The increase of wealth provides more choices available to individuals and governments, reducing the propensity for conflict and threats to democracy. Lipset (1959) found that economic development was stronger in stable democracies compared to unstable democracies and dictatorships. According to modernization theory, democracies are more likely to emerge in countries following the steady path of economic development. Economic development does not guarantee the development of democracy, as it is possible for democracies to emerge without any relation to economic development (Przeworski et al. 2000; Acemoglu et al. 2007). Analyzing a sample of 26 post-communist countries over a 7–9 year period, Kurtz and Barnes (2002) found little empirical support for the claim that socio-economic development promotes political democratization in these countries. However, once established, democracies are most likely to survive in developed countries. Democracies are extremely fragile in the conditions of widespread poverty. According to Vanhanen (1990), it is highly unlikely that democracy would function properly in societies characterized with low level of GDP per capita, literacy rate, widespread poverty, etc. As a country develops, the greater are the chances it will sustain democracy (Lipset 1959), suggesting that democracies flourish best in affluent societies with conditions of widespread literacy and education, and a substantial middle class (Przeworski 2004). Wealthy countries tend to be democratic because democracies are more likely to survive in affluent societies (Przeworski et al. 2000). Similarly, Hadenius (1994) found that the degree of economic development is an important determinant of democratic durability, while Buhlman indicated that, in terms of the economic variables, wealth (measured with GDP per capita), as well as the degree of economic globalization, have a positive impact on the quality of democracy (Bühlman 2011). Analyzing the relationship between income inequality and democracy, Muller (1988) concluded that a durable democratic regime reduces inequality, while transition to democracy in the conditions of high inequality causes increased pressure on democratic institutions and, eventually, reversal to authoritarianism.

Theoretical and empirical research confirms a strong positive effect of development-related socioe-conomic factors on the likelihood of consolidation. Studies about the impact of economic development and modernization on political processes provide valuable insights into the determinants of democratic consolidation and enrich our understanding of democratization. The level of aggregate development is an important factor that supports democracy, but it is only one among the several factors. Evidence shows that the sequence of economic development and the degree of inequality also matters (Dahl 1971; Stephens 1987). The relationship between economic development and democracy is complex and context-dependent.

Civil society, as well as democratic values and norms, support the consolidation of democracy but do not cause the development of democracy (Muller and Seligson 1994). Although civil society is not an indispensable prerequisite of democracy, effective functioning of democratic institutions depends on the existence of rich and vigorous civil society. There are two main views concerning the role of civil society in democratization. The first considers civil society as complementary to the state and to the political system, providing basic socialization functions (Hahn-Fuhr and Worschech 2014). It relies on the idea that civil society organizations and associations represent the "schools for democracy" (Putnam et al. 1993). The emphasis is on the civil society as an integrative power that contributes to the democratic consolidation by enhancing democratic skills and norms. Through socialization and learning civic virtues (social capital), citizens recognize the advantage of democratic virtues. Huntington (1993) points out that it is important that attitudes, values, beliefs, and related behavior patterns in a country are conducive to the development of democracy. The other view perceives civil society as a counterpart to state and government, serving as a barrier against state power, defending democratic rights and values. Civil society supervises the government and alarms the society if it does not act in accordance with the laws. Independent media and networks of various voluntary associations help citizens in their everyday life and in their efforts to influence public policy. Vigorous associational life is an important precondition for securing the responsiveness of government policy and ensuring that the delivery of public services meets the needs of the population (Beetham et al. 2008).

Involvement in the processes of regional or international integration also affects democratization in Central and Eastern Europe. The EU pressures provided not only the impetus to break from the old communist structure, but also affected newly adopted institutional arrangements. Former socialist countries with the aspirations for membership in the EU had to adjust their institutional infrastructure to common standards set out in the *acquis communautaire*, while politicians and citizens were involved in a process of social learning and adoption of democratic norms. Experience of Central European countries that were first to join EU confirmed that external embeddedness of their democratic system made the authoritarian reversal more difficult and costly. EU developed special aid programs for candidate countries in Central and Eastern Europe, with the aim to support development of democracy. Such programs were oriented toward institution building priorities in transition countries: the rule of law, the stability of institutions guaranteeing *democracy*, human rights, and respect for and protection of minorities. Through the mechanisms of political conditionality, EU affects policies and institutional structure of CEE countries. The adoption of EU rules had a significant impact on the promotion of democratic norms in these countries (Sibinescu 2012). Schimmelfennig's (2004) findings imply that a credible perspective of EU accession combined with low adaptation costs, influences policies and institutional structures in CEE countries. Positive effects of the credible promise of accession on the democratic consolidation were also confirmed by Gherghina (2009).

Although the EU conditionality is considered a powerful instrument for promoting democratic standards in the accession countries, there are diverging evidence of

its impact on policy change across the accession countries and target policy areas. Krysko (2008) found that effectiveness of the EU conditionality in the Central and Eastern European countries depends on the credibility of accession, costs of adoption of EU democratic norms, the level of commitment to EU community, and the degree of economic interdependence between the target country and the EU. EU pressure is effective if conditionality is combined with the credible prospect of accession in the foreseeable future. If the latter is uncertain, then conditionality is less effective (Pridham 2002). However, even with a reasonable prospects of accession, implementing democratic reforms may be complicated by domestic political problems. Furthermore, the impact of EU integration process is not uniform across all levels and changes do not progress at the same pace. First effects occur on the institutional level, where political elites are involved, and are less evident at the level of the civil society where changes require longer time horizon (Pridham 2002; Björkdahl 2005).

3 Data and Variables

In our analysis, we attempt to empirically determine the relevance of a number of variables for the process of democratic consolidation. Following earlier empirical studies and taking into account previously elaborated theoretical assumptions, and we consider a set of determinants that are likely to affect the level of democratic consolidation. The analysis is conducted for 16 CEE and Balkan countries, based on the recent data from internationally comparable surveys and transparent ratings. The choice of explanatory variables is based on a theoretical model related to the external embeddedness of democracy.

As an operational measure of democratic consolidation, we have chosen *Democracy scores* and regime rates published annually in the *Nations in Transit* reports (Freedom House 2017). *Nations in Transit* represents the *Freedom House's* project that measures the progress and the setbacks of democracy in post-socialist countries of Central Europe and Central Asia. The annual reports on the democratic reforms in these countries have been published since 1995, observing and measuring democratic changes in several categories, including national and local democratic governance, electoral process, judicial framework, media independence, etc. The achieved category scores are averaged to provide a country's overall democracy score, that scales from 1 (the highest level of democratic progress) to 7 (the lowest democratic progress). Democracy scores capture a wide range of criteria that determine the degree to which the democratic regimes of the analyzed countries are consolidated. For the purpose of our analysis, the ratings from 2017 have been used that reflect the changes observed in the sample countries in 2016 (Table 1).

According to the rankings, the majority of CEE countries seem to have indisputably joined the family of established democracies. All countries that have joined

Table 1 Democratic consolidation of political regimes in Central and Eastern European countries

Regime types	Consolidated democracy (1–2.99)	Semi-consolidated democracy (3–3.99)	Transitional government or hybrid regime (4–4.99)
Countries	Estonia (1.93)	Romania (3.39)	Albania (4.14)
	Latvia (2.04)	Bulgaria (3.36)	FYR of Macedonia (4.43)
	Slovenia (2.04)	Hungary (3.54)	Bosnia and Herzegovina (4.54)
	Czech Republic (2.25)	Croatia (3.71)	
	Lithuania (2.32)	Serbia (3.82)	
	Poland (2.57)	Montenegro (3.89)	
	Slovakia (2.61)		

Source Freedom House (2017)

the EU in 2004, with the exception of Hungary, are classified as consolidated democratic regimes. Regimes with assigned democracy scores within the range of 1.00–1.99 are considered to be closely embodying the best policies of liberal democracies and are characterized by competitive elections, vibrant civil society, independent media, stable and accountable governments, timely and independent judiciary, and effective anti-corruption policies in place. However, the only CEE country with democracy score under 2.00 is Estonia, while other countries from the group, although consolidated democracies, face relatively significant challenges related to corruption and timeliness of judicial decisions. This implies that there are certain defects in their democratic systems, although they are best performers within the post-socialist countries. Taking a closer look into the dynamics of democratic governance in CEE countries implies that almost all of them are experiencing democratic deterioration to a certain extent.

On the other hand, Hungary, 2007 and 2013 EU joiners and Balkan countries that are candidates for EU membership are classified as semi-consolidated regimes. These are the so-called *electoral democracies*, faced with problems in various partial regimes of democracy (electoral irregularities, weak systems of checks and balances, infringed political rights and civil liberties, and widespread corruption). Finally, the rest of Balkan countries that are EU applicants belong to the group of *transitional or hybrid regimes,* with minimal democratic standards, fragile democratic institutions, and compromised political and civil rights.

Current state of democracy in post-socialist countries suggests that the initial assumption about the unidirectional movement toward liberal democracy was rather unfounded. Almost all consolidated democracies have experienced the deterioration of the rule of law and adherence to democratic values in the last 10 years (Freedom House 2017). Among EU members and candidates, 11 countries have experienced declines in democracy scores, one had no net change and only 5 have shown improvements during the last decade. After six consecutive declines, Hungary has suffered

the greatest downgrade (2.14–3.54), with its democracy score now being the worst in CEE, placing Hungary in the group of semi-consolidated regimes. Poland's trajectory has also become worrisome, showing that democratic institutions in this country, which has served as an exemplar of democratic transformation, are vulnerable, rather than mature. Czech Republic, Slovakia, and Bulgaria have experienced declines in democracy score owing to harmful influences of extremist groups on public discourse, while the Baltic states, although being long-term best performers in democratic reforms, have stagnated throughout this decade. These developments have caused the faster decline of the average democracy score in Central Europe than in the Balkan states.

Unfortunately, the democratic prospects of Balkan countries are also rather bleak. Although the EU accession was supposed to facilitate the establishment of liberal democracy in the candidate countries, considerable election irregularities and assaults on the media have led Serbia's democracy score to its lowest level since 2003. FYR of Macedonia, Bosnia and Herzegovina, and Montenegro have all suffered serious declines, owing to problematic elections, nationalist narrative of their leaders and ethnic divisions.

The data presented indicate significant cross-national variations in the progress made by the post-socialist countries toward the consolidation of their democratic regimes. Although the majority of the countries are coping with the erosion of democratic norms, some of them are regarded as consolidated regimes, while others are not yet within the reach of democratic consolidation, for various reasons. Drawing upon the theoretical model of external embeddedness of democracy (Merkel 2004), several potential determinants of democratic consolidation from the external environment can be identified.

Socio-economic inequalities are introduced in the analysis in order to capture the potential of socio-economic development to facilitate and sustain democracy. The transmission mechanism that connects a prosperous economy and consolidated democracy goes most likely through reducing inequalities. Persisting income inequalities and the spread of poverty produce considerable education inequalities, thereby reducing the chances for equal participation in democratic process. Therefore, inequalities serve here as a proxy for a broad range of changes induced by socio-economic development. This determinant is operationalized through the *Coefficient of human inequality* (UNDP Human Development Report 2016), calculated as an unweighted average of inequalities in income, education, and health. Reducing inequality is expected to affect democracy scores positively, as a fair distribution of socio-economic resources is supposed to enhance the quality of democracy.

As a well-developed and vibrant *civil society* has considerable implications for the democratization process, this indicator enters the set of potential explanatory variables in the form of *Freedom House* civil society ratings. This indicator assesses the strength of various community associations, the political environment in which they operate and their capacities for policy advocacy. As the impact of civil society on strengthening democracy has traditionally been recognized through protecting the individual rights, supporting the rule of law and educating the citizens, the expected sign of the influence of this variable is positive.

Table 2 One-way ANOVA and post hoc output for the EU variable

Source	SS	df	MS	F	Prob. > F
Between groups	7.312782	1	7.312782	20.98	**0.0004**
Within groups	12.19197	14	0.348513778		
Total	12.19197	15	0.812798326		

Democracy score	Contrast	St. Err.	t	P > |t|
EU				
1 versus 0	**−1.458545**	0.3184114	−4.58	**0.000**

Source Authors' calculations
Bold values represent the probability $p < 0.05$

Another important component of the external ring of embeddedness of democratic consolidation relates to the political culture of the citizens in the transforming countries. Their political attitudes and support for democracy constitute a vitally important element of democratic consolidation. This attitudinal dimension of democratic consolidation supplements voluntary activities in community associations, captured by the *Civil society variable*. Therefore, we use the *Attitudes towards democracy* as an indicator of political support for democratic political system. This indicator is constructed as the percentage of citizens in analyzed countries that prefer democracy to any other form of political system (EBRD 2016).

Finally, we include a dummy variable of *EU membership* in the model, to determine whether EU accession acts as a significant force in spreading liberal democracy across post-socialist countries. The rationale for including this variable is also founded in the theoretical model of external consolidation determinants, where international (and especially regional) integration into economic and political alliances is assumed to have considerable implications for the stability and the quality of democratic systems. The EU expansion to include CEE and the Balkans has served as a successful vehicle for consolidating democracy in the new members and candidates, but has recently faced serious accountability challenges. The preliminary one-way ANOVA and post hoc test indicate significant differences in democracy scores of EU and non-EU countries (Table 2).

Table 3 presents the descriptive statistics of all the variables used in the analysis.

4 Model Specification

A comprehensive understanding of democratic consolidation must take into account the relevant contextual factors that represent the conditions in the external environment that affect the quality of democracy. The cross-national study of democratic consolidation should therefore examine a range of factors that embody the prerequisites of consolidation. In order to explore how the suggested explanatory variables affect the likelihood of consolidation, we estimate a multiple regression model of

Table 3 Descriptive statistics

Variable	Observations	Mean	St. dev.	Min.	Max.
Democracy score	16	3.16125	0.9015533	1.93	4.54
Human inequalities		9.73125	2.901659	5.3	16.1
Civil society		2.484375	0.7771141	1.75	4.5
Attitudes toward democracy (%)		50.75563	9.353386	36.77	71.28
		0.6875	0.4787136	0	1
EU membership (dummy)					

Source Freedom House (2017), UNDP (2016), EBRD (2016)

democratic consolidation, using the OLS approach:

$$Y = \beta_0 + \sum_{i=1}^{m} \beta_i X_i + \delta_0 D + \varepsilon \tag{1}$$

where Y denotes *Democracy score* of each country, β_0 stands for intercept, and ε represents the error term. X_i represents a vector of i explanatory variables used in the model, elaborated in Sect. 4, while δ_0 represents the coefficient of the dummy regressor D. The estimated coefficients of regressing democracy scores on a selected set of predictors are presented in Table 4.

Standard regression diagnostic tests have been performed to assess the robustness of the model. The Breush–Pagan/Cook Weisberg heteroscedasticity test indicates homogenous residuals (Prob. $> \chi_2 = 0.0993$), while Ramsey RESET test rules out the

Table 4 Estimated coefficients of a linear regression model

Source	SS	df	MS	Number of obs. = 16
Model	10.18365	4	2.545913	F(4, 11) = 13.94
Residual	2.008321	11	0.182575	Prob. > F = 0.0003
Total	12.19197	15	0.812798	R-squared = 0.8353
				Adj. R-squared = 0.7754
				Root MSE = 0.42729

Democratic consolidation	Coef.	Std. err.	T	P > t	[95% Conf. interval]	
Human inequalities	**0.150064**	0.054595	2.75	**0.019**	0.029901	0.270228
Civil society	**0.814888**	0.232327	3.51	**0.005**	0.30354	1.326237
Attitudes towards democracy	−0.01893	0.01368	−1.38	0.194	−0.04904	0.011177
EU membership	0.02391	0.440311	0.05	0.958	−0.99303	0.945208
_cons	0.668813	0.640472	1.04	0.319	−0.74086	2.078481

Source Freedom House (2017), UNDP (2016), EBRD (2016)
Bold values represent the probability $p < 0.05$

omitted variable bias. The results of the test confirm the assumption that the error term and the independent variables in the model are not correlated (Prob. > F = 0.3983). Linktest of specification error indicates that the model is specified correctly (P > |t| = 0.183). The Shapiro–Wilk test for normal data confirms the normal distribution of residuals (Prob. > z = 0.5764). Regression diagnostics indicate that no assumptions of the OLS regression have been violated. On the other hand, the F-statistics and adjusted R-square value indicate that the model is well-fitted.

Regression results partly confirm the theoretical assumptions concerning the impact of external environment on consolidating democracy. All tested predictors have the expected sign of influence on the response variable, although some of them have no apparent effect. However, the important finding of the regression is that socio-economic inequalities and the strength of civil society strongly affect the progress of democratic consolidation in the chosen set of countries.

5 Discussion of the Results

Our empirical model has identified two determinants with strong explanatory power in the regression equation. First, the socio-economic inequalities have a significantly positive coefficient in the model, implying that countries characterized by higher inequalities in income, education, or health have higher values of democracy scores (which means lower levels of democratic consolidation). A rise in the coefficient of human inequalities for 1 point induces the worsening of the democracy score for 0.15. As this variable serves as an approximation of a broad set of development-related factors, these findings indicate that socio-economic development significantly affects the consolidation of political regimes of CEE. This confirms the theories of the impact of economic development and a wide range of its implications on political life (Lipset 1959). Our results are in line with many empirical studies which confirmed that high inequalities pose significant challenges for sustainable consolidation of democracy (Burkhart 1997; Acemoglu and Robinson 2006; Vanhanen 2003). The rationale behind these empirical findings is that an unequal distribution of key resources, such as income or education, affects the distribution of political resources and hence hinders democracy (Böhnke 2011). Some studies empirically confirm that the breakdown of social cohesion brought about by income inequality threatens democratic institutions (Thorbecke and Charumilind 2002). Furthermore, inequality has been proved to be a significant predictor of democratic breakdown (Reenock et al. 2007; Houle 2009). Equal distribution of resources is found to strongly affect democratic consolidation, although it does not necessary hinder democratic transition (Merkel and Weiffen 2012). There is empirical proof that economic and educational inequalities decrease political participation (Solt 2008; Berinsky and Lenz 2011) and support for democracy (Krieckhaus et al. 2014).

Another factor that clearly affects democratic consolidation in our model is the strength of civil society. Considering the link between the chosen proxy for the civil society development and the democracy scores, our results document a statistically

robust case of influence. Positive coefficient estimate of this variable suggests that the more developed and vibrant civil society increases the potentials for consolidation. The results are in line with the vast amount of literature that confirms the importance of civil society in introducing democratic government and practices in Eastern Europe (Ash 1990; Ekiert 1991; Fukuyama 2001). Thus, the ideas advanced by Locke, de Montesquieu, and Tocqueville about the functions performed by civil society have considerable implications for the understanding of democratic consolidation of post-socialist countries. More precisely, an important element of the democratic consolidation in the CEE, besides the institutional building, has been a bottom-up legitimization of democratic institutions, provided by the creation of strong links between the civil society and newly established regimes (Morlino 2011). Owing to the legacy of previous non-democratic regimes, the post-socialist countries have been left with a weakened civil society, and the pace of its development appears to have strongly affected the consolidation prospects. The legacy of ethnic nationalism and distrust in institutions has posed significant challenges to transition countries in the process of building civil society. The average levels of voluntary associations membership in most post-socialist countries is lower than in old democracies, with civil society organizations unable to affect the policy-making process or hold the government accountable. In the Balkans, the civil society sector appears to have fallen short of its social accountability function, since in these countries a widespread perception of high-corruption and distrust in institutions still prevails (Balfour and Stratulat 2011). It is, therefore, reasonable to assume that certain configurations of civil society are more conducive to consolidation than others.

These two explanatory variables provide a robust portrait of democratic consolidation in CEE countries. On the other hand, the model has rejected the importance of attitudinal dimension of the support for democracy. Although the variable has the expected sign of the influence (the increasing percentages of support for democracy improve the democracy score), it is not statistically significant. The plausible explanation for this outcome could be that attitudes and norms, as elements of citizens' political culture do not exert an instantaneous impact on the democratic consolidation. The consolidation of political culture can take decades for the citizens to endorse democracy and for it to be deeply rooted in the society. The progress in certain fields of democratic consolidation does not necessarily imply that the majority of the citizens supports democracy. Previous empirical studies on consolidation in CEE confirm that the democratic regimes depend on public support (Mishler and Rose 1996; Whitefield and Evans 2001). Furthermore, subjective attitudes to democracy are likely to be affected by a number of determinants, so that the preference of democracy to alternative forms of government may not coincide with support for particular regime in one's own country (Fuchs and Roller 2006). Finally, it may as well turn out that the fair part of the citizens' attitudes to democratic norms and values is already captured by or interfere with the civil society variable.

Despite the fact that univariate analysis indicated that EU membership facilitates democratic consolidation, these findings change considerably in the multiple regression model, controlling for the effects of other variables. The mixture of factors in the model generated a statistically insignificant effect and ruled out the international

influence as an explanatory factor of democratic consolidation. Prior research has emphasized the crucial role of EU for ensuring consolidation of democracy (Pridham 2003), even implying that joining the EU should be considered as the completion of the consolidation process (Vachudova 2005). In time, however, cross-national variations have become evident, that were ascribed to a combination of reasons: historical legacies, development of civil society, progress in economic transition. The path dependency of individual countries' transition trajectories have obviously led Central European countries to a better position compared to Balkan states. Also, the accession process has advanced more with those countries that have sooner resolved the modernization problems. This implies that the insignificance of the EU variable in our model might be ascribed to the interference with the variables that approximate socio-economic development and the strength of civil society. The post hoc test performed within our univariate analysis revealed that democracy scores are statistically significantly lower in the EU members, compared to non-members in our sample ($-1.45 \pm 0.32, p = 0.000$), so there is no doubt that the EU had a role in facilitating democratization. At the least, the EU had a role in making the consolidation probable, within the limitations posed by domestic politics of each accession country. However, in the last couple of years, an increasing amount of skepticism related to the EU's capability for consolidating democracy through the harmonization process has been raised. The question remains how long can the effects of conditionality last and how strong the post-accession influences can be. Growing concerns exclusively for the efficiency of the accession process can sometimes serve to override the interest for democratization (Pridham 2006), which in large complicates the EU impact on consolidation of democracy in member as well as candidate countries.

6 Conclusion

Our study contributes to the literature on the consolidation of democratic political regimes across the post-socialist countries and to a deeper understanding of the context dependency of this process. We have elaborated a number of theories about the role of the external environment in the stabilization of democracy. As a number of CEE and Balkan countries have lately been facing substantial challenges in sustaining democratic norms and practices, we examine a range of factors that are likely to affect the level of democratic consolidation. Using data on democracy scores, socio-economic inequalities, vibrancy of civil society and EU membership in 16 post-socialist countries of Central and Eastern Europe, we estimate a multivariate regression model of democratic consolidation.

The main findings of the study indicate two groups of factors that clearly affect the democratic consolidation outcomes, suggesting the significance of the prevailing economic, social, and political context for the prospects for democratic consolidation. Expectedly, the coefficient of human inequalities, as the approximation of development-related socio-economic factors, appears to have a strong explanatory

power in the model. Also, the civil society development clearly underpins the consolidation of new democracies. The rest of the estimated variables turned out to be insignificant, possibly due to the interference with the significant predictors. The paper offers potential explanations for the absence of expected regularities, suggesting that the varying consolidation levels represent partly the outcome of individual democratization paths and cannot be explained taking into account exclusively the common external context.

Socio-economic inequalities and the strength of civil society explain the fair part of the varying levels of democratic consolidation in the sample countries, although this does not rule out the possibility of the existence of alternative systemic influences, not captured by our analysis. The important implications of the study are that reducing the inequalities in income distribution, education, and health increases the probability of consolidation. Reducing inequalities, as some recent studies suggest (Milanovic 2016) should not primarily include the redistributive interventions aimed at taxation of current income, since such measures diminish the incentives for productive economic activity and hinder economic growth, while at the same time increasing the role of the state in the economy. Rather than that, the key to reducing inequalities is through providing an equal access to education and raising the inheritance taxes. Along with reducing inequalities, the development of a vibrant civil society as the source of democratic legitimacy represents a cornerstone of the consolidation of democracy in post-socialist countries.

Acknowledgements The authors are grateful to the Republic of Serbia Ministry of Education, Science and Technological Development for the funds and support that made this research possible.

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Contrasting Theories and Evidence About Income Inequality of Post-socialist Central and Eastern European Countries in the European Union

Gyorgy Andor

Abstract In this paper, the evolution of income inequality in five Central and Eastern European (CEE) post-socialist countries, members of the European Union (EU)—the Czech Republic, Hungary, Poland, Slovakia, and Slovenia—are examined. The similarities of political and economic changes in these countries allow an integrated analysis of their income inequality developments. Moreover, as these countries represent a unique group around the border between high-income and upper-middle-income countries, the paper can also contribute to the debate on inequality in countries at different levels of economic development. It focuses on several relating and often contradictory theories and empirical evidence from the past few years, trying to offer a comprehensive picture of the progress of inequality in this region. After a short introduction, the theories about the relationship between inequality and growth are summarized. Then, the empirical evidence about income inequality in CEE countries is presented and compared with EU-wide data. Finally, some concluding remarks close the paper.

Keywords Inequality · Economic growth · Central and Eastern Europe

1 Introduction

The relation between economic growth and income inequality is far from straightforward. Inequality can be a positive impact on economic growth because income differentials provide incentives and reward personal effort, risk-taking, and innovation. It also promotes growth by stimulating higher level accumulation of savings. Nevertheless, income inequality can against growth by reducing aggregate demand (Carvalho and Rezai 2015); fueling financial instability (Rajan 2011; Acemoglu 2011); hampering investment (Bardhan 2007; Dabla-Norris et al. 2015) and middle class risk-taking (Boushey 2011); impeding the swift upgrade of skills and education,

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*,
Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_3

reducing productivity (Stiglitz 2012); delay socioeconomic mobility (Krueger 2012; Corak 2013; Bubbico and Freytag 2018). The cumulative effect has been debated.

Inequality in Europe is an especially complex question because it has at least three different dimensions: Within member states, between member states, and in the European Union (EU) as a whole.

Finally, inequality issues among CEE countries are particularly difficult to understand because of the parallel effects of transition from a centrally planned economy to a market economy, globalization, and the EU's convergence mechanisms.

2 Contrasting Theories About the Relationship Between Inequality and Growth

2.1 Kuznets Curve

As Nobel Prize winner Simon Kuznets originally stated, as an economy develops, a natural pattern of economic inequality occurs, driven by market forces which, at first, increase inequality, and then decrease it. The simple explanation for this phenomenon is that in order to grow countries have to shift from agricultural to industrial sectors. While there are little variations in agricultural incomes, industrialization leads to large differences in incomes. However, in a growing economy education offers greater opportunities to everybody to learn, through which the inequality decreases. Besides, the part of the population with lower income gains enough political power to force anti-inequality and welfare policies on governments. Kuznets believed that inequality followed an inverted U-shape: The Gini coefficient rises with economic development and then falls with increased per capita income.

In light of new evidence, the pioneering work of Kuznets has been questioned. The period of about 1950–1960, when Kuznets' work was born, has been seen as exceptional from several aspects, and these resulted in, at least in part, false conclusions. The decrease of inequalities measured at that time in the most developed countries does not necessarily continue.

2.2 Piketty's Theory

Works by Piketty gave a new impulse to research on economic inequality and growth. His works focus mostly on wealth concentration and distribution over the past century in high-income countries, and on the long-term evolution of inequality. He argues that the rate of return on capital in developed countries is persistently greater than the rate of economic growth and that this will cause wealth inequality to increase in the future as well (Piketty 2014).

Piketty and Saez (2014) build their review, and interpretations of their observations, on three basic time-series (Figs. 1, 2, and 3). First, they find that whereas income inequality was larger in Europe than in the USA a century ago, it is currently much larger in the USA (this is true for every inequality metric not only for the share of total income going to the top decile in Fig. 1).

On the eve of World War I (WWI), in the early 1910s, the top decile income share was between 45 and 50% of total income in most European countries. At the same time, the top decile income share was slightly above 40% in the USA. In the early 2010s, inequality ordering between Europe and the USA was reversed. That is, the top decile share in Europe is currently almost one-third smaller than what it was one century ago. In the USA, where the top decile income share in 1910 was lower than

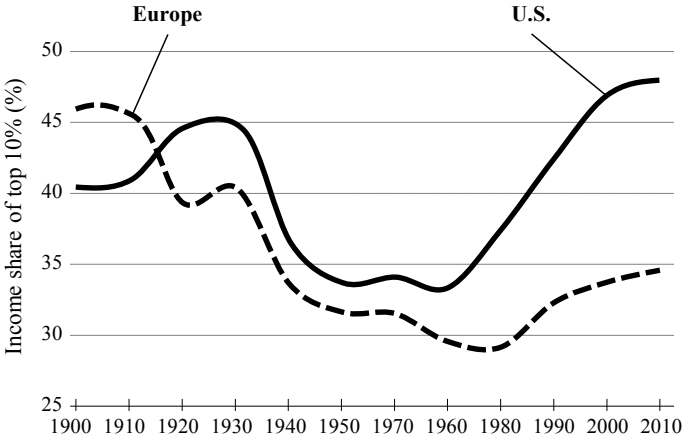

Fig. 1 Income inequality in Europe and the USA, 1900–2010. The share of total income accruing to top decile income holders was higher in Europe than in the USA from 1900 to 1910; it was substantially higher in the USA than in Europe from 2000 to 2010 (Piketty and Saez 2014)

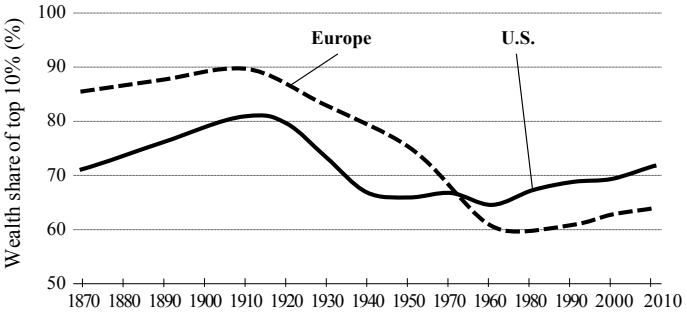

Fig. 2 Wealth inequality in Europe and the USA, 1870–2010. The share of total net wealth belonging to top decile wealth holders became higher in the USA than in Europe over the course of the twentieth century (Piketty and Saez 2014)

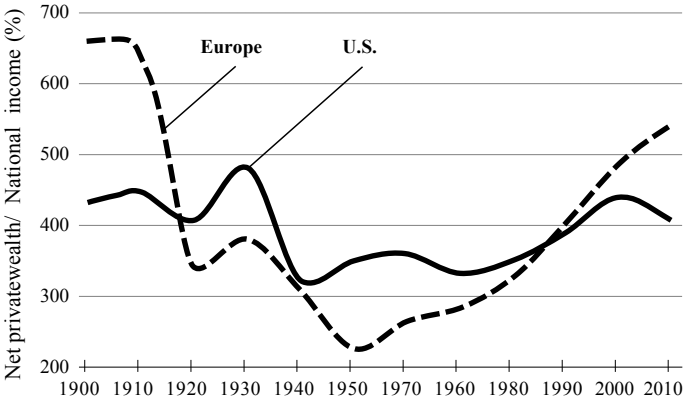

Fig. 3 Wealth-to-income ratios in Europe and the USA, 1900–2010. (Piketty and Saez 2014)

in Europe, it is now close to 50%, higher than it has ever been in US history (Piketty and Saez 2014).

Regarding wealth inequality, they observe the same inequality reversal between Europe and the USA. That is, the share of total net private wealth owned by the top 10% of wealth holders was notably larger in Europe than in the USA one century ago, while the opposite is true today (Fig. 2).

According to Fig. 2, the top decile wealth share typically falls in the 60–90% range, whereas the top decile income share is in the 30–50% range. While the bottom 50% wealth share is always less than 5%, the bottom 50% income share is generally between 20 and 30%. Or, in other words, members of the bottom half of the population (wealth-wise) own less than one-tenth of the average wealth, while members of the bottom half of the population (income-wise) earn about half the average income. Next, in contrast to income inequality, US wealth inequality levels have still not regained the record levels observed in Europe before WWI. Although wealth concentration has been high throughout US history, there has always been a large fraction of US aggregate wealth—about 20–30%—that did not belong to the top 10%. As the wealth share of the bottom 50% has always been negligible, the remaining 20–30% fraction corresponds to the share owned by the 40% "wealth middle class," that is, there has always been a wealth middle class in the USA. In contrast, wealth concentration was so extreme in pre-WWI Europe (the top decile wealth share was close to 90%) that there was basically no wealth middle class. The middle 40% wealth holders in Europe were almost as poor as the bottom 50% wealth holders. However, between 1914 and about 1970, the top decile wealth share fell dramatically in Europe, from about 90–60%. It has been rising since the 1970s–1980s and is now close to 65%. In other words, the wealth middle class now commands a larger share of total wealth in Europe than in the USA—although this share has been decreasing lately on both sides. According to Piketty and Saez, modern US inequality is based more on a very large rise of top labor incomes than upon the extreme levels of wealth concentration that characterized the wealth-based societies of the past. In

1913 Europe, top incomes were predominantly top capital incomes (rent, interest, and dividends) coming from the very large concentration of capital ownership. Top US incomes today are composed about equally of labor income and capital income. This generates approximately the same level of total income inequality, but it is not the same form of inequality (Piketty and Saez 2014).

Third, as to wealth-to-income ratios, they also find large historical variations, again with striking differences between Europe and the USA (Fig. 3). This ratio is of critical importance for the analysis of inequality, as it measures the overall importance of wealth in a given society, as well as the capital intensity of production.

In Europe, the aggregate wealth-income ratio has followed a typical U-shaped pattern over the past century: On the eve of WWI, net private wealth was about equal to 6–7 years of national income; then fell to about 2–3 in the 1950s; finally it is now back to about 5–6. The US pattern is also slightly U-shaped but it is flatter: Net private wealth has generally equaled about 4–5 years of national income. The fall of European wealth-income ratios following the 1914–1945 shocks can be well accounted for by three main factors: Direct war-related physical destruction of domestic capital assets; lack of investment (a large fraction of 1914–1945 private-saving flows was absorbed by the enormous public deficits induced by war financing); and a fall in relative asset prices (real estate and stock market prices were both historically very low in the immediate postwar period, partly due to rent control, nationalization, capital controls, and various forms of financial repression policies) (Piketty and Saez 2014).

The comparison between Figs. 1 and 3 are underlined by Piketty and Saez. Although both figures have two U-shaped curves, these are clearly different. The USA is the land of booming top labor incomes: The U-shaped pattern for income inequality is mostly driven by the large rise of top labor incomes in recent decades. Europe is the land of booming wealth: The U-shaped pattern for aggregate wealth-income ratios comes from concentration of wealth. These are two distinct phenomena, involving different economic mechanisms and different parts of the developed world (Piketty and Saez 2014).

2.3 Kuznets Waves

Milanovic (2016) has introduced the concept of "Kuznets waves," with cycles of increases and decreases of inequality with development. Milanovic identifies a second Kuznets curve in the USA, with inequality rising again. This process is driven by technological change, disruption of organized labor, and globalization, with decline of the middle class and lower taxes on capital.

Milanovic offers an alternative to the two theories mentioned above. While Kuznets argues that high levels of inequality are the temporary side-effect of the development process, Piketty says that high levels of inequality are the natural state of modern economies. Milanovic suggests that both are mistaken. He thinks that inequality tends to flow in cycles. In the pre-industrial period inequality rises as countries enjoy a spell of good fortune and high incomes, then fall as war or famine drags

average income back to subsistence level. With industrialization, the forces creating Kuznets waves changed. Technological advance, globalization, and policy shift all work together in mutually reinforcing ways to produce dramatic economic change. Workers are reallocated from farms to factories, average incomes and inequality soar and the world become unprecedentedly interconnected. Since then, the rich world has been riding a new Kuznets wave, propelled by another era of economic change. Technological progress and trade work together to squeeze workers, he says; technology made in foreign economies undermines the bargaining power of rich-world workers directly and makes it easier for firms to replace people with machines. Workers' declining economic power is compounded by lost political power as the very rich use their fortunes to influence candidates and elections (Economist 2016).

Milanovic expects rich-world inequality to keep rising, in the USA especially. This can be followed by pro-equality trends built on a combination of inequality stabilizers like political change, pro-unskilled labor technological innovations, dissipation of rents eight acquired during technological change, and greater attempts to equalize ownership of assets (Bubbico and Freytag 2018).

2.4 Other Recent Contributions

Nowadays many studies argue that the relation between inequality and growth is variable: It changes over time and with the level of development. For example, Alesina and Rodrik (1994), Bertola (1993), Persson and Tabellini (1994) argue that more inequality causes lower level of economic growth, through highly distortionary taxation (Bubbico and Freytag 2018).

Ostry et al. (2014) do not find evidence of a trade-off between growth and equality, showing that redistributive policies have no adverse effects on growth. Dabla-Norris et al. (2015) show that growth is more robust if the income share of lower quintiles increases, compared to an increase of the top quintile. The poor and the middle class matter the most for growth via a number of interrelated economic, social, and political channels (Bubbico and Freytag 2018).

Some results suggest that in the short and medium term, an increase in income inequality has a significant positive relationship with subsequent economic growth (Forbes 2000; Barro 2000), while in other cases the negativity of this relationship has been confirmed (Aghion et al 1999; Bubbico and Freyta 2018).

World Bank (2016) shows that while levels of inequality at a global scale have gone down, the average person lives now in a more unequal country than in the late 1980s. This view looks at inequality as the price developed countries have to pay for growth in poor countries through trade and globalization channels. Due to effects of globalization and technological changes, returns for skilled occupations and returns on capital are higher (Krueger 2012) because technological changes have been skill-biased, increasing the wage gap (Bubbico and Freytag 2018). Violante (2008) also argues that the main reasons explaining the growing inequalities in wages are

skills-biased technological change, by which new technologies increase the relative productivity of high-skilled workers, and also the demand for them and their wages. Blau and Kahn (2009) claim that trade specialization nine also may have a dampening effect on the wages of low-skilled workers in developed countries.

Increasing inequality is also seen as the result of declining labor market regulation and minimum wage compression. Finally, reduced distributive capacity and effort by governments under severe budget constraints can also contribute to this phenomenon (Nolan et al. 2016; Bubbico and Freytag 2018).

3 Contrasting Empirical Evidence About Income Inequality—Everything Depends on the Period of Time and/or the Countries Observed

If we go back to Piketty's evidence (see Fig. 1), it is obvious that inequality has been growing during the last 50 years both in the USA and in Europe. However, we cannot be as confident as we look at the last 100 years. During this period income inequality has been either growing or declining, maybe growing in the USA and declining in Europe.

Taking shorter periods of time, empirical results are also a bit contradictory. Figure 4 shows the recent results (Darvas 2016) about the developments in inequality in 28 countries of the EU compared with similar results for the USA.

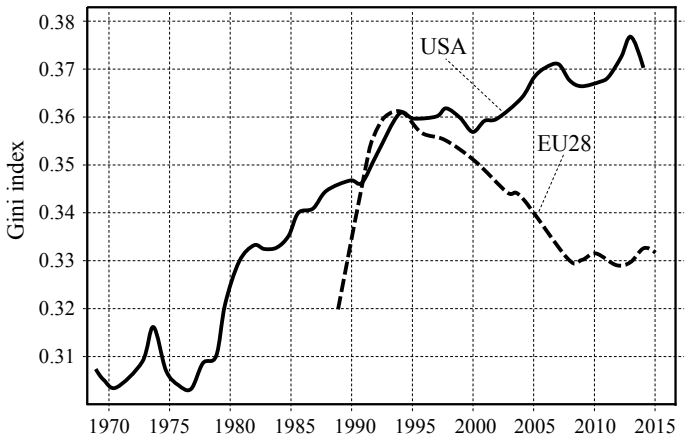

Fig. 4 Gini index for disposable household income for the USA and for 28 countries of EU, 1970–2015. *Sources* US data is from the Standardized World Income Inequality Database (SWIID) from Solt (2016), EU28 data is from Darvas (2016)

As Fig. 4 indicates, there was a sharp increase in income inequality in 28 EU countries in between 1989 and 1993 reaching the inequality level in the USA at that time. It was caused by the significant output declines in the CEE countries during their transition from socialist to market-based economies. As their income declined, people in these countries became even poorer relative to citizens in the rest of EU, and EU-wide income inequality therefore increased. After 1994, inequality declined steadily until 2008 and has remained relatively stable. In contrast, income inequality in the USA increased almost continuously from the late 1970s until 2013.

However, while the Gini index increased considerably (by more than 1 Gini point) in 15 EU countries and practically did not change in six other countries from 1994 to 2008, the EU-wide Gini index decreased due to declines by more than 1 point in seven countries. More importantly, the EU-wide income inequality decrease was almost entirely due to the convergence of average incomes: People in poorer regions of the EU increased their income relative to richer regions. According to Darvas (2016), this process stopped with the crisis, mostly because of some decline in some southern European member states (e.g., Italy and Greece).

As far as the CEE countries are concerned, EU-SILC data (and results of Eurofound 2017 study) are used in the rest of the paper. EU-SILC is a database on income, poverty, social exclusion, and living conditions in the EU, coordinated by Eurostat, with data drawn from different sources at the national level. This paper (like Eurofound 2017) uses EU-SILC data over the period 2005–2014 (income referring to 2004–2013), which is available for 24 EU countries (all EU Member States except Bulgaria, Croatia, Malta and Romania). The EU-SILC is a yearly survey of all private households and their current members residing in the territory of the countries at the time of data collection. Following the Eurofound's classification, we examine the Czech Republic, Hungary, Poland, Slovakia, Slovenia from among Central and Eastern European (CEE) countries.

First of all, Fig. 5 shows a picture about the economic convergence of the CEE region.

In CEE countries, in general, household disposable income grew relatively more than GDP per capita. The discrepancies between the two indicators may be due to a combination of factors. Nolan et al (2016) identified some of them: Price adjustments (since GDP is adjusted by the GDP deflator and household income by the consumer price index); the national income concept (since GDP refers to domestic output and household income to income inflows to resident households); data sources (since GDP arises from national accounts and household income typically come from surveys); household size (given that GDP is divided by the total population and household income is divided by—equalized—household size); levels of inequality (since growth in median household disposable income will be more modest than in GDP per capita or average household income if incomes grow relatively faster at the top of the income distribution) (Eurofound 2017).

Figure 6 provides a more detailed picture of income convergence between EU Member States using country-level data on average household disposable income from the EU-12 SILC. It confirms the view that convergence between EU Member

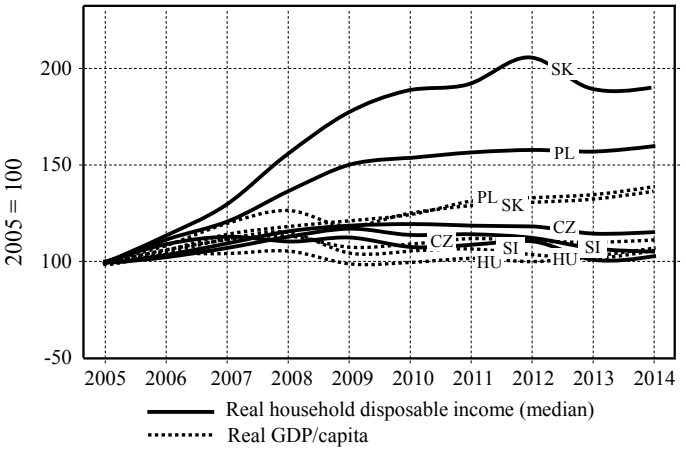

Fig. 5 Changes of real household disposable median incomes and real GDP per capita for CEE countries, 2005 = 100. (HU: Hungary, PL: Poland, SI: Slovenia, SK: Slovakia, CZ: The Czech Republic), 2005–2014. *Sources of data* EU-SILC, Eurofound (2017)

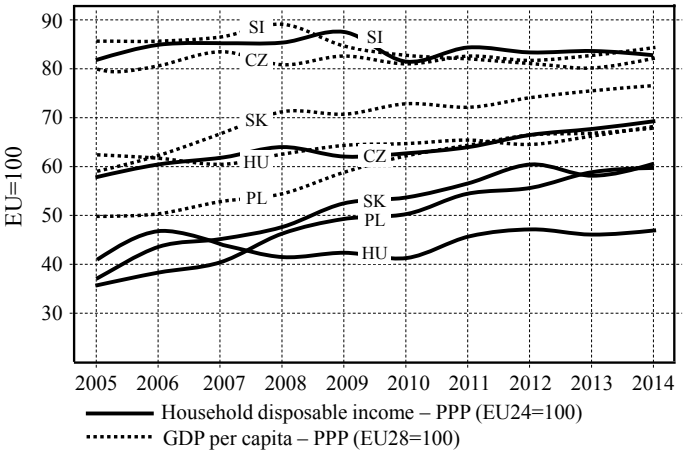

Fig. 6 Changes of real household disposable median incomes and real GDP per capita of CEE countries to those of EU24 and EU28. (HU: Hungary, PL: Poland, SI: Slovenia, SK: Slovakia, CZ: The Czech Republic), 2005–2014. *Sources of data* EU-SILC, Eurofound (2017)

States is mainly driven by the catch-up of Eastern European countries (Eurofound 2017).

Results shown in Figs. 5 and 6 are in line with classical theories of economic growth, which would predict a process of convergence in GDP per capita and income levels due to higher investments in lower-income countries (a catch-up effect), where capital is scarcer and therefore returns to capital investment are higher. This process of convergence should be stronger among countries that share a similar economic

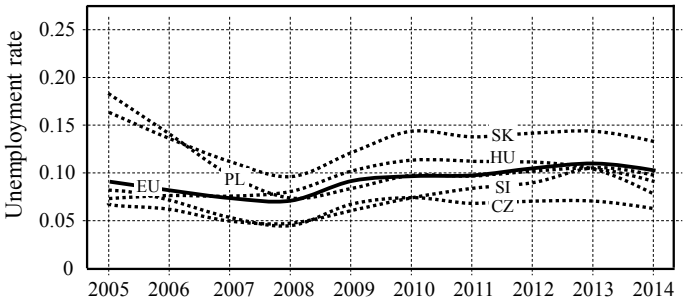

Fig. 7 Changes of unemployment rate of CEE countries and EU as a whole. (HU: Hungary, PL: Poland, SI: Slovenia, SK: Slovakia, CZ: The Czech Republic), 2005–2014. *Sources of data* EU-SILC, Eurofound (2017)

and institutional setting, such as is the case of the EU (Sachs and Warner 1996) Eurofound (2017).

Figure 7 shows the development of unemployment in CEE countries and in the whole EU. The labor market trends were strongly shaped by the impact of the Great Recession. Before the crisis, when CEE countries experienced a rapid catch-up process with fast economic growth, employment levels also rose in CEE countries. With the Great Recession, economic activity was negatively affected across all countries but especially in 13 the CEE countries. However, some CEE countries recovered rapidly and managed to continue their catch-up process Eurofound (2017).

The figures below introduce a panoramic view of inequalities across CEE countries comparing them to of EU-wide development. EU-SILC data and Eurofound (2017) not only map inequality trends in household disposable income, but also in the different sources of income, and the role played by changes in unemployment, family pooling of resources, and redistribution by the welfare state. The following income measures are used in this paper (Eurofound 2017):

(1) Monthly labor income among workers: This refers to the monthly labor earnings of workers, without adjusting for hours worked.
(2) Annual labor income among active individuals: This adds those currently unemployed to the picture and therefore includes individuals with no labor income. Inequality levels will increase notably, depending on unemployment rates.
(3) Annual labor income among all working-age individuals: This adds those currently inactive to the picture and further increases the possibility of including individuals with no labor income. Inequality levels will increase even further and this will be highly influenced by the inactivity rates.
(4) Market income among households: This measure adds the income from capital and also private transfers between households. Inequalities are expected to be higher since capital is generally more unevenly distributed than labor income (the effect of private transfers is less clear).

(5) Disposable income among household: This measure takes into account the effects of the welfare state through the tax and benefit system. Since the welfare state redistributes income across individuals and families in a generally progressive way, inequalities should be notably lower than in the previous measure.

Of course, inequality levels vary across countries, but the different sources of income are similarly related everywhere: Inequality is lower for monthly earnings among workers and widens notably when unemployed and especially inactive people are added, to be reduced again when income is pooled at the household level and especially when it is redistributed by the state. Figure 8 presents inequality data for CEE countries and for the EU as a whole among three different populations: Workers, the active population, and the whole working-age population. Inequalities in monthly earnings among workers are relatively low in CEE countries. As expected, labor income inequalities widen notably once the analysis includes active and inactive people who do not earn labor income, with cross-country differentials mainly depending on the number of unemployed and inactive people (Eurofound 2017).

The inequalities in annual labor earnings among working-age individuals are shown in the last figure (Fig. 8). In Fig. 9, such curves are presented where it is also taken into account that most individuals pool their income at the household level. In the EU as a whole, pooling of personal annual labor income at household level reduces the inequality indicator by around 22% during the period 2005–2014 (Eurofound 2017). This effect is larger in CEE countries (except Hungary which is at the average) by around 27–32%.

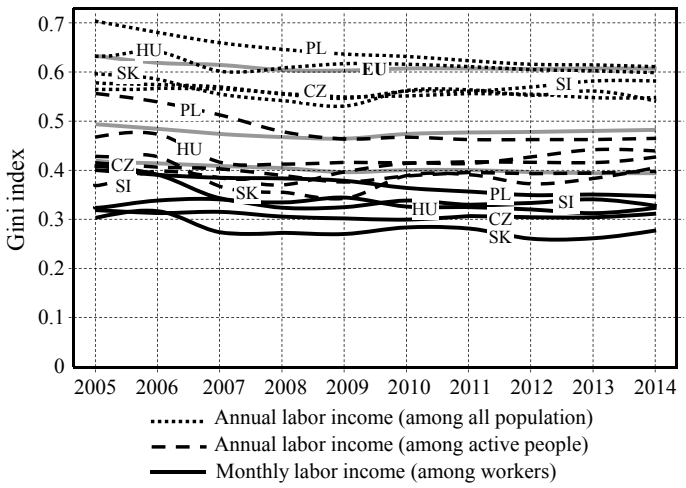

Fig. 8 Gini indexes (annual labor income for all and active population, and monthly labor income for workers) and EU averages. (HU: Hungary, PL: Poland, SI: Slovenia, SK: Slovakia, CZ: The Czech Republic), 2005–2014. *Sources of data* EU-SILC, Eurofound (2017)

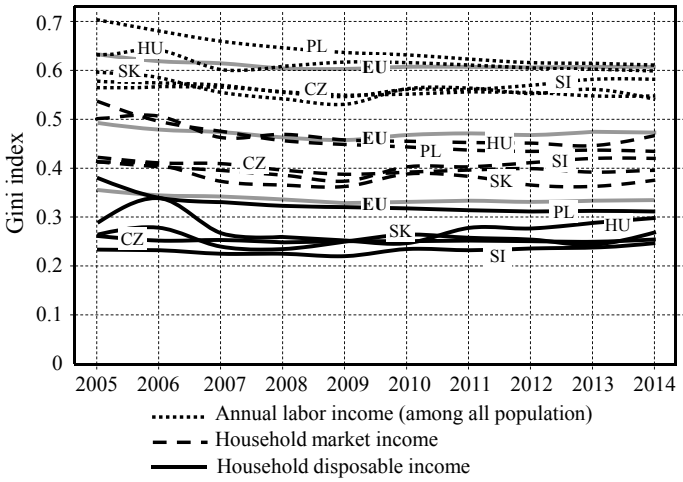

Fig. 9 Gini indexes (annual labor income for all population, household market and disposable income) and EU averages. (HU: Hungary, PL: Poland, SI: Slovenia, SK: Slovakia, CZ: The Czech Republic), 2005–2014. *Sources of data* EU-SILC, Eurofound (2017)

Beside the effect of household pooling, the household-level analysis also considers the capital income of households. Nevertheless, capital incomes hardly have any practical effect on results (Eurofound 2017).

Finally, the redistributive effects of the welfare states are taken into consideration. Welfare states are able to correct inequalities in market income through taxes and benefits that redistribute income across individuals and households. European welfare states, in average, reduce market income inequality by almost 30%. The CEE states typically play an even bigger role, except for Poland which is below the EU average. It is particularly true in the cases of Slovenia and Hungary where welfare states reduce inequality almost by 42% Eurofound (2017).

Curves in Fig. 9 can be grouped into two levels: For Poland and Hungary, where household disposable income inequality is intermediate, and for Slovenia, the Czech Republic, and Slovakia where household disposable income inequality is relatively low. Compared to the whole Europe, CEE countries have relatively low inequality levels among the workforce, but they generally move up the inequality ranking once unemployed and inactive people are included in the analysis. The family pooling of resources generally plays a strong role in reducing inequalities, while the state has a relatively important role in Slovenia, Hungary, and the Czech Republic (Eurofound 2017).

Summarizing the results presented in the above figures, we can conclude that no notable inequality problem is detectable in the CEE region using EU-SILC data in the period of 2005–2014.

However, somewhat different results are presented by Inchauste and Karver (2018). They claim that within-country inequality has increased in most of today's EU countries, particularly in CEE. They divide CEE countries into three groups:

CEE South (Romania and Bulgaria), CEE North (Estonia, Latvia, and Lithuania), and CEE Continental (Slovenia, Slovakia, Hungary, Czech Republic, Poland, and Croatia) which is almost the same as defined in the Eurofound (2017) study except Croatia. They use own estimation using the Standardized World Income Inequality Database (SWIID) version 6.1 (2017). Inchauste and Karver examine data from 1989 to 2015. They find that Gini index of CEE Continental countries has increased from about 24.5 to about 28.0 during 1989–2015.

4 Conclusion

The relation between economic growth and income inequality is very complex. It is true for Europe as a whole with the three dimensions of its inequality: Within member states, between member states and in the European Union (EU) as a whole. However, it is especially valid for the CEE countries where the transition process and EU convergence have been running parallel with the general effects of globalization which also influences inequality developments in these countries.

Taking into consideration the empirical evidences of recent studies we cannot detect any deep inequality problem in the CEE region relative to other developed regions of the world. Nevertheless, there are slightly different research results depending on the examined period, the dataset used and the income indexes analyzed.

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Drivers of Competitiveness in European High-Tech Industries

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Abstract Our paper builds on the importance of high-tech manufacturing and knowledge-intensive services as significant competitiveness and economic growth drivers in the European Union and offers a fresh approach of the study on the competitiveness of secondary and tertiary high-tech industries across EU member states. Our analysis covers the 2008–2015 period and includes twelve old and new EU members. We opt for a balanced panel data approach in OLS and ARIMA frameworks to investigate the competitiveness of high-technology industries in the EU with the aim of uncovering the nature of the main explanatory factors behind their performance. Our results show that the number of persons employed and the investment rate are both determinants of labour productivity and business profitability, while turnover and personnel costs have a specific influence on productivity and profitability, respectively. The GDP level and the percentage of population with tertiary education are the most significant location-related drivers for high-tech industries' competitiveness. Overall, industry-related factors are more important for explaining the competitiveness of high-tech sectors compared to location-related factors, while external factors have a marginal impact on high-tech industries' performance.

Keywords Competitiveness · Performance · High-tech industries · Location · European Union

Jel Classification F23 · L16 · C23

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*, Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_4

1 Introduction

The explanations of business competitiveness are generally focused on two approaches, according to existing literature. As such, the "structure-based" view emphasizes the role of industry factors for businesses' performance, while the "resource-based" view is centred on the firm's advantages, resources and capacities in building its competitiveness. More recently, due to globalization, scholars started to emphasize the role of the external factors—such as the country's openness towards exports and foreign investments—in influencing performance and competitiveness. While literature is abundant, empirical studies have not yet reached clear-cut results on the main drivers of companies or industries' competitiveness. Moreover, a distinction between the various categories of industries is seldom provided.

In this paper, we focus on the factors that influence the competitiveness of the high-tech manufacturing and knowledge-intensive services, due to their emerging importance for the European Union (EU) as drivers of economic growth and productivity. The strategies of the EU in the last two decades, i.e. the Lisbon Strategy and the Europe 2020 Strategy, emphasize the role of the knowledge economy, which encompasses "from high-tech manufacturing and ICTs through knowledge intensive services" (Kok Report 2004, p. 19), as an accelerator for development. As Kranjac et al. (2013) state, the need for new ideas and innovative products, services and processes replaces nowadays the necessity of increased production, and this lies at the heart of the Europe 2020 Strategy. In fact, according to the taxonomy advanced by the European Commission on the high-tech industries and knowledge-intensive services, the EU high-tech sectors covered 4.56% of total number of EU enterprises, 5.9% of the total EU enterprises turnover and 9.6% of the total value added in EU enterprises in 2014, while high-tech manufacturing sectors hired 1.1% of total labour force and high-tech knowledge-intensive services accounted for 2.9% of total employment in EU-28 in 2014 (Horobet et al. 2018).

As compared to previous studies, firstly, this paper widens the sphere of analysis by relating to determinants of companies' performance grouped in three major categories: industry-related factors, location-related factors and international exposure or external factors. Secondly, since the general landscape of high-tech industries in EU suggests significant differences in performance and competitiveness between the old and the new EU countries, we consider that country individualization is required; thus, the panel empirical models used in this paper are built for taking into account the countries' specificities. Thirdly, our analysis is designed for allowing for the distinction between the factors influencing the competitiveness of firms in the secondary and tertiary sectors, as the services sector exhibit special characteristics. Finally, we try to compensate a gap in the literature, which is more focused on the situation of developed economies; therefore, our analysis takes into account both older and newer EU members, thus enriching the literature related to the investigation of Central and Eastern Europe industries' competitiveness.

The paper is organized as follows: Sect. 2 outlines the theoretical and empirical framework that supports our study, Sect. 3 presents the data and methodology, Sect. 4

discusses the main results and Sect. 5 concludes and points towards directions for future research.

2 Literature Review

The first strands of the literature related to the competitiveness or performance of a company were developed under the theory of industrial organization, during 1940–1950, through the work of Bain and Mason (Porter 1981). The major theoretical framework explaining the profitability of a company was the "structure-conduct-performance" model, with a special emphasis on the market or industry structure. While the "structure" includes the environment given by the firm's affiliation in terms of industry—i.e. technological endowment and competition—"conduct" is encompassing the economic choices of the firm in terms of pricing and product strategies, advertising, etc. while "performance" is the result of the decisions related to the efficient allocation of resources, cost minimization, innovation and technological advancement (Porter 1981; Waldman and Jensen 2016). These characteristics would also lead to differences in firm's performance depending on the industry. Porter (1979) also emphasizes the role of the industry and market structure (e.g. the existence of strategic groups and mobility barriers) in explaining the differences in companies' profitability.

The literature sees another turn starting with 1980, when more emphasis is put on the firm's ability to sustainably generate competitive advantages, as in the "resource-based" view of the firm (Ramsay 2001). There are the firm-specific idiosyncrasies or the "dynamic collections of specific capabilities" (Hawawini 2003, p. 6) that determine the profit level of the firm. Once with globalization, the capacity of countries to become integrated in the world value chain—through either trading internationally or attracting foreign direct investments (FDI)—is another component that shapes the competitiveness of firms acting inside the national boundaries.

Therefore, the framework explaining the competitiveness or profitability of companies is inextricably linked to the industry-related factors, location-related factors and external factors. Besides, the empirical studies do not provide a clear-cut conclusion related to the factor that is of the highest importance among them.

The empirical research in this area starts with the work of Schmalensee (1985) who, distinguishing between the contribution of the firm, industry and market share factors to the firm performance, concludes that industry effects are crucial, while market shares poorly explain performance and firm factors are insignificant in the case of the American manufacturing firms. The results of Hansen and Wernerfelt (1989) indicate the interdependence between economic and organizational factors, but with a higher importance for the firm factors over the profit rates; Rumelt (1991) points to the larger impact of industry on the profitability of manufacturing firms, while corporate effects are not important. Hawawini et al. (2003) reach a similar conclusion, but only after excluding from the sample the outliers—namely the best and the worst performers.

A series of studies generally point to the more important influence of the firm over industry effects in explaining business performance and competitiveness (Mauri and Michaels 1998; McGahan and Porter 1997; Ruefli and Wiggins 2003; Hough 2006). The authors usually make the distinction between the "industry effects" emerging from the membership in a particular industry, the "corporate parent effects" as a result of the membership in a particular corporate family (similar, therefore, with "firm effects") and "business segment" or "business specific" factors, for pointing to the influence of "a part of a corporate family working in a particular industry" (Furman 2000, p. 1). Therefore, for encompassing all these effects, we will relate, in this study, to the general notion of industry-related factors.

Hawawini et al. (2004) assess the impact of home country on companies' performance through the generation of biases—such as the tendency to support more the domestic than the international trade and the low financing capacity. Ghemawat (2003) has a rather extensive view, indicating the lack of countries' capacity to integrate in the global flows from the perspective of international trade, FDI or production factors as a cause for poorer firm development. Goldszmidt et al. (2011) investigate the impact of the country effects on company performance and conclude that the influence depends on the development level of the country, being more important in emerging economies than in more developed ones. We consider that, compared to previous studies, the location country influence should be approached from two directions: the capacity to provide a proper environment for companies in order to increase their performance and the ability to integrate in the international value chains, through which both domestic and foreign companies inside the country could enhance their competitiveness. Therefore, our study distinguishes between location-related factors (such as the prospects of economic development, the skilled labour force and the development of innovation) and external factors (the FDI importance, the country's competitiveness level against its partners, etc.). Due to globalization, an important factor in explaining business performance is company's ownership—either foreign or domestic. For the German economy, Weche Gelubcke (2011) emphasizes the difference in terms of employees, wages and export propensity, which are higher for the foreign-owned than for the domestic-owned companies, as compared with labour productivity, in whose case differences are insignificant. Grasseni (2010) supports the heterogeneity of factors influencing the performance gap between domestic multinationals and foreign-owned firms in Italy in 1995 and 1997; interestingly, the author emphasizes a lack of significant difference in labour productivity, capital intensity and profitability between the two types of companies in the high-tech sectors, but recognizes the importance of taking into account industries' characteristics in further studies.

From a different perspective, though, high-tech industries require, in addition, special endowments of the location. Dunning (2004, 2010) uses the notion of "created assets" when emphasizing the actual type of resources that shape a location attractiveness for investors. This concept is especially interesting in the case of high-tech sectors, as literature points to their specific types of structure and outcomes for the economy (Arthur 2000) and, therefore, specific requirements in terms of

location advantages for enhancing their performance, such as knowledge endowments (Arvanitis and Hollenstein 2009), government and business R&D investments (Varum and Cibrao 2008), spillovers and rich technological activities (Cantwell and Piscitello 2005). Ortega-Argiles et al. (2015) conclude that the impact of R&D on productivity in the manufacturing high-tech sectors is higher than for the rest of the sectors. One of the major factors mentioned in the literature as relevant for increasing the performance of either high-tech manufacturing or services sectors is the foreign ownership (Buckley et al. 2002; Patibandla and Petersen 2002; Kafouros et al. 2008; Liu 2008).

3 Data and Research Methodology

Our analysis is undertaken for the period 2008–2015 and includes twelve EU countries, of which eight are older members of the EU—Austria, France, Germany, Italy, Netherlands, Portugal, Spain and the UK—and four are newer EU members—Czech Republic, Hungary, Poland and Romania. The industries that we investigate were selected from the high-technology (high-tech) sectors in the EU based on the Eurostat classification according to technological intensity in both manufacturing and services, at two-digit level, as follows: (i) two high-tech industries from the manufacturing sector—"Manufacture of basic pharmaceutical products and pharmaceutical preparations" (C21) and "Manufacture of computer, electronic and optical products" (C26); (ii) five high-tech knowledge-intensive services—"Motion picture, video and television programme production, sound recording and music publishing activities" (J59), "Programming and broadcasting activities" (J60), "Telecommunications" (J61), "Computer programming, consultancy and related activities" (J62), and "Information service activities" (J63).[1]

The countries included in our research were selected to a large extent based on data availability—all data used in our research is collected from Eurostat— but the sample is significant at EU level from the perspective of high-tech industries. The countries in our sample collectively held a share in EU turnover between 68.61% (C21) and 89.58% (J60) and in persons employed between 79.28% (C21) and 88.34% (J63), based on average shares between 2008 and 2015 but, as expected, the older EU members hold, both collectively and individually, the highest shares at EU level in these industries. At the same time, the four newer EU members tend to held higher shares in turnover (12.35% as 2009–2015 average) and in persons employed (16.36% as 2009–2015 average), both in industry C26.[2] Another interesting remark is that the shares of newer EU members in the total number of persons employed at EU level for our panel of industries are higher than the respective shares in turnover, which suggests a more intensive use of labour in these economies by companies in the high-tech industries and, as consequence, a lower level of competitiveness compared to the

[1] All codes are based on NACE Rev.2.

[2] All data and computations are available from authors.

old member states' industries. This also points towards the use of newer EU member states as locations for more labour-intensive operations of companies from high-tech industries, while keeping the more capital and technology-intensive operations in the older and more developed EU members.

The competitiveness of high-tech industries is described in our study by two indicators provided by Eurostat: (i) apparent labour productivity (ALP)—defined as the "value added at factor costs divided by the number of persons employed" and (ii) gross operating rate (GOR)—defined as the "ratio of gross operating surplus to turnover"; ALP is a labour productivity indicator, while GOR is closest to a profitability ratio at industry level. Various profitability measures were used in previous research for explaining company performance, but by taking into account both perspectives on competitiveness, productivity and profitability, a more comprehensive view on the high-tech industries' performance at EU level is advanced by our research.

Table 1 presents descriptive statistics—mean, median, minimum and maximum values—of ALP and GOR for each industry, country and year included in our research. These statistics show that significant differences in both measures of competitiveness across high-tech industries for all years and between countries are persistent—more importantly between the older and newer EU countries, with significant competitiveness gaps in the favour of the former. More worrying, though, is the lack of any systematic pattern of correction of these competitiveness gaps between 2008 and 2015.

We explain the competitiveness of high-tech industries in EU by considering three types of factors—industry-related, locational- or country-related and international exposure factors—in balanced panels in the following general two forms:

$$Y_{it} = \alpha + \beta_{it} X'_{it} + \delta_{it} Z'_{it} + \theta_{it} W'_{it} + \gamma_{it} + \varepsilon_{it} \quad (1)$$

$$Y_{it} = \alpha + \beta_{it} X'_{it} + \delta_{it} Z'_{it} + \theta_{it} W'_{it} + Y_{it-1} + \gamma_{it} + \varepsilon_{it} \quad (2)$$

where Y_{it} is the dependent variable—an industry competitiveness indicator (ALP or GOR), X'_{it} is a vector of industry characteristics that provide the differentiation in competitiveness across industries, Z'_{it} is a vector of country characteristics that are relevant for explaining the high-tech industries' competitiveness across countries, W'_{it} is a vector of international exposure of high-tech industries, Y_{it-1} is the one-year lagged value of the dependent variable, γ_{it} capture the cross-sectional specific fixed effects, α is the overall constant of the model and ε_{it} is the error terms for i = 1,2, …, M cross-sectional units observed for periods t = 1,2, .., T; $\varepsilon_{it} \sim N(0, \sigma_{\varepsilon}^2)$, where M = 12 and t = 7.[3] Data series used in our panels represent the first difference in the natural logarithm of raw data.

Industry-related factors considered in our analysis are: (i) turnover or gross premiums written (TURN); (ii) the number of persons employed (PERSEM); (iii) the average personnel costs or personnel costs per employee (PERSCOST); (iv) the

[3]The period under analysis is 2008–2015 (8 years), but variables in our panels are the first difference of logarithmic data, which reduces t from 8 to 7.

Table 1 Descriptive statistics of competitiveness indicators across high-tech industries, 2008–2015

	Apparent labour productivity—ALP							
	2008	2009	2010	2011	2012	2013	2014	2015
C21—Manufacture of basic pharmaceutical products and pharmaceutical preparations								
Mean	101.90	96.88	102.78	104.04	107.19	102.37	101.55	103.08
Median	106.60	105.05	110.50	107.95	109.45	114.15	117.00	111.85
Min.	23.00	21.80	33.60	30.20	28.10	31.50	31.50	31.70
Max.	243.00	217.40	220.50	208.22	263.50	208.22	190.70	190.70
C26—Manufacture of computer, electronic and optical products								
Mean	54.36	48.61	56.56	57.48	57.77	57.18	59.62	64.40
Median	55.35	52.35	59.15	56.65	57.80	55.85	58.10	61.15
Min.	14.70	14.20	16.30	15.40	16.20	15.50	15.50	15.30
Max.	115.37	98.20	127.30	108.70	123.50	110.20	124.30	143.70
J59—Motion picture, video and television programme production, sound recording and music publishing								
Mean	43.05	45.21	47.10	50.73	52.15	50.81	51.96	50.86
Median	34.25	41.75	43.25	46.00	46.55	47.15	48.20	50.30
Min.	11.60	10.20	16.70	11.90	14.70	11.70	21.40	13.40
Max.	129.04	129.04	123.20	136.80	130.40	129.50	125.30	106.40
J60—Programming and broadcasting activities								
Mean	100.62	110.50	107.83	110.68	99.13	94.49	97.42	100.24
Median	99.19	89.00	100.40	101.35	98.70	91.05	90.45	101.55
Min.	14.00	8.50	8.00	18.50	17.10	18.20	27.00	32.90
Max.	223.90	378.60	238.68	226.20	194.20	182.60	178.70	194.70

(continued)

Table 1 (continued)

	Apparent labour productivity—ALP							
	2008	2009	2010	2011	2012	2013	2014	2015
J61—Telecommunications								
Mean	164.88	157.85	164.24	162.58	160.00	151.68	148.51	149.56
Median	162.24	160.39	160.20	157.25	158.25	153.20	155.30	166.85
Min.	50.00	44.70	44.60	41.70	41.80	42.20	40.80	38.10
Max.	273.10	271.00	266.20	264.70	260.50	253.10	240.30	233.80
J62—Computer programming, consultancy and related activities								
Mean	52.54	50.84	51.86	53.50	54.33	54.32	55.02	57.24
Median	54.95	53.15	56.05	58.00	58.85	57.70	59.70	59.75
Min.	18.80	16.60	18.60	19.70	20.00	20.40	23.10	24.10
Max.	90.80	82.30	78.90	82.30	97.30	90.40	91.90	112.20
J63—Information service activities								
Mean	46.76	46.09	48.93	53.87	51.01	54.03	54.46	54.74
Median	39.35	39.85	42.35	44.20	43.60	46.25	47.10	45.95
Min.	12.80	13.10	12.30	11.10	13.90	12.70	14.10	15.20
Max.	99.20	110.50	150.20	162.10	138.10	150.20	150.20	150.20
	Gross operating rate—GOR							
	2008	2009	2010	2011	2012	2013	2014	2015
C21—Manufacture of basic pharmaceutical products and pharmaceutical preparations								
Mean	20.35	18.53	20.19	20.70	19.75	18.34	17.75	18.10
Median	18.95	19.15	18.65	19.65	16.85	17.05	17.95	18.50

(continued)

Table 1 (continued)

	Gross operating rate—GOR							
	2008	2009	2010	2011	2012	2013	2014	2015
Min.	10.70	9.30	11.10	10.40	10.90	9.90	5.80	8.50
Max.	38.40	31.20	36.70	41.50	36.10	25.90	24.00	25.50
C26—Manufacture of computer, electronic and optical products								
Mean	8.05	6.60	8.92	9.24	9.55	9.26	8.85	8.98
Median	8.03	6.40	8.65	8.60	8.05	8.30	8.70	8.35
Min.	2.50	0.20	2.00	1.80	4.20	0.80	4.10	4.40
Max.	17.00	15.80	23.70	22.00	20.20	18.40	16.10	18.60
J59—Motion picture, video and television programme production, sound recording and music publishing								
Mean	13.55	15.99	17.75	17.91	19.10	18.01	19.89	17.81
Median	16.25	15.70	20.00	18.55	19.55	18.35	20.50	17.25
Min.	−13.50	−11.10	−7.20	7.30	5.80	5.90	5.60	10.70
Max.	24.80	36.00	33.20	30.10	33.20	31.00	32.30	31.70
J60—Programming and broadcasting activities								
Mean	19.91	20.29	20.05	22.80	19.62	18.88	20.36	25.64
Median	21.70	23.05	24.90	21.30	17.50	18.35	20.85	20.60
Min.	−11.30	−21.00	−20.50	3.40	−3.80	0.80	1.30	5.20
Max.	41.00	57.70	47.60	40.20	40.80	33.90	33.60	60.80
J61—Telecommunications								
Mean	32.25	31.89	31.88	30.63	30.68	29.13	29.48	27.97
Median	32.75	32.55	33.00	28.85	31.15	29.20	29.60	28.95

(continued)

Table 1 (continued)

	Gross operating rate—GOR							
	2008	2009	2010	2011	2012	2013	2014	2015
Min.	25.40	25.00	23.60	19.80	21.10	21.70	20.40	19.00
Max.	40.10	39.30	39.40	39.30	39.50	34.90	35.90	33.40
J62—Computer programming, consultancy and related activities								
Mean	15.04	14.02	14.57	14.49	13.89	13.87	14.28	13.97
Median	14.00	12.55	14.35	14.45	13.20	13.90	14.00	13.70
Min.	8.20	6.70	7.00	6.80	6.80	6.90	6.90	7.10
Max.	23.60	22.40	23.10	24.10	24.10	24.90	23.80	28.00
J63—Information service activities								
Mean	17.08	18.33	18.96	19.36	18.29	19.14	19.30	19.11
Median	18.25	17.50	18.80	16.50	18.00	18.75	18.30	18.30
Min.	−0.60	5.10	6.20	8.60	9.10	8.60	9.60	7.70
Max.	33.60	42.00	38.70	41.00	35.30	41.20	39.50	38.00

Source Authors' calculations based on Eurostat data

investment rate, defined as investment (or gross fixed capital formation) divided by value added at factors cost (INVR).[4] The expected signs of coefficients are positive for TURN—higher levels of productivity and profitability are expected in higher-sized companies, negative for PERSEM and PERSCOST—the more personnel companies employ and the higher the average cost per employee they pay should negatively alter their productivity and profitability and negative for INVR, as in the case of smaller companies this indicator tends to have higher values compared to bigger companies.

The vector of country characteristics includes: (i) gross domestic product at current market prices (GDP)—we use these variable to test whether a higher level of economic development is reflected in the performance of high-tech industries; (ii) the percentage of population with tertiary education (TERTED)—this variable reflects the human resources quality in the countries under investigation; (iii) the support for high-tech industries, measured by the overall economy's research and development (R&D) expenses per inhabitant (RDEXP_INHAB)—we expect this variable to be positively connected to the performance of high-tech industries; and (iv) digital infrastructure availability, measured as the percentage of enterprises with broadband access (BROAD_COMP) in the total number of enterprises[5]—a priori, a more extensive Internet connectivity should positively influence the performance of high-tech industries.

The international exposure of the high-tech industries is taken into account through two variables: (i) The importance of FDI in these industries (FDI_TURN), measured by the ratio of turnover obtained by foreign controlled companies to the turnover obtained by locally controlled companies in each industry; this variable allows us to investigate whether the presence of foreign capital in an industry improves the competitiveness of the respective industry; and (ii) The overall level of country competitiveness, measured by the real effective exchange rate against the main 42 trading partners (REER)[6]; with this variable, we investigate whether the high-tech industries' competitiveness is influenced by the country's competitiveness in terms of prices, reflected by REER, which shows the weighted average value of a country's currency relative to a basket of 42 currencies, belonging to the country's main trading partners, and adjusted for the effects of inflation.

Data for all variables are collected form Eurostat. Panels are estimated under two main specifications, i.e. no effects (NE) and fixed cross-effects (FE). Since NE is a highly restrictive specification that ignores the possible presence of differences in

[4]Definitions of these indicators are available at http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Category:Structural_business_statistics_glossary.

[5]Enterprises with at least 10 persons employed (Eurostat).

[6]The real effective exchange rate (REER) is calculated by the European Commission with the aim of assessing a country's price or cost competitiveness relative to its main competitors in international markets (the groups are the following: (i) the EU member states and euro-area countries; (ii) 37 industrial countries; and (iii) 42 countries). REER is the nominal effective exchange rate deflated by relative price or cost deflators. More information on REER is available at https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/price-and-cost-competitiveness_en.

coefficients across countries or time, the intercept α is allowed to vary across countries in the cross-sectional panel specification. Thus, we introduce the assumption of heterogeneity in our sample of countries, induced by different industry characteristics and/or different macroeconomic structures. Panel coefficients are estimated using panel least squares and ARIMA, after applying Durbin–Wu–Hausman test for endogeneity/heterogeneity, with White cross-sectional standard errors and covariance (no d.f. corrected). At the same time, panel estimations take into account the possible presence of cross-sectional heteroskedasticity through the use of cross section weights. Overall, 56 panels with linear specifications were estimated, eight for each industry, and the results are presented in the next section.

4 Main Results and Discussion

Stationarity tests applied on panels were the Levin et al. (2002), Im et al. (2003), ADF Fisher test and PP Fisher test proposed by Maddala and Wu (1999) and Choi (2001). All tests indicated that panels were stationary in all specifications.[7]

The results of our estimations are presented in Tables 2 and 3. In both tables, results are presented for each industry and for both panel specifications considered, i.e. no effects and fixed cross-effects. These results are explained and discussed in the industry—location—international exposure triad.

Industry factors considered in our analysis were turnover (TURN), the number of persons employed (PERSEM), the average personnel costs (PERSCOST) and the investment rate (INVR). Of these, industry turnover and the number of persons employed are by far the most significant influence factors of high-tech industries productivity level—we find statistically significant coefficients in 27 out of 28 panels for turnover and in 24 out of 28 panels for persons employed, in both no effects and cross fixed effects panels. The signs of coefficients indicate a positive link between turnover and productivity for all industries and a negative link between the number of employees and productivity. The number of persons employed is a highly significant factor for industry profitability, as we find statistically significant coefficients, all negative, in 22 out of 28 panels, for all industries and panel specifications. We consider these results robust regarding the link between turnover and productivity, as larger companies should show higher productivity levels as a result of higher production volumes, as well as the results between the number of persons employed and productivity, as a higher number of persons employed is reflected in higher costs that depress both productivity and profitability levels.

The average personnel cost (PERSCOST) is a significant variable for both productivity and profitability across industries, with a higher importance in the case of profitability. In the case of productivity, significant coefficients are found only in the case of two high-tech services (J62 and J63)—with positive coefficients, which is a rather puzzling result; this might point towards industries' specificities that have

[7] Results are available from authors.

Table 2 Panel estimation results for ALP as dependent variable

Panel specification	α	TURN	PERSEMP	PERSCOST	INVRATE	GDP	TERTED	BROAD_C OMP
C21—Manufacture of basic pharmaceutical products and pharmaceutical preparations								
No effects	−0.0151	0.4750	−0.7763*	0.1105	−0.1066*	0.2651	0.2729**	0.2318
No effects	−0.0094	0.4296*	−0.8023*	0.0927	−0.1142*	0.2553	0.3144*	0.1685
Fixed effects	−0.0325**	0.5533*	−0.7770*	0.1127	−0.0991**	0.3288	0.3012**	0.3506
Fixed effects	−0.0099	0.3769**	−0.7547**	0.1119	−0.1310*	0.4820	0.2633**	0.0286
C26—Manufacture of computer, electronic and optical products								
No effects	−0.0185	0.3526*	−0.5712**	−0.0814	−0.1715*	1.6566*	0.0620	0.0968
No effects	−0.0170	0.3103*	−0.7656*	−0.1731	−0.1528*	1.1504*	0.1705	0.1808
Fixed effects	−0.0232	0.3546*	−0.5280**	−0.0100	−0.1849*	1.6982*	0.0007	0.3180
Fixed effects	−0.0045	0.2203*	−0.5689**	0.0306	−0.1431*	0.9468*	0.0046	0.3473
J59—Motion picture, video and television programme production, sound recording and music publishing activities								
No effects	0.0082	1.4622*	−1.0647*	0.0509	−0.1783*	−1.0455**	−0.3349**	0.5234
No effects	0.0074	1.1264*	−0.9498*	0.0800	−0.0935*	−0.1113	−0.1445	0.2554
Fixed effects	−0.0234	1.5042*	−1.1666*	−0.0332	−0.1446*	−1.2413*	−0.4756**	1.2521
Fixed effects	−0.0225	1.1157*	−0.9920*	−0.0406	−0.0848**	−0.4985	−0.2699**	1.0467
J60—Programming and broadcasting activities								
No effects	−0.0153	0.7338*	−1.1197*	−0.0439	−0.1071*	0.0610	−0.1114	0.2720
No effects	−0.0371	0.6007**	−1.1034*	−0.1062	−0.0949*	0.6869	−0.0533	0.2689
Fixed effects	−0.0365**	0.7687*	−1.3127*	−0.2693	−0.0949*	0.0507	−0.1289	0.5114
Fixed effects	−0.0491*	0.7225*	−1.1292*	−0.2634	−0.0702*	0.7503	−0.0931	0.3643

(continued)

Table 2 (continued)

Panel specification	α	TURN	PERSEMP	PERSCOST	INVRATE	GDP	TERTED	BROAD_C OMP
J61—Telecommunications								
No effects	−0.0263**	0.4898*	−0.8790*	0.0250	−0.0424**	0.6377*	0.0200	−0.1388**
No effects	−0.0450*	0.2565*	−0.7556*	0.0245	−0.056**	1.2988*	0.0817	−0.1786**
Fixed effects	−0.0255**	0.4552*	−0.8584*	0.0364	−0.0407**	0.5582*	0.0704	−0.0078
Fixed effects	−0.0580*	0.2040*	−0.6679*	0.0140	−0.0562	1.3526*	0.1551	0.0884
J62—Computer programming, consultancy and related activities								
No effects	0.0029	0.3105*	−0.5351*	0.3375*	−0.0048	0.2767*	0.0019	0.2510*
No effects	0.0020	0.3009*	−0.5024*	0.3233**	−0.0021	0.2554*	0.0071	0.2404*
Fixed effects	0.0049	0.3233*	−0.5687*	0.2808**	−0.0051	0.2961*	0.0269	0.2068**
Fixed effects	0.0066	0.2485**	−0.5009*	0.2324	0.0006	0.3266*	0.0462	0.1400
J63—Information service activities								
No effects	−0.0054	0.2939*	−0.2634	0.5555*	−0.0280	−0.2432	0.0012	0.3233**
No effects	0.0022	0.1184	−0.0303	0.8793*	−0.0259	−0.1678	−0.0017	0.0839
Fixed effects	−0.0082	0.3078*	−0.2136	0.5763*	−0.0366	−0.2060	0.0296	0.5279*
Fixed effects	−0.0043	0.0857	0.0606	0.8527*	−0.0499**	0.1403	0.0225	0.2443**

Panel specification	RDEXP_ INHAB	FDI_TURN	REER	ALP(−1)	Adj. R^2	S.E. of regression	F-stat
C21—Manufacture of basic pharmaceutical products and pharmaceutical preparations							
No effects	−0.0774	0.1177*	0.3193		0.5555	0.1171	11.3711*
No effects	−0.1553	0.1483*	0.1756	−0.2002	0.6145	0.1111	11.2871*
Fixed effects	−0.0858	0.1212**	0.2056		0.5083	0.1238	5.0855*
Fixed effects	−0.0611	0.1960*	0.3902	−0.2566*	0.5666	0.1192	5.2190*

(continued)

Table 2 (continued)

Panel specification	RDEXP_ INHAB	FDI_TURN	REER	ALP(−1)	Adj. R^2	S.E. of regression	F-stat
C26—Manufacture of computer, electronic and optical products							
No effects	−0.3232	−0.1006*	−1.3099*		0.5435	0.1034	10.8804*
No effects	−0.1450	−0.0951*	−1.3699*	−0.1810	0.5303	0.0908	8.2877*
Fixed effects	−0.4370	−0.1013*	−1.4034*		0.5887	0.1075	6.6566*
Fixed effects	−0.1320	−0.0725*	−1.5607*	−0.2391*	0.5678	0.0902	5.2401*
J59—Motion picture, video and television programme production, sound recording and music publishing activities							
No effects	0.2386	−0.0763*	−0.3457		0.6165	0.1517	14.3445*
No effects	0.0282	−0.0491*	−0.2448	−0.1607*	0.4866	0.1345	7.1175*
Fixed effects	0.3968	−0.0752*	−0.5755**		0.6042	0.1459	7.0328*
Fixed effects	0.2988	−0.0069	−0.5436**	−0.1836*	0.4935	0.1339	4.1443*
J60—Programming and broadcasting activities							
No effects	0.2222	−0.0032	0.1694		0.5127	0.1576	9.7327*
No effects	0.1054	0.0025	−0.3091	−0.0033	0.4894	0.1565	7.1858*
Fixed effects	0.5265*	0.0137	0.1391		0.5376	0.1584	5.5960*
Fixed effects	0.4606*	0.0158	0.1519	−0.0849	0.5583	0.1554	5.0799*
J61—Telecommunications							
No effects	−0.0959	0.0068	0.0266		0.6732	0.0484	18.0986*
No effects	−0.1568	0.0014	−0.2934	0.1208**	0.6536	0.0486	13.1796*
Fixed effects	−0.1314*	−0.0004	0.0360		0.6739	0.0498	9.1680*
Fixed effects	−0.1131**	−0.0072	−0.3616**	0.0834	0.6498	0.0501	6.9891*

(continued)

Table 2 (continued)

Panel specification	RDEXP_ INHAB	FDI_TURN	REER	ALP(−1)	Adj. R^2	S.E. of regression	F-stat
J62—Computer programming, consultancy and related activities							
No effects	0.0143	−0.0075	0.2747*		0.7285	0.0332	23.274*
No effects	0.0554	0.0021	0.2456**	−0.1092*	0.6175	0.0338	11.4187*
Fixed effects	0.0507	−0.0162	0.2739*		0.7137	0.0344	10.8537*
Fixed effects	0.1208	−0.0104	0.1758	−0.2436*	0.6848	0.0332	8.0116*
J63—Information service activities							
No effects	0.1063	0.0361**	0.2032		0.6308	0.0864	15.1817*
No effects	0.0142	0.0070	0.1822	−0.1518	0.6832	0.0682	14.9185*
Fixed effects	−0.0292	0.0364*	0.1668		0.6315	0.0872	7.7744*
Fixed effects	−0.1352**	0.0150	0.1266	−0.2198*	0.7103	0.0681	8.9111*

Note * and ** denote statistical significance at 1% and 5% level, respectively. Adj. R^2 is the R^2 penalized for the number of regressors, S.E. is the standard error of the panel regression and F-stat is the F statistical test

Table 3 Panel estimation results for GOR as dependent variable

Panel specification	α	TURN_EMP	PERSEMP	PERSCOST	INVRATE	GDP	TERTED	BROAD_COMP
C21—Manufacture of basic pharmaceutical products and pharmaceutical preparations								
No effects	−0.0463	0.0002	−1.1582**	−0.4599	−0.2113*	0.6541	0.6252*	0.3813
No effects	−0.0315	0.1545	−1.6114*	−0.7059**	−0.1644**	0.7452	0.7214*	0.1510
Fixed effects	−0.0712**	0.1463	−1.3150**	−0.4872	−0.2188*	0.9499	0.6502**	0.7653**
Fixed effects	−0.0472	0.1898	−2.0536*	−0.8461*	−0.1601**	1.0907	0.6542*	0.1526
C26—Manufacture of computer, electronic and optical products								
No effects	−0.0940*	0.1614	−1.1189*	−1.6028**	−0.4004*	5.9594*	0.0202	0.5353
No effects	−0.0429	−0.3277*	−0.6224	−0.8280	−0.3209*	3.7560*	0.3308	−0.0168
Fixed effects	−0.0978*	0.2430	−1.2861*	−1.7608**	−0.4191*	6.1691*	−0.0949	0.9513
Fixed effects	0.0158	−0.5200*	−0.3446	−0.6386	−0.3033*	3.5387*	−0.2166	0.9975
J59—Motion picture, video and television programme production, sound recording and music publishing activities								
No effects	0.5038	20.3470*	−13.7236*	−9.4929*	−5.0557*	−12.8363	−11.8408*	9.2376
No effects	0.4254	14.4170	−10.8626*	−6.9066	−3.0814*	6.5457	−8.7448*	6.4048
Fixed effects	−0.3494	20.8463*’	−17.6459	−12.5140*	−4.15230*	−15.7593	−14.2322*	28.9906
Fixed effects	−0.5496	13.5326	−13.8800*	−10.4953*	−2.4470	−3.5608/’	−10.4748*	30.3749
J60—Programming and broadcasting activities								
No effects	−0.7192	20.7825**	−34.2016*	−28.7862**	−3.9904*	13.1272	−5.7131	9.8387
No effects	−1.2398	16.3710	−30.1703*	−26.7312**	−3.0843*	45.6657**	−4.3494	5.0986

(continued)

Table 3 (continued)

Panel specification	α	TURN_EMP	PERSEMP	PERSCOST	INVRATE	GDP	TERTED	BROAD_COMP
Fixed effects	−1.1051**	19.5128*	−42.3387*	−36.6151*	−3.2581*	7.6381	−6.8097**	19.6356
Fixed effects	−2.0234*	16.3224**	−32.4125*	−29.5456*	−2.5868*	42.1275**	−5.6124	13.8258
J61—Telecommunications								
No effects	−0.0355**	−0.3021**	−0.3105**	−0.4911*	−0.0770**	0.87245*	−0.0490	−0.1701
No effects	−0.0600*	−0.5351*	−0.1884	−0.5149*	−0.0766**	1.6582*	−0.0255	−0.2139**
Fixed effects	−0.0341	−0.3298**	−0.2784	−0.4719*	−0.0822*	0.8026*	0.0188	0.0115
Fixed effects	−0.0820*	−0.6598*	−0.0011	−0.5100*	−0.0872	1.8407*	0.1485	0.1633
J62—Computer programming. consultancy and related activities								
No effects	−0.0064	0.0364	−0.7043*	−0.5912**	0.0380	0.9661*	−0.0448	0.6208*
No effects	0.0046	−0.1272	−0.5668*	−0.6282*	−0.0082	0.5544*	−0.0541	0.5536*
Fixed effects	0.0077	−0.0672	−0.8018*	−0.7988*	0.0430	1.2922*	0.0681	0.4645
Fixed effects	−0.0193	−0.2656	−0.3061**	−0.7225**	−0.0170	1.0065*	0.1647	0.6131**
J63—Information service activities								
No effects	0.0290	−0.4112**	0.4474**	−0.1902	−0.1473*	−0.7349	−0.2830**	0.4119
No effects	0.0258	−0.7667*	0.5931*	0.2619	−0.1459*	0.1978	−0.1437	0.1275
Fixed effects	0.0165	−0.3465*	0.6024**	−0.1789	−0.1617*	−0.7188	−0.1029	1.2030*

(continued)

Table 3 (continued)

Panel specification	α	TURN_EMP	PERSEMP	PERSCOST	INVRATE	GDP	TERTED	BROAD_COMP
Fixed effects	0.0012	−0.7559*	0.8921*	0.4661*	−0.1518*	0.6028	−0.0315	0.3247

Panel specification	RDEXP_INHAB	FDI_TURN	REER	GOR(−1)	Adj. R^2	S.E. of regression	F-stat
C21—Manufacture of basic pharmaceutical products and pharmaceutical preparations							
No effects	−0.0787	0.2990*	0.4430		0.3919	0.1842	6.3487*
No effects	−0.4178	0.2429**	−0.3983	−0.2635*	0.5107	0.1820	7.7356*
Fixed effects	−0.0955	0.2889*	0.1998		0.4243	0.1928	3.9129*
Fixed effects	−0.2131	0.2652**	−0.2690	−0.3270*	0.4906	0.1936	4.1076*
C26—Manufacture of computer, electronic and optical products							
No effects	−1.2965*	−0.3453*	−5.0552*		0.4405	0.4977	7.53572*
No effects	−0.8216*	−0.1975*	−4.7842*	−0.3065	0.5247	0.3542	8.1248*
Fixed effects	−1.3816*	−0.3681*	−5.0937*		0.3729	0.5235	3.3499*
Fixed effects	−0.7239	−0.1390	−5.0235*	−0.3257*	0.5954	0.3611	5.7497*
J59—Motion picture, video and television programme production, sound recording and music publishing activities							
No effects	3.1458	−1.7006*	−3.6998		0.4213	4.1255	7.0434*
No effects	−1.2120	−1.4622*	−3.2881	−0.2114*	0.1316	3.7998	1.9782**
Fixed effects	6.7424	−1.6873**	−14.6663		0.3840	4.0237	3.4640*
Fixed effects	8.4572	−0.6326	−14.8050	−0.2489*	0.1899	3.7941	1.7566***
J60—Programming and broadcasting activities							
No effects	10.9541	0.2648	10.1616		0.3729	6.9380	5.9354*
No effects	3.5548	0.8605	2.2350	−0.0832	0.3038	6.5967	3.8167*

(continued)

Table 3 (continued)

Panel specification	RDEXP_INHAB	FDI_TURN	REER	GOR(−1)	Adj. R^2	S.E. of regression	F-stat
Fixed effects	27.0630*	0.7474	4.1974		0.4309	6.7138	3.9922*
Fixed effects	23.6530*	0.5650	7.1207	−0.1959**	0.3917	6.5081	3.0778*
J61—Telecommunications							
No effects	−0.1031	0.0050	0.1651		0.6280	0.0735	15.0114*
No effects	−0.1402	0.0019	−0.2859	0.0785	0.6023	0.0765	10.7742*
Fixed effects	−0.1816**	−0.0046	0.1755		0.6620	0.0760	8.7401*
Fixed effects	−0.1213	−0.0128	−0.3957	0.0225	0.5555	0.0796	5.0330*
J62—Computer programming. consultancy and related activities							
No effects	−0.0603	−0.0043	0.0624		0.1459	0.1020	2.4181**
No effects	0.2725	0.0113	0.6974**	−0.3648	0.2732	0.0923	3.4261*
Fixed effects	−0.0381	−0.0354	0.1762		0.0552	0.1069	1.2308
Fixed effects	0.2526	−0.0251	0.6388**	−0.42356*	0.2590	0.0892	2.1280**
J63—Information service activities							
No effects	0.2077	0.0040	0.4814		0.1594	0.2782	2.5738**
No effects	−0.0754	−0.0148	0.0105	−0.0946	0.3691	0.1597	4.7769*
Fixed effects	−0.0547	0.0008	0.2525		0.1816	0.2790	1.8769*
Fixed effects	−0.3670	−0.0240	−0.0386	−0.1333	0.3415	0.1708	2.6736*

Note * and ** denote statistical significance at 1 and 5% level, respectively. Adj. R^2 is the R^2 penalized for the number of regressors, S.E. is the standard error of the panel regression and F-stat is the F statistical test

not been captured in our analysis and remain to be investigated. On its turn, industry profitability is more influenced by the average personnel cost, as we find negative statistically significant coefficients in 20 out of 28 panels, for all industries and panel specifications.

The last variable included under industry attributes is the investment rate (INVR); in its case, results indicate a negative relationship between both productivity and profitability, on the one hand, and industry investment rate on the other hand. Thus, when ALP is considered, we find negative panel regression coefficients for INVR for the two manufacturing high-tech industries and for four out of five services industries (except J62) in both panel specifications, which suggest that the negative relationship between productivity and investment rate is a consistent one. For what concerns industry profitability, the negative influence of the investment rate is even stronger than in the case of productivity, as we find statistically significant coefficients in 23 out of 28 panels, making the investment rate the most important industry factor for profitability. For both competitiveness measures, the negative influence of the investment rate is, in our opinion, a reflection of higher investment rates in the case of smaller companies with smaller turnover, and of lower investment rates for bigger companies with higher turnover; this actually reinforces the positive link between turnover and competitiveness discussed above.

Turning to *location or country-related variables*, the best panel regressions' results (the higher number of statistically significant coefficients) for high-tech industries competitiveness are obtained for GDP, followed by the percentage of population with tertiary education (TERTED) and the percentage of enterprises with broadband access (BROAD_COMP), but for all these variables, the number of statistically significant coefficients across industries is smaller compared to industry-related variables. For GDP, we find statistically significant coefficients in 13 out of 28 panels for productivity, positive in the case of C26, J61 and J62, and negative in the case of J59, and in 14 out of 28 panels for profitability, all positive, but only in the case of C26, J59, J61, J62 and J63. This means that a higher GDP in a specific country is reflected in higher high-tech industries' productivity and profitability levels, which is a result that is not necessarily specific to these industries. At the same time, this finding is connected to the performance gap in terms of productivity and profitability between the older, more developed, members of the EU and newer, less developed member states.

We find somehow surprising results, at least at first sight, for the percentage of population with tertiary education (TERTED), as only one manufacturing high-tech industry and one services industry show statistically significant coefficients in productivity panels (C21—positive coefficient; J59—negative coefficient). Slightly better results are found in profitability panels, as for C21 coefficients are again positive and for services industries negative—now, tertiary education is a significant variable for three industries (J59, J60 and J63). These results might be interpreted as a lack of dependence of industries' performance on the level of education in the countries where they operate, and a global instead of local setting of both productivity and profitability in high-tech industries.

The level of broadband availability for businesses (BROAD_COMP) as a significant variable for productivity and profitability in the high-tech industries is not a surprise, but the different coefficient signs across industries is. We find more positive than negative significant regression coefficients in both productivity and profitability panels, but in only two services industries (J62 and J63—positive coefficients) against one (J61—negative coefficient). The last variable included under location factors, the R&D expenditure per inhabitant (RDEXP_INHAB) shows another puzzling result, as statistically significant coefficients also change their signs depending on industries—positive for J60 and negative for J61 (for both productivity and profitability), and negative for J63 (for profitability). Still, these coefficients are identified only in fixed cross-effects specifications, which might indicate that country specificities play an important role in terms of R&D expenditure and high-tech industries competitiveness.

The *international exposure* of high-tech industries is investigated in our research through two variables: the importance of FDI in these industries (FDI_TURN) and the country's general level of competitiveness (REER). The results for FDI_TURN are less consistent in contrast to the results found for other independent variables; as such, productivity is positively linked to FDI_TURN in the case of two industries (C21 and J63) and negatively linked in the case of two industries (C26 and J59), while profitability is positively linked to FDI_TURN in the case of one industry (C21) and negatively linked to FDI_TURN in two industries (C26 and J59). This might be partially explained by the value of FDI_TURN—a ratio between the turnover generated by foreign- versus local-controlled companies: in industries where the value of this ratio is small and, more important, lower than one, which indicates a reduced presence of foreign investors, and FDI do not have a strong impact on industry competitiveness; at the same time, industries that benefit from a more palpable presence of foreign investors tend to enjoy it through an improved performance. As such, the highest means of this ratio for the 2008–2015 period—also above one—across countries are found for industries C26 (4.77), C21 (2.47) and J61 (2.48), while the lowest belong to industries J59 (0.70) and J62 (0.61). The general level of countries' competitiveness, described by REER, is significant for high-tech industries' competitiveness, but with specificities across industries. The coefficients are statistically significant for four industries in productivity panels (negative for three industries—C26, J59 and J61—and positive for one industry—J62) and for two industries in profitability panels (positive for J62 only in cross fixed effects specifications and negative for J59 in both specifications). Overall, we find more negative than positive coefficients, which suggests a positive link between countries' competitiveness and high-tech industries' performance, but the low number of significant coefficients might confirm the global rather than local determination of competitiveness in these industries.

Panels specified according to Eq. (2) include the one-year lagged values of ALP and GOR as independent variables, as a way of testing whether previous levels of competitiveness, both in productivity and profitability terms, influence current high-tech industries' performance. The results are slightly better in the case of productivity, with mostly negative coefficients, which might indicate a "reversion to the mean"

process for competitiveness in these industries, but also a lack of sustained good performance in high-tech industries over a higher number of years.

All our panels have been implemented in two specifications, no effects and cross-fixed effects, which allowed us to observe whether potential country-related idiosyncrasies are reflected in our results. On one hand, this might be noticeable at the level of statistically significant coefficients' signs identified in no effects versus cross-sectional effects panels. From this perspective, coefficients' signs remain the same in all estimated panels in the two specifications, which is an indication of the robustness of our results but, at the same time, of the lower than expected differences between countries in terms of industries' performance. On the other hand, panels estimated using cross-sectional fixed effects show slightly better performance than panels estimated using no effects—overall, we find better adjusted R-squared values in 57% of the total number of such no effects—cross- fixed effects panel pairs, while standard error's values are similar in both specifications. This is a sign that countries' specificities matter for the relationship between industry, location an international exposure factors and high-tech industries' competitiveness.

5 Conclusions

Our research proposes a newer approach to the study of high-tech industries given our aim of uncovering the role of industry, locational and international exposure drivers of competiveness of these industries. The landscape of high-tech industries in EU is diverse and suggests significant differences between the older and more developed economies, on the one hand, and the newer and less developed economies, on the other hand, for what concerns industries' structures and, in the end, their competitiveness. Thus, a division of labour versus capital and technology-intensive activities of companies in the high-tech industries between older and newer member states seems to exist at EU level, whereby the newer member states are used as locations for the affiliates of multinational corporations that perform more labour-intensive activities, while the older member states benefit from more capital-intensive activities of MNCs' affiliates. This should not be a surprising result, as businesses are searching for more favourable economic environments for their development in any industry—and, most likely, to a higher extent in high-tech industries whose progress depends on connectivity and digitalization, more available and accessible in developed economies.

These industry structures are consequently reflected in a significant and persistent "competitiveness gap" between older and newer EU member countries in all high-tech industries, with no systematic declining pattern over the years, which signals the need for consistent EU policies towards encouraging the growth of high-tech industries in the newer member states as a mean for improved competitiveness at EU level and for increasing real convergence among its members.

The most important result of our research is that, by far, industry-related factors are more important than location-related or international exposure factors for the

competitiveness of high-tech industries. From this perspective, a few conclusions emerge, as follows. First, when referring to industry-related attributes, turnover, the number of persons employed and the investment rate are the most significant influencers for labour productivity—higher turnover, a lower number of employees and a smaller investment rate (linked to higher turnover) lead to improved productivity in high-tech industries. For profitability, the number of persons employed, the average personnel cost and the investment rate are the most important industry factors of influence—profitability is positively influenced by a lower number of employees, a lower average personnel cost and a low investment rate.

Second, the GDP level and the percentage of population with tertiary education are the most significant location-related factors of influence for high-tech industries' competitiveness; in both variables' case, we find that more developed economies with more educated populations tend to attract more competitive industries. The link between high-tech industries' competitiveness and R&D expenses is less conclusive and the findings seem to indicate that high-tech industries enjoy better productivity in countries with less expense on R&D. This is not a surprising result, though, as these countries also have lower average personnel costs and are the least developed from our sample. At the same time, we might imply that when businesses in a country spend more on R&D the overall level of productivity increases, but this increase is industry-specific and is not necessarily matched by an increase in profitability. Moreover, the relationship seems to be intermediated by the size of businesses' spending in the respective industries across countries, as an R&D spending gap is also found here, with industries from developed countries spending more and those from developing countries spending less.

Third, foreign ownership is less important in explaining the performance gap between local- versus foreign-owned companies compared to other factors. We rely on the value of the ratio between foreign versus locally generated turnover in high-tech industries—we might call it "foreign turnover intensity"—as an explanation for these results; as such, in the high-tech industries where this ratio is small and lower than one, indicating a reduced presence of foreign investors, foreign ownership does not have a say on industry performance, but high-tech industries with a more solid presence of foreign ownership enjoy better performance. Consequently, we might interpret these results as a need for a "critical" foreign ownership level in high-tech industries in order for the higher productivity and profitability of foreign-owned companies to be reflected in overall industry performance.

We consider our research insightful and thought-provoking, as it represents the first attempt to investigate the differences in performance and competitiveness between older and newer EU members in a sector that is at the forefront of EU competitiveness agenda for the years to come. We intend to extend our research by exploring these industries' competitiveness at company level, but also by contrasting the factors of influence on industry performance for these industries against the ones for industries with lower technological level, in order to identify competitiveness triggers that might be used as stimulants for industry development and included in future economic measures and policies at country and EU level.

Acknowledgments This work was supported by a mobility grant of the Romanian Ministry of Research and Innovation, CNCS-UEFISCDI, project number PN-III-P1-1.1-MC-2018-0249, within PNCDI III.

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Factors Affecting Consumers' Inflation Expectations in EU Members States with Independent Monetary Policy

Magdalena Szyszko and Aleksandra Rutkowska

Abstract In the light of the research which proves that inflation expectations cannot be fully explained by inflation itself, a question about the possible drivers of expectations arises. In this paper, we look for such drivers with the use of the cointegration analysis. We assume that some economic information is incorporated into a mechanism that explains their changes and long-run development (1) and that the drivers of expectations vary across countries (2). The research covers eight non-euro area EU Member States and the time span of years 2001–2016. We distinguish six monetary, financial, and real sphere factors that could affect expectations, and we elaborate on VECMs for each country, respectively, to analyse short- and long-run dependence of variables. We find that long-run relations do exist between variables as well as—in certain cases—short-run relations. The number of variables and the lags suggested by the information criteria lead to relatively complex models, which means that they are difficult to interpret directly. As a result, we propose further research with respect to the same dataset.

Keywords Inflation expectations · Consumers · VECM

1 Introduction

The pivotal role of economic agents' expectations in economic performance is broadly recognised in the literature. Theoretical and empirical studies focus on the formation of expectations and their properties. As the hypothesis of rational expectations is generally rejected, an attempt was made to address the question about the driving factors of prospective expectations. The goal of our research is to determine

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*,
Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_5

the factors which could affect consumers' expectations in the long-run. We hypothesise that some economic information is incorporated into a mechanism that explains their changes and long-run development (1) and that the drivers of expectations differ across countries (2). The results of previous research that proved the existence of such relations and their diversification caused by geographical location, different economic conditions, and distinct monetary policies have validated our hypothesis.

The results of our previous research motived us to carry out this study. While testing the forward-lookingness degree of expectations, we estimated a hybrid specification of expectations. It detected different (but comparable) forward-lookingness level of expectations in our sample but goodness-to-fit of the specification was not satisfactory. Therefore, we would like to elaborate on the matter of other factors (except for the anticipated and known inflation figure) which may drive expectations. This way, we can contribute to the still up-to-date literature on the formation of expectations.

The research covers eight European Union Member States conducting independent monetary policy: Bulgaria (BG), Croatia (HR), Czechia (CZ), Hungary (HU), Romania (RO), Poland (PL), Sweden (SE), and the United Kingdom (UK). The central banks in those states recognise the importance of expectations for the effectiveness of their monetary policy, but they apply different monetary regimes to attain their goal: inflation targeting in the case of six out of the eight countries and exchange rate commitment in the case of BG and HR. The research period starts between 2001 and 2005 (different data accessibility for our countries) and ends in late 2016.

In contrast to most of the research on expectations of professionals, we decided to examine the drivers of consumers' expectations. The decisions made by individuals and businesses regarding consumptions and investments as well as the setting of prices are pivotal for economic output and—as such—are of primary importance for the policy-makers. We have at our disposal the business and consumer surveys from the European Commission, i.e. a database of methodologically homogenous qualitative surveys on inflation expectations conducted amongst consumers in the EU Member States. There is no such database available for businesses, so we focus on consumers. Nonetheless, consumers' expectations proxy business better that the expectations of professionals (Coibion and Gorodnichenko 2015).

The research hypothesis assumes that a mechanism exists that explains changes in the consumers' inflation expectations. The cointegration technique is commonly applied in the macroeconomic analysis, because economic data are usually not stationary—which is true for our sample as well. VEC(p) models are a straight extension of the VAR(p) models, where we add—as an explanatory variable in the VAR(p) specification—the error-correction mechanism that drives the cointegrated series.

The paper contains a section with a literature overview to emphasise our assumptions and methodology; then, there is a methodological section, a section with the results and their interpretation, and finally, we sum up our findings.

2 Literature Overview

The discussion on the properties of expectations presented in the literature covers the formation pattern of expectations. Rationality of expectations is rejected on the empirical basis for the UK (Mitchell and Weale 2007), CZ, PL, HU (Kokoszczyński et al. 2010), SE (Dräger 2015), and HR (Erjavec et al. 2015). As for our sample, we also covered the test of rationality of expectations (Szyszko and Rutkowska 2017) as it legitimises further research on the formation of expectations and properties. During the performance of the macroeconomic efficiency test, we found out that the expectation errors are driven by failure to incorporate into the formation process of expectations the economic and financial data that differ across the countries. The private forecasts would be far more accurate, if the forecasters took into account additional variables in the formation process of expectations. Comparable results were also found by other authors, such as Geberding (2001) and Łyziak (2013). They studied a broad set of economic and financial data to test the macroeconomic efficiency of expectations.

The examination of factors—other than inflation—which could be the drivers of expectations is also presented in the literature on the expectations-learning mechanism: the assumption that the consumers update their forecasts to the variable that they mean to predict is relaxed (Pfajfar and Santoro 2010). The example of such relaxation can be found at Cruijsen and Strobach (2015). While analysing learning rules of individuals in the six EU Member States, they assumed that the consumers incorporate professional forecasts, other future information about inflation, and energy prices. The learning rule that outperformed the other rules differed across the sample. This examination confirmed the results on learning rules cross-country heterogeneity obtained by Weber (2009) who also incorporated some economic variables while designing learning rules. The procedure of testing different learning rules was also applied by Stanisławska (2008) for Poland. She specified five laws of motion and incorporated some macro-variable into three of them.

The other strand of literature relevant to the examination of the factors that influence expectations involves the research based on the regression analysis and VARs/VECMs. Ueda (2010) used a four-variable-structured VAR model (output gap, short-term interest rate, realised, and expected inflation) with two exogenous variables (oils prices and food prices) to analyse determinants of households' inflation expectations in Japan and the USA. He found that inflation expectations respond fast to the changes of oil and food prices as well as to monetary policy shocks (interest rate change). The study also noticed the difference in the response persistence amongst countries.

Cerisola and Gelos (2009) used a reduced form of an inflation equation derived from the hybrid price-setting model to examine the macroeconomic determinants of inflation expectations in Brazil since the adoption of inflation targeting. They considered: realised inflation, inflation target, fiscal policy, as proxied by the ratio of the consolidated primary surplus to GDP, real interest rate, real effective exchange

rate, and wage deviation from their trend values. The study exposed a large impact of the budget and a relatively low impact of past inflation on inflation expectations. To trace the impact of administrative prices on inflation and expectations, an impulse response function was generated from a two-variable VAR.

The influence of oil price fluctuations and a lower output growth (identified as secular stagnation) on market-based long-term inflation expectations in Australia, Euro Area, Japan, Sweden, the UK, and the USA over the sample 2007–2015 was examined by Gambetti and Moretti (2016). They covered the post-crisis period of decline in inflation expectations. They used a three-variable VAR including the industrial production index, oil prices, and a proxy of inflation expectations: inflation swaps. The lower output growth explained the decline in expectations only to some extent. Market-based expectations proved their increased sensitivity to the oil price shocks as well.

Ciccarelli and Garcia (2009) also focused on market-based expectations (break-even inflation rates) for the euro area. To assess the dependence of expectations, they determined a broad set of potential explanatory variables from monetary and financial indicators, commodity and energy prices, price indicators, real sphere variables, and confidence indices. They applied a multivariate linear regression to detect dependencies and VAR to trace impulse responses. They found many variables that explained expectations and differences between short- and long-term horizons of expectations.

The short overview of recent literature on the drivers of inflation expectations presented above has led us to the conclusion that the research results differ and that this variety is a consequence of the choices made by the authors with respect to the territorial scope of the research, proxy of expectations, methodology, and the factors that are predetermined as explanatory for the way expectations are formed. Essentially, any cross-country comparison offers mixed results in terms of variables significant in the formation of expectations. The authors adapt the research choices to their goals. Most studies have two points in common: they take into account past inflation figures and energy prices. In our research, we decided to leave inflation out. We realise that it helps in explaining expectations, but as the goodness-of-fit of the hybrid specification of expectations is not satisfactory (from 0.2 to 0.8), we pursue other factors which determine expectations. This approach was also applied by Gambetti and Moretti (2016) and is commonly used in the studies on the impact exerted by energy prices on expectations (Badel and McGillicuddy 2015; Sussman and Zohat 2016).

At the end of this section, we would like to comment on the choice of our methodology. The cointegration technique is prevalent in the macroeconomic analyses, as macroeconomic data are usually non-stationary. Conventional regression estimators, including VARs, have good properties when applied to covariance stationary time series, but with non-stationary or integrated processes, they encounter difficulties and lead to spurious regressions. This concept was presented by Granger and Newbold

(1974). Then Nelson and Plosser (1982) showed that a wide variety of macroeconomic series is non-stationary and that unit roots might be present in time series in levels or logarithms. Early work on error-correction models goes back to Sargan (1964), however, a full analysis of the VECM is presented, amongst others, in Johansen (1995). There are also empirical examples of the application of VECMs to the analysis of expectations (Dräger 2015).

3 Sample and the Methodology

The sample covers eight non-euro area Member States of the EU: BG, HR, CZ, HU, RO, PL, SE, and UK. The research period starts in 2001, except for HR and RO (the EC survey coverage of the two states started in 2005). The EC Business and Consumers Surveys provide a structure of answers on the qualitative question about expected price changes within the next 12 months. Then, the survey results are quantified with Carlson and Parkin method (Carlson and Parkin 1975) adapted to a five-category base (Batcherol and Orr 1988).

The macroeconomic and financial control variables that we incorporated into our analysis are as follows: unemployment, industrial production index (real sphere indicators), broad money (monetary indicator), exchange rates of national currency (vs. EUR and USD), 3M interbank offer rates (financial indicators), and oil prices. We derived the data from central banks and the publications of national statistical offices. Oil prices were taken from the Macrobond platform. Daily data were averaged to obtain a monthly average.

The aim of the study is to find a mechanism which explains the changes in the consumers' inflation expectations based on the macroeconomic or financial factors. A VECM for two variables *x*, *y,* and one cointegration vector take the following form:

$$\begin{aligned}\Delta y = {} & \beta_{y0} + \beta_{y1}\Delta y_{t-1} + \cdots + \beta_{yp}\Delta y_{t-p} + \gamma_{y1}\Delta x_{t-1} + \cdots + \gamma_{yp}\Delta x_{t-p} \\ & - \lambda_y(y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + \epsilon_t^y, \end{aligned} \tag{3.1}$$

$$\begin{aligned}\Delta x = {} & \beta_{x0} + \beta_{x1}\Delta y_{t-1} + \cdots + \beta_{xp}\Delta y_{t-p} + \gamma_{x1}\Delta x_{t-1} + \cdots + \gamma_{xp}\Delta x_{t-p} \\ & - \lambda_x(y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + \epsilon_t^x, \end{aligned} \tag{3.2}$$

where $y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}$ is the long-run cointegrating relationship between the two variables, while λ_y and λ_y are the error-correction parameters that measure how y and x react to the deviations from the long-run equilibrium. To deal with more variables, we use a generalised testing procedure for cointegrating relationships. With such procedure, more than one cointegrating equation and multiple error-correction terms are allowed in each equation.

Statistical verification of the hypotheses with the use of the cointegration analysis is carried out in the following steps:

- examination of the integration degree of variables at the level of confidence equal to 0.05, using the Dickey–Fuller test with the autocorrelation correction (ADF), which checks the null hypothesis of whether a unit root is present in a time series sample,
- determination of the optimal number of delays in the autoregressive model,
- testing of cointegration,
- formation and analysis of the vector error-correction models (VECM), as it adds error-correction features to a multi-factor model.

The problem of lag selection is not unequivocal and might influence the results of the cointegration analysis. Information criteria, such as Akaike's information criterion (AIC), the Bayesian information criterion (BIC), the consistent AIC, and the Adjusted BIC, are widely used to select a lag model, but they can support different models as well—see: Emiliano et al. (2014), Dziak et al. (2012). The lag number corresponds to the length of the response to the deviation from the long-term equilibrium, which results from the interpretation of the error-correction mechanism. Given that corrections should occur in a relatively short time, too many lags are not recommended. Thus, we relied on the BIC information criterion which prefers a minimum size model.

A similar issue of ambiguity occurs when cointegration is tested. We use one of the most popular tests—namely the system based test of Johansen, either with trace or with eigenvalue. The null hypothesis for the trace test is that the number of cointegration vectors is $r = r^* < k$, the alternative being that $r > k$. Testing continues sequentially for $r^* = 1,2,\ldots k$ and the first non-rejection of the null is taken as an estimate of r. The null hypothesis for the maximum eigenvalue test is the same as for the trace test, but the alternative is $r = r^* + 1$; here, also testing continues sequentially with the first non-rejection used as an estimator for r.

4 Results and Their Interpretation

With the values of the ADF test, we can presume that there is a unit root in most of our time series.[1] Since in the case of differenced variables[2] the null hypothesis that a unit root is present in a time series sample was rejected, time series of differences are stationary.

The results of Johansen's cointegration test are shown in Table 1. The numbers of cointegrating vectors, determined using the trace test and the maximum eigenvalue

[1]The exceptions are the stationary variables WIBOR3M, PLN/EUR, IPI, unemployment for Poland, IPI for Czechia, and IPI and unemployment for Hungary. These variables will be included in the further analysis as additional exogenous variables

[2]The exceptions are unemployment (for BG and HR) PUBOR3M (HU) IPI (RO) variables, which must be differenced two times to get a stationary series

Table 1 Results of Johansen's cointegration test[a]

R*	Eigenvalue	Trace test	*p*-value	L_{max} test	*p*-value	Eigenvalue	Trace test	*p*-value	L_{max} test	*p*-value
BG (1lag) 2 cointegrating vectors						*PL (2 lags) 3 cointegrating vectors*				
0	0.34979	150.92	[0.0000]	66.722	[0.0000]	0.43095	111.79	[0.0000]	67.654	[0.0000]
1	0.24743	84.193	[0.0018]	44.061	[0.0012]	0.19804	44.133	[0.0005]	26.484	[0.0064]
2	0.12402	40.132	[0.2198]	20.525	[0.3165]	0.08956	17.649	[0.0217]	11.26	[0.1431]
HR (6 lags) 3 cointegrating vector						*CZ (1 lags) 2 cointegrating vector*				
0	0.3680	161.190	[0.0000]	51.8570	[0.0081]	0.32079	210.79	[0.0000]	61.893	[0.0023]
1	0.2544	109.330	[0.0035]	33.1650	[0.2521]	0.25826	148.9	[0.0007]	47.801	[0.0292]
2	0.2486	76.1680	[0.0129]	32.2910	[0.0738]	0.18184	101.1	[0.0188]	32.112	[0.3082]
3	0.1793	43.8770	[0.1119]	22.3240	[0.2102]	0.16202	68.984	[0.0562]	28.281	[0.2064]
SE (4 lag) 6 cointegrating vectors						*RO (2 lags) 2 cointegrating vectors*				
0	0.99167	620.26	[0.0000]	210.66	[0.0000]	0.65057	207.93	[0.0000]	60.984	[0.0031]
1	0.95044	409.6	[0.0000]	132.2	[0.0000]	0.55437	146.95	[0.0011]	46.879	[0.0382]
2	0.8499	277.39	[0.0000]	83.444	[0.0000]	0.41797	100.07	[0.0227]	31.392	[0.3503]
3	0.79747	193.95	[0.0000]	70.262	[0.0000]	0.35507	68.675	[0.0596]	25.439	[0.3681]
4	0.76211	123.69	[0.0000]	63.181	[0.0000]	0.33035	43.236	[0.1267]	23.258	[0.1662]

(continued)

Table 1 (continued)

R*	Eigenvalue	Trace test	*p*-value	L_{max} test	*p*-value	Eigenvalue	Trace test	*p*-value	L_{max} test	*p*-value
5	0.52083	60.504	[0.0000]	32.371	[0.0005]	0.18843	19.978	[0.4353]	12.109	[0.5499]
6	0.46183	28.134	[0.0003]	27.262	[0.0002]	0.12213	7.8686	[0.4868]	7.5549	[0.4346]
7	0.01962	0.87166	[0.3505]	0.87166	[0.3505]	0.00539	0.31373	[0.5754]	0.31373	[0.5754]
UK (2 lags) 3 cointegrating vectors						*HU (1 lag) 2 cointegrating vectors*				
0	0.4299	224.860	[0.0000]	79.7880	[0.0000]	0.76546	182.88	[0.0000]	85.558	[0.0000]
1	0.2844	145.070	[0.0016]	47.5210	[0.0317]	0.55493	97.326	[0.0369]	47.762	[0.0036]
2	0.2485	97.5530	[0.0355]	40.5720	[0.0398]	0.32088	49.564	[0.6577]	22.831	[0.5550]
3	0.1809	56.9810	[0.3418]	28.3350	[0.2039]	0.21019	26.733	[0.8614]	13.922	[0.8227]

R* stands for rank

[a]Table comprises only the relevant rank number in the process of inference

test, are as follows: for PL—3, BG—2, HR—3, CZ—4, HU—2, SE—6, RO—2, UK—3. Once there is more than one cointegrating vector, some difficulties with interpretation of the results might occur. Multiplication of cointegration vectors is possible when the analysis covers several variables, and when the information criterion suggests many lags to be considered. It complicates the relations between the variables. Generally, Johansen's cointegration tests suggest the existence of cointegration—and of long-run dependence—amongst the variables. These results provide the basis for the specification and testing of VECMs for variables in all selected countries.

The number of lags indicated by BIC differs substantially across the sample. As we focus on consumers' expectations, we find the justification for accounting of quite long lags: consumers are relatively poorly educated in the field of economics and they need time to process information. Moreover, they are secondary readers of economic news as they do not rely directly on specialist publications (of central banks or statistical offices), but they tend to read media news in turn.

The estimation of equations for inflation expectations in VEC models β for each country are included in Tables 2, 3, 4, 5, 6, 7, and 8. It is worth mentioning that the cointegrating α parameters indicate how variables are related in the "equilibrium". The EC component presents an error-correction mechanism. The parameter at this variable carries information on short-term adjustments at time t to the equilibrium of period t − 1. The results for RO are not included as in this case, we did not find statistically significant relations amongst our variables.

All the VECMs' residuals were tested for autocorrelation (Ljung-Box test with H0: the data are independently distributed). The statistics (and the *p*-value in brackets) are presented in Table 9. H0 has been rejected for Bulgaria, which means that the model might fail to capture certain information (e.g. an additional variable).

Table 2 VECM estimations—Bulgaria

Cointegrating vectors					
Expectations	1.0000	0.0000			
M3	0.0000	1.0000			
HUFEUR	−4.3774	−0.1410			
HUFUSD	−70.7250	−3.3486			
IPI	0.1153	0.0307			
OILPRICE	−0.2765	−0.0144			
	Coefficient	Std. error	t-ratio	*p*-value	
Equation for d_expectations					
Const.	3.0120	3.2875	0.9162	0.3636	
EC1	0.0151	0.0104	1.456	0.1512	
EC2	**−0.0228**	**0.0075**	**−3.032**	**0.0037**	***

***Significance at the 1 percent level

Table 3 VECM estimations—Croatia

Cointegrated vector					
Expectations	1.0000		0.0000	0.0000	
M3	0.0000		1.0000	0.0000	
ZIBOR3M	0.0000		0.0000	1.0000	
HRKEUR	15.2780		−0.0488	−5.3094	
HRKUSD	−3.2470		−0.0004	−1.8645	
IPI	−0.1274		−0.0015	−0.9599	
OILPRICE	−0.1100		−0.0003	−0.1166	
	Coefficient	Std. error	t-ratio	*p*-value	
Equation for d_expectation					
Const.	**18.9165**	**6.379**	**2.965**	**0.0041**	***
d_expectations_1	0.0801	0.113724	0.7045	0.4833	
d_expectations_2	0.0194	0.117108	0.1653	0.8692	
d_expectations_3	0.0483	0.116045	0.4162	0.6785	
d_expectations_4	0.1180	0.11024	1.07	0.2881	
d_expectations_5	0.0893	0.108942	0.8197	0.415	
d_M3_1	−1.6480	3.14712	−0.5236	0.6021	
d_M3_2	−5.1700	3.26472	−1.584	0.1176	
d_M3_3	−2.3528	3.75972	−0.6258	0.5334	
d_M3_4	−2.5665	3.88884	−0.6600	0.5114	
d_M3_5	−5.7467	3.57766	−1.606	0.1125	
d_ZIBOR3 M_1	0.0028	0.07455	0.03739	0.9703	
d_ZIBOR3 M_2	−0.0737	0.07282	−1.012	0.3148	
d_ZIBOR3 M_3	−0.0954	0.06902	−1.382	0.1712	
d_ZIBOR3M_4	−0.0091	0.07010	−0.1298	0.8971	
d_ZIBOR3M_5	0.0783	0.06994	1.12	0.2664	
d_HRKEUR_1	2.0535	1.65768	1.239	0.2194	
d_HRKEUR_2	**3.6098**	**1.57973**	**2.285**	**0.0252**	**
d_HRKEUR_3	−0.1846	1.55886	−0.1184	0.906	
d_HRKEUR_4	0.3618	1.45949	0.2479	0.8049	
d_HRKEUR_5	**2.5723**	**1.33994**	**1.92**	**0.0588**	*
d_HRKUSD_1	−0.1331	0.42630	−0.3122	0.7558	
d_HRKUSD_2	−0.0171	0.4591	−0.03725	0.9704	
d_HRKUSD_3	0.6394	0.4431	1.443	0.1533	
d_HRKUSD_4	−0.5986	0.4074	−1.469	0.1461	
d_HRKUSD_5	−0.3756	0.4152	−0.9045	0.3687	
d_IPI_1	**0.0682**	**0.0286**	**2.392**	**0.0193**	**

(continued)

Table 3 (continued)

	Coefficient	Std. error	t-ratio	*p*-value	
d_IPI_2	**0.1000**	**0.0305**	**3.282**	**0.0016**	***
d_IPI_3	0.0517	0.03182	1.625	0.1084	
d_IPI_4	0.0052	0.02980	0.1761	0.8607	
d_IPI_5	0.0025	0.02573	0.09675	0.9232	
d_OILPRICE_1	−0.0036	0.00904	−0.4008	0.6897	
d_OILPRICE_2	0.0059	0.01027	0.5765	0.5661	
d_OILPRICE_3	0.0133	0.00994	1.337	0.1853	
d_OILPRICE_4	−0.0035	0.01015	−0.3470	0.7296	
d_OILPRICE_5	**−0.0190**	**0.01138**	**−1.668**	**0.0995**	*
EC1	**−0.1416**	**0.04238**	**−3.341**	**0.0013**	***
EC2	**4.9317**	**1.90163**	**2.593**	**0.0115**	**
EC3	**0.03887**	**0.02267**	**1.715**	**0.0906**	*

*Significance at the 10 percent level
**Significance at the 5 percent level
***Significance at the 1 percent level

The VECM-based analysis did not provide definite results. In each case, the model suggests the existence of the long-run mechanism describing dependence of variables. For Bulgaria and Hungary, we did not detect any short-run relation for lagged variable differences. Table 10 summarises the short-run relations between consumers' expectations and other variables for the remaining five countries.

The intention to examine the eight non-euro area Member States was the starting point of our research. We were unsuccessful, however, in obtaining VECM for RO with a significant error-correction formula in equation for inflation expectations. Neither did we capture a short-run relation for BG and HU. In our search for the explanation of such results, we succeeded in pointing out difficulties arising from the monetary policy during the research period. Since the shaping of expectations is the role of an adequately planned and implemented monetary policy, its changes might affect the formation of expectations; hence, the information that is incorporated into this process may be a force for change. Up until 2008, the National Bank of Hungary had been pursuing a rather eclectic monetary policy. The central bank combined the declared implementation of inflation targeting with the fixed exchange rate regime. Its actions aimed at the stabilisation of the exchange rate rather than targeted medium-run inflation. The National Bank of Romania switched to inflation targeting at the beginning of the research period, so the consumers were required to learn the new regime. The inflation goal was substantially lowered in several steps. At the same time, the disinflation process in Romania was intermittent. The conditions for the shaping of expectations were disturbed. The Bulgarian National Bank operates under the currency board. The channels used to stabilise expectations are different there

Table 4 VECM estimations—Czechia

Cointegrated vector					
Expectations	1		0		
M3	0		1		
PRIBOR3M	−1.9745		−7.8823		
CZKEUR	1.2288		2.2354		
CZKUSD	−1.3416		−4.6547		
IPI	0.1302		0.0789		
Unemployment	−0.5032		1.3985		
OILPRICE	−0.0572		−0.3064		
	Coefficient	Std. error	t-ratio	*p*-value	
Equation for d_expectation					
Const.	**2.5015**	**1.1313**	**2.2110**	**0.0293**	**
d_expectations_1	0.0802	0.1158	0.6931	0.4899	
d_expectations_2	0.0191	0.1073	0.1780	0.8591	
d_expectations_3	0.0892	0.1058	0.8431	0.4012	
d_expectations_4	0.1197	0.1116	1.0730	0.2860	
d_expectations_5	−0.0143	0.1090	−0.1311	0.8959	
d_expectations_6	−0.0348	0.1056	−0.3292	0.7427	
d_expectations_7	0.1272	0.0996	1.2780	0.2043	
d_M3_1	0.0410	0.0503	0.8157	0.4166	
d_M3_2	−0.0040	0.0521	−0.07720	0.9386	
d_M3_3	0.0286	0.0495	0.5785	0.5643	
d_M3_4	−0.0063	0.0481	−0.1303	0.8966	
d_M3_5	−0.0454	0.0474	−0.9573	0.3407	
d_M3_6	−0.0113	0.0472	−0.2395	0.8112	
d_M3_7	−0.0152	0.0477	−0.3179	0.7513	
d_PRIBOR3M_1	0.3380	0.4858	0.6958	0.4882	
d_PRIBOR3M_2	0.1491	0.5118	0.2913	0.7715	
d_PRIBOR3M_3	0.0662	0.5401	0.1225	0.9027	
d_PRIBOR3M_4	−0.1741	0.5145	−0.3383	0.7358	
d_PRIBOR3M_5	0.6477	0.5059	1.2800	0.2034	
d_PRIBOR3M_6	0.1476	0.5297	0.2787	0.7810	
d_PRIBOR3M_7	0.5528	0.4752	1.1630	0.2475	
d_CZKEUR_1	−0.04327	0.1585	−0.2729	0.7855	
d_CZKEUR_2	0.2599	0.1672	1.5540	0.1233	
d_CZKEUR_3	−0.1439	0.1586	−0.9073	0.3664	
d_CZKEUR_4	−0.0766	0.1588	−0.4827	0.6304	

(continued)

Table 4 (continued)

	Coefficient	Std. error	t-ratio	*p*-value	
d_CZKEUR_5	0.0560	0.1595	0.3510	0.7263	
d_CZKEUR_6	−0.0650	0.1573	−0.4130	0.6805	
d_CZKEUR_7	0.0901	0.1542	0.5840	0.5605	
d_CZKUSD_1	0.0907	0.0989	0.9171	0.3613	
d_CZKUSD_2	−0.0015	0.0997	−0.01513	0.9880	
d_CZKUSD_3	0.0582	0.1003	0.5804	0.5630	
d_CZKUSD_4	**0.1479**	**0.0860**	**1.7200**	**0.0885**	*
d_CZKUSD_5	0.0722	0.0894	0.8073	0.4214	
d_CZKUSD_6	0.0778	0.0906	0.8582	0.3928	
d_CZKUSD_7	0.0780	0.0844	0.9244	0.3575	
d_IPI_1	0.0126	0.0087	1.4470	0.1510	
d_IPI_2	0.0003	0.0095	0.0310	0.9754	
d_IPI_3	−0.0007	0.0096	−0.07173	0.9430	
d_IPI_4	−0.0048	0.0092	−0.5227	0.6023	
d_IPI_5	−0.0012	0.0091	−0.1342	0.8935	
d_IPI_6	−0.0140	0.0095	−1.466	0.1459	
d_IPI_7	−0.0060	0.0081	−0.7377	0.4624	
d_Unemployment_1	−0.0166	0.3067	−0.05413	0.9569	
d_Unemployment_2	0.1655	0.3027	0.5465	0.5859	
d_Unemployment_3	0.2722	0.3188	0.8540	0.3951	
d_Unemployment_4	−0.5410	0.3383	−1.599	0.1129	
d_Unemployment_5	−0.6345	0.3489	−1.818	0.0720	
d_Unemployment_6	0.5615	0.3606	1.5570	0.1226	
d_Unemployment_7	−0.1795	0.3811	−0.4709	0.6387	
d_OILPRICE_1	0.0124	0.0075	1.6560	0.1008	
d_OILPRICE_2	**0.0225**	**0.0085**	**2.6290**	**0.0099**	***
d_OILPRICE_3	0.0053	0.0084	0.6249	0.5335	
d_OILPRICE_4	0.0109	0.0083	1.3150	0.1916	
d_OILPRICE_5	**0.0157**	**0.0078**	**2.0140**	**0.0467**	**
d_OILPRICE_6	0.0038	0.0084	0.4508	0.6531	
d_OILPRICE_7	0.0042	0.0084	0.4988	0.6190	
EC1	**−0.0976**	**0.0563**	**−1.733**	**0.0862**	*
EC2	**0.0312**	**0.0152**	**2.0530**	**0.0427**	**

*Significance at the 10 percent level
**Significance at the 5 percent level
***Significance at the 1 percent level

Table 5 VECM estimations—Hungary

Cointegrating vectors					
Expectations		1		0	
M3		0		1	
HUFEUR		0.0775		0.4470	
HUFUSD		0.0502		−0.1996	
IPI		2.8454		1.5666	
Unemployment		−0.8549		2.1444	
OILPRICE		0.0675		−0.2095	
	Coefficient	Std. error	t-ratio	*p*-value	
Equation for d_expectations					
Const.	3.01202	3.28754	0.9162	0.3636	
EC1	0.0151296	0.0103942	1.456	0.1512	
EC2	**−0.0227916**	**0.00751638**	**−3.032**	**0.0037**	***

***Significance at the 1 percent level

than in the inflation-targeting countries. The central bank's communication does not refer directly to the inflation target and its determinants.

There is no common pattern with respect to the content of information that supports short-run expectations in the remaining countries. All the dependencies found for the UK are counterintuitive; thus, they cannot be interpreted. A predictable result can be obtained for the national currency to the euro exchange rate, while no relation has been found for USD. In Croatia, Czechia, and Sweden, a real sphere indicator affects the change of consumers' expectations. The interbank rate and broad money are related to expectations only in two economies. It means that the central banks in the majority of countries from our sample cannot exert impact on expectation in the most direct way. Since much of our research has confirmed the impact of oil prices on expectations, also in short-run, the fact that it is revealed only for CZ is quite surprising as well.

Once we have established six variables as prospective drivers of expectations, in addition to lags ranging from one to seven, the complexity of the model-based analysis excludes its more direct interpretation. More general caveat could be made: while applying VECMs, it is more convenient to interpret the covariance analysis and the impulse response function than its parameters directly. The reference to this possibility will be made in our conclusion.

Table 6 VECM estimations—Poland

Cointegrating vectors					
Expectations	1.0000		0.0000	0.0000	
M3	0.0000		1.0000	0.0000	
PLNUSD	0.0000		0.0000	1.0000	
OILPRICE	0.0575		0.3390	−0.0561	
	Coefficient	Std. error	t-ratio	*p*-value	
Equation for d_expectation					
Const.	−2.6489	1.6346	−1.620	0.1079	
d_expectations_1	0.0055	0.0970	0.0566	0.9550	
d_M3_1	−0.01934	0.0229	−0.8447	0.4000	
d_PLNUSD_1	0.0651	0.3895	0.1671	0.8676	
d_OILPRICE_1	0.0042	0.0044	0.9460	0.3461	
WIBOR3M_1	**0.7978**	**0.1958**	**4.0740**	**0.0001**	***
WIBOR3M_2	**−0.6614**	**0.1860**	**−3.555**	**0.0006**	***
PLNEUR	**0.5914**	**0.3314**	**1.7840**	**0.0770**	*
PLNEUR_1	−0.8198	0.6315	−1.298	0.1969	
PLNEUR_2	0.5872	0.4949	1.1860	0.2379	
IPI_1	0.0046	0.0038	1.2100	0.2287	
IPI_2	0.0009	0.0039	0.2223	0.8245	
Unemployment_1	0.0932	0.0929	1.0030	0.3179	
Unemployment_2	−0.1142	0.0913	−1.252	0.2133	
EC1	**−0.1768**	**0.0548**	**−3.227**	**0.0016**	***
EC2	0.0098	0.0115	0.8468	0.3989	
EC3	**−0.1442**	**0.0853**	**−1.689**	**0.0939**	*

*Significance at the 10 percent level
**Significance at the 5 percent level
***Significance at the 1 percent level

Table 7 VECM estimations—Sweden

Cointegration vectors						
Expectations	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
M3	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000
SIBOR3M	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
SEKEUR	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
SEKUSD	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000
IPI	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Unemployment	−9.9664	−48.6260	19.3730	−3.7546	−12.9470	17.3760
OILPRICE	1.1731	5.2735	−1.9216	0.4063	1.5571	−1.7945

	Coeff.	Std. dev.	t-ratio	*p*-value	
Equation for d_expectation					
Const.	**42.7655**	**18.7426**	**2.2820**	**0.0415**	**
d_Expectations_1	0.3996	0.3935	1.0150	0.3300	
d_Expectations_2	−0.2372	0.2865	−0.8274	0.4242	
d_Expectations_3	-0.0721	0.2800	−0.2576	0.8011	
d_M3_1	**−0.1430**	**0.0731**	**−1.956**	**0.0742**	*
d_M3_2	−0.0509	0.0520	−0.9787	0.3471	
d_M3_3	−0.0415	0.0335	−1.238	0.2393	
d_SIBOR3M_1	0.3324	0.3071	1.0820	0.3004	
d_SIBOR3M_2	**0.4680**	**0.2108**	**2.2200**	**0.0465**	**
d_SIBOR3M_3	0.0956	0.1248	0.7663	0.4583	
d_SEKEUR_1	**2.9189**	**1.3498**	**2.1620**	**0.0515**	*
d_SEKEUR_2	0.3649	1.1536	0.3163	0.7572	
d_SEKEUR_3	−0.6105	0.6673	−0.9149	0.3783	
d_SEKUSD_1	−0.2370	0.2462	−0.9627	0.3547	
d_SEKUSD_2	−0.2505	0.2771	−0.9039	0.3838	
d_SEKUSD_3	0.4242	0.2621	1.6180	0.1315	
d_IPI_1	**0.0382**	**0.0126**	**3.0370**	**0.0103**	**
d_IPI_2	**0.0190**	**0.0084**	**2.2680**	**0.0426**	**
d_IPI_3	**0.0116**	**0.0047**	**2.4360**	**0.0314**	**
d_Unemployment_1	−8.9832	9.7030	−0.9258	0.3728	
d_Unemployment_2	−4.7275	8.2130	−0.5756	0.5755	
d_Unemployment_3	7.0584	8.6187	0.8190	0.4288	
d_OILPRICE_1	−0.0043	0.0435	−0.09952	0.9224	
d_OILPRICE_2	0.0145	0.0339	0.4284	0.6760	
d_OILPRICE_3	0.0364	0.0245	1.4830	0.1638	
EC1	**−0.9086**	**0.4913**	**−1.849**	**0.0892**	*

(continued)

Table 7 (continued)

	Coeff.	Std. dev.	t-ratio	*p*-value	
EC2	**0.1950**	**0.0902**	**2.1610**	**0.0516**	*
EC3	**−0.5898**	**0.3055**	**−1.930**	**0.0775**	*
EC4	−2.6315	1.8470	−1.425	0.1797	
EC5	−0.1251	0.3041	−0.4113	0.6881	
EC6	**−0.0441**	**0.0158**	**−2.791**	**0.0163**	*

*Significance at the 10 percent level
**Significance at the 5 percent level
***Significance at the 1 percent level

Table 8 VECM estimations—the UK

Expectations	1.0000	0.0000	0.0000
M3	0.0000	1.0000	0.0000
LIBOR3M	0.0000	0.0000	1.0000
GBP/EUR	−36.4280	18.9600	52.9940
GBP/USD	−22.6850	16.3760	39.7710
IPI	−0.5027	0.1822	0.0133
Unemployment	1.8522	1.3215	−3.9410
OILPRICE	−0.0799	−0.0084	0.0715

	Coefficient	t-ratio	*p*-value		
Equation for d_expectation					
Const.	**−11.0432**	**2.4134**	**−4.576**	**0.0000**	***
d_expectations_1	−0.0684	0.0818	−0.8367	0.4043	
d_M3_1	−0.0620	0.0483	−1.282	0.2021	
d_LIBOR3M_1	0.0907	0.1006	0.9019	0.3688	
d_GBPEUR_1	**−2.7087**	**1.4953**	**−1.811**	**0.0724**	*
d_GBPUSD_1	1.1026	1.7609	0.6262	0.5323	
d_IPI_1	**−0.06025**	**0.0236**	**−2.557**	**0.0117**	**
d_Unemployment_1	**0.4781**	**0.2047**	**2.3360**	**0.0211**	**
d_OILPRICE_1	−0.0014	0.0038	−0.3729	0.7098	
EC1	**−0.1698**	**0.0309**	**−5.495**	**0.0000**	***
EC2	0.0408	0.0253	1.6120	0.1094	
EC3	**−0.1026**	**0.0222**	**−4.628**	**0.0000**	***

*Significance at the 10 percent level
**Significance at the 5 percent level
***Significance at the 1 percent level

Table 9 Ljung-Box autocorrelation tests

Country	BG	HR	CZ	HU	PL	SE	UK
Ljung-Box test	27.242 [0.007]	19.7009 [0.073]	17.321 [0.138]	7.6222 [0.814]	15.6831 [0.206]	16.1981 [0.182]	9.46928 [0.662]

Table 10 Short-run relations—a summary

Country	HR	CZ	PL	SE	UK
M3				X(1)	
Interbank rate			**X(1, 2)**	X(2)	
National currency/EUR	**X(2,5)**	**X(4)**	**X(1)**	**X(1)**	X (1)
National currency/USD					
IPI	**X(1,2)**			**X(1,2,3)**	X(1)
Unemployment		**X(5)**			X(1)
Oil prices	X (1)	**X (2, 5)**			

X—stands for existence of short-run dependence between the change of inflation expectations and the change of the control variable; lag of controls is given in parentheses; bolded—direction of the dependence is in line with intuition

5 Conclusion

We hypothesised that some economic information is incorporated into the mechanism that explains changes and long-run development, (1) and that the expectation drivers differ across countries (2). The analysis of expectations usually covers several aspects: their formation (including the learning rules applied), the impact of monetary policy on expectations, and the driving factors behind expectations. This paper follows the latter perspective. Based on the cointegration analysis, we have found that a mechanism exists that explains the changes in inflation expectations in the case of our sample (except for RO). However, the results could not be interpreted straightforwardly due to the complexity of the model. Therefore, we have proposed further research with respect to this dataset. Firstly, restrictions applied to the model would help organise the lag structure and limit the length of the lag incorporated into the model. Secondly, the limitation of the number of variables is also an option. The most natural candidate for such exclusion is the USD exchange rate. Without a doubt, the EUR exchange rate is of more importance for the EU Member States. Thirdly, we could apply two additional tools to analyse the relations between expectations and other factors, i.e. the impulse response functions that describe the existence and persistence of the shock response once a variable changes, and the variance decomposition that traces the sources of the variable change over time. These procedures were not applied here due to the limited size of this paper.

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Development of Financial Markets and Insurance in Central and Eastern Europe

Assessing the Financial Integration of Eastern European Countries

Özcan Karahan, Metehan Yılgör and Hakan Öndes

Abstract The relationship between domestic saving and investment provides important insights for the integration of national financial markets into the world capital market. In case of perfect financial integration, it is generally assumed that there should be no close relationship between national saving and investment. The aim of this study is to measure the degree of financial integration by exploring the saving-investment nexus in Eastern European countries. We employ panel cointegration and causality tests for the annual time series covering the period of 2000–2016. Empirical results show that there is a strong causality between domestic saving and investment rate by indicating the low degree of financial integration of the Eastern European countries into the world capital market. This finding also implies that Eastern European countries are not attracting enough foreign resources that serve as a stimulant to domestic investment as well as economic growth. As a policy implication, it could be asserted that policy-makers should focus on financial reforms promoting financial integration processes in order to attract enough foreign resources for economic growth.

Keywords Financial integration · Saving and investment · Panel data models

1 Introduction

One of the most important phenomena that shaped the contemporary world economy is the expansion of the capital movements. Along with the spread of the financial liberalization policies, the amount of capital movements among national financial markets

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*, Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_6

has increased considerably. Most countries have made remarkable progress in the financial integration processes enhanced by strong financial liberalization policies over the last decades. Thus, increasing trends in the liberalization of financial markets have enhanced international capital mobility in all over the world. An increase in international capital mobility makes national financial markets rapidly integrated and hence becomes a significant research subject of open economy macroeconomics. Furthermore, the role of capital inflows in the relationship between domestic saving and investment is at the top of the research list for economists focusing on issues related to open economy macroeconomics.

The relationship between saving and investment can generally be explained by the loanable funds market model. In a closed economy, the demand for loanable funds comes from domestic entrepreneurs who need to finance their new investments and savings which are the basic source of loanable funds in the capital markets. Thus, the supply of loanable funds comes from the savings of domestic economic agents. A country's domestic saving is the total of savings by household and companies as well as the government. When savings and investments are defined as the supply and demand portion of the loanable funds market, it is possible to analyse these two variables in a cause-and-effect relationship. In this cause-and-effect relationship, savings finance investments and as a result, promote economic growth. In other words, savings that finance investments play a pivotal role in a continually growing economy. Thus, in the case of closed economy, domestic savings will completely cover the financing of domestic investments which lead to enhancing economic growth. Accordingly, the role of the domestic saving-investment nexus in promoting economic growth has received considerable attention in the literature. Consequently, in the case of closed economy, a strong relationship between domestic saving and investment is theoretically expected.

However, when the economy becomes open to the outside, the strong relationship between domestic saving and investment is weakened or even destroyed. In the case of an open economy, the hypothesis of perfect capital mobility argues that domestic investment can also be financed by foreign saving. In other words, domestic investment can also be financed by international financial funds via attracting capital inflows to a host country. Consequently, most of the economists advocating the hypothesis of perfect capital mobility have argued that in highly integrated capital markets, the amount of domestic investment should be weakly dependent on domestic saving. Contrarily, Feldstein and Horioka (1980) showed that domestic saving and investment rates are highly correlated even in cases of perfectly integrated capital markets. They found that saving and investment are highly correlated in 16 OECD countries. This empirical fact has been called "Feldstein–Horioka puzzle" since high correlation between domestic saving and investment is inconsistent with the hypothesis of perfect capital mobility.

After the seminal study of Feldstein and Horioka (1980), economists also started to measure the degree of capital market integration by examining the relationship between domestic saving and investment. The presence of any strong causal relationship between domestic saving and investment is interpreted as an indication that there

is a lack of national capital markets being integrated into international financial markets. Accordingly, by examining relationship between saving and investment rates, this study aims to measure the degree of capital market integration of Eastern European countries into the world capital markets. Most Eastern European countries made a rapid shift from a closed economy to an open market system by establishing the relevant legal framework and institutions after 1990. Special priority was also given to the liberalization of capital accounts in order to better integrate into international financial markets. Thus, Eastern European countries constitute a significant research study on the development of capital mobility and its impact on the economy. The rest of this paper is structured as follows. Section 2 presents a brief review of the relevant literature on the saving-investment nexus. Section 3 presents data, methodology and empirical results. The final section concludes and makes some policy implications.

2 Literature Review

There are ongoing discussions among economists on the degree of international capital integration. However, after the implementation of significant financial liberalization policies in the 1980s, conventional wisdom holds that world's individual national capital markets have been highly integrated with each other. In order to measure the degree of a country's integration into the world capital market, different criteria have been established such as the covered, uncovered and real interest rate parity conditions. Feldstein and Horioka elaborate on a criterion focusing on the correlation between domestic saving and investment. According to this criterion, if the domestic financial market is perfectly integrated into the world capital market, domestic investments are also financed by the worldwide pool of capital and hence do not strongly rely on domestic savings. Namely, the capital markets around the world cater for domestic investment needs independent of the domestic savings supply. Therefore, if no causality between domestic saving and investment is found in a country, one can conclude that this country's capital market is perfectly integrated with the world capital market.

Feldstein and Horioka (1980) firstly measured the integration of national capital markets into the world capital market by investigating the relationship between saving and investment using data from OECD countries during 1980–2000. They found a strong correlation between saving and investment, which indicates that OECD countries are not perfectly integrated into the world capital market. The high correlation between national savings and domestic investment rates in OECD area has also been interpreted as an evidence that capital is not perfectly mobile internationally. Thus, the empirical findings contradict the assumption of perfect capital mobility. Namely, in the case of perfect capital mobility, there should be no strong relationship between domestic saving and investment. Therefore, this fact has called the "Feldstein–Horioka puzzle" and became a new research topic for empirical and theoretical studies in the literature. Looking at the literature, there seems to be a lot of studies

trying to investigate national economies integrating into the world capital market by analysing the relations between savings and investments.

Some studies have attempted to solve the Feldstein–Horioka puzzle by analysing the relationship between saving and investment rates in individual countries. Narayan (2005) examined the saving and investment nexus as postulated by Feldstein and Horioka for Japan during 1960–1999. Using Autoregressive Distributed Lag (ARDL) model, the author found that saving and investment are cointegrated for Japan. Granger causality test also showed that saving causes investment and investment causes saving. Thus, empirical results show the presence of imperfect capital mobility for Japan. Mastroyiannis (2007) investigated the degree of integration of the Greek economy into the international capital markets using the analytical framework proposed by Felstein and Horioka during the period of 1960–2004. Empirical results indicated that the degree of integration of the Greek economy into the international capital markets after Greece's accession to EU is quite high. Adebola and Dahalan (2012) analysed the relationship between saving and investment for Tunisia during 1970–2009 based on ARDL model and Granger causality test. They found the existence of a long-run relationship when investment is taken as a dependent variable. The results of Granger causality test indicated two-way causality validating the low capital mobility as suggested by Felstein's and Horioka's hypothesis. Nasiru and Usman (2013) explored the relationship between saving and investment in Nigeria during 1980–2011. The results of the bounds test suggest that there is a long-run relationship between saving and investment, which indicates the low degree of financial integration of Nigeria into the world capital market. Rahman and Hossain (2015) examined the dynamic relationships between saving and investment in Bangladesh by using annual data covering the period of 1980–2014. The Johanse–Juselius cointegration analysis suggested that there exists a long-run relationship between saving and investment, while Granger causality test also suggests unidirectional causality running from saving to investment which indicates low capital mobility in Bangladesh.

In the literature, cross-country studies are also effectively performed to examine Feldstein–Horioka puzzle. Afzal (2007) studied relationship between saving and investment in 10 developing countries by using Johansen cointegration and Granger causality tests. He indicated that there is no long-run relationship between saving and investment in seven countries of the sample, which implies weakening of saving and investment relationship, and hence high degree of capital mobility. Guillaumin (2009) investigated the degree of financial integration for selected East Asian countries from 1988 to 2006 using panel cointegration techniques. Results reveal a high degree of financial integration of nine East Asian countries into the world capital market. More specifically, empirical findings show that high-income countries have stronger financial integration than middle-income countries. Mehrara and Musai (2013) investigated the causal relationship between domestic saving and investment rates for 40 Asian countries by using panel cointegration analysis during 1970–2010. The empirical results indicated the absence of long-run relationship between saving and investment, which is attributed to the high degree of capital mobility for

40 Asian countries. İyidoğan (2016) examined domestic saving-investment interactions, namely Feldstein and Horioka relation in 14 countries of Euro area by using bounds testing and Granger causality analysis. The relationship between domestic saving and investment is found to be very weak for most of the European countries, which could be interpreted as an evidence of high capital mobility. Murthy (2016) examined the validity of the Feldstein–Horioka puzzle for 14 Latin American and 4 Caribbean countries during 1960–2002. Results of maximum likelihood panel cointegration procedure show a low correlation between investment and saving, which indicates the prevalence of a moderate degree of capital mobility. That means Feldstein–Horioka puzzle is not valid in most of these countries. Hassan (2016) investigated the status of international capital mobility in West Africa using the saving retention coefficient of Feldstein's and Horioka's hypothesis. Panel data of 13 West African countries, spanning from 1980 to 2011, is used to examine the relation between saving and investment. The results from empirical analysis indicate a low association between domestic saving and investment and hence higher capital mobility in West Africa.

Concerning with the studies specially focusing on Eastern European countries, Köhler (2005) examined the degree of financial integration in Czech Republic, Hungary, Poland, Slovak Republic and Slovenia on the basis of saving-investment correlations. According to the analysis of saving and investment correlations, the Eastern European countries are perfectly integrated into the world capital market. Dobrinsky (2005) examined the interrelationship between domestic saving, capital accumulation and economic growth in the emerging market economies including Central and Eastern European countries. The empirical evidence presented in the paper points to a strong positive relationship between national saving and business investment. Thus, the domestic financial system emerges as one of the central factors for the efficient channelling of savings into growth-enhancing investment in these countries. Çiftçioğlu and Begoviç (2010) examined the impact of domestic saving on economic growth in Central and East European countries by increasing the amount of investment. Empirical results based on panel regression analysis suggested that the domestic saving rate has exerted a statistically significant effect on economic growth rate. Consequently, it is clearly indicated that there exists the low level of integration of Central and East European area into the world capital market. Petreska and Blazevski (2013) investigated the existence of the Feldstein–Horioka puzzle in transition countries including Central and Eastern European countries during 1991–2010. The results of panel cointegration analysis showed that saving and investment are positively integrated into Central and Eastern European countries. Thus, they provide more proof supporting the existence of the Feldstein–Horioka puzzle in these countries. Irandoust (2017) examined the causal relationship between domestic saving and investment rates in 6 Eastern European countries (Estonia, Latvia, Lithuania, Ukraine, Belarus and Russia). The findings showed a strong causality between saving and investment, thereby implying that capital is not perfectly mobile internationally in these countries.

As seen from the literature, there are lots of studies in the literature evaluating international capital mobility by estimating the saving-investment correlation based

on Feldstein's and Horioka's criteria. It appears that there are studies that reject the Feldstein's and Horioka's hypothesis as well as studies supporting their arguments. Thus, among the economists, there is no consensus whether Feldstein–Horioka puzzle holds or not. However, to know the degree of domestic saving-investment nexus and its implication on international capital mobility, it is critical for policy-makers to design policies towards enhancing economic growth. Therefore, there is much room in the literature for empirical studies focusing on Feldstein's and Horioka's criteria in order to measure the degree of capital mobility.

3 Data, Methodology and Empirical Results

In this section, the relationship between domestic saving and investment in 15 Eastern European countries is examined by using Westerlund panel cointegration and Dumitrescu–Hurlin panel causality tests. The data is downloaded from the World Bank's World Development Indicators. Given the data availability, the annual data is used covering the period of 2000–2016 for the following countries: Belarus, Bulgaria, Czech Republic, Croatia, Estonia, Greece, Hungary, Lithuania, Latvia, Poland, Russia, Romania, Slovakia, Turkey and Ukraine. Thus, the data set consists of 17 years (T) related to each 15 Eastern European countries (N) covering the period of 2000–2016. Investment (INV) is the ratio of gross domestic investment to GDP and domestic saving (SAV) is the ratio of gross domestic saving to GDP.

When panel data is used to test the unit root, the cross-sectional dependency firstly must be tested. If the presence of cross-sectional dependency in the panel data set is rejected, the first generation unit root tests can be used. However, if there is cross-sectional dependency in the panel data set, it is better to use second generation unit root tests for consistent, efficient and powerful forecasting. Data for 17 years (T) and 15 Eastern European countries (N) covering the period of 2000–2016 is required to be employed the cross-sectional tests such as Breusch and Pagan (1980) LM test, Peseran et al. (2008) LM adjusted Test, Pesaran (2004) CDLM test and Pesaran (2004) CD test. All of these tests are suitable to check for cross-sectional dependency in the case of T>N. Accordingly, these cross-sectional dependency tests are performed for each variable and cointegration equation in order to test the null hypothesis that "there is no cross-sectional dependency between units". Results of the tests are presented in Table 1. According to the cross-sectional dependency test results, the null hypothesis "there is no cross-sectional dependency between units" is statistically rejected. Thus, in order to find out the stationary status of time series, it is necessary to use second generation unit root tests which take cross-sectional dependency into consideration.

Given the presence of cross-sectional dependency in the panel data, it became a necessity to use the second generation unit root tests in this study. Accordingly, two tests are performed such as the covariate-augmented Dickey–Fuller (CADF) test and CIPS test. CADF tests separately for each country data whether the series have stationary process. CIPS test, which is an extension of the CADF test, is a unit root test

Table 1 Cross-sectional dependence tests

Tests	SAV	INV	Cointegration equation
LM (Breusch and Pagan 1980)	415.519 (0.000)	496.798 (0.000)	477.324 (0.000)
LM adj (Pesaran et al. 2008)	128.361 (0.000)	166.785 (0.000)	132.451 (0.000)
CDLM (Pesaran 2004)	21.430 (0.000)	27.049 (0.000)	19.402 (0.000)
CD (Pesaran 2004)	20.961 (0.000)	26.580 (0.000)	18.972 (0.000)

Note The relevant values are the test statistic and the p values in parentheses. *Ho* there is no cross-sectional dependency between units. *Ha* cross-sectional dependency between units

for the parent panel. Table 2 shows the results of applying the second-generation unit root tests for the Eastern European countries to the panel data. Results obtained from both tests indicate that saving and investment are nonstationary, but both become stationary after taking their first difference.

After the unit root tests have been performed, a cointegration test is conducted to investigate whether there is a long-term relationship between shocks in the series. The Westerlund (2007) cointegration analysis method, which takes cross-sectional dependency into account, is used to investigate a long-term reciprocal relationship between saving and investment. This method is based on the assumption that the

Table 2 Unit root test (CADF–CIPS)

	SAV	D(SAV)	INV	D(INV)
Belarus	−1.296	−2.734*	−1.317	−2.873**
Bulgaria	−2.238	−2.811**	−2.355	−3.438***
Czech Republic	−1.744	−2.949**	−1.428	−2.653*
Croatia	−2.633	−3.654***	−2.283	−2.686*
Estonia	−1.785	−2.695*	−1.764	−2.775**
Greece	−2.005	−2.845**	−1.954	−2.885**
Hungary	−1.703	−2.658*	−2.013	−3.026***
Lithuania	−1.746	−2.661*	−1.268	−2.678*
Latvia	−1.357	−2.743*	−1.673	−2.857**
Poland	−1.889	−2.782**	−1.993	−2.827**
Russia	−2.567	−3.635***	−2.341	−3.433***
Romania	−1.875	−2.872**	−1.810	−2.734*
Slovakia	−1.568	−2.779**	−1.692	−2.792**
Turkey	−2.218	−2.857**	−1.779	−2.765*
Ukraine	−2.427	−2.994**	−2.016	−2.933**
CIPS (panel)	−1.487	−2.98*	−1.674	−3.004*

Note Pesaran (2007) CADF test critic values: 10% (*): −2.64, 5% (**): −2.77, 1% (***): −3.00, Pesaran (2007) CIPS critic value: −2.96. *Ho* has a unit root. *Ha* has not a unit root

Table 3 Westerlund (ECM) panel cointegration test

Tests	Test statistics	Probability values of boostrap
G_τ	−4.066	0.000***
G_a	−3.775	0.000***
P_τ	−6.032	0.000***
P_a	−3.763	0.000***

Note The bootstrap cycle is 10,000 units. Regression contains a constant. The delays and precursors are set to 2. *Ho* there is no cointegration. *Ha* there is a cointegration

panel series are at the same level and I(1) is stationary in the first difference. Westerlund developed four tests based on the error correction model to eliminate the lack of other panel cointegration tests. Accordingly, Westerlund (2007) cointegration analysis includes four new panel cointegration tests (G_τ, G_a, P_τ and P_a) based on structural dynamics instead of residual dynamics. The first two tests in the panel cointegration test are the group mean statistics (G_τ and G_a), and the last two tests show panel statistics (P_τ, and P_a). The panel statistics consist of the information about the error correction of the horizontal cross-sectional dimension of the panel. Group average statistics do not use this information.

The results of Westerlund panel cointegration test are given in Table 3. The probability values of G_α, G_τ, P_τ and P_a are less than 1%, providing an evidence of a long-run relationship between domestic saving and investment in the Eastern European countries. Thus, findings indicated that domestic saving and investment integrated with each other in the long-run since the null hypothesis that "there is no a cointegration" is rejected. These findings imply that the economies of Eastern European countries are not perfectly integrated with the world capital market.

After determining that there is a long-run relationship between domestic saving and investment, cointegration equation can also be estimated. Pesaran (2006) developed the Common Correlated Effects (CCE) method which predicts cointegration coefficients in the presence of cross-sectional dependency. This method estimates the cointegration coefficient of the panel as a whole after determining the individual cointegration coefficients in Common Correlated Mean Group Effect (CCMGE) method. However, it is more plausible that the general effect of the panel of each country differs depending on the differences in the economic sizes of the countries. In panel Augmented Mean Group (AMG) method developed by Eberhardt and Bond (2009), while considering the dependence between the cross sections, the average group effect is calculated by weighting the individual results and individual coefficients of the panel at the same time. This is more reliable than CCMGE. The panel AMG method can also take into account common factors in the series and common dynamic effects, produce effective results in unstable panellists, and be used in the presence of the problem of internality related to the error term. Therefore, the panel AMG (Augmented Mean Group) method is preferred in order to estimate the long-term coefficient related to nexus between domestic saving and investment in this section.

Table 4 Estimation of long-term coefficient

	Coefficient	Probability value
Panel (General)	8.275	0.030**

Note *, ** and *** indicate significance at 1%, 5% and 10% significance levels, respectively

The equation of cointegration based on the expectation that savings will affect investments is estimated by panel AMG method in the framework of the equation below:

$$\Delta \mathrm{INV}_{it} = \alpha_{1i} + \alpha_{2i} \Delta \mathrm{SAV}_{it} + \varepsilon_{it} \quad (1)$$

The result of long-term coefficient estimation in the framework of AMG method is given in Table 4. Considering that the panel-settled countries are considered generic, the 1% change in domestic savings that has taken place in the long term has increased investments by 8.275%. The coefficient of domestic saving is statistically and economically significant. The results from these long-run estimations show a high association between domestic saving and domestic investment and hence a low capital mobility in Eastern European countries. In other words, the result confirmed that the Feldstein–Horioka puzzle does hold for Eastern European countries.

The short-term relationships between the series are also examined by the estimation of the error correction model indicated below:

$$\Delta \mathrm{INV}_{it} = \alpha_{1i} + \alpha_{2i} \Delta \mathrm{SAV}_{it} + \alpha_{3i} \mathrm{ECT}_{1,i-1} + \varepsilon_{it} \quad (2)$$

The results of short-term analysis are given in Table 5. When the results are examined, it is seen that the coefficient of error correction term is negative and statistically significant. These results show that short-run divergences from the tendency of long-term relationship between the domestic saving and investment return long-term equilibrium values. This result of short-term analysis also proves that the series are cointegrated and that the results of long-term analysis with these series are reliable.

We also checked the direction of relationship between domestic saving and investment in Eastern European area by using Dumitrescu and Hurlin panel causality test (2012). All of the panel causality tests estimate under the assumption of cross-sectional independence. Only the Dumitrescu–Hurlin test can be used to predict both cross-sectional dependence and cross-sectional independence in order to achieve effective results. This test expresses the average of the individual Wald tests calculated for cross-sectional units under the Granger causality test. This test considers both

Table 5 Estimation of short-term coefficient

	Coefficient	Probability value	Error correction term	Probability
Panel (General)	0.983	0.043**	−0.644	0.011**

Note *, ** and *** indicate significance at 1%, 5% and 10% significance levels, respectively

Table 6 Dumitrescu–Hurlin panel causality test

Null hypothesis	Test	Statistics value (probability)
SAV is not the Granger cause of INV	*Whnc*	2.647(0.063***)
	Zhnc	2.364(0.068***)
	Ztild	2.016(0.082***)
INV is not the Granger cause of SAV	*Whnc*	1.435(0.136)
	Zhnc	1.946(0.105)
	Ztild	1.744(0.128)

Note *, ** and *** indicate significance at 1%, 5% and 10% significance levels, respectively

heterogeneity and section dependence. Another characteristic of the Dumitrescu–Hurlin test is that it works both in the presence and in the absence of a cointegrated relationship. In this test, where three different test statistics (h, h,) are calculated, the null hypothesis claims that there is no causal relationship between the variables. Table 6 gives the results of the panel causality test and indicates that the unidirectional relationship between saving and investment for the 15 Eastern European countries runs from domestic saving to investment. Thus, this unidirectional causality relationship again implies a low degree of international capital integration in the Eastern European region.

Overall, empirical findings show a positive and significant correlation between national saving and domestic investment rates in Eastern European countries. The implications of these findings suggest that a large proportion of domestic investment is financed by domestic saving in Eastern European countries. In other words, the results show that the effect of national saving on national investment is notable in Eastern European area. The saving-investment relationship is closely tied to the pattern of capital flow and gives important information on the integration of the national capital markets into the world capital market, as well as the economic growth process.

A strong relationship between saving and investment implies that the capital is not perfectly mobile yet in the Eastern European countries. It is based on the assumption that in a world with perfect capital mobility, a country will be able to have a very little correlation between domestic saving and investment. If perfect capital mobility does not exist, then a country's investment rates strongly correspond to any change in the saving rates. Most of the Eastern European countries made a rapid shift from a planned economy to open market system by establishing the relevant legal framework and economic institutions after 1990. Special priority has also been given to the liberalization of capital accounts in order to integrate into international financial markets. However, empirical results of this study indicated that Eastern European countries are not open enough to the cross-border capital flows.

Low capital mobility means that domestic investment is mostly financed by domestic saving, while foreign saving plays a marginal role. Thus, a country's saving rate in the Eastern European countries is determined by households' attitudes towards savings. Given the low saving propensity of households, it can be indicated that these

countries are in a significant constraint to finance their investments and hence economic growth. Because of this reason, the key factor for triggering a virtuous cycle of high saving and investment rates and accelerating growth in these economies is to attract much more foreign saving by increasing capital inflows. Accordingly, the integration process of financial markets into the world capital market is important for the economic growth in Eastern European countries since access to foreign capital allows for expansion into investments under the constraint of domestic savings.

From a policy point of view, it can be asserted that the priority should be given to the liberalization of capital accounts in order to be integrated with the international financial markets. Thus, creating an environment that is conducive to the mobilization of foreign capital obviously can also play an important role in increasing the overall levels of domestic investment. In a perfectly free capital mobility world, the foreign capital emerges as one of the central factors for the efficient channelling of foreign savings into growth-enhancing investment. In other words, capital inflows to Eastern European countries can serve as a stimulant to investment as well as economic growth. Therefore, it is recommended that further measures must be taken by relevant authorities to initiate policies that will improve capital mobility in Eastern European countries as inefficient domestic savings cannot fully meet the requirements of domestic investment. In conclusion, empirical findings of this study reveal low capital mobility and suggest policies that will improve capital mobility in Eastern European countries in order to get advantage of foreign savings for financing domestic investment.

4 Conclusion

The degree of capital mobility is increasing while the world financial markets are becoming increasingly integrated. This paper aims to augment the literature on measuring the degree of financial integration based on Feldstein's and Horioka's criteria. Accordingly, by examining the relations between saving and investment, this paper provides an empirical investigation of the degree of financial integration of Eastern European countries into the world capital market. The relationship between domestic saving and investment in 15 Eastern European countries has been examined using Westerlund panel cointegration test and Dumitrescu–Hurlin panel causality test for the data from 2000 to 2016. The results of panel cointegration analysis show that saving and investment have a long-run relationship. Panel causality test reveals that direction of causality runs from saving to investment. Thus, the empirical evidence presented in this study points to a strong positive relationship between national saving and investment. It seems that the effect of national saving on national investment is notable in Eastern European area. All of these findings imply that the financial markets of the Eastern European countries are not perfectly integrated into the world capital market.

The low degree of integration of Eastern European countries into the world financial markets can be attributed to the inefficient capital liberalization efforts that have been made since the 1990s. It is also worth mentioning when interpreting the results that in a free capital mobility world, domestic savings are still significantly matters for domestic investment in Eastern European area. The presence of domestic saving-driven investment implies that the amount of investment and the potential for economic growth are still limited by the low propensity to saving of households. However, in a world where international capital flows are growing, by attracting foreign capitals, developing countries have the opportunity to compensate for low local saving rates which are ineffective in financing their investments. This may be one of the key factors for triggering a virtuous cycle of high saving and investment rates and accelerating growth in Eastern European countries. Therefore, it is clear that policy-makers in Eastern European area should aim at encouraging foreign capital flows to their countries much more in order to finance domestic investment and hence promoting economic growth.

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Starting New Business and Access to Finance: A Panel Data Investigation

Valentina Diana Rusu and Angela Roman

Abstract The objective of our paper is to investigate how the access to finance affects the creation of new business in EU, by identifying the relationship between several indicators, measuring the access to finance, the specifics of business environment, and the dynamics of new business creation. Our analysis includes ten indicators and it is covering the period from 2007 to 2016. We use a fixed effect model on panel data for 18 EU countries. The dependent variable is the nascent entrepreneurship rate, which we use as a proxy for the creation of new business. As independent variables, we use indicators expressing the availability of financial resources and measuring the specifics of business environment. We considered also several control variables. Our results highlight that starting new business in EU countries is significantly linked to easy access to finance. Thus, the creation of new business is encouraged when it is easier to obtain financial resources. Also, the characteristics of business environment are indirectly affecting the creation of new business. Our study contributes to completing the literature in the field by providing empirical evidence regarding the effects of access to finance to the start of new business in the EU.

Keywords Nascent entrepreneurship · Financial constraints · Venture capital · Equity market · Panel data

1 Introduction

The access to financial resources is indispensable for the proper development of a business. The survival and growth of many firms are conditioned by providing easy access to finance. Financing constraints are one of the biggest problems of the newly

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*, Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_7

established entrepreneurs. Most of the times, the businesses in their early stages face important constraints when are seeking financing resources. Bastié et al. (2013) have shown that access to financial resources plays an important role for the creation of new firms, highlighting that finance affects the mode of enterprises entry.

Starting from the stated problem, the primary objective of this paper is to investigate if the access to finance affects the creation of new business in the European Union member countries, by identifying the relationship between several indicators, measuring the access to finance and the specifics of business environment, and the dynamics of new business creation. Our analysis includes ten indicators and it is covering the period from 2007 to 2016. In order to realize the empirical analysis, we apply a fixed effect model approach on a panel data for a period of 10 years and 18 European Union member countries (Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom). We chose only 18 EU member countries due to the availability of data for the entire period and for all the indicators considered in the analysis.

Our study contributes to completing the literature in the field by providing empirical evidence of the extent to which access to finance encourages or hampers the start of new business in the European Union member countries.

The rest of this paper is organized as follows. In the second section, we briefly discuss the streams of literature that relate to our analysis, and that emphasize the financing behavior of the entrepreneurs in their early stages. In the third section, we describe the sample considered for analysis and also the methods used. In the fourth section, we present the results of the empirical investigation and also discussions on these results. The paper ends with some concluding remarks.

2 Literature Review

The vital role of entrepreneurship and of a high level of new business creation for the development of economies led to an increase of the interest of researchers and policy makers for investigating the factors which stimulate or hamper the starting of new business. Several empirical studies have indicated financial capital as being between the main predictors of entrepreneurship.

Financial capital is the main resource needed by a business to operate and survive in its nascent stage. In the case of new business, entrepreneurs may find it difficult to obtain financing from bank and debt financing because they do not have sufficient guarantees and skills to signal to potential prospects their current and future capabilities.

The literature in the field has analyzed the financing behavior of entrepreneurs in their early stages. Blumberg and Letterie (2002) realized an empirical analysis to identify which individuals face difficulties in obtaining financial resources when they decide to start a new business and found that exist a series of factors that affect the access to external financial resources, such as: home ownership, the experience of the

individual from other jobs, the level of education, family composition, nationality, parental self-employment, multiple-ownership, and income derived from previous occupation. They also emphasize that business plans and support obtained from an accountant are effective ways to signal credibility to a bank and to obtain more easy financial resources in the early stage of the business. On the other hand, Arenius and Minniti (2005) find that entrepreneurs are usually confronted with liquidity constraints and those individuals who have greater family wealth are more likely to switch from employment to entrepreneurship.

Klapper et al. (2006) using a sample of European firms highlight that financial development has a positive effect on the entry of new firms in the sectors that are more dependent on external financing. Moreover, they find that entry regulations are also associated with lower entry rates and larger entry size in sectors with higher natural turnover rates. Similar findings are obtained by Alfaro and Charlton (2006) which, using a large cross-sectional firm-level data set for 1999–2004, have shown that reducing restrictions on international capital flows enhances firm entry. Moreover, De Serres et al. (2006), analyzing a sample of 25 OECD countries, have shown that regulation and the efficiency of financial systems can have a positive impact on the entry of new firms.

Kessler and Frank (2009) after realizing a longitudinal study on 290 nascent entrepreneurs in Austria over a period of three years showed that founding resources constitute significant predictors along with other influencing factors: the person of an entrepreneur, the environment, and the start-up process. Frid (2009) examines the types of financial resources that entrepreneurs acquire in the early stages of a business and how the characteristics of the entrepreneur, firm, and industry affect access to finance. Their results show that nascent entrepreneurs seem to use personal funds as the only source of funding in the early stages of the business, and the characteristics of the entrepreneur seem to have an effect on the acquisition of financial resources. Gradually, with the passage of time, it is likely that these entrepreneurs will use external sources of funding. In the same note, Gartner et al. (2012) have shown that almost 60% of all financing used by new business comes from personal contributions. Also, the study highlights that the nascent entrepreneurs with higher levels of education were more likely to use external financing.

More recent studies (Popov and Rosenboom 2013) using panel data for 21 European countries examine the impact of venture capital investment on creating new business. The authors find that the impact of venture capital is positive, especially in R&D-intensive industries and in countries with lower taxes on capital gains and higher human capital.

Hechavarria et al. (2015) realize an empirical study on the US start-ups with the purpose of providing evidence on how these newly established firms choose their ownership and initial capital structure, and why the decision regarding initial capital structure plays an important role for the future of the firm. Their results emphasize that the decision regarding the initial capital structure exerts influence on the future outcomes that the firm might obtain. Thus, newly established firms that use larger proportions of external equity in their initial capital structure have a higher chance

to become new firms more quickly over time. In the same time, the firms that use a higher share of debt and equity are also less likely to quit over time.

Aparicio et al. (2016) analyze credit constraints as a potential barrier to the entry and post-entry growth of firms. Their results show that finance matters most for the entry of small firms, especially in those sectors that are more dependent upon external finance. They also find that higher entry on the market stimulates the growth of the industry, because new entrants can determine the firm with inefficient activity to exit and can determine the efficient ones to innovate.

The review of the empirical studies in the field has shown the existence of a small number of recent researches focused on the EU member countries. Therefore, our study complements the literature in the field of entrepreneurship by providing empirical evidence on the relationship between access to finance and specifics of business environment in EU countries.

3 Materials and Methods

The objective of our paper is to test if the access to finance affects the creation of new business in the European Union member countries, by identifying the relationship between a series of indicators, measuring the access to finance and the specifics of business environment and new business start-ups. Our analysis targets 10 indicators and it is covering the period from 2007 to 2016. The annual data for the indicators considered in the analysis are obtained from the Global Entrepreneurship Monitor database (2018), World Bank Data Bank (2018a), and TCdata360 (World Bank 2018b), for 18 countries member of the European Union (Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom). We chose only 18 EU member countries due to the availability of data.

For measuring the level of new business start-ups, we use as a proxy *the nascent entrepreneurship rate* (NER), which is considered by the Global Entrepreneurship Monitor to be expressed by the percentage of working-age population (between 18 and 64 years) who are currently a nascent entrepreneur actively involved in setting up a business they will own or co-own. This business has not paid salaries, wages, or any other payments to the owners for more than three months.

From Fig. 1, we observe that new business creation has registered a decrease in the years when the financial crisis was felt in the EU countries (2009 and 2010). From 2011, the nascent entrepreneurship rate (NER) has registered an increasing trend, with a slight decrease in 2013. In 2016, NER has registered an increase with 1.5% compared to the year when we began the analysis, 2007.

The explanatory variables considered for our model reflect the availability of different types of financing (debt financing, venture capital, and local equity market) for the business in the EU member countries. We also use a series of business environment characteristics and macroeconomic indicators as control variables. All these

variables and their expected relationship with the dependent variable are summarized in Table 1.

The studies in the field have shown the importance of debt financing and ease access to loans for the creation of new firms on the market. Therefore, Aghion et al. (2007) show that credit constraints are a potential barrier to the entry of firms. They also found that finance matters most for the entry of small firms, especially in the sectors that are more dependent on external financing. Thus, relaxing credit constraints has a higher positive effect on the entry of small firms than of larger firms and higher financial development of a country stimulates the growth of new firms. From another perspective, the results of Wennekers et al. (2005) suggested

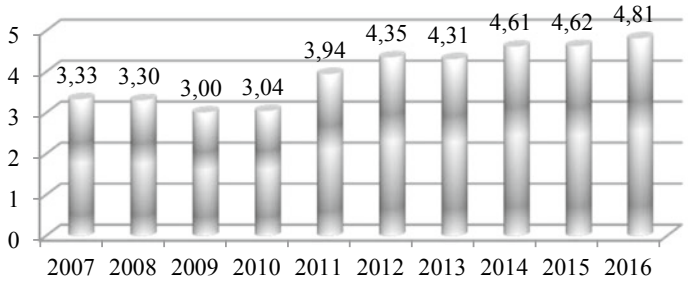

Fig. 1 The dynamics of nascent entrepreneurship rate, 2007–2016 (*Source* authors' own calculations after Global Entrepreneurship Monitor 2018)

Table 1 The explanatory variables of the model and the expected relationship

Explanatory variable (abbreviation)	Measurement	Expected sign
Availability of debt financing (debt)	Domestic credit provided by financial sector (percentage of GDP)	±
Venture capital financing (venture)	Percentage of GDP	±
Ease of access to loans (loans)	Measured from 1 (worst) to 7 (the best)	+
Financing through local equity market (equitym)	Measured from 1 (worst) to 7 (the best)	+
Cost of business start-up procedures (cost)	Percent of GNI/capita	−
Time required to start a business (time)	Number of days	−
Number of procedures for starting a business (noproc)	Number of procedures	−
Control variables		
GDP growth (GDP)	Annual percentage growth	+
Inflation rate (Infl)	Consumer prices, annual percentage	±

Source processed by the authors

that there exists a "natural rate" of nascent entrepreneurship that is related to the level of economic development, and these new entrepreneurs are not necessarily affected by the availability of debt financing. They also show that for the majority of developed countries, improving incentive offered to business start-ups has the effect of increasing the number of entrepreneurs. For developing economies, they identify other factors that affect the new business creation, such as: foreign direct investment and promoting management education.

Other empirical studies (Black and Strahan 2002; Hurst and Lusardi 2004; Kim et al. 2006; Mueller 2006; Aghion et al. 2007; Musso and Schiavo 2008; Klapper et al. 2010; Werner 2011; Paniagua and Sapena 2015) indicate that the availability of financial capital and the ease of access to finance for potential entrepreneurs can lead to an increase in the number of entrepreneurs and also to the development of entrepreneurship.

Credit granted by financial sector can be positively related with new business creation because the increase in credit flows to the private sector determines an easier access to finance that is stimulating new business start-ups and the development of the existing firms (Aghion et al. 2007; Klapper et al. 2010; Vidal-Suñé and Lopez-Panisello 2013; Sayed and Slimane 2014; Arin et al. 2015). However, a couple of empirical studies (Hurt and Lusardi 2004; Kim et al. 2006; Mueller 2006) have indicated the existence of a negative relationship between access to finance and new business creation because the access to finance is not considered to be a problem for earliest stages enterprises, because many of them do not need large amounts of financial capital in their initial phase. Thus, new start-ups continue to enter the market, even if their access to debt financing is decreasing, like in the case of an economic downturn or a financial crisis.

Besides the indicator expressing the availability of debt financing, we have considered for the analysis the indicator measuring the perception of the entrepreneurs regarding the ease of access to loans. Ease of access to loans takes values between 1 and 7 (showing the best access). Financing constraints are one of the biggest concerns with the impact on potential entrepreneurs. We expect that if the access to different sources of financing is easier, then the creation of new business on the market to be encouraged. Because loans are between the most preferred sources of financing of the enterprises in Europe (Robb and Robinson 2014; European Commission 2015), we consider the indicator expressing the ease of access to loans an important determinant of the decision to start a new business.

Venture capital financing is another source of funding whose availability plays an important role in creating new businesses on the market. Venture capital help start-up enterprises to reduce the time needed to develop a new product and put it on the market. Besides offering the necessary funds, venture capitalists offer help and expertise in the needed fields. Venture capital companies are seen as better investor than banks because they share also the potential profits and losses of a start-up, while banks only share losses.

Venture capital represents an important part of national economies, because the enterprises that are supported by this type of financing create new employment

positions, develop innovative technologies, and can be a significant contributor to GDP.

According to the European Investment Fund, the attractiveness of European Venture Capital as an alternative asset class has grown in the last years, with the purpose of supporting innovation and entrepreneurship. Venture capital investment increased in Europe by 2% in 2016 reaching the value of 4.3 billion euro and a number of 3.124 companies that received investment. Analyzing investments by stage, venture capital for start-ups reached in 2016 the value of 2.0 billion euro (compared to 2.2 in 2015 and 1.6 in 2012). The number of companies that benefited from venture capital investments increased from 1.923 in 2012 to 2.057 in 2015, and 1844 in 2016 (Invest Europe 2016, pp. 32–33).

The majority of empirical studies in the field highlighted a positive relationship between venture capital investments and new business creation. Puri and Zarutskie (2012) found that venture capital investors finance the companies that have no initial revenues but only if they demonstrate stronger growth potential. They also show that venture capital-backed companies grow faster at every stage of the investment cycle, both before and after the receipt of venture capital. Samila and Sorenson (2011) using panel data have examined the relationship between venture capital financing and the number of start-ups, the level of employment and income, and found that exist a positive relationship between venture capital financing and all the number of start-ups on the market. Moreover, they showed that an increase in venture capital investments determines the increase of new business creation. Following the same line of thinking, Popov and Roosenboom (2013) found that higher levels of venture capital investment were associated with more entry on the market, especially in industries with high investments in research and development. Also, they demonstrated the existence of a positive correlation between venture capital, new entry on the market, and employment growth.

Because debt financing is sometimes difficult to obtain by newly established firms, often they turn to equity financing to get the financial resources they need. Between the most used sources of external equity financing, we can mention: family or friends, business angels or venture capital. An entrepreneur who obtains money through equity financing is, in fact, selling parts of its enterprise in return for outside investment. An advantage of this type of financing for newly established enterprises, as shown by Oranburg (2016), is that they do not have any loan that has to be paid back. Thus, the start-up gains certain flexibility and can invest capital in the growth of the business. Investors usually do not ask to be paid back until the business starts to obtain profit. And, even when the business becomes profitable, equity investors may want to reinvest the profits obtained in order to sustain the continuous growth of the business (Booth 2014).

The business environment characteristics are important determinants for the opportunities of starting a firm; thus, in our empirical analysis, we consider as explanatory variables: the cost of business start-up procedures, the time required to start a business, and the number of procedures needed for creating a new firm. Aparicio et al. (2016) have found empirical evidence highlighting the fact that start-up costs discourage the entry of new firms on the market. Other empirical studies that

have considered for the analysis of these variables (Grilo and Thurik 2004; Wennekers et al. 2005; Klapper et al. 2006; Van Stel et al. 2007; Aghion et al. 2007; Klapper and Love 2011) have shown that the entry of new firms on the market is seriously discouraged by factors expressing bureaucratic barriers like the costs, procedures, and time needed to create a new business and also by employment rigidity.

As regards the control variables, GDP controls for different economic growth levels in the sample of 18 European Union countries. Also, inflation rate controls for different stages of economic development. We consider indicators of economic development as control variables because some studies (such as Wennekers et al. 2005) have found a significant relationship between the level of economic development of a country and the nascent entrepreneurship rate.

Starting from those stated above, we formulated two hypotheses that we intend to test through panel data regression models:

Hypothesis 1: the ease of access to financial resources has a positive relationship with the creation of a new business
Hypothesis 2: the considered characteristics of business environment are negatively affecting the creation of new business.

We started our empirical analysis by testing the variables for unit root, in order to see if data is stationary and to control for the existence of false relationship among variables. The null hypothesis (considering that all the variables contain unit root) was rejected in almost all the cases. Only one variable had a unit root (the number of procedures) and we have determined the first difference for this variable. Therefore, they met the necessary conditions to apply a regression analysis on this data.

Further, we have analyzed the descriptive statistics of the variables, the correlations between variables and we have applied the regression model.

To obtain the estimated coefficients of the regression models, we have applied a panel data regression model. The equation of our model is:

$$NER_{it} = \alpha_i + \beta_1 debt_{it} + \beta_2 venture_{it} + \beta_3 loans_{it} + \beta_4 equitym_{it} + \beta_5 cost_{it} + \beta_6 time_{it} + \beta_7 noproc_{it} + \varepsilon_{it} \quad (1)$$

where NER_{it} is the dependent variable; $\beta_1 \ldots \beta_7$ are the coefficients; *debt* is availability of debt financing; *venture*—venture capital financing; *loans*—ease of access to loans; *equitym*—financing through local equity market; *cost*—cost of business start-up procedures; *time*—time required to start a business; *noproc*—number of procedures for starting a business; α_i represents all the stable characteristics of the countries; i represents the unknown intercept of every country; t is the year analyzed; ε_{it} is the error term.

The results of the empirical analysis are presented in the following section.

4 Results and Discussion

The results obtained for the descriptive statistics of the variables included in the analysis are summarized in Table 2. From the results obtained, we observe that nascent entrepreneurship rate varies across countries and also over time, from 1.3% of the working-age population (Italy, 2010) to 9.7% (Latvia, 2016).

Domestic credit provided by financial sector has registered the highest variation, compared to the other independent variables. The smallest value of the credits granted by financial sector, of 34% of GDP, was registered in Romania (2016), while the highest value of this indicator was registered in Spain (in 2011, almost 250% of GDP). The high value of standard deviation for this variable indicates that there exist important differences between countries regarding the availability of debt financing, and also that the availability of debt financing has varied significantly across the years analyzed.

Venture capital as a percentage of GDP varies from zero in Greece (2012, 2014, 2015) to 1.6% in the United Kingdom (2007). The mean value of only 0.25% shows that venture capital is a form of finance not very used by the enterprises, maybe because they do not have information about how to access it. The use of venture capital has observed an important decrease in 2009, on the background of the financial crisis, and still did not reach the pre-crisis value.

Ease of access to loans and financing through local equity market are the two variables that express the perceptions about the access to loans and to equity market. Access to loans is harder in Greece, in 2013, this indicator obtained values slightly higher than 1, and easier in Denmark in 2007 (a value of 5.5). Access to financing through equity market has higher values than financing through loans, fact shows that the enterprises from EU countries consider harder to access loans than financing

Table 2 Descriptive statistics of the variables used in our analysis

Variable	Min.	Max.	Mean	Std. deviation
Ner	1.300	9.700	3.909	1.525
Credit	34.100	248.940	142.854	56.387
Venture	0.000	1.568	0.250	0.264
Loans	1.570	5.510	3.253	0.995
Equity	2.120	6.240	3.925	0.912
Cost	0.000	22.500	4.712	5.461
Time	2.500	61.000	11.308	9.648
Noproc	3.000	15.000	5.744	2.510
GDP	−14.350	26.300	0.686	3.801
Infl	−4.480	15.400	1.851	2.225

Note for "venture" were no available data for Croatia, Latvia, and Slovenia
Source authors' calculations

through equity market. The smallest value of this indicator was registered in Greece (2016) and the highest value in Sweden (2007).

The time needed to start a new business has also registered a high standard deviation expressing important variations from 2.5 days in Portugal (2013 and 2014) to 61 days in Spain (2008 and 2009). Cost of business start-up procedures varied from no costs in Denmark and Slovenia for almost all the period considered for the analysis to almost 23% of GNI/capita in Greece (2008). The number of procedures needed for creating a new business varied from three in Belgium, Finland, and Sweden for all the considered period to 15 in Greece (2007–2010). For this indicator, we observed a tendency of improvement, in the last years, in the countries where the number of procedures needed was too high.

The control variables considered in the analysis—GDP and inflation—have registered, especially in the last four years, a tendency of improvement, almost all the countries registering an improvement of the economic growth rates and also lower rates of inflation.

The correlation matrix of the considered variables is presented in Table 3. For some of the explanatory variables, we observe a high correlation coefficient (above 0.80).

We consider the reference point the value of 0.80 according to the findings of Kennedy (2008). Because we identify the presence of multicollinearity between some of the explanatory variables, we use separate regression models by excluding one of the two highly correlated variables, and so obtaining accurate results.

The purpose of the applied panel regression analysis is to test if the access to finance affects the creation of new business in EU countries. In order to empirically analyze the relationship between the creation of new business and the considered factors, we use panel data regression models. We determine the estimator variance–covariance matrix by the white cross method. The results obtained after applying the panel data regression models are summarized in Table 4.

Generally speaking, our results are consistent with the predictions of theoretical studies, but also with the results of the empirical studies in the field. The coefficient for the availability of debt financing is negative and statistically significant at 1% level. This result shows that in EU-18 countries, the new businesses continue to be created even if the availability of debt financing decreases, because, in their initial phase, the newly established firms often do not require very large amounts of money, and they are able to obtain their financial resources for setting up from informal sources. These results are consistent with the results obtained by Hurt and Lusardi (2004), Kim et al. (2006) and Mueller (2006).

Venture capital financing has also a negative coefficient and statistically significant at a 5% level. This result shows that the creation of new businesses will continue even if the availability of venture capital is reduced, because very few firms have knowledge of how to apply and use this funding source and are targeting other funding ways. Also, using venture capital implies that the investor will own a part of the newly established firm and many new entrepreneurs are not willing to share their business from its early stage.

Table 3 Correlation matrix

	Ner	Credit	Venture	Access	Equitym	Cost	Time	Noproc	GDP	Infl
Ner	1.000									
Credit	0.207	1.000								
Venture	0.400	−0.528	1.000							
Access	0.683*	−0.380	0.830*	1.000						
Equitym	0.461	−0.619	0.881*	0.950*	1.000					
Cost	−0.857*	0.007	0.699*	0.862*	0.706*	1.000				
Time	−0.803*	−0.185	0.752*	0.934*	0.827*	0.972*	1.000			
Noproc	−0.824*	0.058	0.668*	0.836*	0.688*	0.984*	0.955*	1.000		
GDP	0.344	−0.558	0.597	0.095	0.297	−0.098	−0.063	−0.128	1.000	
Infl	−0.487	0.093	0.660	0.716*	0.595	0.734*	0.683*	0.737*	0.100	1.000

Note * denotes that coefficients are significant at 5% level

Table 4 Factors affecting the creation of new business

Dependent variable: Nascent entrepreneurship rate				
	Coefficient	Prob.	Adjusted R-squared	F-statistic
Predictors				
Availability of debt financing	−0.005***	0.006	0.5546	11.179***
Venture capital financing	−0.764*	0.066		
Ease of access to loans	0.219**	0.043		
Financing through local equity market	0.361***	0.003		
Cost of business start-up procedures	−0.035*	0.060		
Time required to start a business	−0.009**	0.027		
Number of procedures for starting a business	−0.003	0.927		
Control variables				
GDP growth	0.079***	0.008		
Inflation rate	−0.075	0.120		

Note *, ** and *** denotes that coefficients are significant at 10, 5, and 1% level
Source authors' calculations

Ease of access to loans has a positive coefficient and statistically significant at a 5% level. This result shows that the new business start-up is encouraged when it is easier to obtain loans to finance the beginning of the activity. Similar result is obtained for the variable financing through local equity market. This variable has obtained also a positive coefficient and statistically significant at a 1% level, fact that shows that the creation of new enterprises is encouraged when it is increasing the access to resources of financing that are coming from the local equity market.

All three variables expressing the characteristics of business environment, namely cost, time, and number of procedures, have a negative coefficient. But only cost and time have statistically significant coefficient. These results are showing that the creation of new business is discouraged when the cost of business start-up procedures is high, and also when are needed many number of days for the creation of a new business. According to our results, the number of procedures needed for starting a new business does not have a significant effect on the creation of new business. Our findings are in line with the results obtained in the literature in the field (Grilo and Thurik 2004; Wennekers et al. 2005; Klapper et al. 2006; Van Stel et al. 2007; Aghion et al. 2007; Klapper and Love 2011; Aparicio et al. 2016).

The coefficient of inflation rate is negative but is not statistically significant. The coefficient of GDP is positive and statistically significant at 1%. These results are in line with the findings of a series of empirical studies (Grilo and Thurik 2004; Klapper et al. 2010; Vidal-Suñé and Lopez-Panisello 2013; Aparicio et al. 2016) and show the increase of GDP has a positive impact on entrepreneurship because the increase of economic growth can determine an increased demand for a wide range of goods

and services that would stimulate entrepreneurial activity, especially new business start-ups.

The effects of the investigated variables combined for each model had a medium impact on nascent entrepreneurship rate as shown by adjusted R-squared value of around 55%. These results highlight the fact that we can also consider other factors that may affect the decision of starting up a new business.

5 Conclusions

The vital role of entrepreneurship and of a high level of new business creation for the development of economies led to an increase of the interest of researchers and policy makers for investigating the factors which stimulate or hamper the starting of new business. Several empirical studies have indicated financial capital as being between the main predictors of entrepreneurship.

In this paper, we investigated the relationship between the creation of new businesses and their access to financial resources and also the specifics of business environment. Easier access to financial capital is likely to help the start-up of a new company. Also, a friendlier business environment encourages the creation of new firms. Thus, a panel data regression model of new business creation based on access to financial resources and the specifics of business environment showed indeed that easy access to finance is a significant positive predictor for starting new business in EU. When the amount of personal wealth of the potential entrepreneurs is not enough for creating a new business, they will look for external financing resources. If the search for these resources is successful, the new firm will be created. But when the potential entrepreneurs are confronted with financial constraints and do not find other options for financing their ideas, they will be discouraged in creating a new business. However, the correlation between the characteristics of business environment and the creation of new business is negative. We found evidence that when the costs, time, and number of procedures needed to create a new company are increasing, the new business start-up is discouraged.

Therefore, our main conclusion is that access to finance and the specifics of business environment are important predictors of the start-up of new business. We consider that the results of our empirical investigation could be of interest to policy-makers, because they should be concerned about identifying the ways in which they can reduce the financial constraints faced by newly created firms in order to sustain innovative entrepreneurship with beneficial effects on economic growth.

The limitation of our empirical study comes from the different level of economic development of the countries considered in the sample. Thus, in future research, we intend to group the EU countries based on their level of economic development.

Acknowledgements This work was supported by a grant of the Alexandru Ioan Cuza University of Iasi, within the Research Grants program, Grant UAIC, code GI-UAIC-2017-02.

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An Environmental Surety Bond in Chosen CEE Countries as a Type of Financial Security in Case of an Environmental Damage

Jacek Lisowski and Aleksandra Hęćka

Abstract From year to year, the surety bonds (insurance guarantees) are becoming a more and more popular form of securing receivables of business entities, which is caused by many economic and legal factors. Increasingly, an alternative to civil liability insurance or bills is usually required by law for the purpose of performing a specific activity. Despite the relatively short content and relatively simple structure, the guarantee is an instrument that gives a wide range of possibilities to adapt to the type of transaction being secured, as well as the expectations of those entities that expect such security. It has been eight years since the Environmental Liability Directive 2004/35/CE was fully implemented. New regime, based on the 'polluter-pays' principle, has increased environmental liability with regard to prevention and remedying of environmental damage. The paper aims at description of an environmental surety bond as a financial instrument which gives a guarantee from an insurance company ensuring the liabilities of an operator, arising from ELD, will be met. On the one hand, it provides the necessary funds to the local authorities when operator defaults on its obligations and, on the other hand, creates incentives for the companies to promote environmental safeguards.

Keywords Environmental liability directive · Environmental damage · Environmental surety bond · 'Polluter-pays' principle · Financial security

1 Introduction

European Union's environmental policy aims at helping to create a healthy and sustainable environment for present and future generations. It has also a great impact on the well-being of both society and economy. One of the key factors, which guarantees

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*,
Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_8

above, is the protection of Europe's natural resources such as protected species, natural habitats, water, land and functions they performed. Negative effects of extensive use of natural resources through human activities, including major losses to biodiversity, and lack of the uniform environmental liability regime across the Member States led the European Union to implement in 2004 the Directive 2004/35/CE 'on environmental liability with regard to the prevention and remedying of environmental damage'.

This innovative legislation, based on the 'polluter-pays' principle, makes those whose activity has caused an imminent threat to the environment or an environmental damage liable for taking preventive and remedial action. Thus, financial security plays an important role in the Environmental Liability Directive (ELD). Due to the fact that standard general third party liability or property insurance does not cover a new type of liability, there is an opportunity for alternative financial instruments, such as environmental surety bond, to be developed.

2 Environmental Liability—Legal Basis

The 'polluter-pays' principle is, next to the principles of precaution and prevention and rectifying pollution at source, one of the main that the European environment policy, especially the ELD, rests on. Increased operator's [defined in Article 2(6) of ELD as 'any natural or legal, private or public person who operates or controls the occupational activity or (…), to whom decisive economic power over the technical functioning of such an activity has been delegated, including the holder of a permit or authorisation for such an activity or the person registering or notifying such an activity'] responsibility is to be held financially liable for preventing and remedying environmental damage to biodiversity, land and water. It should induce operators to adopt measures and develop practices to minimise the risks of environmental damage.

According to Article 3 of Environment Liability Directive, there are two types of operators: those carrying out dangerous activities described in Annex III of the Directive (e.g. IPCC/IED permit, waste licence/permit, discharges polluting substances to water, manufacture, use, storage, processing, filling, release into the environment and onsite transport of dangerous substances and GMOs) and those involved in all other occupational activities. First type of operators falls under strict liability, which means that there is no need to proof fault. For the others, a fault-based liability scheme applies; however, only for damages to protected species and natural habitats. What is crucial, there is no limit on financial liability, which means that the costs that a liable polluter may incur to remedy the environment can be very high.

From the ELD objective's point of view, which is to establish a common framework for the prevention and remedying of environmental damage, the most important regulations are contained in Article 5 and 6. According to them, liable polluter is under the duty to:

– take the necessary preventive measures if environmental damage has not yet occurred, but there is an imminent threat of such damage occurring and
– inform the competent authority and take all practicable steps in order to limit or to prevent the event and to remedy the damage if environmental damage has occurred.

The costs of above actions shall be borne by the operator. In case, where a competent authority acts in the place of an operator, that authority shall recover the costs it has incurred in relation to the preventive or remedial actions taken under the Directive (Article 8 of ELD). Such recoverable costs should include, inter alia, the costs of environmental assessments, any remediation efforts taken by the authority, the administrative, legal and enforcement costs, the cost of data collection, monitoring and supervision (Article 2(16) of ELD). According to Annex II of the ELD, there are three ways to achieve the restoration of the environment to its baseline condition: primary remediation, complimentary remediation and compensatory remediation.

Environmental liability in the Directive is imposed under administrative law, which means that preventive and remedial measures are mandated by a competent authority without prior court adjudication (OECD 2012, p. 12). Above is one of the main reasons, why traditional insurance product such as general third-party liability insurance can be not enough to cover environmental risk.

3 Environmental Damages in Europe

According to the second implementation report on the ELD,[1] presenting the experience gained in applying the Directive between 2007 and 2013, in the mentioned period, approximately 1.245 cases of environmental damage under ELD were reported. However, only two countries (Hungary and Poland) reported more than 86% of all damage cases. On the same time, eleven have reported no cases, possible because if there were any, they triggered their national system (European Commission 2016, p. 3).

Taking into consideration the category of environmental damage, most frequently, damages occur in land (more than a half of reported cases) and in water (around 30% of reported cases). On average, only one in five damage concerns biodiversity. According to the mentioned report, the most dangerous occupational activities causing environmental damage are connected with waste management, dangerous substances, actions under IED and transport of dangerous goods (European Commission 2016, pp. 3–4).

The costs of preventive and remedial actions can be very both resources and time considerable. According to the mentioned report, the average cost of remedy

[1]Report from the Commission to the Council and the European Parliament under Article 18(2) of Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage, COM (2016) 204 final, Brussels 2016.

in Member States is around EUR 42,000.[2] However, in Greece, a mean value is EUR 60,000. Individual cases were varied from a few thousand EUR to more than 50 million for large-scale losses. The total amount of remediation costs incurred in analysed Member States was around EUR 180 million (European Commission 2016, p. 6).

Box 1. Case Study: The Kolontár Red Sludge Disaster

On 4 October 2010, due to the accidental breach of a dam wall on a waste storage at the MAL aluminium processing plant in Hungary, a two-meter high wave of the sludge and water was unleashed. Approximately, 1 million m^3 of toxic red sludge and highly alkaline water spilt from the plant causing 10 people's death, injury of more than 200 others, destruction of ca. 350 homes, contamination of thousand hectares of land (including agriculture land), pollution of waterways and protected sites (including four Natura 2000 sites) with harm and destruction of all life in them.

Remediation costs were estimated at EUR 65 million. However, MAL had an insurance policy that did not provide cover for environmental damages but only for claims for traditional damage (bodily injury and property damage). What is more, the limit of liability, which was reportedly EUR 40,000, was highly insufficient for this kind of accidents. MAL was fined nearly EUR 420 million, which was the highest fine allowable by national law (Mackie et al. 2016, pp. 38–39). The Kolontár Red Sludge Disaster is one of Europe's largest environmental damage.

Due to the complex nature of environmental risk and lack of data sufficient to identify the probability and magnitude of impact (including the scale of potential environmental damage, the costs of preventive and remedial measures and the final impact on the company's financial condition), the environmental risk assessment is one of the most difficult stage in risk management process (Hęćka 2017, p. 45).

According to the author's own empirical research,[3] the most important area of environmental risk for enterprises is duty to bear the costs for the preventive and remedial actions (see Fig. 1). This may lead to the conclusion that companies are aware of the fact that these costs can be very high and could affect the financial results of companies.

Apart from bearing the prevention and/or remediation costs (mentioned by nearly 62% of respondents), enterprises are concerned about loss of business reputation (mentioned by 43% of respondents) and delays in the construction and/or production

[2]Calculated on the basis of 137 cases representing just over 10% of all reported ELD cases by Member State and without considering, in particular, the three largest losses.

[3]The survey was conducted in 2015 by the Computer-Assisted Telephone Interview CATI method among large polish enterprises from industries that could be regarded as highly exposed to environmental liabilities: food, energy and heating, chemical, raw materials and fuel, transport and logistics.

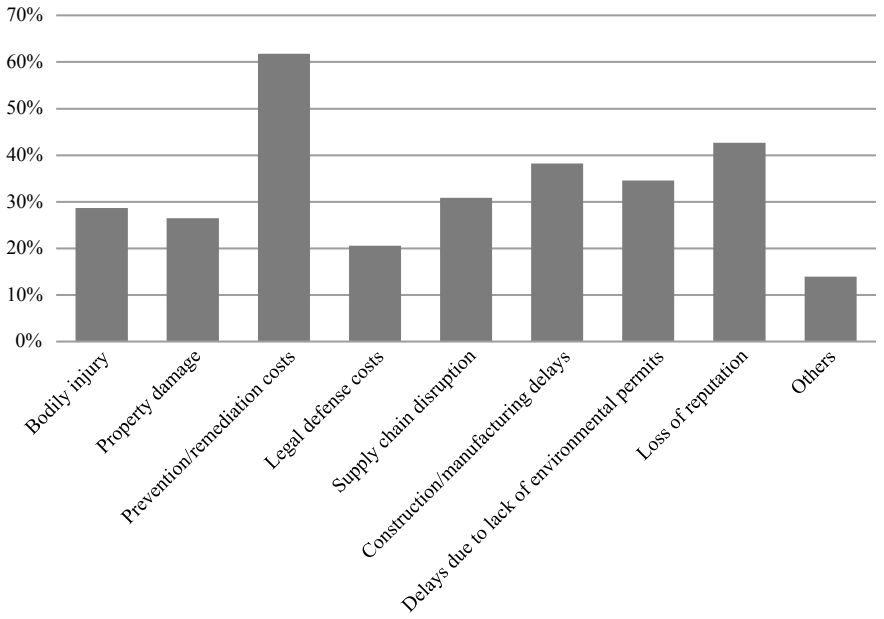

Fig. 1 The most important areas of environmental risk in polish companies (respondents could choose more than one answer). *Source* Authorial computation

caused by imminent threat to the environment or environmental damage (mentioned by 38% of respondents).

Because of the high level of costs related to environmental damages, liable operator, whose activity can lead to occurrence of such damage, should consider reducing it through the implement of financial security instruments. Additionally, financial provision for environmental damage is a rapidly developing requirement in the European Union.

4 Financial Security Instruments in Central and Eastern European Countries

There is a variety of financial security instruments to cover environmental liability in the Member States. Most common are insurance, bank guarantees, market-based instruments, financial guarantees and others (Bio Intelligence Service 2008, pp. 32–35). The main role in providing such cover plays an insurance market, especially the mature one in western European countries such as Germany, France, Italy and Spain (Strategic Risk 2011, p. 13). According to Marsh, a leading global insurance broker, the demand for environmental impairment liability (EIL) in Europe has risen in line with increased regulation and awareness. What is more, midsized companies have

increased the average limits of indemnity in EIL by almost 15% (from average EUR 6, 9 million to EUR 7, 9 million) between 2011 and 2015 (Marsh 2016, pp 1-2).

The Directive aims at ensuring that financial consequences of environmental incident will be borne by the operator who has caused it. Thus, according to Article 14 of ELD, 'Member States shall take measures to encourage the development of financial security instruments and markets by the appropriate economic and financial operators, including financial mechanisms in case of insolvency, with the aim of enabling operators to use financial guarantees to cover their responsibilities under this Directive'. This is very important in the context of developing, still young environmental insurance market in Central and Eastern European Countries. Nevertheless, the ELD does not impose mandatory financial security. Despite from that, some of the Member States have decided to introduce or consider introducing mandatory financial provisions (see Table 1), which apply only for operators carrying out dangerous activities listed in Annex III of the ELD or, in some cases, related to the persons (Mackie et al. 2016, p. 21).

According to Table 1, the calculation of the minimum amount of financial provision based on estimation of probable scale of environmental damage becomes most problematic. The question is if it is enough to cover all costs of remedial and preventive actions. Apart from that, the above requires the existence of developed financial markets.

Decision about which type of financial security instruments implement should be preceded by a very thorough risk assessment, including identification of financial liabilities and analysis of the cost effective reduction of risk.

Risk layering strategy, which means matching most suitable financial instruments with level of risk, is based on company's risk control strategy and its relation to the risk probability and magnitude of impact (see Fig. 2). In general, for low-probability and low-impact risks, which can be managed by companies themselves, they are looking for self-retention instruments or financial provisions as deposits, funds and surety bonds. For higher level of risks, more sophisticated instruments, available at insurance and capital markets, are used (Staccione 2016, pp. 14–15).

5 Environmental Surety Bond as a Financial Provision to Meet the ELD's Aim

One of the available financial provisions ensuring a financial security to cover operator's responsibilities under the Directive is an environmental surety bond. It works even if the liability claims exceed the financial capacity of the liable operator or in case of its insolvency.

The mechanism of environmental surety bond is based on provision of a monetary guarantee for activities that can lead to environmental damage from an insurance company to the competent authority that often authorised the activity. It involves three parties which are: the principle, the surety and the beneficiary (see Fig. 3).

Table 1 Mandatory financial provisions in chosen CEE countries

Member state	Implementation date	Minimum amount of provision/method of calculating	Additional information
Bulgaria	1st January 2011	Bulgarian Lev 50,000 (EUR 25,025)	
Czech Republic	1st January 2013	Based on estimated cost of remediation. A basic risk assessment focused on the sensitivity of the environment requirement: – if points exceed 50—a detailed risk assessment focused on environmental damage scenarios and their consequences will be required and – if costs exceeds CZK 20 million (EUR 739,569)—financial provision will be required	Exemptions for operators with a certified environmental management system (EMAS or ISO 14001)
Greece	31st December 2012 has been postponed	Based on the extent, type and size of damage. Calculation based on 'technical criteria capable of ensuring a homogenous assessment of risk scenarios and of the corresponding remediation costs'	
Hungary	1st January 2010	No data	
Romania	1st January 2010	No data	Applies to shipment of waste
Slovakia	1st July 2012	Based on a risk assessment of the estimated cost of remediation	Financial provision mechanisms include insurance and bank guarantees

Source Authorial computation based on (Mackie et al. 2016, pp. 23–25) and (Strategic Risk 2011, p. 9)

In case of principal defaults on its obligations under environmental law or its environmental permit to the regulator, surety (instead of the operator) pays the beneficiary, according to the contractual arrangements, up to the amount specified in the bond (Bradley et al. 2017, p 30). Usually, two kinds of environmental surety bonds are used: performance and payment bond.

There are both advantages and disadvantages of using environmental surety bond. Key strengths of this financial provision are:

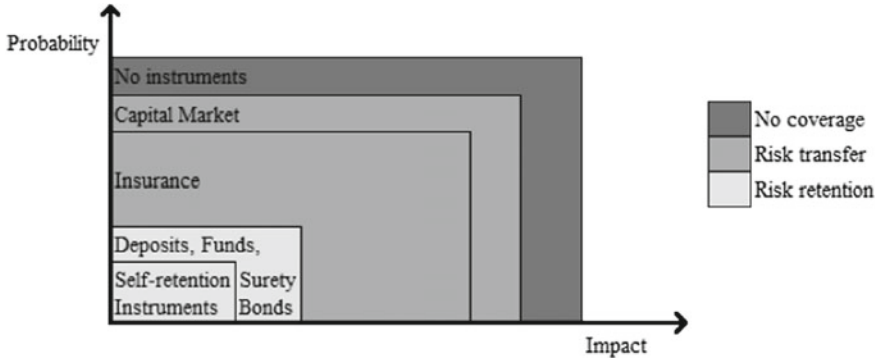

Fig. 2 Company's risk control strategy. *Source* Authorial computation based on (Staccione 2016, pp. 14–15)

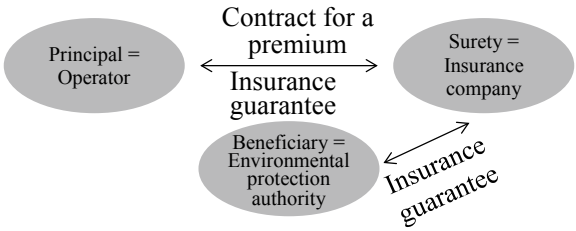

Fig. 3 The mechanism of environmental surety bond. *Source* Authorial computation

- meeting the environmental obligations even the operator's insolvency,
- meeting the formal condition for obtaining a permit required by the environmental protection authority,
- avoiding the risk of waiting for funds (availability from the outset),
- no connection between operator's financial condition and surety's financial condition,
- increasing the operator's credibility as a business partner,
- no impact of negative changes in operator's financial conditions to funds, and
- supporting the pro-ecological activity and creating an incentive to minimise environmental risk by applying environmental management system.

The main drawback of environmental surety bond is that it does not transfer the actual risk to an external entity. This means that insurance company after paying the guaranteed amount will apply to operator for a refund of the amounts paid. What is more, sometimes the collateral, such as cash or real estate, as security is required (Bradley et al. 2017, p 30).

Despite this type of financial instrument is rather used by operators for more defined environmental obligations and foreseen costs such as site restoration and land reclamation (Boyd 2001, pp. 19–20), according to the authors' opinion, it can be also used for uncertain environmental liabilities such as costs resulting from a pollution incident. It is due to the fact that environmental surety bond ensures that some activities which may potentially cause an environmental damage will be fully covered within bond.

The environmental surety bond available on polish insurance market is guarantee for performing obligations for the removal and liquidation of negative effects on the environment and environmental damage. Despite financial security under ELD is not mandatory in Poland, the competent authority may require an operator to obtain financial provision when it applies for an emission permits (which include, inter alia, integrated permit and permits for discharge of wastewater) and also applies to the Landfill Directive permits. It especially refers to the activities that may result in 'a major deterioration of the condition of the environment' (Mackie et al. 2016, p. 27). It occurs mainly as a collateral required by Environmental Protection Law or Waste Act. Subject of the environmental bond is an insurance company's obligation to pay the amount specified in the contract in the event that the entity upon request, has not removed the negative effects on the environment arising from its activities, and despite a written request for payment, did not pay, within the prescribed period, all or part of the claim resulting from the costs incurred in remedying the environmental damage. This type of instrument secures claims of the State Treasury represented by the competent public administration authorities (environmental protection authorities).

Many insurance (surety) companies are not interested in writing environmental bonds due to the high level of liability they can create like, for example, contracts which involve mould. It is easier for them to underwrite contracts for underground tank or lead contamination removal. Due to the quite long list of insightful questions, and documentation refers to environmental performance in EIL proposal form, its underwriting process may seem to be more complex than environmental bond's. However, in environmental bond's application form, apart from the questions referring to operator's financial condition, it also includes many questions which refer to the environmental risk. The most important questions are those referring to, inter alia, loss history (including public administration authorities' filed proceeding against the company and penalties paid), environmental protection procedures, certificated environmental management system, etc.

6 Conclusions

The European Union's environmental standards are one of the highest in the world. Moreover, implementation of the Environmental Liability Directive has extended the liability of operators whose activity can lead to the environmental damage. A growing number of companies became aware of the magnitude of environmental risk and its impact on business activity, including company's financial condition and reputation.

Despite the improvement in financial security developments, problems endure regarding the application of the Directive to large-scale accidents and insolvency among liable economic operators. Thus, ensuring sufficient availability of financial security, in particular, for large losses or in case of insolvency is one of the three main pillars of present Multi-Annual Work Programme (MAWP) 2017–2020 'Making the Environmental Liability Directive more fit for purpose' (European Commission 2017, p. 8).

Thus, the government in accordance with insurance market should be more active in developing new provisions, guidelines and risk management services that facilitate market-based solutions to current and pending environmental issues, especially in Central and East European Countries.

As an alternative to the environmental insurance, environmental surety bond needs to be developed as an effective financial security mechanism which protects both government and public from paying to remediate environmental damage in case of insolvency of a responsible operator. Thanks to environmental bond, both operators meet requirements and are allowed to run their business in line with law standards, and the necessary funds to prevent and remedy environmental damage are provided.

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The Equilibrium on the Motor Insurance Market in Selected CEE Countries

Adam Śliwiński and Łukasz Kuryłowicz

Abstract This chapter shows the possibility of introducing the usage-based insurance (UBI) for the sake of the individualisation of compulsory motor Third-Party liability insurance premiums with the aim of achieving the stability in Central and Eastern European markets and bringing them closer to the state of equilibrium. The chapter presents both the historical perspective of UBI development and the summary of the research carried out over the last decade. It is concerned with the advancement of UBI tariffs and the successful modification of the applicable pricing schemes as well as points to issues that may hinder the market launch of UBI. Finally, it shows that thanks to the usage-based insurance, the industry can minimise the negative effect information asymmetry has on the motor insurance market.

Keywords Motor insurance · Market equilibrium · Insurance telematics · Usage-based insurance (UBI)

1 Introduction

Motor insurance plays a dominant role in the portfolios of many insurers in selected Central and Eastern European (CEE) countries. Fierce competition and the diminishing diversification of the offer on the motor insurance market led to significant decreases in the margin, and hence, the income of insurers.

It may be necessary to adopt a long-term policy that will lead to ensuring the stability and predictability of compulsory motor insurance on the market. It is recognised that to achieve this, more attention should be paid to the individualisation of premiums. Among insurance practitioners, there is a belief that the latest technological achievements such as telematics systems, allowing the implementation of usage-based insurance solutions, may help achieve this goal.

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*, Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_9

The main purpose of this chapter is to facilitate a better understanding of the topic through a review and summary of selected literature and research achievements, which may prove useful in a discussion about domestic UBI.

2 Motor Insurance Market in Selected Central and Eastern European Countries

2.1 Definition and Division of Motor Insurance

The starting point for considerations should be the clarification of the scope of insurance covered in this paper. For its needs, we will accept the definition of motor insurance[1] proposed by Cieślik (2013): all types of insurance of cars and their owners, excluding the liability of the carrier and cargo insurance. In order to avoid narrowing the scope of the insurance in question, we suggest that the term *car* should be identified with *motor vehicles*, which also include trailers or low-speed vehicles.

The criterion for making the basic and the most intuitive division of motor insurance in Poland is the subject of insurance which can be considered in the context of the type and nature of losses to which the insurer is obliged under the contract. Due to this feature, it is possible to distinguish their basic types, which include:

- third-party liability insurance for motor vehicle's possessor (MTPL),
- vehicle own-damage insurance and
- accident insurance.

It should be emphasised that motor insurance also includes additional coverage such as *assistance services* or *legal protection*.

The division can also be made taking into account the degree of autonomy of the parties to the insurance contract. In this case, it stands out:

- *compulsory insurance*—concluded as a result of an order resulting from directly applicable laws; the main representative of this group is compulsory MTPL and
- *voluntary insurance*—for which there is no obligation to conclude a contract; include the remaining ones except liability insurance, such as own-damage cover or accident insurance.

In the further part of the paper, we will limit the considerations to compulsory third-party liability insurance calling them interchangeably both *motor insurance* and *MTPL*.

[1] Also referred as car insurance.

2.2 Compulsory MTPL Insurance

The liability insurance of vehicles possessor is, due to its mandatory nature, the most frequently concluded insurance in various CEE countries. MTPL contracts are somewhat homogeneous across the EU in terms of the cover provided, and the scope of MTPL includes any damage to the property and health of victims caused by the driver's fault. This is an extraordinary type of insurance in which the vehicle possessor pays a premium while the compensation payment is made directly to the injured parties (Cieślik 2013). However, it should be noted that, despite the fact that this insurance has to ensure payment to victims, at its foundation still lies the protection of the vehicle owner's wealth.

The MTPL insurance contract applies usually to one vehicle and is concluded for a period of one year. In Poland, for example, after its expiration its automatic prolongation usually follows, unless the contract is terminated[2] (Cieślik 2013). It covers the scope of damage caused by the movement of the vehicle, but it should be taken into account that the concept of *vehicle movement* includes not only using the vehicle to travel, but also getting in and out of it, loading and unloading the vehicle and also parking it (Szymańska 2014).

The liability of the insurer for these damages is limited by the amount of the guarantee sum which cannot be lower than the equivalent of[3]:

- EUR 5,210,000—in the case of bodily injury and
- EUR 1,050,000—in the case of property damage.

The guarantee sum refers to one event (regardless of the number of victims), and the insurer does not limit the number of events that are covered. The payment of compensation does not result in a reduction of the guarantee sum for subsequent events.

2.3 The Situation of the MTPL Insurance Market in Greece, Hungary, and Poland Between 2007 and 2016

As mentioned above, the compulsory MTPL is the most frequently concluded insurance in various European counties. For this reason, it also constitutes the largest share in the whole non-life insurance premium. In Greece, for a long time, with only a few exceptions, it remained above 46%, and in Poland above 33%. In Hungary, it dropped slightly between 2009 and 2013, but since then, it increases and again constitutes almost one-third of whole non-life premiums in that country. That is traced in Fig. 1.

[2] Apart from the scope of considerations, there are short-term insurance and fleet insurance.

[3] Guarantee sums, in accordance with art. 9 par. 2 of Directive 2009/103/ EC, were updated in 2017 by the European Commission by changes in the European Index of Consumer Prices covering all Member States and published by Eurostat (The European Parliament and the Council 2009).

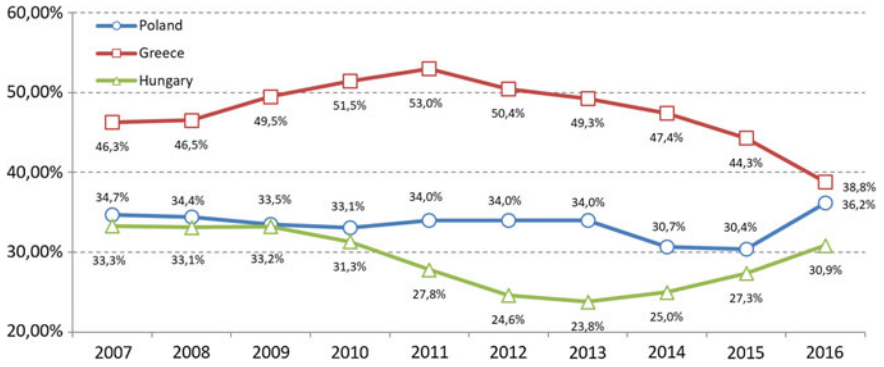

Fig. 1 Share of MTPL in the premiums of non-life business in Poland between 2007 and 2016 (PFSA 2017)

The basic data regarding activities under compulsory MTPL insurance in 2007–2016 are presented below in Tables 1, 2 and 3.

In 2016, the gross written premium in Poland amounted to EUR 2,692 million, which means that it increased by 42.9% y/y. It was a non-standard period due to the rapid acceleration of premium growth, which had previously remained at a similar level from 2011. This acceleration was the consequence of a few parallel factors, e.g. the end of the price war on the market, the implementation of the recommendations put forward by the Polish Financial Supervision Authority and including, in the premiums, the potential costs related to the extension of the insurers' equivalence resulting from court decisions and changes in law. Also GWP in Hungary increased to EUR 403 million (+23.7% y/y). In Greece, however, gross written premium dropped by 9.7% to EUR 728 million what means the continuation of the trend visible since 2010. In 2016, in Poland, gross claims paid in respect of compulsory MTPL insurance amounted to EUR 1,843 million marking an increase of 16.9% y/y. Similar increase (+14.98%) can be noticed also in Hungary. In both countries, the upward trend in the value of claims has been noticeable since 2012 with growth dynamics significantly accelerating since 2015. That has been affected in Poland mainly by changes in law allowing reopening damage claims from contracts already completed. In addition to the increased payouts, the reserves also changed as it was necessary to secure funds to cover further claims from already completed contracts. The opposite trend can be seen in Greece where the claims value gradually decreases.

The technical result from 2012 in the MTPL in Greece decreases and it amounted at the end of 2015 EUR 332 million. The technical profit dropped by 8.8% comparing to 2014 when it amounted EUR 364 million.

In Poland, from 2007 to 2016, the technical result in the MTPL insurance was negative. The technical loss at the end of 2016 amounted to EUR 253 million and it increased y/y, when it amounted to EUR 244 million. The technical loss has been maintained since 2007, when it amounted to EUR 34,366 thousand. It has long been emphasised that the reason for the negative result in this insurance group is premiums

Table 1 Technical result of the MTPL in Greece in the years 2007–2016 in EUR thousand (data provided by Hellenic Association of Insurance Companies—EAEE)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GWP	1,011,464	1,263,668	1,454,287	1,550,871	1,493,549	1,198,736	1,083,099	934,111	805,853	727,552
Gross claims paid	–	–	–	634,384	583,380	530,807	491,108	473,719	408,626	355,915
Loss ratio (%)	–	89	47	64	64	47	60	44	41	43
Technical result	–	–	–	126,900	201,200	401,500	389,300	364,300	332,100	–

Table 2 Technical result of the MTPL in Poland in the years 2007–2016 in EUR thousand (PFSA 2017)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GWP	1,433,431	1,619,296	1,648,156	1,738,987	1,986,535	2,063,096	1,955,374	1,864,418	1,884,504	2,692,224
Gross claims paid	902,306	1,012,553	1,423,086	1,220,635	1,262,412	1,258,228	1,273,370	1,361,752	1,576,894	1,843,361
Loss ratio (%)	85	90	88	89	81	84	82	90	94	93
Technical result	−34,366	−163,751	−222,480	−205,923	−147,782	−109,017	−76,216	−183,810	−243,973	−252,519

Table 3 Gross written premium and gross claims paid of the MTPL in Hungary in the years 2007–2016 in EUR thousand (data provided by Magyar Biztosítók Szövetsége—MABISZ and Magyar Nemzeti Bank)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GWP	412,731	416,962	390,916	366,820	301,742	260,434	254,274	279,335	325,736	403,087
Gross claims paid	315,602	276,753	205,856	261,408	172,549	171,523	203,872	208,274	216,014	248,366
Loss ratio (%)	80	68	67	73	77	82	93	95	83	79

set at an inappropriate level. Despite a significant increase in the premium in 2016, some factors caused that the loss remained at a level similar to that in 2015. Those were:

1. constantly increasing costs of vehicle repairs and medical procedures,
2. increase in the costs of business activity of insurers in connection with the introduction of the guidelines of the Polish Financial Supervision Authority in the scope of claim settlement,
3. changes in the interpretation of tax law regarding the inclusion of VAT in the claims handling process as well as the introduction of new tax burdens and
4. changes in the income of the society that lead to an increase in future annuities.

2.4 Perspectives for the Development of Motor Insurance in Poland

Motor insurance plays a dominant role in the portfolios of most insurers in selected CEE countries. In Poland, at the end of 2016, they accounted for a total of 61.51% of GWP for non-life insurance with the share of MTPL accounting for 36.2% (the share of this product varies among insurers from 0.06 to 76.58% with a median of 36.76%). In comparison with the previous year, it has increased by 7.01 pp (PFSA 2017). In Greece, they accounted for a total of 51.25% of GWP for non-life insurance, and in Hungary, they reached 45.75%.

A decade ago, it was common to say that despite the unquestioned development of the market in the last dozen or so years, it still had not reached the size determining the more diversified offers, which negatively affected the situation of policyholders who had too modest choices. Currently, this allegation is losing its importance and there are many insurers on the market offering coverage in the field of motor insurance. It is becoming increasingly difficult for them to compete solely by diversifying the offer, which is why the emphasis is placed mainly on precise segmentation of the insured, reliable selection, assessment and valuation of insurance risk,[4] and reduction of operating costs.

The role of motor insurance will be slowly decreasing, although some premium growth may be possible in the near future due to, among others, the increase of claims, especially those related to bodily injuries. Such a tendency is traced in Table 4, in which the share of motor insurance in non-life insurance on large European insurance markets and in Greece, Hungary as well as Poland was presented. It is easy to notice that the share of motor insurance in all countries except for Italy, Greece and Poland is below 50% and is systematically dropping.

[4]Modern economic theory and practice occupy a large variety of both dogmatic and dialectic interdisciplinary explanations of risk. In the further part of the paper, the risk will be understood as the possibility of a loss expressed in the probability of a particular event occurring between 0 and 1 (Śliwiński 2002; Śliwiński and Klapkiv 2017).

Table 4 Share of motor insurance in the non-life premiums in selected European countries (European insurance industry database, Insurance Europe)

	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 (%)
UK	28.41	29.11	28.64	27.86	28.02	30.29	30.76	29.95	29.79	30.35	26.11
DE	38.58	38.17	37.30	36.67	36.51	36.89	37.51	38.41	38.96	39.16	39.08
FR	36.99	35.98	35.31	35.01	35.06	34.84	34.84	34.79	34.92	32.89	32.79
IT	61.17	60.36	58.97	58.26	59.31	60.41	60.67	58.97	57.14	55.73	54.48
ES	49.35	48.61	47.40	45.97	45.44	44.94	43.90	43.57	42.87	42.86	41.17
CH	35.44	35.74	35.57	34.36	33.67	34.35	34.40	34.90	35.32	35.55	35.53
NL	28.40	28.21	26.91	27.10	27.42	28.01	27.71	27.48	26.56	26.43	29.86
GR	**59.90**	**64.06**	**63.78**	**65.70**	**67.10**	**67.39**	**67.30**	**64.38**	**61.37**	**58.65**	**51.25**
HU	**57.29**	**55.70**	**55.26**	**51.07**	**50.85**	**45.05**	**41.15**	**37.34**	**37.63**	**41.28**	**45.75**
PL	**61.53**	**60.43**	**60.65**	**57.85**	**57.09**	**58.94**	**57.93**	**55.09**	**53.21**	**53.92**	**61.51**

Legend: *UK* United Kingdom, *DE* Germany, *FR* France, *GR* Greece, *HU* Hungary, *IT* Italy, *ES* Spain, *CH* Switzerland, *NL* Netherlands, *PL* Poland

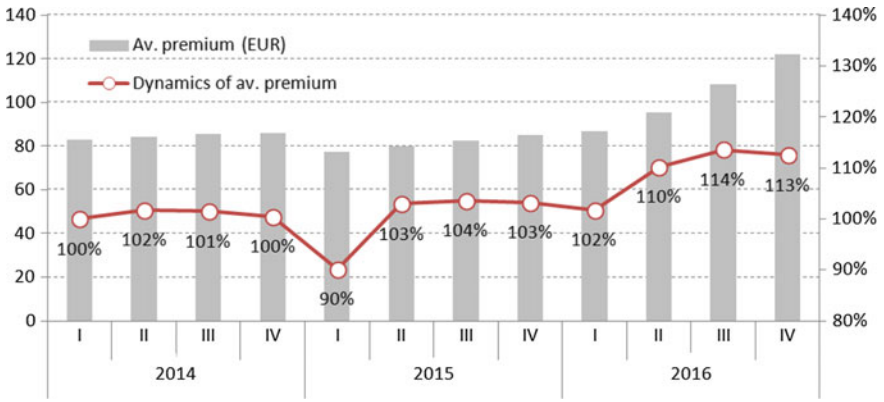

Fig. 2 Development of the MTPL average premium in Poland between 2014 and 2016 (own work according to the data gathered by the Polish Financial Supervision Authority)

Strong competition as well as the diminishing diversification of the offer on the motor insurance market lead to significant decreases in the margin and, hence, the income of insurers. For instance, 2016 brought the biggest loss in history of Polish market. Although this is reflected in the apparent increase in average premiums noticeable from the second quarter of 2016, which is shown in Fig. 2, it is often emphasised that premiums are still set at too low a level.

It may be necessary to adopt a long-term policy that will ensure the stability and predictability of compulsory motor insurance on the market. It is recognised that to achieve this, more attention should be paid to the individualisation of premiums. Among insurance practitioners, there is a belief that the latest technological achievements, such as telematics systems allowing the implementation of *usage-based insurance (UBI)*, may help achieve this goal.

3 Insurance Telematics

3.1 Terms and Definitions Found in the Literature

The telematics solutions that are currently used by insurers are known as *insurance telematics*. Insurance telematics is principally applied in pricing schemes of motor insurance.[5] Such schemes can be divided into the following categories based on the scope of use of telematics solutions and the impact of a vehicle's usage on the pricing process:

[5]There are other examples of telematics-enabled insurance such as travel insurance.

- *Traditional pricing*—these schemes do not use telematics and the pricing is not dependent on the actual vehicle usage.
- *Pay-At-The-Pump (PATP)*—the premium is a component of the fuel price; thus, it depends on fuel consumption.
- *Pay-Per-Mile (PPM)*—the systems do not use telematics, but the premium is wholly or partially based on the distances travelled by a vehicle (self-reported by the insured).
- *Pay-As-You-Drive (PAYD)* or *Pay-As-You-Go (PAYG)*—here, the tariff takes into account a relationship between the premium and a vehicle's mileage. Nevertheless, telematics solutions are used to collect, store and transmit the data on the covered distances.
- *Pay-How-You-Drive (PHYD)*—this model of insurance incorporates telematics analyses of the mileage and also a driving style which is characterised by variables such as speed, types of roads or time frames of the most frequent daily use of a vehicle.
- *Pay-As-You-Speed (PAYS)*—this pricing scheme includes a system of financial penalties for speeding, which take the form of decreases in previously granted discounts.

All the systems, excluding traditional pricing, are collectively referred to as "UBI". Additionally, PATP, PPM and PAYD(G) schemes form the *distance-based insurance (DBI)* group, which is shown in Fig. 3.

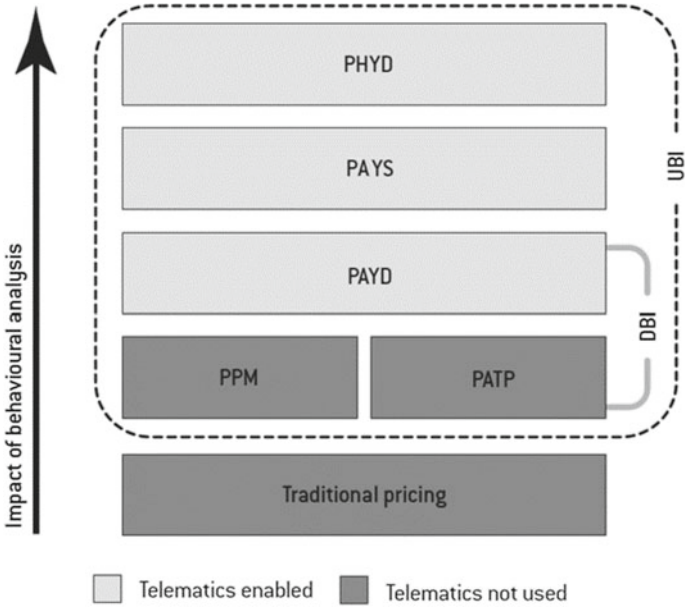

Fig. 3 Categorisation of insurance pricing schemes based on the impact of telematics and analysis of the insured's behaviour

3.2 The Origins and History of Insurance Telematics

The concept of UBI is a direct consequence of the discussion that took place in the United States in the late 1960s and early 1970s. Vickrey (1968) was one of the first to criticise the idea of pricing schemes based on lump-sum premiums which were commonly used. At the same time, he proposed to implement tariffs based on the distance covered by the insured vehicle over a particular period of time. Vickrey's PATP system and the insured tyres coverage were innovative proposals. In the case of the former, the idea was to include premiums in fuel prices paid by drivers at petrol stations. Under the latter scheme, an insurer, in some way associated with a tyre manufacturer, would cover claims related to vehicles with specific brand of tyres. However, these solutions had a weakness: they did not satisfy the conditions of the horizontal equity principle (Guensler et al. 2003). In addition, the usage of a vehicle would be characterised solely by fuel consumption or a type of the tyres used rather than by the covered distances.

The periodic examination of odometers turned out to be the easiest way to measure a vehicle's mileage. Thus, the idea of PPM was born from the reflection on the inadequacies of the systems proposed by Vickrey. However, the PPM solution proved to be vulnerable to fraud (e.g. a deliberate rolling back of odometers). Although some researchers, such as Litman (2011), argue that with odometers becoming more resistant to tampering their "audits" should be a sufficient solution to this problem, the idea of PPM ultimately has not found its way to the market. However, modern technology facilitates vehicle usage measurements thanks to the employment of more accurate systems such as the GPS. This enabled the introduction of more complex tariff schemes in which prices are associated not only with the actual distance travelled but also with factors such as speed, the time of day when a vehicle is used, and geographical areas. All these factors have an impact on the probability of an accident (Ayuso et al. 2010).

In 1999, Progressive Insurance launched in Texas the pilot project *Autograph*. About 1000 vehicles were covered by innovative insurance with premiums based on the data obtained from GPS devices. Although the policyholders were charged a fixed monthly fee for the use of the device, the solution proved to be effective (considering the potential benefits in the context of incurred expenses), especially for those drivers who used their vehicles less frequently than the average or seldom travelled in high-risk areas. A 13% drop in the average mileage and a reduction of premiums by about 25% was reported by the project participants. Both the pilot project and its follow-up *TripSense* (renamed into *MyRate*) brought the insurer significant publicity and resulted in telematics solutions' reach expanding on other US states (Carnahan 2000).

In Europe, UBI solutions have been greeted with far less optimism. In 2006, the Aviva Group, operating under the Norwich Union brand, introduced an innovative UBI product in the UK but was forced to cancel the project after about two years of operation. Despite that, other insurers have later launched certain telematics solutions

in their home markets such as the Netherlands, Italy, Switzerland, Spain, Germany or Japan.

The development of UBI in various countries is proceeding at different dynamics, which is a consequence of a large variation in the level of economic development, legal systems and social conditions (Cieślik 2017). Ptolemus Consulting Group (2016) estimates that by 2020 the number of UBI policies will increase to 100 million while in 2012 there were nearly 2 million of such policies with over one billion of insured vehicles (Tselentis et al. 2016). Currently, in the world, it is already over 10 million policies, and the growth rate of this market reaches 40% y/y. The share of telematics policies in most countries in 2015 was close to 1%, and in Italy, where the penetration rate of the motor insurance market by UBI is the highest, reached only 4% (Cieślik 2017). Although the forecast seems to be overestimated, the rate at which new UBI insureds arrive is still impressive.

After the initial period of considerable interest in the subject, insurers have started expressing disappointment in UBI as they realised they needed to deal with several challenges presented by this type of insurance (Ippisch 2010):

1. Telematics-based tariffs generate high implementation costs related to corporate infrastructure and on-board devices installed in vehicles.
2. Costs associated with the transmission of data from the device to the insurer are still considerable and represent a significant share of an UBI project's budget.
3. Prospective policyholders present a cautious approach to UBI products; they expect only minor savings which are not a sufficient incentive to change an insurer. Moreover, policyholders fear of the invasion of their privacy and are concerned about surcharges applicable in the case of *dangerous* driving.
4. Intermediaries tend to more frequently offer traditional insurance than UBI because in the former they have real influence on the final value of the premium.

Nowadays, many insurers attempt to find appropriate solutions that would enable them to tackle these challenges.

3.3 Development of UBI Tariffs

According to the conventional approach, net insurance premiums are calculated based on the best estimate of the number and cost of random claims that may occur during a reported period. A premium is usually calculated for an individual insurance portfolio as the former is determined through the assessment and measurement of risk, which usually is described by the collective risk model. The final amount of the gross premium (the sum of money the policyholder pays to the insurer) includes an allowance designed to cover the insurance company's operating expenses and risk loadings (Ronka-Chmielowiec 2002). In addition, a properly conducted premium calculation process should respect the postulates of the three basic golden insurance principles (Śliwiński 2002):

- *balance of premiums and claims*—the need to maintain a balance between the insurance fund and the expected claims value,
- *proportionality of premiums and claims*—postulating the need to maintain the relation of the premium value and the sum insured and
- *actuarially fair premium*—the need to keep the premium relation to the level of the risk contributed to the insurance pool.

Within this calculation framework, the insured disregard the marginal cost of insurance when making decisions about the frequency of a vehicle's use and travel distances (whereas such decisions are influenced by factors such as fuel costs). This results in the insured using their vehicles more frequently (Litman 2012), which in turn has an impact on the higher risk and the average premium. The remainder of the chapter will summarise approaches to UBI tariffs that address the above shortcomings related to the calculation of premiums through relying on the actual usage of a vehicle.

Litman (1997) was a precursor of the idea of using GPS data in premium calculation schemes. He compared different tariff schemes referring to twelve evaluation criteria (e.g. implementation costs, road safety, energy and emissions) and argued that a premium depending on the number of kilometres covered[6] would be superior to other schemes, as it significantly improves actuarial accuracy and provides the insured with noticeable savings. The greatest benefit would be enjoyed by low-income households and the introduction of tariffs based on GPS data in mandatory insurance would not be feasible due to the high costs associated with technology and privacy restrictions.

Oberholzer (2003) suggested that such problems might be solved by further development of UBI business models. He pointed to low-risk and low-mileage drivers as potential target groups for telematics-based insurance. Coroamă (2006) proposed yet another iteration of UBI, introducing the Smart Tachograph—a prototype platform for the calculation of premiums based on individual drivers' behaviour. The system collects GPS data and data on the engine operation so the premium calculated in Coroamă's platform would reflect not only the mileage but also any rapid accelerations[7] or decelerations. The feedback is designed to make drivers aware of their negative behaviours and encourage them to change them.

The role of a regulatory authority and the goal that an insurer wants to achieve have the major impact on the choice of an appropriate pricing scheme that may effectively be applied across a domestic market. Zantema et al. (2008) examined seven different models of pricing schemes, including compulsory insurance with a fixed premium, voluntary insurance with diverse premiums reflecting factors such as road types and compulsory insurance for young drivers. Zantema's team showed that when the goal is to improve road safety, the best results can be brought by the differentiation of premiums for all insured persons, which should reflect the type of roads on which

[6]The covered distance would be determined on the basis of periodic odometer inspections.

[7]The degree of rapid acceleration or braking is defined as the number of accelerations or brakes per unit of travelled distance (e.g. kilometre or mile) or time unit (Händel et al. 2014). The authors showed that the degree of rapid braking is an important variable, which should have a significant impact on the level of the insurance premium.

a vehicle is mostly used (with motorways being "less costly" than local roads) and the driving hours (with night hours resulting in higher premium costs due to the increased risk).

The above outline attempts at illustrating how extensively UBI has been studied. Such studies are performed in the field of actuarial science and refer to economic and social development and applied technology. With a significant increase in the number of relevant research attempts, insurance telematics is gradually becoming a better-known area. A simultaneous decrease in technology costs creates favourable conditions for more economically and practically feasible market implementation of UBI.

At the same time, there are new expectations about the implementation of UBI: not only insurance practitioners perceive usage-based insurance as an opportunity to gain a market advantage under conditions of strict competition, but also politicians and academics consider UBI as a promising approach to deal with social and environmental problems (Ippisch 2010).

4 The Influence of the Insurance Telematics on the Market

4.1 Expectations Regarding UBI and Opportunities Arising from Its Implementation

Telematics-based insurance had been arousing high expectations even before it was technically possible to implement UBI solutions in practice. From the insured's perspective, UBI benefits are quite straightforward—a lower premium is paid for a vehicle travelling shorter distances or used in a more responsible and safer manner. Moreover, UBI policies provide access to add-on safety services such as remote diagnostics, emergency assistance or vehicle recovery after theft (Husnjak et al. 2015).

The insurance industry's perspective on UBI is multidimensional. According to Hagerbaumer (2004), the insurers who implement UBI tariffs will be seen as customer-oriented, proactive and environmentally responsible, for example due to the effect of mileage reduction. UBI may also help organisations to improve their corporate image and potentially increase the market share. These are the externalities resulting from the implemented solutions. The opportunities related to UBI can also be categorised based on particular aspects of the internal impact of usage-based insurance on an insurer's business, namely:

- *preventive function*—exerting a positive influence on the individual loss ratio of the insured by claims frequency reduction,
- *pricing function*—adherence to the actuarially fair premium principle and
- *selection function*—market share increase accompanying the improvement of insurance portfolios.

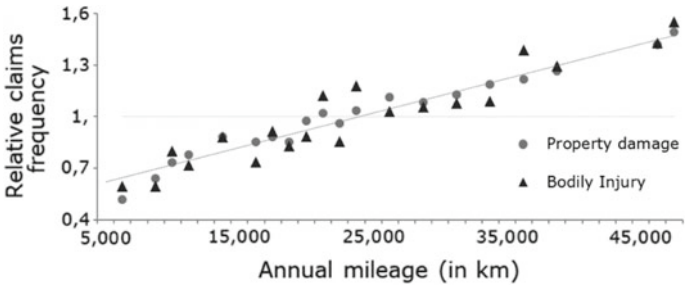

Fig. 4 Relative claims frequency depending on annual mileage (own study based on the data of Progressive Insurance)

Claims Frequency Reduction The introduction of insurance premiums that reflect actual mileage of insured vehicles may lead to a significant reduction of the mileage, estimated at the level of 8% (Buxbaum 2006; Bordoff and Noel 2008) or even 10% (Hagerbaumer 2004). This reduction is a consequence of insureds having actual impact on the amount of insurance premiums and their readiness to modify their habits. A driver, aware of the relationship between the mileage and the premium, is willing to reduce covered kilometres in order to lower insurance costs (*mileage-reduction effect*). Principally, this results in a reduction in claims frequency. The empirical evidence of such reduction was provided by a study of Progressive Insurance (2005). The study covered more than 200,000 vehicles, divided into groups of equal numbers of earned vehicles years. The relative claims frequency in these groups (Fig. 4) ranged from approximately 0.5–1.5, which means that the claims frequency observed in the group with the lowest annual mileage was lower by nearly 50% than that recorded in the total sample.

The reasons for this reduction can be explained by two factors: a lower vehicle risk exposure and the fact that a vehicle not used in traffic is not a potential "target" for other drivers, which prevents it from being damaged (Edlin 2003).

Moreover, drivers with UBI policies tend not only to drive less often, which alone can reduce the claims frequency, but also have the tendency to drive more safely, which has a significant impact on the overall improvement of road safety (*driving-behaviour-change effect*). A study of the Dutch market indicates that a significant relationship exists between PHYD premiums and a tendency to avoid speeding, mainly among young drivers (Hultkrantz and Lindberg 2011). Unfortunately, there are still certain factors that are not implemented in pricing schemes (e.g. eco-driving). Such factors materially influence the risk of accident as speeding or sudden accelerations or decelerations affect fuel consumption, which starts to differ from manufacturer's specifications (Tselentis et al. 2017).

The impact of driving experience on the probability of claim occurrence is also shown by Boucher, Pérez-Marín and Santolino (2013). The researchers observed a large angle of slope of frequency curve for low mileages, which marginally decreases with the rise in the number of kilometres covered by an insured per year. Although the slope is always positive, it reaches its lowest values in the range between 15,000

and 20,000 km and from that point it is almost constant. The relationship between the frequency of claims and the annual mileage can be linear in the higher ranges of the mileage. Thus, the higher risk associated with covering a greater number of kilometres is partially balanced by the combination of the five aforementioned factors. The positive effect of greater driving experience and other safety-related aspects leads to a reduction in claims frequency; however, that does not seem to be the case with drivers who travel 15,000–20,000 km per year.

Adherence to the Actuarially Fair Premium Principle One of the most difficult topics in economic theory in recent decades is to understand the nature of market equilibrium in terms of information asymmetry. The existence and effectiveness of such equilibrium states have been the subject of discussion since Akerlof described the unreliability of the market mechanism, which consisted in the equal valuation of goods in spite of various features, which they characterise. Incorrect valuation is the result of information asymmetry, which Akerlof presented on the example of the used car market. The results of his considerations were quickly referred to the insurance market[8] and became the basis for the thesis that if all insurers have incomplete information on the risks of individual insured, the balance on the market may not exist, and if it does exist, it may not be effective.

From the point of view of these considerations, it is important that insurance telematics is potentially able to provide a fair level of premiums in relation to a specific owner of a vehicle. Full compliance with the postulate of this principle is possible only through individualisation and diversification of premiums, which is in turn possible through differentiation of insurance risk (Śliwiński 2002). An example to this can be an instance of the annual mileage of a vehicle that is traditionally reported by the insured. Earlier research showed that the data collected in this way is usually understated compared to the actual values, which in turn results in determining the incorrect amount of the premium due (White 1976). An insurer that does not have reliable data on the annual mileage of a vehicle before the conclusion of a given contract is forced to quote the "average" premium (adjusted by the predicted vehicle's mileage declared by an insured) for all insured persons named in the contract, regardless whether their actual mileage is high or low. This approach is particularly disadvantageous for drivers with low annual mileage who are charged an extra premium to compensate for claims made by high-mileage insureds. This can be the reason for adverse selection. Here, the use of telematics seems to be the best solution to mitigate the problem. What is more, the individualisation of premiums most rewards low-income drivers, for whom insurance will become more affordable (Litman 1997). Consequently, this may be conducive to a reduction in the number of uninsured drivers.

Furthermore, telematics allows for the replacement of other traditional risk factors. An example of that would be the sex or age of drivers. Here, the properly obtained

[8]In the case of insurance market participants, the issues of asymmetric access to information can be considered on two levels: in the supervision authority–insurer relationship and in the insurer–insured relationship. In the first case, due to the competence of the state supervision authority, the problem of asymmetry is practically not analysed, and in the second case, asymmetry may appear on the side of the insurer or the insured (Kurek 2012).

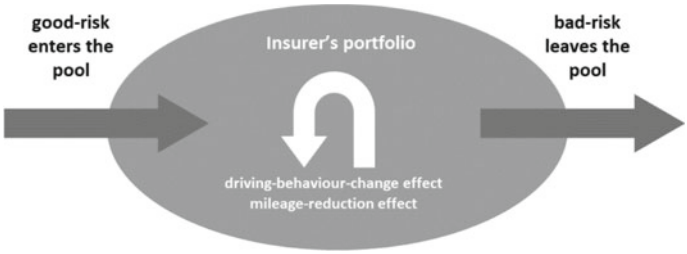

Fig. 5 Impact of individual groups of insured on the insurer's result

and analysed data on an insured's driving style can explain different levels of risk associated with those characteristics (Ayuso et al. 2016).

Market Share Increase and Improvement of Insurance Portfolios Most researchers agree that telematics-based insurance can have a strong and positive impact on both the size of an insurance portfolio and the level of risk that the portfolio presents. Since UBI tariffs enable insureds to exercise some degree of control over their premiums (and savings), UBI may encourage drivers to change their insurers (Litman 1997) with fair premium quotations attracting mainly good-risk insureds (Lindberg et al. 2005). At the same time, those of the insured drivers who will be asked to pay higher, less attractive premiums are likely to leave the portfolio. Furthermore, there exists the *driving-behaviour-change effect*: some insureds will review their driving styles in an attempt to reduce annual insurance expenses.[9] All the above factors taken collectively facilitate insurers' ability to obtain a desired size, structure and sustainability of a portfolio.

Figure 5 presents the effects of the above factors on the insurer's portfolio. Low-risk insureds have a positive impact on the company's profit, and the undesirable, high-risk ones bring the opposite effect.

There is another aspect impacting an insurer's underwriting profit: the effect of lowering the average claim value that is a consequence of the claim settlement process based on reliable data about the accident collected by vehicle's on-board recorders.

The described benefits, available for customers and insurers alike, are quite significant. However, attention should also be given to the positive social and economic effects of UBI, such as reduced traffic congestion, lower road upkeep and CO_2 emissions, resulting from the decreased usage time of a vehicle (Peña Pérez 2007). Buxbaum estimates that an 8% drop in annual mileage (and the resulting decrease in fuel consumption) translates into a 2% reduction in CO_2 emissions and a 4% decrease in motor oil consumption (Bordoff and Noel 2008). Additionally, Parry (2004, 2005) concludes that UBI products can substantially contribute to a reduction in fuel consumption, surpassing the similar effect of fuel taxes.

[9] It should be noted that the described processes may be triggered by factors other than tariffs based on a driving style or covered mileage. Fincham (1996) observed in his study similar effects in those insured persons who had installed a type of on-board "black box", an event data recorder (EDR), a device gathering data on a vehicle's parameters at the time of a loss occurrence.

It should be noted here that the above expectations in telematics insurance are partially implemented by the so-called *bonus-malus systems (BMS),* in the literature also referred to as a *merit rating* or *no-claim discount systems*.

4.2 Possible Sources of Insureds' Resistance

The fear of violation of insureds' privacy is a key reason for their conservative approach to telematics-based insurance. Data-collecting technology is capable of violating insureds' privacy because it provides comprehensive information about driving times and locations and, first and foremost, about a person's driving style or the number of kilometres driven. However, it seems that insureds are willing to relinquish their privacy to motor insurers in consideration for a minor financial compensation (Derikx et al. 2016).

Stigler (1980) showed that individuals are willing to accept the invasion of their privacy only if they consider this move effective (e.g. a person can allow access to their data stored by a credit reference agency to receive a lower mortgage rate). Nevertheless, we should be aware that different individuals value privacy differently; in other words, some people value and protect their privacy more than others.

Given the above, the studies of privacy conducted by Hollis and Strauss (2007) and Filipova (2007) employed an economic perspective. The researchers observed that those insureds who are less concerned about the invasion of their privacy tend to receive greater benefits under UBI as compared to those who value their privacy more. Under the conditions of perfect competition, after the latter leave the portfolio, the average premium will increase for the remaining insureds. This, in consequence, will persuade the privacy-sensitive insureds to switch to UBI. Although they will be disadvantaged in terms of utility loss, for them choosing an UBI policy will still be a better option than staying with an insurer offering a traditional tariff scheme. Finally, the researchers concluded that some policyholders would find themselves at a disadvantage no matter their choice of insurance type: these are the high-risk insureds or those with a very high valuation of their own privacy.

Contemporary studies show that policyholders are likely to be persuaded to switch to UBI if offered technological privacy-protecting solutions *and* appropriate financial incentives. With adjustment processes taking place at the portfolio level, such incentives may be smaller than the subjective privacy valuation of particularly privacy-sensitive insureds. Besides, not only the value but also the form of an incentive has a major impact on its effectiveness. When designing a new UBI tariff, one cannot ignore the consequences resulting from the concerns an insured can voice over the prospects of premiums increasing in the case of unsafe driving. Why? Because a tariff based primarily on penalties could not produce the desired results.

5 Conclusions

The interest in UBI dates back to the times when the criticism of motor insurance tariffs based on lump-sum premiums was first expressed. Several decades of research in the areas of technology, actuarial science and psychology have provided a solid foundation for exploring UBI as an alternative to traditional tariff schemes.

Although insurance based on telematics solutions can be a potential source of competitive advantage, UBI is still little-known. The vast majority of research and studies are mainly related to the analysis of the impact of telematics on the operation of an insurance company, technical solutions enabling the use of data obtained in the premium calculation process or issues related to the broadly defined protection of consumer privacy.

So far, little attention has been devoted to analysing the impact of insurance telematics on the behaviour of the motor insurance market as a whole. Also, the analysis of the possibilities of using telematics solutions to reduce information asymmetry, which insurance practitioners are currently considered to be the main cause of the lack of equilibrium on the market, has not received many studies and is still a significant challenge both in the scientific and practical dimension.

The implementation of UBI solutions cannot only generate the competitive advantage necessary on a saturated market but also bring about positive social and environmental consequences. The obstacles faced by insurers introducing UBI are tackled with increasing efficiency and new ideas for telematics insurance emerge on a daily basis making its implementation easier to apply.

On the basis of the above considerations, however, we can put at least two questions:

- Will the introduction of the UBI contracts on the market allow for proper segmentation of the insured and achieve the state of market equilibrium?
- Will the mechanisms of self-selection allow for the unambiguous definition of the profile of the insured who do not decide to enter into UBI contracts, and thus—do not agree to monitor their driving style?

Obtaining the answers to the above questions is one of the objectives of the research currently being conducted at the Risk and Insurance Department at the Warsaw School of Economics.

Taking into account the hitherto achievements, it can be stated today that the implementation of UBI may not only provide a competitive advantage necessary in the conditions of a saturated market, but also bring positive social and environmental effects. The obstacles faced by insurers introducing UBI are tackled with increasing efficiency and new ideas for telematics insurance emerge on a daily basis making its implementation easier to apply. However, the area of usage-based insurance and insurance telematics requires further research and analysis. Therefore, the next step should be making a full analysis of empirical data from pilot market implementations.

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The Relationship Between Locational Preferences of Banking Sector and Socioeconomic Structures of Cities in Turkey

N. Aydan Sat and Cigdem Varol

Abstract Considering socioeconomic development differences among regions is a key factor to direct investment decisions of institutions targeting to provide service through widespread branch networks in a country. When it comes to the investments of banking and retail sector that have been used as instruments to reduce income and social inequalities in the last decades, the prospect becomes even greater. Recent studies emphasize that there is a strong relationship between the location of commercial banking branches and regional development characteristics. The studies show that the development of banking sector in a region may highly be correlated with the socioeconomic capacity of the region. From this point of view, the aim of this study is to investigate the relationship between locational preferences of banking sector and socioeconomic structure of cities in Turkish case. For this aim, after the introduction, a literature review on the relationship between locational preferences of banking sector and socioeconomic characteristics of cities is given in the second section. In the third section, data gathering and methodology are presented. In the fourth session, the results of the statistical and spatial analyses are discussed. Finally, discussions of the results and concluding remarks are given in the fifth section.

Keywords Banking sector · Socioeconomic structure · Multiple regression analysis · Turkey

1 Introduction

Every economic sector can be characterized by a specific spatial configuration and metropolitan areas, which carry the potentials of agglomeration economies, represent important nodes for these economies. Martin (1999) points out that like other economic activities, financial activities are also characterized by economies of agglomeration and historically have tended to cluster geographically in particular urban

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A. Śliwiński et al. (eds.), *Economic Development and Financial Markets*,
Contributions to Economics, https://doi.org/10.1007/978-3-030-32426-1_10

centers and regions. Banks which concern both banking headquarters and branches represent one of the most relevant target groups in this context. It can be stated that the geographical distribution of banking sector embodies spatially differentiated economic power (Sucháček et al. 2017).

Despite the increasing trend in electronic banking and online channels, banks still require to invest in the geographical space. Recent studies emphasize that there is a strong relationship between the spatial pattern of the locational choices of banking sector and the regional development. The development of the banking sector in a region may highly be correlated to the economic development capacity and socioeconomic capacity of the region. Therefore, analyses of the spatial pattern of banking sector have become an important aspect of financial geography.

From this point of view, two questions appear to be answered in this study: "Do banking sector prefer metropolitan areas to invest in order to take the advantage of agglomeration economies?" and "Do the locational choices of banking sector become closely aligned with the socio-spatial characteristics of cities?" Regarding these two questions, the aim of this study is determined to investigate the relationship between locational preferences of banking sector and socioeconomic structure of cities in Turkey case. Within this context, the content of the study is organized under five sections. After the introduction, a literature review on the relationship between the locational preferences of banking sector and the socioeconomic characteristics of cities is given in the second section. In the third section, data gathering and methodology are presented. In the fourth section, the results of the statistical and spatial analyses are discussed. Finally, discussions of the results and concluding remarks are given in the fifth section.

2 Spatial Patterns of Banking Sector and Socioeconomic Characteristics of Cities

The study on the spatial pattern of banking sector has become an important aspect of financial geography (Porteous 1995; Martin 1999). Banks are generally perceived as the hubs of the geography of finance. Taking deposits and granting credits that embody principal functions of the banks carry a distinct spatial dimension (Özbek 2002). Semple (1985) introduces quaternary place concept concentrating on strong interconnectedness of banks with other producer services. Besides, Porteous (1995) underlines the importance of face-to-face contacts, concomitant to actors living in large metropolitan areas.

However, technological developments have a challenging role in the constitution of different financial geographies. In the early 1970s, the introduction of credit cards and the development of ATM networks constituted a starting point in the evolution of electronic banking. Internet banking has opened a new channel for new financial services and products including low-cost financial services of loans and mortgages, checking, bill payment, securities trading, insurance, and more (Gurley 1999). Thus,

most transactions have moved to the electronic environment. When compared to the physical branch channel, internet/mobile channels have a very low marginal transaction cost. Thus, this phenomenon has recently derived banks to improve their investment in internet and mobile channels (Ortakoy 2017).

The ability to access many banking services of mobile devices and computers without going to physical branches has increased the spread of mobile devices in recent years. However, Okumuş et al. (2010) point out that the lack of information and the fear of technology are important factors affecting customers negatively to make transactions on mobile channels. It is emphasized that to convince especially female customers and customers with a low level of education in online banking services are more difficult, and these customers choose for physical banking branches instead of these channels. On the other side, Yıldız and Karadirek (2014) suggest that internet banking should place emphasis on security in order to increase the number of internet channel customers and provide extra assurance to customers that this channel could perform transactions in a complete and correct way.

The ease of operation and the cost advantage of online channels lead customers to this channel, but space and place still matter for financial transactions and allocations and continue to play a key role in assuring trust between customers and banks. In this sense, online services are not completely independent, but serve together with physical channels.

The locational choice of banking sector argument is tied with a close relationship with the capacity of local economy (Dow 1999). From economic geographical view, different from other sectors, banking like other tertiary sectors has sought for profitability and service. Its spatial distribution follows both economic benefit maximization and service opportunity. Therefore, market forces always take the orientation of economic benefit maximization and promote to form a well-coordinated relationship between spatial pattern of banking sector and the regional economic development pattern. The orientation of economic benefit maximization driven by market causes banking sector to concentrate in economically developed regions. The developed regions can attract many bank resources and enjoy lower costs of bank services and lots of opportunities while undeveloped regions can only attract limited bank resources and have to endure higher costs and few opportunities. In some regions, people even lose the opportunity to enjoy bank services (Chen and Fan 2011).

In the study conducted by Willer (1990), the working population, income distribution, and individual/business potential are effective in determining the branch locations of banks. In the research by Weon et al. (2010), the level of income, the level of spending, the number of businesses, and the number of workers come to the front for bank location selection. Similarly, Cinar (2009) and Cebi and Zeren (2008) reveal that demographic (urban, population growth rate), socioeconomic (gross national product per capita, literacy rate, rate of population with higher education, average household size, employee rate, employer rate), sectoral employment (agricultural employment rate, manufacturing employment rate, construction employment rate, services employment rate), banking (number of bank, number of branch, bank deposit per branch, credit per branch, bank deposit per capita, credit per capita), and

trade potential (number of firms, number of organized industrial zone) are used to determine the correct branch location for banks (Ortakoy 2017).

3 Methods and Data

In this study, the relationship between locational preferences of banking sector and socioeconomic structure of cities in Turkey has been investigated. For this, the methodology of the study consists of three steps; the selection of the variables, conducting Pearson correlation, and OLS regression analyses.

The first step—Selection of variables for the analyses The variables on banking sector, which are the location and the assets of publicly held and actively traded banking, are obtained from Banking Regulation and Supervision Agency. Number of branches, total amount of deposits, and credits of banks in each city are selected as dependent variables for OLS regression analyses. On the other hand, to clarify the socioeconomic characteristics of cities, "Well-Being Index for Provinces" (WBI) prepared by TurkStat in 2015 is used. WBI is a study on the province level, aiming to measure, compare, and keep track in a time of the well-being of individuals and households on distinct life dimensions, using objective and subjective criteria. WBI for provinces covers 11 dimensions of life; housing, work life, income and wealth, health, education, environment, safety, civic engagement, access to infrastructure services, life satisfaction and presents these dimensions which are represented with 41 indicators, in a single composite index (TurkStat 2015a). The index value is measured between 0 and 1, and values approximating to 1 state a better level of well-being. These indicators can help provinces to identify and compare strengths and weaknesses, monitor their tendency in different life dimensions, and compare these elements (Table 1).

The second step—Pearson Correlation Analysis Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. Positive correlation indicates that both variables increase or decrease together, whereas negative correlation indicates that as one variable increases, so the other decreases, and vice versa. (http://learntech.uwe.ac.uk/da/Default.aspx?pageid=1442). In this study, to calculate the degree of the correlation between locational preferences of banking sector and socioeconomic structures of cities, Pearson correlation analysis is derived by using Statistical Package for Social Sciences (SPSS).

The third step—OLS Regression Analysis Ordinary least squares (OLS) regression analysis, which estimates the relationship between one or more independent variables and a dependent variable is conducted in this step of the study. In regression analyses, two different models are used to specify the effects of each independent variable on dependent variables (number of branches, total amount of credits in a province, and total amount of deposits in a province). While Model (1) takes into account of each indicator of Well-Being Index for Provinces, Model (2) considers the overall value of WBI. Using these different models helps to interpret results with more robustness (Brezzi and Veneri 2015). Additionally, being a metropolitan or not is selected as

Table 1 Dimensions and indicators of WBI for provinces (TurkStat 2015a)

Dimensions	Indicators
Housing	Number of rooms per person
	Toilet presence percentage in dwellings (%)
	Percentage of households having problems with quality of dwellings (%)
Work life	Employment rate (%)
	Unemployment rate (%)
	Average daily earnings (TL)
	Job satisfaction rate (%)
Income and wealth	Savings deposit per capita (TL)
	Percentage of households in middle or higher income groups (%)
	Percentage of households declaring to fail on meeting basic needs (%)
Health	Infant mortality rate(‰)
	Life expectancy at birth (years)
	Number of applications per doctor
	Satisfaction rate with health status (%)
	Satisfaction rate with public health services (%)
Education	Net schooling ratio of pre-primary education between the ages of 3 and 5 (%)
	Average point of placement basic scores of the system for transition to secondary education from basic education (point)
	Average points of the transition to higher education examination (point)
	Percentage of higher education graduates (%)
	Satisfaction rate with public education services (%)
Environment	Average of PM10 values of the stations (air pollution) ($\mu g/m^3$)
	Forest area per km^2 (%)
	Percentage of population receiving waste services (%)
	Percentage of households having noise problems from the streets (%)
	Satisfaction rate with municipal cleaning services (%)
Safety	Murder rate (per million people)
	Number of traffic accidents involving death or injury (per thousand people)
	Percentage of people feeling safe when walking alone at night (%)
	Satisfaction rate with public safety services (%)

(continued)

Table 1 (continued)

Dimensions	Indicators
Civic engagement	Voter turnout at local administrations (%)
	Rate of membership to political parties (%)
	Percentage of persons interested in union/association activities (%)
Access to infrastructure services	Number of internet subscriptions (per hundred persons)
	Access rate of population to sewerage and pipe system: (%)
	Access rate to airport (%)
	Satisfaction rate with municipal public transport services (%)
Social life	Number of cinema and theater audience (per hundred persons)
	Shopping mall area per thousand people (m^2)
	Satisfaction rate with social relations (%)
	Satisfaction rate with social life (%)
Life satisfaction	Level of happiness (%)

TL Turkish Liras

control variable in the analyses (Table 2). It should be emphasized that these models are an attempt to distinguish the most explanatory factors of locational preferences of banks and to list the most exhaustive factors.

4 Results: Locational Preferences of Banking Sector in Turkey

The brightest periods of banking and finance sector in Turkey were in the early stages of the Republic during the 1930s, even though it was the toughest because of lack of capital and unfavorable initial conditions (Görmez 2008). In the following years, boom and bust conditions dominated financial services provision with a crisis in every decade under different economic policy frameworks. Since 2001, European convergence has been leading the way, supported by fast-increasing foreign participation that has increased capital adequacy.

Figures 1 and 2 display the changes in the number of branches and deposits in Turkey between 1988 and 2017. As seen from the figures, there is a sharp decrease in the number of banks with the effect of 2001 crises and stabilization appears after 2004. Despite the decrease in the number of banks, number of branches increases steadily after 2004. The amount of deposits in Fig. 2 clearly displays the economic ups and downs of the country.

Table 2 Descriptions and sources of selected variables used in Pearson correlation and OLS regression analyses

Variables	Descriptions	Sources, year
Dependent variables		
BRANCH	Number of branches	BRSA, 2017
CREDIT	Total amounts of credits in a province (million $)	BRSA, 2017
DEPOSIT	Total amounts of deposits in a province (million $)	BRSA, 2017
Independent variables		
POP	Population	TurkStat, 2017
METROPOL	Metropolitan provinces (dummy variable) (1 = yes, 0 = no)	–
WBI	Well-Being Index for Provinces	TurkStat, 2015
HOUSING	Housing quality index	TurkStat, 2015
WORK	Work life index	TurkStat, 2015
INCOME	Income and wealth index	TurkStat, 2015
HEALTH	Health index	TurkStat, 2015
EDUCA	Education index	TurkStat, 2015
ENVIRON	Environment index	TurkStat, 2015
SAFE	Safety index	TurkStat, 2015
CIVIC	Civic engagement index	TurkStat, 2015
INFRA	Access to infrastructure services index	TurkStat, 2015
SOCIAL	Social life index	TurkStat, 2015
SATIS	Life satisfaction index	TurkStat, 2015

Table 3 illustrates provinces which have higher and lower amount of deposits. Although metropolitan cities take place on the top of the list, relatively less-populated (small-sized) provinces are on below. This table gives some clues on the relationship between locational preferences of banking sector and the size of the cities. Banking

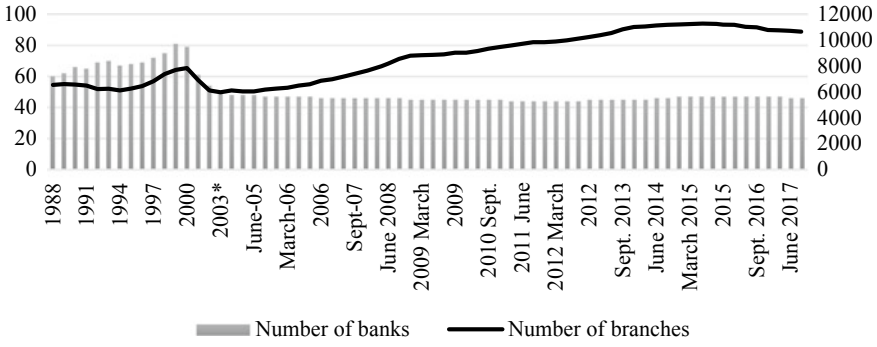

Fig. 1 The number of banks and branches in Turkey by time (BRSA 2017)

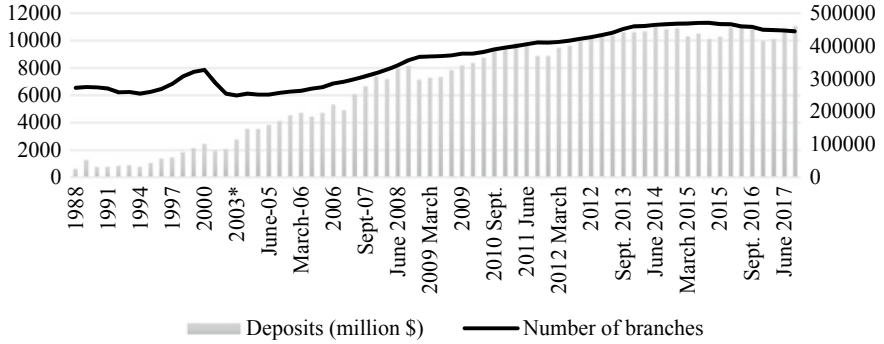

Fig. 2 The number of branches and deposits in Turkey by time (BRSA 2017)

Table 3 Ranking of the provinces according to the amount of deposits and population (BRSA 2017)

	Provinces	# of branch	# of ATMs	# of employees	Credits (000 TL)	Deposits (000 TL)	Population
1	İstanbul	2818	11,225	84,687	748,465,121	683,930,194	15,029,231
2	Ankara	991	3967	18,546	249,707,633	228,397,274	5,445,026
3	İzmir	724	3165	11,094	100,849,548	87,693,288	4,279,677
4	Bursa	380	1859	5420	61,010,129	38,906,614	2,936,803
5	Antalya	415	1942	5713	70,852,403	37,392,925	2,364,396
6	Kocaeli	230	1315	7103	41,433,766	32,558,974	1,883,270
7	Adana	236	990	3893	37,713,444	21,980,770	2,216,475
8	Mersin	193	795	2528	27,121,307	18,855,615	1,793,931
9	Muğla	185	1113	2140	20,295,241	18,301,856	938,751
10	Gaziantep	160	666	2486	42,785,237	15,425,704	2,005,515
72	Bingöl	14	58	139	1,222,326	1,022,574	273,354
73	Siirt	17	72	177	2,440,675	988,033	324,394
74	Bitlis	21	73	218	1,857,535	952,387	341,474
75	Iğdır	15	51	170	1,541,802	933,936	194,775
76	Muş	18	67	172	1,668,060	930,205	404,544
77	Hakkari	16	67	129	1,002,005	888,552	275,761
78	Kilis	12	43	109	1,000,465	813,385	136,319
79	Gümüşhane	18	55	144	1,102,819	811,863	170,173
80	Ardahan	14	35	118	1,082,542	433,571	97,096
81	Bayburt	10	28	94	494,772	408,904	80,417

Fig. 3 WBI for provinces (TurkStat 2015b)

sector prefers larger cities to invest in order to take advantage of agglomeration economies.

Similar results can be seen, when the WBI are taken into account. East and especially south-eastern parts of the country have very low values in the overall value of WBI (Fig. 3). These are also less developed provinces in terms of socioeconomic development compared to the rest of the country. In WBI, Isparta with the highest index value of 0.6745, takes the first place. Provinces following Isparta are Sakarya with 0.6737 and Bolu with 0.6553, respectively. The last province with the lowest WBI value of 0.2765 is Mus in the east.

On the other hand, the results of separate dimensions in WBI are very different. In social life index which has positive effects on the other life dimensions like health and work life of people, İstanbul took the first place with the highest index value 0.6747. Provinces that follow İstanbul are Uşak with 0.6534 and Bolu with 0.6441. The last province in the social life index with the lowest value 0.1912 is Şırnak (TurkStat 2015a). Istanbul, which is also mostly preferred metropole by banks, takes the first place in income and wealth index, access to infrastructure services index and social life index.

Table 4 shows the results of Pearson correlations between the variables. Population (POP), being a metropolitan city (METROPOL), access to infrastructure services index (INFRA), social life (SOCIAL), and income and wealth index (INCOME) correlate positively with number of branches, credits, and deposits, and the degree of these correlations are higher when compared to all other variables. The results of correlation analysis show that banks' locations and total assets are directly correlated with social, technical, and economic characteristics of the provinces. The higher the level of these indexes, the more branches, credits, and deposits take place in the provinces.

Table 4 Pearson correlations among variables

Variables	Branch	Credit	Deposit
POP	0.985**	0.970**	0.958**
Metropol	0.465**	0.403**	0.367**
HOUSING	0.160	0.129	0.127
WORK	0.084	0.069	0.070
INCOME	0.456**	0.422**	0.421**
HEALTH	0.157	0.124	0.121
EDUCA	0.051	0.021	0.020
ENVIRON	0.089	0.056	0.046
SAFE	−0.301**	−0.269*	−0.251*
CIVIC	0.143	0.124	0.121
INFRA	0.576**	0.516**	0.495**
SOCIAL	0.353**	0.326**	0.317**
SATIS	−0.124	−0.105	−0.093
WBI	0.220*	0.191	0.188

**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

Safety index (SAFE), which is composed of "murder rate number of traffic accidents involving death or injury," "percentage of people feeling safe when walking alone at night," and "satisfaction rate with public safety services," correlates negatively with number of branches, credits, and deposits variables. It shows that banking sector prefers to locate and invest in safer provinces.

The correlation value between population (POP) and number of branches, credits, and deposits is the highest one. In order to measure the strength of the association between variables, POP is not integrated into the OLS regression analyses in the third step.

As mentioned in the previous section, two different models are derived in OLS regression analysis (Table 5). Before giving information about the results of these models, it should be mentioned that the regression models significantly fit for the data. That means the models are statistically significant and locational preferences of banking sector are associated with the selected independent variables.

The results of Model (1), which takes into account of each dimension of WBI, are given below:

- The most important location factors influencing the banking sector are "income and wealth" and "access to infrastructure services" indices. These indices correlate positively with all dependent variables both in correlation and regression analyses, and in the degree of these correlations are higher when compared to all other variables.
- The association between "income and wealth index" and dependent variables is the highest one. Income and wealth index is composed of "savings deposit per capita,"

Table 5 OLS estimation results

Variables						
Dependent	Branch		Deposit		Credit	
Independent	Model (1)*	Model (2)*	Model (1)*	Model (2)***	Model (1)*	Model (2)**
CONSTANT	−7.183E−016	9.663E−017	−5.366E−016	1.461E−016	−5.107E−016	1.638E−016
METROPOL	0.042 (*0.363*)	**0.441 (*4.376*)**	−0.040 (*−0.311*)	0.345 (*3.247*)	−0.004 (*−0.035*)	**0.382 (*3.649*)**
HOUSING	**−0.558 (*−2.203*)**	–	**−0.570 (*−2.069*)**	–	**−0.569 (*−2.103*)**	–
WORK	−0.141 (*−1.099*)	–	−0.161 (*−1.156*)	–	−0.150 (*−1.099*)	–
INCOME	**0.847 (*3.784*)**	–	**0.903 (*3.709*)**	–	**0.872 (*3.646*)**	–
HEALTH	−0.143 (*−1.008*)	–	−0.186 (*−1.202*)	–	−0.179 (*−1.181*)	–
EDUCA	−0.155 (*−0.915*)	–	−0.155 (*−0.842*)	–	−0.159 (*−0.880*)	–
ENVIRON	−0.215 (*−1.373*)	–	−0.244 (*−1.431*)	–	−0.228 (*−1.361*)	–
SAFE	0.057 (*0.534*)	–	0.082 (*0.710*)	–	0.075 (*0.656*)	–
CIVIC	0.063 (*0.609*)	–	0.081 (*0.716*)	–	0.078 (*0.701*)	–
INFRA	**0.528 (*2.645*)**	–	**0.488 (*2.246*)**	–	**0.492 (*2.308*)**	–
SOCIAL	0.143 (0.995)	–	0.176 (1.126)	–	0.178 (1.162)	–

(continued)

Table 5 (continued)

Variables						
Dependent	Branch		Deposit		Credit	
Independent	Model (1)*	Model (2)*	Model (1)*	Model (2)***	Model (1)*	Model (2)**
SATIS	−0.027 (*−0.250*)	–	−0.029 (*−0.252*)	–	−0.032 (*−0.278*)	–
WBI	–	0.152 (*1.500*)		0.136 (*1.269*)		0.132 (*1.257*)
R^2	0.605	0.239	0.533	0.153	0.549	0.180

Notes t-stats in parentheses, authors' calculations
*$p < 0.05$, **$p < 0.02$, ***$p < 0.005$

"percentage of households in middle or higher income groups," and "percentage of households declaring to fail on meeting basic needs" indicators. According to the results of the analysis, the wealthier the city, the more banking sector exists. The increase in the wealth of the city attracts banking sector in a positive way.

- "Access to infrastructure services" index, composed of "number of internet subscriptions," "access rate of population to sewerage and pipe system," "access rate to airport," and "satisfaction rate with municipal public transport services" indicators, emphasize the importance of effective communication technologies and transportation infrastructure on locational preferences of banking sector. The results of correlation and regression analyses are very similar. Banking sector prefers cities, which have developed technical infrastructure.
- Different from correlation analysis, results of regression analysis confirm the negative association between "housing index" and all three indicators of banking sector. Housing index is composed of "the number of rooms per person" and "percentage of households having problems with quality of dwellings" indicators. The negative association between variables can be explained by the old housing stock, which has relatively small square meters and low-quality construction, in the traditional central business district, where banking sector highly prefers to locate in Turkey.
- According to the results of regression analysis, there is no strong association between being a metropolitan city (control variable) with banking sector in Model (1), although the results of correlation analysis emphasize the strong correlation between dependent and independent variables. However, the results of both analyses suggest that there is a positive association between them.

Model (2), which considers the association between overall value of WBI and dependent variables, has varied results.

- The results of correlation analysis show that the overall value of WBI correlates positively banking sector. This result is also consistent with the results of regression analyses in Model (2). The association between WBI and dependent variables is slight and positive. Different from the results of Model (1), the overall value of WBI has poor influences on the locational preferences on banking sector.
- Another slight and positive correlation exists between being a metropolitan city and banking sector. The results of regression analysis confirm this association for all indicators of banking sector. All in all, the results would suggest that being a metropolitan city have positive influences on locational preferences of banking sector in Turkey case.

5 Concluding Remarks

In the last decades, banks have reduced their physical branch investments and begun to focus more on online channels, as a result of low level of sectoral profitability and the latest technological trends. As marginal transaction costs are rather low compared

to physical branches, online platforms become channels for the customers to realize their particular operations. Nevertheless, it seems that the adaptation and capability to use technology for all customers are not the same, because of socioeconomic differences among them. Such reasons advocate that banks still need a certain amount of physical channels.

As an economic actor, location decision-making is one of the most important tasks for banking management. This research, which aims to investigate the relationship between locational preferences of banking sector and socioeconomic structure of cities in Turkey case, shows that traditional location factors mainly agglomeration economies are still important in the process of location of banking sector in Turkey. Thus, like other businesses, banks enjoy proximity to numerous services, consumers, skilled workforce, cultural and social amenities, and so on.

The results of the study support the idea of "Do banking sector prefer larger cities to invest in order to take the advantage of agglomeration economies?" in many ways. Population, income, and wealth and being a metropolitan city are some of the most associated variables with locations and investments of banking sector. The results also support the second question of the study: "Do the locational choices of banking sector become closely aligned with the socio-spatial characteristics of cities?" The analyses confirm the association between the locational choices and the socio-spatial profile of urban areas. Savings deposit per capita, percentage of households in middle or higher income groups, and percentage of households declaring to fail on meeting basic needs are the most important factors effecting locational preferences and distribution of total assets of banking sector.

The conclusions demonstrate that despite the increase in the information and communication technologies in banking sector, physical location is still of primary importance. Banks mostly prefer more developed provinces to use the advantages of agglomeration economies. Having powerful communication technologies and transportation infrastructure is also very critical in the investment decision of banking sectors.

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