Chapter 5
Bank Lending Procyclicality and Digital Technologies; Does the Structure of the Financial Sector Matter?

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5.1   Introduction

Cyclical factors have a significant impact on bank lending. Therefore the concept of bank lending procyclicality has been widely discussed in the literature on macrofinancial linkages concerning the relation between the business cycle and the behavior of banks (Levine 2004; Granville and Mallick 2009; Bouvatier et al. 2012, 2014; Leroy and Lucotte 2019; Kouretas et al. 2020). The procyclical nature of bank lending is one of the basic arguments for regulating the financial sector and the regulatory framework may contribute to the procyclical nature of bank lending (Dewatripont and Tirole 2012).

In the economy, the course of the business cycle may be strengthened by the processes that occur in the financial system. The banking sector plays a major role here due to the banks' important functions when financing enterprises' investment activities and individual clients' use of products and services. The phenomenon of lending procyclicality means the existence of a feedback loop between the financial system and the real economy—increasing lending by banks boosts the economic situation, whereas limiting loan supply, due to losses caused by the economic slowdown, makes it difficult to exit the recession (Goodhart and Hofmann 2008).

Financial market imperfections related to the asymmetry of information about borrowers contribute to this phenomenon, which leads to negative selection and moral hazard problems (Stiglitz and Weiss 1981; Bernanke and Gertler 1989; Kiyotaki and Moore 1997). Furthermore, by credit rationing during an economic downturn or extending credit. Excessively during an economic expansion, banks distort the real business cycle, which leads to unsustainable growth, such as deeper

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recession in downturns. In this way, relatively minor economic shocks can be amplified and propagated by procyclical changes in the lending market (Borio 2014). Furthermore, advances in information technologies (ITs) have transformed banking practices and products. In this era of a dynamically changing world, the young generation of consumers is receptive and open to digitization, freely using innovative solutions with electronic channels (Internet, mobile devices) that allow remote access to financial services. Undoubtedly, technical changes have a huge impact on the current status of retail and corporate banking (Philippon 2017; Boobier 2020; Beaumont 2020) and also have an impact on the market structure of the financial sector and credit procyclicality (FSB 2017).

Although the impact of new ITs on the development of finance is not a novelty, it has gained more importance in the digital age. Consumers in both developed and emerging market economies are increasingly turning to digital financial services that are more affordable and more convenient. In recent years, the FinTech sector has been growing faster than traditional finance and will therefore have a huge impact on the lending market. While the most noticeable change, due to the use of new technologies, took place in the payments segment, also FinTech companies gradually took up basic banking services, including lending activities. This phenomenon influences the business models of banks and the level of competition in the market (Claessens et al. 2018; Cornelli et al. 2020).

This study focused on the determinants of the loan from the supply side. However, the relation between the situation on the financial market and the macroeconomic conditions of the economy is dynamic and bilateral. The nature of the links between the financial sector and the real economy depends on the market structure measured by the degree of concentration (CR_5, HHI index), foreign presence (e.g., the share of domestic banks in assets compared with that of foreign banks); as well as other characteristics of the development of the banking sector, including the degree of risk exposure (share of non-performing loans (NPLs), the measure of leverage, and the ratio of loans to deposits (LTD) as macroprudential policy tools (Vivies 2016; Pawłowska 2021).

In this study, we analyze the phenomenon of procyclicality in relation to market concentration measures, that is, the share of the five largest banks in total assets (CR_5), and also in relation to new digital technology. An economic term or a financial indicator is considered to be "procyclical" if it tends to amplify the fluctuations of the business cycle. The concept of lending procyclicality has also been widely discussed in the literature on macrofinancial linkages, especially to the extent that it explains the cyclical behavior of the banking sector. According to this characterization, lending behaves procyclically if fluctuation of lending dynamics decrease during an economic downturn and increase during a recovery (Borio et al. 2001; Borio 2014). The research questions are the following: *Does the market structure has varying effects on bank lending procyclicality in different European Union (EU) banking sectors and for different types of loans? Does the new digital technology affect bank lending procyclicality for different types of loans*?

In case to answer above questions concerning the relations between the real and the financial spheres, dynamic panel regression with using the generalized methods

of moments estimator (GMM),[1] is used (see Kouretas and Pawłowska 2020). An alternative econometric approach to dynamic panel models is the construction of a vector regression panel model (VAR/pVAR panel), whose structural parameters are also often estimated using the GMM estimator (cf., Canova and Ciccarelli 2013; Leroy and Lucotte 2019). The main contribution of this research in relation to the existing literature on the apparent link between the banking sector's structure and credit procyclicality (e.g., Leroy and Lucotte 2019) is that this paper considers the phenomenon of procyclicality separately for different types of bank loans (residential mortgage, consumer and corporate) and we take into account concentration and digitalization in the banking sector in EU. Findings of this paper are in line with the paper by Kouretas, Pawłowska, and Szafrański (2020) that confirms that concentration in the banking sectors impacts on credit procyclicality, but this effect mainly occurs for mortgage loans and consumer loans. Furthermore, this study was conducted on a larger sample and broken down into other groups of EU countries, and additionally confirms impact of digitalization on credit procyclicality. Finally, this paper also contributes to the macroprudential literature and support sectoral macroprudential policy in EU and confirms that foreign ownership also contributes to procyclical variations across banking sectors.

5.2 Literature Review

In supply-side models that incorporate information asymmetry, access to external financing is typically linked to the strength of borrowers' balance sheets and the value of collateral for easily marketable assets, especially liquid assets, such as cash (Besanko and Thakor 1987). For demand side, many studies have shown that even relatively large enterprises, including listed companies, suffer from adverse balance sheet fluctuations, which also negatively affect their investments, especially in periods of recession (Levin and Natalucci 2005; Blanchard 2009; Degl'Innocenti et al. 2019). Financial market imperfections also affect loans to households. Households may be limited in borrowing due to income fluctuations. Household loans usually dominate banks' portfolios. For this reason, the monetary policy of some EU countries' central banks and the macroprudential policy developed in response to the 2008 financial crisis are mainly aimed at minimizing the credit risk of households.

Research on loans to households can be divided into research on consumer loans and mortgage loans. Many empirical studies have confirmed that changes in aggregate consumption are positively correlated with delayed or predictable changes in income growth and with an increase in bank loans (cf. Love and Zicchino 2006). Ludvigson (1999) shows a statistically significant correlation between an increase

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[1] For our estimations, we also used the GMM system, a two-step robust estimator (Arellano and Bond 1991; Arellano and Bover 1995).

in consumption and a predictable increase in loans. Changes in house prices have a significant impact on household debt and spending, and the analysis of these prices plays an important role in research on financial crises. It has also been shown that financial imperfections related to house markets have implications that go beyond individual households, for example findings of recent empirical studies emphasizing the importance of house price dynamics in shaping business cycles (Cecchetti 2008; Leamer 2007). Changes in house prices have a significant impact on household debt and spending, and the analysis of these prices plays an important role in research on financial crises. It has also been shown that financial imperfections related to home markets have implications that go beyond individual households. This was highly visible in the United States, where there was an expansion of subprime lending and securitization. The loosening of the lending policy resulted in an avalanche of unpaid mortgage loans, a drop in real estate prices, and a rapid increase in unemployment rate.

In the literature, there are many papers concerning the relation between the business cycle and credit market in a broad sense (i.e. Chaibi and Ftiti 2015, Cull and Martinez Pería 2013; Huizinga and Laeven 2019). However, empirical research on the impact of the market structure on the dynamics of loans has ambiguous results. While financial services have some peculiarities, their distribution channels are similar to those of other industries. In the theoretical model developed by Besanko and Thakor (1992), taking into account the fact that financial products are heterogeneous, they analyze the impact of competition on the cost of loans and deposits. They show that increased competition causes lower interest rates on loans and raises interest rates on deposits. There is evidence that a greater concentration in the deposit and loan markets can lead to a deterioration of conditions for clients, that is, an increase in the loan cost, although the strength of this impact varies widely and differs among banking sectors in given countries (Degryse et al. 2009, p. 119; Vives 2016, Azar et al. 2019). In empirical paper, Huizinga and Laeven (2019) for banking sector in euro zone countries find that loan loss provisions tend to be more procyclical at larger and better capitalized banks. Cull and Martinez Pería 2013, analyzed determinants of three categories of credit for households (mortgage, consumer) and for nonfinancial corporation and find the impact of bank ownership on credit growth in developing countries.

Research on lending procyclicality has become the main topic of many economic publications, also from the perspective of the market structure's influence on this phenomenon in Europe (e.g., Bouvatier et al. 2012, 2014; Leroy and Lucotte 2019). For example, using panel data from EU countries, Leroy and Lucotte (2019) show the non-linearity of the dependence of lending procyclicality on the variables characterizing the market structure. These results are confirmed by Kouretas, Pawłowska, and Szafrański (2020) for the years 2004–2017 in EU. Claessens and Kose present a comprehensive review of the existing empirical research on procyclicality in the context of macrofinancial linkages (Claessens and Kose 2018). The theoretical underpinnings of supply-side procyclicality, in particular with regard to the procyclical behaviour of the banking sector, have been extensively explained in Athanasoglou, Daniilidis and Delis (2014).

Furthermore, the new technologies also influence the bank loan market on both the demand and the supply sides. On the supply side, as computers' computing power increases, the use of application programming interfaces on the Internet, Big Data technology, and cloud computing also increases. The demand factors include changes in consumer behavior (related to the convenience of investing using online and mobile tools), demographic factors, and the level of the development of the economy and the financial market. Demographic factors driving the demand for FinTech services are related to the growing influence of the younger generation in the financial service market (FSB 2019, pp. 5–10). FinTech companies influence the structure of the financial service market through the number and the size of market participants, entry and exit barriers, and the availability of information and technology to all market participants (Feyen et al. 2021). According to Vives (2017), competitors from the FinTech sector put pressure on banks to adapt their traditional business model to current trends and demands. Compared with FinTech companies, banks have two competitive advantages in the financial market: they can borrow at low rates, have access to deposits, which explicit or implicit insurance by the government, they enjoy privileged access to a stable customer base (Vives 2017). This indicates that entering the intermediation industry with new technologies will depend heavily on government regulations and guarantees related to COVID-19. Along with the development of the FinTech sector, there is a growing number of studies on its impact on the bank loan market and the stability of the financial sector by influencing the structure of the lending market. Research efforts are directed at organizing the ever-expanding literature on the development of the sector (e.g., Thakor 2020) or focus on a narrow aspect of this phenomenon; for example, Morse (2015) has studied social loans, and Buchak et al. (2018) have analyzed the housing loan market. Ultimately, it has been found that despite the rapid development of the FinTech sector, public trust favors banks and provides them with regular customers (Thakor 2020, p. 12). According to Thakor (2020), such trust provides lenders with reliable access to finance, and a loss of investor confidence makes regaining trust dependent on market conditions and the reputation of the lender. Finally, also Fintech contribute to procyclicality (Financial Stability Board 2017, p. 15). With the emergence of fintech's providing credit through either direct lending or by matching investors and borrowers through peer-to-peer (P2P) platforms, credit provision could potentially become more procyclical. While banks have exhibited procyclical lending behavior in the past, there is potentially a higher risk of such lending with fintech's.

5.3   Model Description

In case to answer questions put in the introduction, in this chapter was presented the panel data analysis concerning lending procyclicality for different types of loans in the context of the market structure, foreign capital and new technology, that is, whether they prolong economic cycles and whether their impact depends on the

type of loan and the size of the banking sector in EU. The panel data analysis was provided for the period 2004–2019 with using the GMM estimator.

The study presented by Kouretas, Pawłowska, and Szafrański (2020) shows that the banking sector's market concentration, that is, its share in total assets affects procyclicality. Foreign ownership also contributes to procyclical variations across banking sectors. In the face of a strong crisis in the financial market, foreign banks tend to cause more procyclicality in the economy than domestic banks. This study was conducted on a larger sample than that in Kouretas, Pawłowska, and Szafrański's (2020) study, additionally covered the data for years 2018 and 2019,[2] and took into account the impact of new technology on credit growth. Particular attention was paid to the impact of digitalization of banks (technical progress and new players from the FinTech sector) and of the market structure (concentration and the foreign ownership) in the EU banking sectors on the dynamics of various types of bank loans (residential mortgage, consumer, and corporate loans).

The nature of the links between the financial sector and the real economy is complex (Pawłowska 2021). In good times, equity providers often tend to be overly generous with funding, thus creating bubbles (also encouraging more lending before the bubbles burst). In bad times, the flow of credit to the market is stalled too abruptly, limiting economic activity and consequently, financing. In the case of banks, these swings in sentiment are known as fluctuations in the credit cycle. It illustrates the volatility of loan availability for borrowers throughout the business cycle. In the first phase of the credit cycle (growth), loans are readily available. The characteristic features of this period include low interest rates and lower credit requirements, which then increase the availability of loans. In the second phase, the availability of loans decreases. During this period, interest rates rise, which increases the interest rates on loans and tightens credit requirements, which means that fewer people can meet them. Therefore, procyclicality is influenced by factors related to prudential regulation. For example, if more regulatory capital is required during a stunting phase, banks must reduce leverage and lending. The situation becomes worse than necessary. After the financial crisis of 2007–2009, reformers of the financial system have looked for ways to alleviate this phenomenon.

The study used annual data at the level of individual EU banks and at country level data. The used panel data set[3] contained microeconomic and macroeconomic data in the form of the panel for 28 EU countries at the level of individual EU banks and at country level data. The microeconomic data contained balance sheet information from individual banks in EU countries at the level of individual data from the Orbis Bank Focus database and the Bankscope database.[4] The macroeconomic data from individual EU countries were obtained from publicly available

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[2] Furthermore, this research was carried out for all EU countries and divided into other groups than in the paper Kouretas, Pawłowska, and Szafrański's (2020).

[3] These were cross-sectional and time-series data. Usually, the number of observed objects N is large in relation to the number of points in time t [Arlano, 2003; Baltagi 2005].

[4] Individual data from the Orbis Bank Focus database was combined with data from the Bankscope database, which contained data from before 2011.

online databases of international organizations, such as: the European Central Bank (Statistical Data Warehouse), Eurostat and the International Monetary Fund. As the coverage of the research period began in 2004 (i.e., the year when 10 countries became EU members, including Poland), the research on the determinants of bank loans in the EU was divided into groups: small banking sectors, large banking sectors, and all EU countries. Small banking sectors belong to the so-called new EU (Cyprus, the Czech Republic, Estonia, Lithuania, Latvia, Malta, Poland, Slovakia, Slovenia, Hungary, Bulgaria, and Romania). Large banking sectors come from the countries of the so-called old EU (Austria, Belgium, Denmark, Finland, France, Greece, Spain, the Netherlands, Ireland, Luxembourg, Germany, Portugal, Sweden, Great Britain, and Italy). However, the consolidation processes in the banking sector in Central and Eastern Europe (CEE) were largely a natural consequence of the earlier privatization of domestic banks, attracting strategic investors to them, which generally increased not only the competition in the sector but also its concentration. The above processes resulted from the fact that the banking sector in the EU is not homogeneous (Pawłowska 2016) because the basic features of banking sectors differ in the old and the new EU member states. First, an important feature of banking sectors in the new EU countries is a high level of concentration and a high share of foreign capital (Arena et al. 2007; Anginer et al. 2017) as opposed to banking sectors in Western Europe. Second, the banking sectors in CEE are small compared with those of the old EU, and banks use relatively simple, traditional business models and focus on deposit and lending activities for businesses and households. Based on the characteristics of the above sectors, the data panel for the EU was thus divided into two subpanels. The first contained data on the countries of CEE; Croatia was added to the new EU, but two countries—Malta and Cyprus—were removed from it (CEE-11). The second panel (EU-17) contained data from the banking sectors of the old EU. This group was extended to include Malta and Cyprus because they do not belong to the countries of CEE and have not undergone any systemic transformation. The research period covered the years 2004–2019.

An empirical model was built to test the lending procyclicality and impact of new technology, on the supply side. To check whether the market structure and new technology strengthened or weakened the procyclicality phenomenon, the model was further extended to examine the interactions between the market structure and new technology and the business cycle. In a linear model, the effect of cross-enhancement of the effects of individual variables can also be taken into account concerning bank performance such profitability, capitalization and the size. Moreover, the model takes into account a binary variable defining foreign capital (Chen et al. 2017; Wu et al. 2017). The following model is described by following equation:

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\begin{aligned}
\Delta Loan_{i,t} = & \gamma_i + \mu_t + \varrho \Delta Loan_{i,t-1} + \sum_{j=1}^{k} q_j X_{i,t} + \alpha_1 MS_{c,t} + \alpha_2 MS_{c,t}^2 \\
& + \alpha_3 DigTech_{c,t} + \left(\beta_1 + \beta_2 MS_{c,t} + \beta_3 MS_{c,t}^2 + \beta_4 For_{i,t} + \alpha_5 DigTech_{c,t} \right) \\
& GDP_{c,t} + \Delta I_{c,t} + \beta_0 + e_{it},
\end{aligned}
$$

$$(5.1)$$

where: β_0 denotes the constant in the model, γ_i, μ_t represent standard errors in the model, e_{it}-random effect and q_j, βj, α_j signify regression coefficients $j = 1, \ldots, 4$. The dependent variable $\Delta Loan$ represents the annual variation of three types of loans: residential mortgage loans (household lending for house purchases), consumer loans, and corporate loans (lending to non-financial corporations) for each bank i in year i.

The independent variables include the following:

$MS_{c,t}$ denotes the variables regarding the structure of the banking defined as the share of the five largest credit institutions in total assets (CR5) for each year t in country c.

$GDP_{c,t}$ signifies the country-specific GDP growth in year t in country c.

Furthermore, the interest rate is one of the main factors influencing the cost of credit by affecting the creditworthiness of households and businesses and credit availability. The interest rate cycle has a close positive correlation with the business cycle. It is now an era of low interest rates, and central banks are pursuing a snow policy based on quantitative easing (QE).

$\Delta I_{c,t}$ represents annual changes in interest rates for different types of loans (residential mortgage loans $Irhome_{ct}$, consumer loans $Ircons_{ct}$, and corporate loans $Ircorp_{ct}$) for each year t in country c, which measures the effect of the price of credit.

In the literature review, we suggested that increasing the bank market share may have two opposite effects on lending growth and that the impact of the market structure on the lending procyclicality may be non-linear (i.e., U-shaped). To take this possibility into account, in the base model described by Eq. (5.1), the market structure component raised to the second power $MS^2_{c,t}$ was also taken into account. Moreover, a binary variable defining foreign ownership was adopted as the measure of foreign capital. It was constructed on the basis of the information on the bank's ownership structure, which specified the bank's ownership type ($For_{i,t}$). The value of the variable is one if the bank is foreign; otherwise, the value is zero.

X is a vector of the following control variables that determine a bank's performance and macroprudential policy instruments, for each bank i for each year t in country c: – loan-to-deposit ratio (LTD), − loan-to-asset ratio (LTA), − cost-to-income ratio (CTI), − the bank's capital-to-asset ratio ($Tier1$), and – bank profitability ratio: return on assets (ROA) and return on equity (ROE).

Additionally, as a bank-specific variable, one describing its 'size' for each bank i for each year t in country c was used, defined as the logarithm of total assets (LA).

$DigTech_{c,t}$ vector is consist of the following of the variables that take into account the new technology in country c in year t:

– the individuals in the population using the Internet for online banking (by percentage of the population) (*Internet*),
– Internet access from a mobile device, such as a laptop or a notebook (by percentage of the population) *(Mobile)*.

To estimate the impact of the market structure and foreign capital on the lending procyclicality, the following interaction conditions were defined in the base model:

$(MS_{c,t} \times GDP_{c,t})$ and $\left(MS_{c,t}^2 * GDP_{c,t} \right), \left(For_{i,t} * GDP_{c,t} \right), \left(DigTech_{c,t} * GDP_{c,t} \right)$.

Based on eq. (5.1), estimations were made for three types of bank loans (residential mortgage, consumer, and corporate loans). The data panel covered the years 2004–2019. The estimation results, broken down into two subpanels, allow a comparative analysis of bank lending procyclicality in the CEE-11 countries versus all EU countries (EU-28).

5.3.1 Results of the Model

To answer our research questions, we hypothesized that the procyclicality of the market structure would depend on the loan type and on various groups of EU countries. We also attempted to confirm that the influence of concentration and foreign capital on the procyclicality of a bank loan would differ, depending on the type of loan considered (residential mortgage, consumer, or corporate). The model estimation results according to eq. (5.1), with using GMM estimator, are presented in the Table 5.1. In order to check the correctness of the model described by the eq. (5.1), several tests proposed by Arellano and Bond (1991) and Arellano and Bover (1995) were used. Among the tests used should be mentioned: the Hansen test of over identifying restrictions, which tests the overall strength of the instruments for a two-step estimator; and the Arellano-Bond tests for AR(1) and AR(2) in the first differences.

Table 5.1 shows a negative and significant α_1 coefficient for the CR_5 index (estimation 1). This means that concentration, measured by the five largest banks' share in assets, has had a negative impact on the growth of mortgage loans, mainly in the EU-17 countries. In contrast to a negative and significant α_1 coefficients were found only for the EU-28 countries for consumer and corporate loans (estimations 6 and 9). This means that competition has had generally a positive impact on the growth of corporate and consumer loans in the EU countries. Moreover, we found that the impact of the market structure on the growth of lending was U-shaped, as a positive and significant α_2 coefficient was obtained for the $CR_5{}^2$ index for the EU-17 countries for mortgage loans (estimation 1) and also for growth of corporate and consumer loans in the EU countries (estimations 6 and 9). This may mean that in countries with lower concentration, the impact on credit growth is negative, versus the positive impact on countries with high concentration, but it depends on the type of bank loans.

Next, we examined whether economic growth had an impact on the dynamics of various types of loans in the context of lending procyclicality. It has been shown that the market structure mainly influences the procyclicality of mortgage loans. This result confirms a different relation between the concentration and the procyclicality of different loan types. Additionally, Table 5.1 shows a significant and positive coefficient β_2 for CR_5 for mortgage loans in the EU-17 countries (estimations 1

Table 5.1 Results of the GMM model for mortgage, consumer and corporate loans

	EU-17	CEE-11	EU	EU-17	CEE-11	EU	EU-17	CEE-11	EU
	Mortgage loans (morloans)			Consumer loans (conloans)			Corporate loans (corloans)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Loans_{t-1}$	−0.28*	−0.29***	−0.32***	−0.11	−0.53***	−0.43***	−0.51***	−0.55***	−0.58***
Tier1	−1.04**	−2.76	−0.91**	−0.87*	−1.256	−0.48	−0.68	−0.75	−0.11
ROA	4.796	10.81	3.37	6.247**	10.25**	3.28	0.29	15.86***	1.63
LIQ	−6.87***	16.72	−5.82	−2.7	7.98	2.7	12.67***	1.95	7.82**
LTA	−0.987	1.299	−0.686	1.672*	3.40	1.58**	0.746	1.27	2.49***
LTD	0.036	0.211	0.261*	−0.226	−2.894*	−0.094	0.242	0.277	−0.26
CTI	−0.25	0.274	−0.29**	0.606*	0.038	0.167	−0.073	−0.245	−0.33**
LA	−4.88***	7.208	−7.71***	−8.15**	−4.18	−6.72*	−2.82	6.899	3.49
MS	−2.97**	−3.29	−2.18	−2.27	−1.425	−7.17*	−1.92	−4.61	−3.35**
MS^2	0.03**	0.06	0.02	0.02	0.009	0.057*	0.016	0.043	0.021*
GDP	0.09	0.09*	0.12**	10.628	−66.93*	16.11	4.58	16.145	3.88
MS*GDP	−1.19***	−1.23	−1.47***	−0.318	1.625	−0.69	−0.206	−0.416	−0.255
MS^2*GDP	0.013***	0.009	0.015***	0.002	−0.010	0.006	0.003	0.002	0.003*
For*GDP	0.06	−0.01	−0.26*	−14.401*	−0.702	2.962	−3.684	4.984*	4.06*
FinTech	−0.00	−0.00	−0.00*	0.02	−0.38**	0.03	0.00	0.00	−0.00
FinTech*GDP	0.02	−0.01*	−0.00	−0.00	0.01**	−0.00	0.00	0.00	−0.00
No. of observations	1763	228	1991	1867	498	2365	1225	472	1697
No. of ID	776	87	863	815	183	998	486	172	658
AR(1) test	0.273	0.503	0.071	0.273	0.503	0.168	0.927	0.479	0.793
AR(2) test	0.741	0.731	0.159	0.741	0.731	0.049	0.147	0.818	0.133
Hansen test	0.622	0.269	0.427	0.622	0.269	0.517	0.460	0.963	0.332

Source: authors' own calculations

Notes: The dependent variable *Loans* denotes the growth rate of mortgage loans, consumer loans, and corporate loans. GMM is a two-step generalized method of moments estimation, a two-step difference GMM estimator. *MS* is the CR_5 ratio (the five largest credit institutions' share in total assets). *For* is the foreign bank dummy variable. *Tier1, ROA, LIQ, LTA, LTD, CTI,* and *LA* denote banking control variables. *GDP* denotes GDP growth yoy. Interest rates (*Irhome, Ircons, Ircorp*) are inserted but not reported. AR(1) refers to the Arellano-Bond test for AR(1) in first differences. AR(2) refers to the Arellano-Bond test for AR(2) in first differences. The Hansen test is the test for over-identifying restrictions in GMM. Robust standard errors are in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

and 2). Also, Table 5.1 shows a significant and positive coefficient β_2 for CR$_5$ for mortgage loans in the EU-17 countries (estimations 1 and 2). Table 5.1 shows a positive and significant coefficient β_1 only for consumer loans (estimations 4). They therefore suggest a different procyclicality effect that may change as concentration increases, in the case of household loans (for mortgage and consumer loans).

Based on the estimation results, we found that on one hand, foreign ownership had an impact on procyclicality mainly in the case of mortgage loans and consumer loans; the β_4 coefficient for the EU-17 countries turned out to be significant and negative for consumer loans and for all EU for mortgage loans (Table 5.1, estimations 3 and 4). On the other hand, foreign ownership had a positive impact on the procyclicality of corporate loans for the CEE-11 countries and all EU countries based on the GMM estimation (Table 5.1, estimations 8 and 9). Finally, based on the estimation results, we found that new digital technology mainly had a positive impact mainly on the procyclicality of consumer loans and negative impact of mortgage loans in the case of CEE-11.

The estimation results also showed different responses to microprudential and macroprudential policies, depending on the group of EU countries and the type of the loan under consideration. However, capitalization as measured by the Tier1 ratio had a negative impact mainly on the growth of mortgage loans from EU-17 banks (see Table 5.1, estimations 1 and 3). The results confirmed that the deleveraging process in EU banks contributed to the growth of mortgage loans. Profitability and liquidity also contributed to increasing lending in the EU. Profitability had a positive impact mainly on the growth of mortgage loans in the case of EU-17 banks, and liquidity had a positive impact mainly on the growth of corporate loans in the case of EU-17 banks (see Table 5.1, estimations 4 and 8). However, in case of profitability for corporate loans for CEE-11. Also, the results also showed that the ratio of total deposits to total net loans had a positive and significant impact mainly on mortgage loans. Summarizing all of the above results, evidence showed that macroprudential instruments and new capital regulations contributed to lending growth in the context of the business cycle. Moreover, the size of the bank, measured by the amount of total assets (*LA*), positively influenced the growth of mortgage loans in the CEE-11 countries and negatively did so in the EU-17 countries. This finding is confirmed that bank size is an important factor in loan growth.

Finally this study showed that the market structure variables had the greatest impact on the dynamics mainly of residential mortgage home loans. In the case of consumer and corporate loans, the variables determining the structure of the banking sector turned out to be insignificant. Additionally, this this study's findings have shown that at the microeconomic level, there are non-linear dependencies between market concentration and lending procyclicality, mainly in relation to household loans. The results suggest that the procyclicality effect of lending is U-shaped and may change as the concentration increases.

The results of this research also contribute to the literature on the subject of the impact of macroprudential policy on bank lending procyclicality. They may also prove that the deleveraging process in EU banks reduces lending procyclicality. All of the above results confirm that the determinants of the growth of different types

of loans in both groups of countries (CEE-11 and EU-17) differ. The impact of concentration and foreign capital on the growth of lending varies, depending on the type of loan (residential mortgage, consumer, or corporate loans). These results also confirm the heterogeneity of the banking sectors in the EU. Finally, this study's findings show a negative impact of new technology on the growth of bank loans, particularly consumer loans, in EU countries. Which means that competitors from the fintech sector are taking some of the customers away from traditional banks.

5.4   Impact of COVID-19 on Bank Lending

EU governments, central banks, and international institutions (the International Monetary Fund, the World Bank and the European Investment Bank) took immediate action to reduce the negative effects of the COVID-19 pandemic in 2020. These activities applied to all areas of economic policy, including lending and the behavior of clients of financial institutions (Armantier et al. 2021). Regarding micro-prudential supervision, most of the activities of the EU countries concerned the banking sector, and their main goal was to maintain the flow of credit to the real economy. These included allowing the use of capital buffers to absorb losses, temporary non-compliance with certain capital requirements, and waiving of related sanctions. In the case of liquidity standards, these were allowing banks to temporarily operate below regulatory requirements; a flexible approach to the classification of credit exposures, including issuing guidelines for reducing the procyclical effects of applying International Financial Reporting Standard 9 (IFRS9); and reduction of operational burdens resulting from existing supervisory priorities or from reporting obligations. Recommendations were also issued regarding the suspension of dividends and the buyback of treasury shares. As for activities related to the banking sector, we should mention the introduction of statutory moratoria on loan repayments in some countries. The macroprudential authorities of the EU countries also took quick action, easing the parameters of the instruments already in force or withdrawing from the announced tightening of macroprudential measures. These measures were aimed at reducing the risk of a procyclical tightening of lending conditions by allowing banks to absorb losses through previously accumulated capital buffers. In particular, countries that previously had a countercyclical buffer decided to reduce its required level, sometimes to zero, or cancelled its increase. The macroprudential authorities of several EU countries have lowered (or fully released) the systemic risk buffer and the buffer of other systemically important institutions. At the same time, some countries have eased the parameters of tools not harmonized by EU law, such as loan to value limits (LTV) or on the burden of the borrower's current income with borrowing obligations or the costs of servicing them (Carletti et al. 2020, p. 18). It should be noted that monetary and prudential support caused that bank asset quality has been preserved despite the sharp recession. However, in fact, for the euro area, the non-performing loans ratio (NPLs) reached its lowest level on record at 2.7% in 2020, due to that banks reduced legacy portfolios (ECB 2022). It

should be noted that at this stage of the data, the impact of COVID-19 on banks' lending activities is impossible to quantify. Although the study presented in this paper ended in 2019, the impact of COVID-19 on banks' lending activities cannot be overlooked in the model. However, Çolak, and Öztekin, (2021) evaluated the influence of the pandemic on global bank lending and identified bank and country characteristics that amplify or weaken the effect of the disease outbreak on bank credit and find that bank lending is weaker in countries that are more affected by the health crisis.

5.5 Conclusions

The results of the analysis makes it possible to conclude that for two groups of EU countries (CEE-11 and EU-17), the influence of the market structure and new technology on the lending procyclicality differs, depending on the type of loan (residential mortgage, consumer, or corporate). The results of the studies do not provide an unequivocal answer about the role of foreign capital; rather, they indicate the impact of bank concentration and size on lending procyclicality. However, the relation between bank concentration and loan availability is certainly not as simple as the relation between concentration and the product market in the real economy. Moreover, separate lending channels (for residential mortgage, consumer, or corporate loans) may differ in strength in spreading real shocks during business cycles. The dominant role of loans to households in the intensification of macroeconomic volatility is also confirmed, which speaks for the sectoral and the national approach in macroprudential policy. Furthermore, in this paper, we confirm the impact on new digital technologies on the growth of consumer loans.

A further direction of thus research could be the more deeper analysis of the influence of digitalization on procyclicality observed for various types of loans (especially the differences between consumer and residential mortgage loans). Another direction of research should be the enhancement of the bank-level database and the pandemic period in the context of the increasing role of digital technology FinTech. Futhermore, financial stability conditions have deteriorated due to higher inflation couse to polytytical situation (ECB, Financial Stability Review, May 2022).

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