Cross Country Heterogeneity of Procyclicality of Bank Loans: Evidence from OECD Countries using the SURE Model

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ABSTRACT

Procyclicality of credit supply, which refers to the simultaneous movement of credit issued to the non-financial sector alongside economic activity indicators, can create a destabilizing feedback loop between the banking system and the real economy. The impact of credit supply on the financial and real sectors may vary across different economies, and the interconnectedness between countries can magnify the effect.

We conducted research examining procyclicality of loans provided by banks, analyzing data at the country level for 13 OECD countries for over 16 years (2005–2020). Our research findings indicate that the parameters measuring the procyclical effect are statistically insignificant when using the FE panel model. To showcase diversity of relationships under scrutiny across countries, we employed an OLS regression approach to estimate procyclicality for each country's loans. This approach assumes a lack of interconnectedness between economies.

We then introduced the Seemingly Unrelated Regression Equations (SURE) framework to examine how interconnectedness among countries affects the strength of loan procyclicality. Our analysis reveals the existence of procyclicality in many countries, and utilizing the SURE model further reinforces the phenomenon. Moreover, we found that bank-specific variables are more significant as loan supply determinants than macroeconomic variables.

JEL classification: E32, G21, G28

Keywords: procyclicality, credit supply, bank loans, capital management, risk management, seemingly unrelated regression.

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1. INTRODUCTION

Procyclicality refers to the feedback loops between the real economy and the financial system that amplify the business cycle. Alternative indicators can measure economic fluctuations (Boehl et al., 2016). According to Vanhoose (2010), the banking sector is inherently procyclical. This viewpoint was highlighted by Franco Modigliani, who believed that the tendency of credit markets toward instability, reflected in upswings and downturns, is natural (Modigliani et al., 1998).

During expansion periods, people can save more, leading to increased bank deposits. Additionally, consumers and entrepreneurs tend to increase spending, resulting in a higher overall demand for loans and credit from banks. Banks can meet the demand by supplying additional credit, which boosts their profits. Conversely, during a recession, individuals typically withdraw their funds to support themselves, leading to decreased deposits held by banks and a reduction in the overall supply of loans. The demand for loans also diminishes during a recession due to decreased consumption and reduced investment activities. Thus, it is expected that the aggregate level of loans supplied by banks will generally increase during expansion periods and decrease during recession periods.

Banks' procyclicality of credit supply is observed when it falls during economic downturns and rises during upturns (Borio et al., 2001). Literature on credit procyclicality can be broadly categorized into three groups, as Kouretas et al. (2020) outlined. The first group analyses various determinants of loans (Hempell and Sorensen, 2010; Jiménez et al., 2011; Cull and Martinez Pería, 2013; Cull et al., 2017; Kouretas et al., 2020). The second group focuses on the role of market structures in the real economy and their impact on credit (Petersen and Rajan, 1995; Kashyap and Stein, 2000; Altunbas et al., 2002; Claessens and Laeven, 2004; De Guevara and Maudos, 2011; Bikker and Leuvensteijn, 2014). The third group examines macro-financial linkages using panel vector autoregression models (Love and Zicchino, 2006; Marucci and Quagliariello, 2008; Bouvatier et al., 2012; Antonakakis et al., 2015; Apostolakis and Papadopoulos, 2019; Leroy and Lucotte, 2019).

Bank credit is determined by endogenous factors (bank-specific variables) and exogenous factors (macroeconomic variables). A robust financial system and a well-developed economy mutually support each other's growth. The ability of banks to expand long-term business loans depends on various factors, including capitalization, size, and the availability of long-term liabilities (Imran and Nishat, 2013). Vanhoose (2010) demonstrates that the aggregate level of loans in the economy typically increases during expansions and decreases during recessions. Goodhart and Segoviano (2004) explain that regulators are more stringent during recessions when reviewing banks due to higher default risk. This may lead to a contraction in loan supply to the economy. On the other hand, regulators are less strict during expansions, resulting in increased loan supply to the economy by banks. Bouheni and Hasnaoui (2017) show positive co-movements between bank lending and the business cycle for Eurozone banks, with differentiated impacts for larger and smaller banks.

The role of credit markets in the severe global recession of 2007–09 highlighted the need for a better understanding of the relationship between the financial sector and the real economy, which needed to be adequately incorporated into macroeconomic models (Gambetti and Musso, 2012). Comprehending the relative influence of supply and demand forces on credit and output is crucial, as this may require different responses from monetary and fiscal policy (Fourie et al., 2011). The global financial crisis, which triggered a severe worldwide recession, increased concerns about the procyclicality of bank risk-based capital requirements (Jokivuolle et al., 2015). Banks face more significant capital constraints than constant capital requirements as risk-based capital requirements rise during recessions. Consequently, banks may be compelled to significantly reduce lending, potentially exacerbating the recession (Kashyap and Stein, 2004).

While extensive research has focused on cyclicality of business credit, empirical evidence of credit supply cyclicality is available only for a limited number of countries (e.g., Gambacorta and

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Mistrulli, 2004; Marcucci and Quagliariello, 2008; Ivashina and Scharfstein, 2010; Becker and Ivashina, 2011; Jiménez et al., 2011). There is no evidence of cross-country linkages in analyzing credit growth procyclicality. Increasing interconnectedness of financial institutions and markets, along with more highly correlated financial risks, has intensified cross-border spillovers through various channels (Claessens et al., 2011; Olszak and Pipień, 2016; Fernandez-Gamez et al., 2020). Arčabić and Škrinjarić (2021) analyze spillovers and synchronization of business cycles in the European Union and find pronounced spillovers, highlighting the importance of studying cross-country linkages for the EU countries. Kouretas et al. (2020) investigate the impact of market structure on the EU bank loans and find heterogeneities between advanced and transitioning EU banking sectors.

Against this backdrop, our paper aims to investigate the link between bank loans and their determinants using a balanced panel dataset comprising 13 OECD countries (Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, and the United States) from 2005 to 2020. We employ an empirical estimation approach in two steps. First, we apply the Fixed Effect (FE) panel regression approach to identify the common procyclicality effect across all analyzed countries. The approach considers data from multiple countries and assumes constant parameters across countries. We employ the Seemingly Unrelated Regression Equations (SURE) system in the second step. The novel approach allows for variable parameters of interest across countries, enabling the testing of cross-country heterogeneity in the procyclicality effect. Moreover, it is an econometric framework suitable for analyzing the empirical significance of the standard panel regression outcomes, assuming a similar procyclicality effect for each explored country. Our primary research hypothesis posits that each country's procyclicality effect is specific, exhibiting substantial variability across different economies.

Previewing our main findings, we uncover a procyclical nature of loans in 6 of the 13 countries examined. Moreover, bank-specific variables hold greater significance as loan supply determinants than macroeconomic variables. Notably, applying the Seemingly Unrelated Regression Equations (SURE) model reinforces the statistical significance of business cycle and banking sector-specific variables, thus bolstering the procyclical effect of loans. Our research contributes to the existing literature on the procyclicality of bank loans in two significant ways. Firstly, we employ the SURE approach, allowing for distinct procyclical effects across each country. Secondly, our analysis sheds light on the role of interconnectedness among countries in estimating the strength of the procyclicality effect.

The remainder of the paper is organized as follows. Section 2 discusses hypotheses about the determinants of loans, considering both bank-specific and macroeconomic variables. Section 3 outlines the dataset and provides an overview of the empirical methodology. Subsequently, in Section 4, we present empirical results. Finally, Section 5 concludes the paper, highlighting implications for further research.

2. DETERMINANTS OF LOAN SUPPLY AND HYPOTHESES DEVELOPMENT

Extensive empirical research has consistently demonstrated that loan growth tends to be positive during economic upswings and damaging during recessions. Consequently, periods of rapid loan expansion are often accompanied by a decline in credit quality (Caporale et al., 2014). It can be attributed to banks' ability to increase lending by reducing interest rates or relaxing credit screening criteria for prospective borrowers. When screening criteria are relaxed, individuals previously deemed lacking sufficient creditworthiness may now be eligible for loans. However, such borrowers typically carry higher risk and are more likely to default in adverse scenarios, such as an economic downturn. Understanding the relationship between business cycles and the banking system remains a significant challenge for researchers and economists, particularly in light of the global financial crisis dated from 2007 to 2009.

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Our study considers a set of variables traditionally employed to explain credit supply, considering the income smoothing hypothesis (Greenawalt and Sinkey, 1988; Beatty et al., 2002; Liu and Ryan, 2006). Additionally, we modify the variables by incorporating measures of the business cycle, as observed in previous studies (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Olszak and Pipień, 2016). The chosen variables are presented in Table 1.

Table 1
Definitions of variables

Variable	Measure	Notation	Expected effect on Loan supply
Dependent variable:			
Loan Supply	Gross loans & advances to customers divided by total assets	*LOANS/TA*	
Determinants:			
Banking sector-specific:			
Profit	Profit before taxes divided by total assets	*PROFIT/TA*	+
Credit risk	Loans loss reserves divided by total assets	*LLP/TA*	–
Deposits	Capital to assets ratio.	*DEP/TA*	+
Macroeconomic:			
Business cycle measure	Real GDP growth	*GDPG*	+
	Inflation (Consumer Prices Index)	*INF*	+/–
	Unemployment (% of total labor force)	*UNEMP*	–

Source: Author’s own elaboration.

2.1. Macroeconomics determinants

Our analysis focuses on three macroeconomic determinants of loan supply, denoted as GDPG, INF, and UNEMP. GDPG represents real GDP growth and is a crucial indicator of loan procyclicality. It is widely preferred in investigating procyclicality at quarterly or annual frequencies (Banerjee, 2011). Empirical research consistently demonstrates a positive relationship between GDPG and credit supply (Gambacorta and Mistrulli, 2004; Bikker and Metzemakers, 2005; Jiménez et al., 2011; Banerjee, 2011; Kelly et al., 2013; Imran and Nishat, 2013). However, a negative correlation between GDP and loan supply may suggest countercyclical behavior by banks (Ibrahim, 2016; Albaity et al., 2020).

INF represents the inflation rate, measured by the consumer price index, which reflects the annual percentage change in the cost of a basket of goods and services for the average consumer. We include INF as an exogenous control variable. Previous studies have utilized inflation as a determinant of credit supply (Gambacorta and Mistrulli, 2004; Djiogap and Ngomsi, 2012; Klein, 2013). If INF is considered as an economic cycle variable, increasing during economic booms and decreasing during economic downturns, we would expect a positive relationship with loans, aligning with the procyclicality hypothesis that emphasizes loan supply increases during economic upswings and reduces during economic downturns (Klein, 2013).

UNEMP represents the unemployment rate, indicating the share of labor force without work but actively seeking employment. Unemployment and GDP series exhibit a negative correlation, meaning that unemployment tends to be higher during recessions and vice versa. Okun’s law

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suggests that for every 3-percentage-point decrease in GDP from its long-run level (also known as potential GDP), the economy experiences a one-percentage-point increase in unemployment. Conversely, a 3-percentage-point increase in GDP from its long-run level is associated with a one-percentage-point decrease in unemployment. As an economic variable, unemployment is expected to affect loan supply negatively. Previous studies have considered unemployment a determinant of loans (Gambacorta and Mistrulli, 2004; Klein, 2013; Donaldson et al., 2015).

2.2. Bank determinants

As determinants of loan supply specific to the banking sector, we consider three bank-related variables: Profit, Loan Loss Provisions, and Deposits.

PROFIT represents the operating profit before provisions and taxes divided by the bank's total assets (PROFIT/TA). We examine the variable to assess whether profits lead to bank credit expansion. Richter and Zimmermann (2019) find that profits increase banks' net worth and lending capacity, thereby increasing the supply of loans. Profitability is positively correlated with credit supply (Barona and Xiong, 2017). Bank profitability could motivate banks to expand their loans, suggesting a positive correlation between profits and credit supply (Awdeh, 2017; Alihodžić and Ekşi, 2018).

Loan Loss Provisions divided by total assets (LLP/TA) are introduced as an independent variable to proxy for credit risk. Changes in total loans outstanding are related to changes in default risk (as well as credit risk). If banks use Loan Loss Provisions (i.e., their allocation to cover expected losses) to manage credit risk, the relationship between LLP and LOANS is expected to be positive. Conversely, if banks exhibit imprudent loan loss provisioning behavior, the supply of loans may have a negative impact on LLP. Empirical findings regarding the relationship vary. Some studies find a positive influence of real loan growth on LLP (Bikker and Metzemakers, 2005; Fonseca and González, 2008), implying that banks set aside provisions to cover risks accumulated during economic booms. Other studies document a negative coefficient on loans (Laeven and Majnoni, 2003), which rejects the prudent loan loss provisioning behavior hypothesis. Shala and Toçi (2021) explored banks in SEE (South-Eastern Economies) and their use of LLPs. They investigated procyclicality, capital management, and income smoothing. The authors recommend a dynamic provisioning system to enhance efficiency during business cycles. Transparency on provisioning could enhance proper provisioning and counter-procyclicality, which would help market discipline.

Total Deposits normalized by total assets (DEP/TA) are included to test the liquidity hypothesis. Traditionally, the amount of credit provided by banks was directly linked to the level of deposits they held. However, financial innovation in the past decade has severed the link between credit and deposits. The decoupling has been identified as a primary contributing factor to the 2007–09 financial crisis (Kelly et al., 2013). Given the structure of the banking system, lending typically generates deposits. When a bank grants a loan to a household or firm, the loan proceeds are initially credited to the borrower's bank account. It means that lending is initially offset by corresponding deposits, increasing the money stock (Bang-Andersen, 2014). Therefore, deposits exhibit a direct and positive relationship with credit supply in the economy.

Shala et al. (2020) provided empirical evidence that banks in nine South-Eastern European countries use loan loss provisions to smooth their incomes and that components of LLPs do matter in growth in bank lending. However, the study does not support the hypothesis that LLPs are used for capital management by banks in the region. Shala et al. (2022) analyzed NPL determinants using macroeconomic, structural, and bank-specific data from 17 CEE countries from 2006–2017. It includes legal environment indicators and assesses the GFC's effect on NPLs. The findings suggest strengthening microprudential supervision, considering credit growth and regulatory quality, and ensuring accurate indicator measurements for policy implications. Ozili (2017) examined whether Western European banks' discretionary provisioning is driven by credit risk

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or income smoothing. After the 2007–2009 financial crisis, bank regulators in Europe introduced strict rules on bank provisioning and risk-taking behavior. However, it is unclear whether Western European banks' provisioning behavior is driven by credit risk or income smoothing incentives. The study by Ozili (2017) finds that Western European banks' discretionary provisioning is driven by both income smoothing and credit risk considerations.

3. DATA AND RESEARCH METHODOLOGY

Our analysis utilizes aggregated yearly bank balance sheet and income statement data covering the period of 16 years (2005–2020). The dataset comprises information from 4870 banks across 13 OECD countries: Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, and the United States. The comprehensive dataset is sourced from Moody's Analytics BankFocus at the bank level and then aggregated at the country level for our analysis.

We also incorporate macroeconomic variables from the World Bank Development Indicators database to supplement our analysis. The variables include the GDP growth rate, inflation rate, and unemployment rate, which provide essential contextual information for our study.

The basic model, based on Olszak and Pipień, 2016, is formulated within a panel regression framework as follows:

$$\frac{LOANS_{t,j}}{TA_{t,j}} = \alpha_0 + \alpha_1 \Delta GDPG_{t,j} + \alpha_2 INF_{t,j} + \alpha_3 UNEMP_{t,j} + \\ + \alpha_4 \frac{PROFIT_{t,j}}{TA_{t,j}} + \alpha_5 \frac{LLP_{t,j}}{TA_{t,j}} + \alpha_6 \frac{DEP_{t,j}}{TA_{t,j}} + \varepsilon_{t,j}, \tag{1}$$

where all variables are observed for the j-th country ($j = 1, \dots, n$) at year $t = 1, \dots, T$. The dependent variable is the loan supply (LOANS) of a bank divided by the bank's total assets (TA). Independent variables can be subdivided into two groups. In the first group we collect macroeconomic variables, like annual growth of the real Gross Domestic Product ($\Delta GDPG_{t,j}$), inflation rate ($INF_{t,j}$), and unemployment rate ($UNEMP_{t,j}$). The second group of variables consist of various bank-specific variables, like profits before taxes $\frac{PROFIT_{t,j}}{TA_{t,j}}$, loans loss provisions $\frac{LLP_{t,j}}{TA_{t,j}}$, and customer deposits of the bank $\frac{DEP_{t,j}}{TA_{t,j}}$. All banking sector specific variables are normalized by the bank total average assets (TA) to mitigate potential estimation problems with heteroscedasticity. Following Olszak and Pipień (2016), we move forward by relaxing assumption in (1) about cross-country homogeneity of parameters α_i. In order to perform this task, we refer to the system of Seemingly Unrelated Regression Equations (SURE) elaborated by Zellner (1962). To start let us rewrite equation (1) making all regression parameters variable across j:

$$\frac{LOANS_{t,j}}{TA_{t,j}} = \alpha_{0,j} + \alpha_{1,j} \Delta GDPG_{t,j} + \alpha_{2,j} INF_{t,j} + \alpha_{3,j} UNEMP_{t,j} + \alpha_{4,j} \frac{PROFIT_{t,j}}{TA_{t,j}} + \\ + \alpha_{5,j} \frac{LLP_{t,j}}{TA_{t,j}} + \alpha_{6,j} \frac{DEP_{t,j}}{TA_{t,j}} + \varepsilon_{t,j}, \tag{2}$$

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The standard assumption that, for each t, Gaussian error terms $\varepsilon_{t,j}$ and $\varepsilon_{t,i}$ in (2) are uncorrelated if $i \neq j$, makes the system of equations (2) independent. We denote the case by M_0. An application of such a system corresponds to the econometric strategy based on estimation of regression parameters separately for each country analysed. However, in general, error terms $\varepsilon_{t,j}$ and $\varepsilon_{t,i}$ can be correlated and system (2) can be treated as falling under the Seemingly Unrelated Regression Equations (SURE) model. We define the case as M_1, while $\varepsilon_t = (\varepsilon_{t,1}, \ldots, \varepsilon_{t,n})$ stands for the vector of error terms at time t with the covariance matrix $\sum$. In the case of model M_1 the matrix $\sum$ is symmetric and positively definite with $n(n+1)/2$ free elements (σ^2_{ij}), $i = 1, \ldots, n$ and $j = 1, \ldots, n$, such that $\sigma^2_{ij} = \sigma^2_{ji}$. In the standard notation the variance of the error terms in the i-th country is denoted by $\sigma^2_{ii} > 0$ and the covariance between error terms in j-th and i-th country is denoted by $\sigma^2_{ij} \in R$. We apply the following notation to the dependent variable and the vector of explanatory variables:

$$y_{t,j} = \frac{LOANS_{t,j}}{TA_{t,j}},$$

$$x_{t,j} = \left(1, GDPG_{t,j}, INF_{t,j}, UNEMP_{t,j}, \frac{PROFIT_{t,j}}{TA_{t,j}}, \frac{LLP_{t,j}}{TA_{t,j}}, \frac{DEP_{t,j}}{TA_{t,j}}\right).$$

The system of equations (2) can be formulated in the following closed form:

$$y^{(j)} = x^{(j)} \alpha^{(j)} + \varepsilon^{(j)}, \qquad j = 1, \ldots, n,$$

where $y^{(j)} = (y_{1,j}, \ldots, y_{T,j})'$, $x^{(j)} = (x'_{1,j}, \ldots, x'_{T,j})'$, $\varepsilon^{(j)} = (\varepsilon_{1,j}, \ldots, \varepsilon_{T,j})'$ and $\alpha^{(j)} = (\alpha_{0,j}, \alpha_{1,j}, \ldots, \alpha_{6,j})'$. In the next step we stack the observations presenting the system of equations as a regression of the following form:

$$Y = X\alpha + \varepsilon, \tag{3}$$

where: $Y_{[nTx1]} = (y^{(1)\prime}, \ldots, y^{(n)\prime})'$, $\quad \varepsilon_{[nTx1]} = (\varepsilon^{(1)\prime}, \ldots, \varepsilon^{(n)\prime})'$, $\quad \alpha_{[n7x1]} = (\alpha^{(1)\prime}, \ldots, \alpha^{(n)\prime})'$, and:

$$X_{[nTxn7]} = \begin{pmatrix} x^{(1)} & 0_{[Tx7]} & \cdots & 0_{[Tx7]} \\ 0_{[Tx7]} & x^{(2)} & \cdots & \vdots \\ \vdots & \ddots & \ddots & 0_{[Tx7]} \\ 0_{[Tx7]} & \cdots & 0_{[Tx7]} & x^{(n)} \end{pmatrix}.$$

Simple calculations yield the following form of the covariance matrix for the error term ε in (3):

$$V(\varepsilon) = \textstyle\sum \otimes I_n,$$

where $\otimes$ denotes the Kronecker product. The form of the covariance matrix of ε makes the system (2) a generalized linear regression. Given $\sum$, the Aitken Generalized Least Squares estimator of all parameters in the system can be expressed in the following form:

$$\hat{\alpha} = (X'(\textstyle\sum \otimes I_n)^{-1} X)^{-1} X'(\textstyle\sum \otimes I_n)^{-1} y.$$

In the M_0 case, where $\sum = \mathrm{diag}(\sigma^2_{11}, \ldots, \sigma^2_{nn})$ we have:

$$\hat{\alpha} = \hat{\alpha}_{OLS} = (X'X)^{-1} X'y, \tag{4}$$

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which is equivalent to the application of the OLS estimator to each equation separately. In the general case, M_1, we have to estimate the covariance matrix $\sum$. In the empirical part of the paper, we apply the Zellner (1962) method, and estimate elements of matrix $\sum$ on the basis of OLS residuals, denoted by $\hat{\varepsilon}_{[nTx1]} = (\hat{\varepsilon}^{(1)\prime}, \ldots, \hat{\varepsilon}^{(n)\prime})$. The Estimated GLS, elaborated by Zellner (1962) takes the following form:

$$\hat{\alpha}_{EGLS} = (X'(\mathrm{S} \otimes I_n)^{-1} X)^{-1} X'(\mathrm{S} \otimes I_n)^{-1} y. \quad (5)$$

where:

$$S = \frac{1}{T}(\hat{\varepsilon}^{(1)}, \ldots, \hat{\varepsilon}^{(n)})'(\hat{\varepsilon}^{(1)}, \ldots, \hat{\varepsilon}^{(n)}).$$

The nondiagonal matrix S explains correlations between error terms from different equations. Hence, it can be treated as a measure of the strength of cross-country linkages. In the empirical part of the paper, we discuss the importance of the SURE specification in explaining the heterogeneity of the relationship between loans and the banking sector – i.e. their specific determinants.

4. RESULTS AND DISCUSSION

We constructed a balanced panel dataset using annual data from 2005 to 2020 for 13 OECD countries, specifically Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, and the United States. The countries were chosen to ensure comparability with the study conducted by Olszak and Pipień (2016). Descriptive statistics for the variables employed in our analysis are presented in Tables 2 and 3. On average, the loan-to-assets ratio in the banking sectors of our sample was at 52% over the entire period, although the ratio varied considerably across countries, ranging from 5.7% to 93.2%. Notably, Sweden, Poland, and Denmark exhibited high loan-to-assets ratios, with values of 71.9%, 65.5%, and 63.7%, respectively, while Switzerland and France had lower proportions of 32.4% and 38.8%, respectively. The levels of profits, deposits, and loan loss provisions relative to total assets also displayed significant variation across countries.

Table 2
Descriptive statistics of the analyzed series

	LOANS/TA	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
Mean	0.515511	1.31521	1.515383	7.474712	0.006587	0.008544	0.383678
Median	0.510628	1.842526	1.531628	6.975000	0.006352	0.005285	0.388337
Maximum	0.931885	7.061544	4.489444	26.09000	0.019751	0.040059	0.73337
Minimum	0.056583	–10.8229	–1.14391	2.490000	–0.012108	0.000416	0.02884
Std. Dev.	0.137083	2.616323	1.13641	3.981535	0.004762	0.008522	0.154807
Skewness	0.070785	–1.50307	0.12625	2.200512	–0.306749	1.734758	0.142825
Kurtosis	3.009366	6.590182	2.649199	9.234274	4.509617	5.408717	2.414647
Jarque-Bera	0.17446	190.0274	1.619088	504.705	23.0128	154.6087	3.676701
Probability	0.916466	0.000000	0.445061	0.000000	0.00001	0.000000	0.15908
Sum	107.2264	273.5636	315.1997	1554.74	1.37001	1.77725	79.80498
Sum Sq. Dev.	3.889871	1416.945	267.3254	3281.493	0.004693	0.015033	4.960808
No. of observations	208	208	208	208	208	208	208

Source: Author's own calculation.

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Table 3
Country-wise statistics of the analyzed series

Country	Avg. of LOANS/TA	Avg. of GDPG	Avg. of INFLATION	Avg. of UNEMPLOYMENT	Avg. of PROFIT/TA	Avg. of LLP/TA	Avg. of DEPOSIT/TA
Belgium	0.49	1.03	1.86	7.45	0.01	0.01	0.41
Canada	0.49	1.94	1.70	6.98	0.01	0.00	0.57
Denmark	0.64	1.14	1.43	5.88	0.01	0.01	0.16
France	0.39	0.64	1.22	8.93	0.00	0.01	0.30
Germany	0.44	1.12	1.39	6.03	0.00	0.00	0.40
Italy	0.59	0.53	1.35	9.49	0.01	0.02	0.32
Netherlands	0.50	1.16	1.60	5.14	0.00	0.00	0.43
Norway	0.45	1.30	2.06	3.61	0.01	0.00	0.19
Poland	0.65	3.59	2.08	8.38	0.01	0.03	0.67
Spain	0.57	0.51	1.59	17.21	0.01	0.01	0.49
Sweden	0.72	1.80	1.17	7.39	0.01	0.00	0.24
Switzerland	0.32	1.83	0.28	4.45	0.01	0.00	0.41
United States	0.45	1.57	1.99	6.23	0.01	0.01	0.40

Source: Author's own calculation.

Among the three macroeconomic determinants examined, the mean levels of two variables, GDP growth and unemployment rates, were relatively comparable at 1.3% to 1.5%. However, the GDP growth rate exhibited greater diversity across countries, with minimum and maximum values of –10.82% and 7.06%, respectively. The average GDP growth rate across all countries during the analysis period was 1.32%. Italy was the only country with a negative average GDP growth rate (–0.53%) during the period, while Poland experienced the highest average GDP growth rate (3.59%). The average unemployment rate across the sample was 7.47%, showing substantial heterogeneity across countries, with the possibility of outliers indicated by a sample kurtosis greater than 9. Spain recorded the highest average unemployment rate (17.2%), whereas Norway had the lowest average unemployment rate (3.6%).

Table 4 presents the correlation matrix of the regression variables. The overall sample suggests relatively weak associations between the loan-to-assets ratio and the explanatory variables. Notably, the variables representing the banking sector's condition, namely profits, deposits, and loan loss provisions, exhibit strong correlations. Surprisingly, the variables do not display as strong a correlation with the loan-to-assets ratio as expected. However, as we will demonstrate later in the article, reporting weak relationships between the analyzed variables would be erroneous. The nature of the relationships between the variables is primarily driven by cross-country heterogeneity, as revealed within the SURE model.

Table 4
Matrix of sample correlation of the analyzed series

	LOANS/TA	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
LOANS/TA	1	0.0139	0.0437	0.0373	0.0051	0.0258	0.0070
GDPG	0.0139	1	0.0721	0.0398	0.0128	0.0384	–0.0067
INFLATION	0.0437	0.0721	1	0.0006	–0.0002	0.0044	0.0003
UNEMPLOYMENT	0.0373	0.0398	0.0006	1	0.0020	–0.0002	0.0004
PROFIT/TA	0.0051	0.0128	–0.0002	0.0020	1	–0.3626***	0.5667***
LLP/TA	0.0258	0.0384	0.0044	–0.0002	–0.3626***	1	–0.4158***
DEPOSIT/TA	0.0070	–0.0067	0.0003	0.0004	0.5667***	–0.4158***	1

Note: *** denotes significance at 1% level.
Source: Author's own calculation.

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Tables 5, 6, and 7 present estimation results of the parameters in equations (1) and (2). Initially, we estimated the parameters in equation (1) using fixed-effect (FE) panel regression techniques, as shown in Table 5. In the case, the FE approach does not account for cross-country diversity in the impact of explanatory variables on the loan-to-assets ratio. Among all the factors that potentially influence loan variability, profits and loan loss provisions are empirically important, as indicated by statistically significant parameter estimates. Surprisingly, deposits do not appear as significant as the LLP measure and profits. In contrast, macroeconomic variables do not contribute significantly to the loan-to-assets ratio, with relatively small and insignificant point estimates for the corresponding parameters.

Table 5

Determinants of $\frac{LOANS_{t,j}}{TA_{t,j}}$ – the FE panel estimates of parameters in equation (1)

	Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
FE panel regression estimates							
Est.	0.4416***	–0.0040	0.00357	0.002161	9.2319***	5.3059***	–0.1267***
Std. error	0.0315	0.00377	0.00794	0.00259	2.0830	1.3123	0.0661
p-value	0.0000	0.2970	0.6561	0.4111	0.0001	0.0003	0.0643

Note: *** denotes significance at 1% level.

Source: Author's own calculation

The empirical insight into cross-country heterogeneity is presented in Tables 6 and 7. In Table 6, we report estimation outcomes for parameters in models M_0 and M_1. In model M_0, which assumes no correlations between $\varepsilon_{t,j}$ and $\varepsilon_{s,i}$ in the system of equations (2) (model M_0) we run separate OLS regressions for each country, treating the regression for each country independently and disregarding interactions among equations. Table 7 presents the results of estimation in the case of M_1, which accounts for a non-diagonal covariance matrix in the system (2) using the Zellner (1962) estimator. In both cases, M_0 and M_1, the data strongly supports cross-country diversity in the relationships between the loan-to-assets ratio and other variables of interest. In most cases, the relationships are statistically significant, as measured by the corresponding parameter estimates. The lack of significance between the GDP growth rate and the loan-to-assets ratio in the case of the United States is noteworthy. There are also countries where fluctuations in economic growth hurt the loan-to-assets ratio. Among the countries, which include Canada, Denmark, Spain, Sweden, and Switzerland, only Sweden exhibits vital significance, with some evidence for Switzerland.

Table 6

Cross country heterogeneity of determinants of $\frac{LOANS_{t,j}}{TA_{t,j}}$ – estimates of parameters in equation (2) provided the model M_0 (independent regressions)

Country		Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
The system of independent regressions; M_0								
Belgium	Est.	–0.0711	0.0047	–0.0021	0.0350	–6.1422	–2.2310	0.8253
	Std. error	0.0866	0.0018	0.0036	0.0076	1.4003	3.2544	0.1350
	p-value	0.4178	0.0136	0.5611	0.0001	0.0001	0.4979	0.0000
Canada	Est.	0.4600	–0.0019	–0.0124	–0.0086	5.9418	–32.8700	0.3281
	Std. error	0.1550	0.0039	0.0092	0.0066	4.6054	6.6498	0.2875
	p-value	0.0056	0.6270	0.1898	0.2052	0.2062	0.0000	0.2623

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Table 6 – continued

Country		Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
Denmark	Est.	0.9561	–0.00086	–0.0121	–0.0087	0.0913	–0.1550	–1.5486
	Std. error	0.0305	0.0016	0.0042	0.0084	1.7588	4.5363	0.1063
	p-value	0.0000	0.5871	0.0068	0.3094	0.9589	0.9730	0.0000
France	Est.	0.2216	0.0042	–0.0096	–0.0254	0.2904	19.75	0.6941
	Std. error	0.0358	0.0014	0.0047	0.0042	1.6235	1.2707	0.0628
	p-value	0.0000	0.0055	0.0510	0.0000	0.8591	0.0000	0.0000
Germany	Est.	–0.5604	0.0091	–0.0308	0.0274	–28.93	9.3119	2.2475
	Std. error	0.2000	0.0035	0.1350	0.0059	7.9103	8.6623	0.3744
	p-value	0.0086	0.0149	0.0299	0.0001	0.0009	0.2904	0.0000
Italy	Est.	0.2642	–0.0031	0.0539	0.0090	17.35	1.2588	0.1582
	Std. error	0.2320	0.0111	0.0269	0.0342	7.7527	6.5491	0.3813
	p-value	0.2632	0.7845	0.0537	0.7949	0.0323	0.8488	0.6811
Netherlands	Est.	–0.0664	0.0041	0.0178	–0.0026	1.5027	29.45	1.0088
	Std. error	0.0921	0.0030	0.0095	0.0082	1.5549	9.24	0.1682
	p-value	0.4762	0.1916	0.0713	0.7532	0.3411	0.0032	0.0000
Norway	Est.	0.0257	0.0307	0.0008	–0.0072	–4.32	90.42	1.2583
	Std. error	0.1437	0.0157	0.0180	0.0305	6.57	26.1949	0.3418
	p-value	0.8594	0.0600	0.9636	0.8155	0.5149	0.0016	0.0008
Poland	Est.	1.0974	–0.0027	–0.0164	–0.0230	6.29	15.83	–1.0482
	Std. error	0.1476	0.0043	0.0054	0.0045	0.95	2.696	0.2543
	p-value	0.0000	0.5432	0.0048	0.0000	0.0411	0.0000	0.0002
Spain	Est.	0.0168	–0.0012	–0.0022	–0.0157	7.7049	26.24	0.8151
	Std. error	0.0330	0.0013	0.0039	0.0016	1.0477	1.5228	0.0654
	p-value	0.6140	0.3455	0.5852	0.0000	0.0000	0.0000	0.0000
Sweden	Est.	0.3220	–0.0146	0.00072	0.0062	54.94	40.04	–0.5960
	Std. error	0.1162	0.0025	0.0069	0.0111	6.08	8.69	0.1309
	p-value	0.0092	0.0000	0.9172	0.5829	0.0000	0.0001	0.0001
Switzerland	Est.	0.0085	–0.0056	0.0103	0.0110	–0.2791	9.24	0.6449
	Std. error	0.0478	0.0025	0.0059	0.0124	0.7271	13.64	0.0588
	p-value	0.8604	0.0306	0.0902	0.3781	0.7040	0.4948	0.0000
United States	Est.	0.4276	–0.00012	0.0062	–0.0273	4.8280	22.27	–0.0771
	Std. error	0.1156	0.0081	0.0055	0.0112	3.4537	8.1279	0.2491
	p-value	0.0008	0.9884	0.2682	0.0205	0.1718	0.0100	0.7590

Source: Author's own calculation.

Table 7

Cross country heterogeneity of determinants of $\frac{LOANS_{t,j}}{TA_{t,j}}$ – estimates of parameters in equation (2) provided the model M_1 (SURE specification)

Country		Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
The SURE model; M_1								
Belgium	Est.	–0.0604	0.0038	–0.0011	0.0342	–5.5754	–1.2658	0.7889
	Std. error	0.0668	0.0015	0.0025	0.0059	1.1326	2.5806	0.1065
	p-value	0.3726	0.0145	0.6572	0.0000	0.0000	0.6271	0.0000
Canada	Est.	0.4732	–0.0019	–0.0122	–0.0125	5.1763	–33.38	0.3694
	Std. error	0.0797	0.0013	0.0033	0.0028	1.9310	4.2648	0.1400
	p-value	0.0000	0.1338	0.0009	0.0001	0.0115	0.0000	0.0128

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Table 7 – continued

Country		Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
Denmark	Est.	0.9597	–0.0010	–0.0134	–0.0081	–0.2718	–0.3267	–1.5613
	Std. error	0.0280	0.0015	0.0038	0.0075	1.4402	3.9712	0.0955
	p-value	0.0000	0.5003	0.0012	0.2906	0.8515	0.9349	0.0000
France	Est.	0.1982	0.0039	–0.0059	–0.0219	0.7255	18.6232	0.6842
	Std. error	0.0259	0.0009	0.0032	0.0026	1.0701	0.9052	0.0474
	p-value	0.0000	0.0002	0.0760	0.0000	0.5027	0.0000	0.0000
Germany	Est.	–0.5215	0.0074	–0.0304	0.0229	–21.8209	13.2469	2.1279
	Std. error	0.1187	0.0022	0.0080	0.0040	5.1639	5.1010	0.2231
	p-value	0.0001	0.0021	0.0006	0.0000	0.0002	0.0141	0.0000
Italy	Est.	0.2865	0.0068	0.0416	0.0134	14.3284	–2.0080	0.2857
	Std. error	0.1112	0.0071	0.0146	0.0155	3.3844	2.8156	0.2394
	p-value	0.0148	0.3424	0.0078	0.3936	0.0002	0.4809	0.2413
Netherlands	Est.	–0.0428	0.0032	0.0187	–0.0024	2.0691	20.6508	1.0215
	Std. error	0.0672	0.0026	0.0069	0.0061	1.1665	6.7065	0.1202
	p-value	0.5291	0.2156	0.0108	0.7002	0.0856	0.0042	0.0000
Norway	Est.	0.1296	0.0240	0.0053	–0.0298	–5.1175	79.3370	1.3000
	Std. error	0.0913	0.0121	0.0124	0.0202	4.0089	19.3885	0.2268
	p-value	0.1655	0.0568	0.6748	0.1497	0.2110	0.0003	0.0000
Poland	Est.	0.9508	0.0007	–0.0113	–0.0177	3.7840	13.4419	–0.7867
	Std. error	0.1098	0.0030	0.0042	0.0034	2.0948	2.0524	0.1912
	p-value	0.0000	0.8195	0.0112	0.0000	0.0803	0.0000	0.0003
Spain	Est.	0.0024	–0.0008	–0.0009	–0.0164	7.3853	25.5120	0.8878
	Std. error	0.0249	0.0010	0.0027	0.0011	0.6882	1.1137	0.0541
	p-value	0.9242	0.4644	0.7514	0.0000	0.0000	0.0000	0.0000
Sweden	Est.	0.4028	–0.0144	–0.0030	–0.0064	54.8008	39.9204	–0.5237
	Std. error	0.0790	0.0017	0.0048	0.0071	3.9758	4.5496	0.0926
	p-value	0.0000	0.0000	0.5281	0.3782	0.0000	0.0000	0.0000
Switzerland	Est.	0.0187	–0.0039	0.0041	0.0058	–0.2482	22.91	0.6261
	Std. error	0.0299	0.0019	0.0037	0.0075	0.3379	9.5677	0.0411
	p-value	0.5364	0.0510	0.2733	0.4476	0.4679	0.0226	0.0000
United States	Est.	0.3526	0.0060	0.0060	–0.0157	2.4820	14.7957	0.0993
	Std. error	0.0803	0.0058	0.0039	0.0075	2.3874	5.6534	0.1718
	p-value	0.0001	0.3031	0.1354	0.0441	0.3063	0.0134	0.5673

Source: Author's own calculation.

Tables 8 and 9 present the statistical significance and the direction of the relationship between the loan-to-assets ratio and explanatory variables. The tables provide qualitative insights into the procyclicality effects and the strength of the analyzed linkages, complementing the information from Tables 6 and 7. Initially, when examining the role of economic growth in explaining loan fluctuations, we reported a very weak, slightly negative, but statistically insignificant impact in the FE panel regression outcomes shown in Table 5. However, according to the system (2) in both stochastic settings (M_0 and M_1), the relationship between economic growth and loans exhibits substantial diversity across countries. Overall, the SURE model (M_1) provides more precise estimates, resulting in stronger inferences about the statistical significance of the parameters compared to the independent regressions in M_0. Among the countries with a positive impact of

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economic growth fluctuations on the loan-to-assets ratio there are Belgium, France, Germany, Norway, and the United States. However, based on model M_1, the impact can be considered decisively significant only for Belgium, France, and Germany. The lack of significance between the growth rate of GDP and loans (to total assets) in the case of the United States is worth noting. On the other hand, there are countries where economic growth fluctuations have a negative impact on the loan-to-assets ratio. Table 9 shows that among the countries, including Canada, Denmark, Spain, Sweden, and Switzerland, only in the case of Sweden can we report strong significance, with some evidence also found for Switzerland.

Table 8
The sign and significance of impact in (2) – the model M_0 (independent regressions)

Country	Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
Belgium	–	+*	–	+***	–***	–	+***
Canada	+	–	–	–*	+	–***	+
Denmark	+***	–	–***	–	+	–	–***
France	+***	+***	–*	–***	+	+***	+***
Germany	-***	+**	–**	+***	–***	+	+***
Italy	+	–	+*	+	+**	+	+
Netherlands	–	+	+*	–	+	+***	+***
Norway	+	+*	+	–	–	+***	+***
Poland	+***	–	–***	–***	+**	+***	–***
Spain	+***	–	–	–***	+***	+***	+*
Sweden	+***	–***	+	+	+***	+***	–***
Switzerland	+	–**	+*	+	–	+	+***
United States	+***	–	+	–**	+	+***	–

Note: A particular variable's positive/negative impact is denoted by +/– respectively. We also put notation reporting the significance at levels 0.01, 0.05 and 0.1 by ***, ** and *.

Source: Author's own calculation.

Table 9
The sign and significance of impact in (2) – the model M_1 (independent regressions)

Country	Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
Belgium	–	+**	–	+***	–***	–	+***
Canada	+***	–	–***	–***	+**	–***	+**
Denmark	+***	–	–***	–	–	–	–***
France	+***	+***	+*	–***	+	+***	+***
Germany	–***	+***	–***	+***	–***	+**	+***
Italy	+**	+	+***	+	+***	–	+
Netherlands	–	+	+**	–	+*	+***	+***
Norway	+	+*	+	–	–	+***	+***
Poland	+***	+	–**	–***	+*	+***	–***
Spain	+	–	–	–***	+***	+***	+***
Sweden	+***	–***	–	–	+***	+***	–***

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Table 9 – continued

Country	Intercept	GDPG	INFLATION	UNEMPLOYMENT	PROFIT/TA	LLP/TA	DEPOSIT/TA
Switzerland	+	–*	+	+	–	+**	+***
United States	+***	+	+	–**	+	+**	+

Note: A particular variable's positive/negative impact is denoted by +/– respectively. We also put notation reporting the significance at levels 0.01, 0.05 and 0.1 by ***, ** and *.

Source: Author's own calculation

Regarding the impact of inflation on the loan-to-assets ratio, the FE estimates presented in Table 5 indicate insignificance. However, when considering model M_1, we observe some diversity. Negative and statistically significant impacts are found for Canada, Denmark, and Germany, while positive and statistically significant influences are reported for Italy and the Netherlands. In the case of other countries, the relationship between inflation and loans (to total assets) is insignificant.

Unemployment rate is the third and final macroeconomic variable in our analysis. Like the GDP growth rate and inflation, the FE panel estimates indicate the empirical insignificance of the relationship between the unemployment rate and the loan-to-assets ratio. According to Table 9, in the SURE model (M_1), the predominant statistically significant impacts are negative and can be attributed to Canada, France, Poland, Spain, and, to some extent, the United States. On the other hand, Belgium and Germany exhibit a positive and significant impact of the unemployment rate on the loan-to-assets ratio.

In addition to the variables discussed earlier, we also considered some observed categories representing the activity of the banking sector as explanatory variables in the panel regression (1) and the system (2). Among the variables, profits and loan loss provisions (relative to total assets) exhibit significance in the FE panel regression at the 0.01 level. The results obtained for model M_1 shed light on the nature of the analyzed relationships. The impact of profits on loans (relative to total assets) is positive and statistically significant, at least at the 0.1 level, for Canada, Italy, the Netherlands, Poland, Spain, and Sweden. However, in the cases of Belgium and Germany, the impact is also statistically significant but negative. Similarly, regarding the relationship between loan loss provisions and loans (relative to total assets), model M_1 (Table 9) indicates an increasing relationship for nine countries. In most cases, the identified associations are characterized by statistically significant parameters in equation (2). The only substantial evidence supporting a negative impact of loan loss provisions on loans (both relative to total assets) is found for Canada. FE panel regression estimates in Table 5 show a negative relationship between deposits and loans (relative to total assets), which is statistically significant at a level no smaller than 0.1. The SURE specification (M_1) strengthens the level of statistical significance for negative relationships in Denmark, Poland, and Sweden, as compared to the FE panel outcomes.

Table 10 presents estimation results for the elements of the covariance matrix Σ, which are necessary for the SURE specification. The point estimates of the variances (shown in bold font), contemporaneous covariances (shown in italics, above the diagonal), and contemporaneous correlations (displayed below the diagonal) of error terms are reported. Analyzing the correlation estimates, it becomes evident that the system regression approach employed in model M_1 is empirically important. SA simple analysis based on country-independent regressions, which formally assume a diagonal covariance matrix, overlooks substantial cross-country financial linkages. The strongest correlations in the system are positive, with some exceptions. The strongest financial linkage, as measured by the correlation of the error terms, is observed between the United States and Norway (0.91). Additionally, pairs such as Sweden-Canada, Spain-Italy, Poland-the Netherlands, Sweden-the Netherlands, and Sweden-Poland exhibit positive correlations exceeding 0.5. A few exceptions with strong negative correlations include Germany-Canada, France-Switzerland, Italy-Germany, Germany-Spain, and Italy-Switzerland.

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Table 10
Point estimates of the variances (bold), contemporaneous covariances (in italics above the diagonal) and contemporaneous correlations (shaded cells below the diagonal) of error terms in case of model M_1 (SURE specification), calculated based on matrix S

Country	Belgium	Canada	Denmark	France	Germany	Italy	The Netherlands	Norway	Poland	Spain	Sweden	Switzerland	US
Belgium	**0.0001150**	*0.0000284*	*–0.0000005*	*0.0000195*	*0.0000295*	*–0.0004204*	*0.0000106*	*0.0001407*	*0.0000063*	*–0.0000730*	*0.0000212*	*0.0000446*	*0.0000938*
Canada	0.1658733	**0.0002544**	*–0.0000120*	*0.0000113*	*–0.0003180*	*0.0006955*	*0.0001168*	*0.0002504*	*0.0002279*	*0.0000641*	*0.0002168*	*–0.0000508*	*0.0000757*
Denmark	–0.0042713	–0.0672037	**0.0001244**	*–0.0000071*	*–0.0000248*	*–0.0001280*	*–0.0000525*	*0.0000141*	*–0.0000506*	*–0.0000253*	*–0.0000972*	*0.0000068*	*–0.0000109*
France	0.2229476	0.0870313	–0.0781787	**0.0000668**	*0.0000512*	*–0.0000185*	*0.0000089*	*0.0002016*	*0.0000648*	*0.0000112*	*0.0000036*	*–0.0000596*	*0.0000760*
Germany	0.1036583	–0.7518819	–0.0836982	0.2361591	**0.0007032**	*–0.0012450*	*–0.0002041*	*0.0003153*	*–0.0003779*	*–0.0002156*	*–0.0001372*	*0.0000940*	*0.0001156*
Italy	–0.4337105	0.4822548	–0.1268689	–0.0249895	–0.5192681	**0.0081748**	*–0.0004161*	*0.0013682*	*–0.0001995*	*0.0008029*	*–0.0001913*	*–0.0008492*	*0.0001446*
Netherlands	0.0475832	0.3533172	–0.2272467	0.0528037	–0.3714958	–0.2220645	**0.0004294**	*–0.0004881*	*0.0004020*	*–0.0000108*	*0.0002761*	*0.0000205*	*–0.0001140*
Norway	0.2395314	0.2864947	0.0230606	0.4500130	0.2169736	0.2761481	–0.4298034	**0.0030028**	*–0.0003864*	*–0.0000689*	*0.0001882*	*–0.0001493*	*0.0010126*
Poland	0.0204586	0.4947619	–0.1571236	0.2745120	–0.4934451	–0.0763929	0.6717509	–0.2441794	**0.0008339**	*0.0002192*	*0.0003546*	*–0.0000383*	*–0.0001089*
Spain	–0.4285458	0.2526436	–0.1426980	0.0862174	–0.5114171	0.5585861	–0.0326624	–0.0790681	0.4775088	**0.0002527**	*–0.0000071*	*–0.0001117*	*–0.0000353*
Sweden	0.0888881	0.6100625	–0.3911547	0.0197464	–0.2322535	–0.0949728	0.5980872	0.1541711	0.5510650	–0.0200013	**0.0004965**	*0.0000820*	*0.0000959*
Switzerland	0.3210598	–0.2458503	0.0472764	–0.5623761	0.2734880	–0.7246409	0.0763722	–0.2102010	–0.1023475	–0.5419391	0.2839402	**0.0001680**	*–0.0000226*
US	0.4291456	0.2328357	–0.0480180	0.4557898	0.2138238	0.0784228	–0.2697751	0.9064217	–0.1849465	–0.1090304	0.2110975	–0.0853804	**0.0004156**

Source: Author's own calculation.

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5. CONCLUSIONS

The paper utilizes a balanced panel database of aggregated financial statements from the banking sector in 13 OECD countries (Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, and the United States) to examine procyclicality of credit supply by banks from 2005 to 2020. We investigate bank loan determinants by considering bank-specific and macroeconomic variables. Firstly, we address the critical question of identifying determinants of bank loans at the country level using panel regression analysis. Secondly, we employ the Seemingly Unrelated Regression Equations (SURE) methodology to explore the impact of interconnectedness among countries on the diversity of the strength of the procyclicality of bank loans.

Our research contributes to the existing literature on the procyclicality of bank loans by utilizing the SURE approach, which allows us to empirically measure the interconnectedness between countries as a determinant of bank loans. As compared to panel regression models, which serve as the reference econometric framework, and the regression analysis conducted independently for each country, applying the SURE model enhances the statistical significance of the business cycle and banking sector-specific variables in countries with a procyclical effect.

Our findings provide empirical evidence supporting the procyclicality of loans in 6 out of the 13 countries included in the analysis. Furthermore, we observe that bank-specific variables have greater significance as loan supply determinants than macroeconomic variables.

A potential path for further research is to analyze whether the procyclicality of bank loans differs based on the type of loans, such as consumer loans, commercial loans, and residential mortgage loans.

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