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Regulation of Finance and Accounting

21st and 22nd Virtual Annual Conference on Finance and Accounting (ACFA2020-21), Prague, Czech Republic

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Preface

Dear readers,
We are glad to present to you the next edition of the papers presented at the Annual Conference of Finance and Accounting (ACFA). The Conference, organised by the Faculty of Finance and Accounting of Prague University of Economics and Business, provides a vital platform for the presentation of research that address up-to-date developments in the field.

Unexpected real and financial shocks occurring recently are bringing new challenges to global finance and accounting. As a result, traditional regulatory patterns as well market participants' behaviour are being reshaped in unprecedented ways. Being co-affected by ongoing globalisation, fiscal and monetary policy, public regulation and supervision, financial markets, corporate reporting, and auditing have to adapt to those shocks which are expected to persist in the long run. Shocks manifest themselves through many channels, requiring a variant approach to investigating their causes and consequences. ACFA therefore supports the use of a mix of research methods (including modelling, empirical testing, case studies or qualitative analysis) to gain a deeper understanding of the drivers of and responses to the recent events affecting the global financial and accounting systems.

The volume offers different research perspectives on not only economic but also non-economic impacts of global developments in financial regulation, monetary and fiscal measures, or sustainable development, with a tailored focus on specifics in emerging and transitioning countries. Contributing authors investigate emerging topics (e.g., economics of emissions and corporate social responsibility reporting) as well as traditional issues requiring new approaches (e.g., exchange rate mechanisms, investment strategies and the impact of corporate reporting on economic fundamentals). We believe that such a comprehensive view of contemporary economic phenomena makes the volume attractive not only to academia but also to regulators and policymakers, when deliberating on the potential outcomes of competing regulatory mechanisms.

Prague, Czech Republic — David Procházka

Contents

Chapter 1
Financial Regulations, Supervision Structure and Banking Performance in CESEE

Karel Janda and Oleg Kravtsov

Abstract We examine the effects of supervision activities and structure on the risk-adjusted performance of banking institutions. For a data set of 450 banks from 20 economies of Central Eastern Southern Eastern Europe, we employ the moderation analysis framework and find that the supervision structure affects the supervision activities. Especially, this is relevant for bank units with a status "too-big-to-fail" on the national level. Seemingly, supervision scrutiny does not affect their performance, and it is associated with lower riskiness. On the contrary, such an effect is negligible for bank units with lower capitalization. The findings highlight the area of attention for regulators and policymakers and thus contribute to the designing of effective supervision mechanisms.

Keywords Supervision · Regulation · RAROC · Moderation analysis · Central Eastern Southern Eastern Europe (CESEE)

1.1 Introduction

While the academic literature has paid increasing attention to the impacts of financial regulations on the banking sector, for example (Demirgüç-Kunt et al., 2008; Laeven & Levine, 2009; Barth et al., 2010, 2013), few studies are dedicated to the analysis of supervision efforts in the monitoring and enforcement of established rules, which are often carried out by national regulators or on behalf of supranational banking authorities, e.g. in the case of cross-border banking activities. Supervision is rarely

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examined separately from regulations for several reasons. In the practical world, it is difficult to explore regulation and supervision separately due to their overlapping nature as they can interact in a complex way (Ongena et al., 2013). Partly, it is attributable to the relative opacity of supervisory activities, which stems from supervisors' reliance on confidential information (Eisenbach et al., 2016). Relatively, little is known about the distinct impact of supervisory monitoring efforts on the performance of banks.

In this paper, we build upon the recent studies with the focus on broad concept of supervisory attention without limiting to the specific supervisory programme similar to Eisenbach et al. (2016) and Hirtle et al. (2019) and adapt it to the analysis of the banking sector in Central Eastern and Southern Eastern Europe (CESEE) (Janda & Kravtsov, 2021). We exploit a cross-country difference in supervisory activities and structure to analyze the effects of supervision scrutiny on the risk-adjusted performance of the banking sector. Our hypothesis is that supervisory monitoring is associated with the lower riskiness of banking institutions and simultaneously does not impact their economic performance. Specifically, we attempt to answer the following questions:

1. How the proposed proxies for enhanced supervisory: (i) too-big-to-fail (TBTF) status measured as top three highest-ranking banks on a country level and (ii) low quartile of capitalization relate to the risk-adjusted performance of the banking units in CESEE
2. Whether the structure of supervision, i.e. national or decentralized versus centralized or supranational, has an impact on monitoring efforts and supervision activities in the form of the Single Supervisory Mechanism (SSM)

These questions are especially relevant for the regulation of banks in the region of our interest, where cross-border banking activities are significant and supervisory structure plays a significant role in the financial stability of the national economies and, consequently, the European Union (EU). In this study, we are motivated also by the latest European Central Bank (ECB) discussions on the allocation of power and responsibilities for conduct and supervision policies for the economic and financial environment, in the context of integrated supervision and regulations (Schoenmaker et al., 2011; Ampudia et al., 2019; Carstens, 2019).

Our paper contributes to the latest literature dedicated to the investigation of the impact of regulations and supervision structure on the performance of banking institutions; for example, the studies of Ongena et al. (2013), with a focus on the Central Eastern Europe (CEE) region, indicate the presence of cross-border spillover effects of domestic regulation and supervision; Djalilov and Piesse (2019) suggest that banking regulations such as those concerning capital requirements, market discipline and supervisory power are not sufficiently effective to improve the banking efficiency in the region. Bisetti (2020) highlights a novel substitution effect between public monitoring by regulators and private monitoring by shareholders; Hirtle et al. (2019) find that more supervision adds value over and above the effects of regulation. As an example, when it comes to top US banks, ranked by size within supervisory districts, these bank units, which are subject to increased supervisory

attention, tend to hold less risky loan portfolios, are less volatile and are less sensitive to industry downturns. However, they have slower growth and are less profitable.

According to Bisetti (2020), the agency theory predicts a positive role for regulation in reducing shareholder monitoring costs. His findings highlight a novel substitution effect between public monitoring by regulators and private monitoring by shareholders. The results of the studies by Djalilov and Piesse (2019) suggest that banking regulations such as those concerning capital requirements, market discipline and supervisory power are not sufficiently effective to improve banking efficiency in the transition countries. This suggests that policymakers and supervisors need to explore the weaknesses of existing banking regulations and improve their effectiveness. While doing so, they need to take account of the specifications of their institutions as well as the business and economic environment.

Kandrac and Schlusche (2019) find that financial institutions that witnessed a reduction in supervision took on much more risks than their counterparts, which were subject to identical regulations but unaffected by a change in supervisory attention. From a policy perspective, their findings underscore the importance of supervision per se as a companion to financial regulation in banking policies. They show that allocating sufficient supervisory resources has an important effect on bank behaviour and is crucial for optimal banking policy and financial stability. Additionally, our paper relates to the stream of theoretical literature with a focus on the analysis of the incentives of regulators in cross-border banking activities (Calzolari & Loranth, 2011; Beck et al., 2012) and the benefits and costs of centralized and decentralized banking supervision (Schoenmaker et al., 2011; Näther & Vollmer, 2019).

Following the conceptual framework (Laffont & Tirole, 1993; Dewatripont & Tirole, 1994; Eisenbach et al., 2016), we construct the proxies for higher supervisory attention on the country level. The identification strategy stems from the cross-country comparison of the supervision structure in relation to the strength of a signal to the enhanced supervision contingent on the individual bank characteristics and country macroeconomic conditions. We propose two proxies as a signal for enhanced supervisory attention from the point of view:

1. *Macroprudential*: "too-big-to-fail" (TBTF), which is represented by the three largest banks, i.e. the highest ranking by asset size, on a single country level. On an individual bank level, the TBTF status is aligned with the definition of a large bank according to the World Bank statistics. A large bank is defined as such when its total assets account for larger than 20% of the national gross domestic product (GDP).
2. *Microprudential*: the lowest quartile of the solvency ratio (CAP_low) among peers on a single country level.

The main findings indicate that the supervision structure (i.e. centralized or decentralized supervision) matters only for the segment of larger banks (TBTF) in the national economies in the CESEE region. Supervision scrutiny does not affect their performance and is associated with a decline in the riskiness of these banks. For bank units with lower capitalization (measured as the lowest quartile of solvency

ratio on a country level), we do not find any statistical evidence that the supervisory structure affects supervisory efforts ultimately leading to improvement in risk-adjusted performance. This study provides important policy implications highlighting the area of attention on banking regulators and policymakers in the CESEE region.

1.2 Data and Variables

The sample consists of 450 commercial banks from 20 economies of the European Union (EU) and European non-EU member states.[1] The bank-level data are obtained from the database BankFocus. The data cover a 7-year period, from 2012 to 2018, which corresponds to the time after the financial crisis in 2008–2010. It allows us to consider the effect of changes in economic cycles, as in Stádník et al. (2016), on the results of the calculation. The data from BankFocus are presented in the form of annual results of banks, whose financial statements are available for at least 3 years during the period 2012–2018. We restrict our sample to bank units with total assets above 100 million EUR by the end of 2018. Furthermore, the sample is refined by manually checking and removing bank units that report an error and inconsistent data. To remove the outliers, we winsorize all financial data at lower 2.5% and upper 97.5%. We acquire the macroeconomic data for GDP growth, unemployment and inflation, as well as market power concentration, from the World Bank Development Indicators.

The dependent variables are the risk-adjusted performance metrics. We use several metrics that capture performance, taking into account risk and economic capital, and for robustness, we use mixed metrics, including the simple accounting metrics. The primary measure of performance is a risk-adjusted return on capital (RAROC). It is commonly employed to assess the profitability of a portfolio or financial institution, taking into account the risk that is being assumed. The ratio shows a risk traded off against a benefit. It is defined as the ratio of the expected rate of return to the risk-based required capital or economic capital (Klaassen & Eeghen, 2009):

$$\mathrm{RAROC}_{it} = \frac{ER_{it}}{EC_{it}} \tag{1.1}$$

where ER_{it} is the expected rate of return and EC_{it} is the economic capital of the bank unit i at the time period t. The expected rate of return ER_{it} for banking unit i at time

[1] List of countries in sample – EU members: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Other are non-EU members: Albania, Bosnia and Herzegovina, Kosovo, Macedonia and Serbia, and former Soviet Union independent states: Belarus, Moldova, Russia and Ukraine.

t is its realized profit NI, plus profit fluctuations σ_i, which can vary across units and over the observation period.

The economic capital EC in the denominator is the amount of capital that is needed to secure survival in a worst-case scenario or potential unexpected losses. Thus, we work with a common benchmark of minimum capital requirements.[2] It is calculated as risk-weighted assets *(RWA)* of the banking unit divided by the minimum required regulatory capital *(CAR)* threshold:

$$EC_{it} = \frac{\mathrm{RWA}_{it}}{\mathrm{CAR}^{\mathrm{reg\ min}}} \tag{1.2}$$

For robustness, we employ other metrics with semi-risk adjusted and pure accounting measures. Semi-risk adjusted metrics are represented by the ratio of return on risk-weighted assets (RORWA). It is an indicator of accounting profit per unit of risk and is measured by profit before tax as a percentage of the total risk-weighted assets. These measures are complemented by the classic accounting metrics on the performance of investments, which is measured by the ratio of net income to average equity (ROAE).

1.2.1 Observable Characteristics

The proposed proxies of supervisory attention, such as the highest ranking and low capitalization, imply certain observable characteristics, which we ought to control in the selection of the relevant covariates. First of all, we control for the size, which is an important determinant of banks' risk and performance; for example, Demsetz and Strahan (1997) find evidence that size is an advantage due to the diversification effect. Size is represented by a logarithm of total assets (TAlog). The business model and efficiency are the determining factors of the performance and riskiness of banking operations. For this, we consider metrics such as net interest margin (NIM) and the ratio of the gross loan to total assets (LOANTA). These identify the portfolio and business mix and the proportion of standard banking activities, such as lending (Teplý et al., 2015; Kuc & Teplý, 2018). The funding and liquidity structure is represented by the ratio of customer deposits to total liabilities (DLR) and loan-to-deposit ratio (LDR). DLR is capturing the structure of funding with more safe deposits in comparison to other funding sources. LDR ratio is used to assess a bank's liquidity by comparing its total loans to its total deposits for the same period. If the ratio is too high, it means the bank may not have enough liquidity to cover any unforeseen fund requirements (Table 1.1).

[2]Note: the minimum capital requirements may vary slightly across the countries and the period 2011–2016. The exact data for calculation are obtained from the World Bank – Bank Regulation and Supervision Survey

Table 1.1 Descriptive statistics of variables

Variable	*n*	Mean	s.d.	Min	Median	Max
RAROC	1,603	0.08	0.28	−0.89	0.11	0.67
RORWA	1,603	0.01	0.03	−0.09	0.01	0.08
ROAE	2,610	0.05	0.18	−0.65	0.07	0.41
TBTF	2,759	0.41	0.49	0.00	0.00	1.00
CAP_low	2,325	0.19	0.40	0.00	0.00	1.00
SSM_ dummy	3,191	0.43	0.50	0.00	0.00	1.00
TAlog	2,736	6.82	1.50	4.70	6.55	10.39
DLR	2,758	0.87	0.24	0.00	0.95	0.99
LDR	2,596	0.77	0.27	0.16	0.79	1.47
LOANTA	2,614	0.61	0.19	0.12	0.64	0.96
NIM	1,351	3.38	1.59	0.00	3.25	7.64
GDP	3,219	1.98	2.29	−9.77	2.26	9.04
INF	3,219	4.20	6.28	−1.74	2.85	59.22
UNP	3,219	9.45	6.56	0.50	6.56	35.15
HHI	3,149	1,073	342	450	1,078	2,493

Source: BankFocus Bureau van Dijk and own calculation
Note: The reported data are after winsorizing the upper and lower 2.5% to mitigate the effect of outliers

1.3 Empirical Strategy and Methods

Noting the complexity of relationships and interlinks on various levels of policies, regulations and individual bank performance, primarily we attempt in our modelling approach to track evidence of statistical significance in the causal relationships among the model inputs, namely outcome variables of performance, supervision attention proxies, supervision structure and explanatory variables. With the goal of establishing a potential link between the effect of supervision structure and the bank risk-adjusted performance, we adopt the following empirical strategy.

First, since supervisory attention is endogenously related to the current and expected bank performance, we construct the relevant proxies for a signal to enhanced supervisory attention. Identification stems from a cross-country comparison of the supervision structure (mediator) in relation to the strength of a signal to the enhanced supervision (treatment effect). Simultaneously, we control the bank-specific and country macroeconomic conditions that potentially can influence the outcome of interest (bank performance). In modelling, we assume that the effectiveness of supervision activities is identical irrespective of the geography.

Second, we employ the conventional way of analyzing the causal interactions effects in moderation analysis (Judd & Kenny, 1981; Baron & Kenny, 1986) with a help of hierarchical multi-regression approach (Aiken & West, 1991) and adapted to the causal inference framework (Imai et al., 2010; Imai & Ratkovic, 2013). The advantage of such an approach is that it allows researchers to test competing theoretical explanations by identifying intermediate variables or moderators, which

contribute to the outcome through the treatment effect. A moderation analysis implies a statistical interaction effect from the interaction between continuous or categorical variables, whereby the introduction of a moderating variable tends to change the direction or magnitude of the relationship between treatment and outcome variables (Hayes, 2013).

1.3.1 How Does a Signal for Higher Supervisory Attention Relate to the Risk-Adjusted Performance of Individual Banks?

We start with testing how the proxies for a signal to enhanced supervisory attention relate to the performance of the banking units in our sample. There are three types of performance metrics for the purpose of cross-examination and robustness, as described in Sect. 1.2. We employ the ordinary least square (OLS) unit and fixed effects regression to the panel data as a baseline model:

$$Y_{ict} = \alpha_{i0} + \beta_0 T_{ict} + \gamma' \text{Controls}_{it} + \delta' \text{Macro}_{ct} + \eta_{ct} + \varepsilon_{ict} \tag{1.3}$$

where i, c and t represent the bank, country and time period, respectively. Outcome variable Y_{ict} is a performance metric that is measured by the following indicators: (i) risk-adjusted return on capital (RAROC), in the definition of Klaassen and Eeghen (2009); (ii) alternatively, return on risk-weighted assets, which is the ratio of net income to risk-weighted assets (RORWA); and (iii) the standard accounting measure of return on average equity (ROAE). T_{ict} is a treatment indicator for the signal of enhanced supervision. It takes a value of 1 if the bank unit belongs to the treated group (e.g. status of TBTF on the national level or with the lowest quartile of the capitalization CAP_low), and 0 is assigned to the control group, i.e. other remaining units in the sample. $Controls_{it}$ denotes a set of specific characteristics of the bank units. $Macro_{ct}$ is a set of country-specific variables that capture macroeconomic conditions: GDP growth, inflation and unemployment. Following Vozková and Teplý (2018), we incorporate also market concentration metrics measured by the Herfindahl Hirschman Index (HHI). η_{ct} represents the dummy variables capturing, within the state, endogenous time-variant macroeconomic country conditions, such as economic growth. ε_{ict} is the idiosyncratic error.

The results of the specification are presented in Table 1.2 in the Appendix. As anticipated, we observe in the sample that the largest banks show a better risk-adjusted performance in all types of metrics (1–3), probably utilizing the economy of scale effect and benefits of diversification. On the other hand, the bank units with lower capitalization indicate poorer risk-adjusted performance (4–6), most likely due to less efficient operations or defaults in their portfolio.

1.3.2 Does the Centralized or Decentralized Supervision Structure (SSM) Have Any Contribution to the Total Effect of Supervision Scrutiny?

With an ambitious goal of drawing a conclusion on the nature of causal relationships between supervisory structure, proposed proxies and outcome, a finding of any statistical significance will help us confirm the existence (or absence) of a link between supervision structure and the effectiveness of supervision scrutiny. Ultimately, it should lead us to the assessment of the impact on the performance of individual banks and thus fulfilling the main goal of this analysis. To do so, we adopt the hierarchical multi-regression approach of Aiken and West (1991). A common approach to the moderator analysis is based on multiple regressions, where we test the impact of different variables alone and together with interactions by determining whether their coefficients differ significantly from 0 (Baron & Kenny, 1986). In our case, we are interested in the investigation of the effect of the treatment T (supervisory attention) on the final outcome Y (bank performance) through the intermediate variable or moderator M (supervision structure). The intermediate effect variable is a binary variable that equals 1 if the bank unit belongs to the country under the centralized supervisory regime (e.g. SSM) and 0 otherwise. The simple moderation model employed in the study is formally expressed as a series of regression equations:

$$Y_{ict} = \alpha_{i1} + \beta_1 T_{ict} + \xi^T X_{it} + \delta' Z_{ct} + \eta_{ct} + \varepsilon_{ict} \tag{1.4}$$

$$Y_{\text{ict}} = \alpha_{i2} + \beta_1 T_{ict} + \beta_2 M_{ict} + \xi^T X_{it} + \delta' Z_{ct} + \eta_{ct} + \varepsilon_{ict} \tag{1.5}$$

$$Y_{ict} = \alpha_{i3} + \beta_1 T_{ict} + \beta_2 M_{ict} + \beta_3 (T \cdot M)_{ict} + \xi^T X_{it} + \delta' Z_{ct} + \eta_{ct} + \varepsilon_{ict} \tag{1.6}$$

where X denotes a set of bank-specific characteristics related to the treatment effect (signal to supervisory attention) with the indexes unit i, time period t and country c. The specification includes macroeconomic and market controls all identical to the ones used in Eq. 1.3. If the β_1 and β_3 coefficients in Eqs. 1.4, 1.5, and 1.6 are non-zero and statistically significant, then the existence of the moderation effect can be confirmed. The interpretation of the β_1 and β_3 estimates hold greater relevance for the moderation model. In testing the size of the moderation effect, the aim is not just to confirm whether treatment T causes Y contingent on moderator M, controlling a set of confounders X, but also to determine whether β_3 deviates too far from 0 or not.

1.4 Results and Discussions

The results of hierarchical linear regressions on the outcome variable of risk-adjusted performance are reported in Table 1.3 in the Appendix. For the treatment indicator "too-big-too-fail" (TBTF) in the models (2–3), the β_1 and β_3 estimates are significant, and $\beta_3 \neq 0$. The results confirm the presence of a moderation effect of the supervision structure through a treatment effect (enhanced supervisory attention) on the outcome. Adding the interaction term in the regression model (3), the explanatory power of the regression model is strengthened negligibly, with a minor increase in the values of the adjusted R^2 from 0.274 to 0.276. For a treatment indicator of higher supervisory attention, such as a lower quartile of capitalization (CAP_low), we observe a weak association and an absence of the moderation effect. The estimate β_3 shows no statistical significance in the model (6), while the estimate β_1 in the model (4–5) indicates a significant statistical power (-0.052**) at a 95% confidence interval. No changes in the values of the adjusted *R*-squared in the models (4, 5 and 6) confirm the absence of such an effect too. These findings indicate that the supervision structure (i.e. centralized or decentralized supervision) matters only for the category of larger banks (TBTF) on the country level in the CESEE region. Supervision scrutiny does not affect their performance, while seemingly it is associated with lower risk in this category of bank institutions. For the bank units with lower capitalization, we find no statistical evidence that the supervisory structure contributes in any way to supervisory efforts ultimately leading to improving risk-adjusted performance. A more comprehensive analysis has to be performed to get more insights into this matter.

This analysis presents an initial view and is not intended to draw an explicit conclusion about the positive or negative nature of the causal relationships between supervisory structure, proposed proxies for supervisors' attention and outcome. Nevertheless, a finding of evidence with statistical significance helps us identify the existence of a link between the supervision structure and its impact through the scrutiny of banking supervision on the safety and soundness of the largest banking institutions in the CESEE region. Thus, it fulfils the ultimate goal of this specific study. These findings provide also important policy implications related to the banking regulation and supervisory mechanism of the larger banks in the region. Especially, it is important for ensuring the financial stability of the CESEE region, where the subsidiaries of large multinational banking groups constitute a large proportion of the systemically important banks in the national economies.

1.5 Conclusion

In this paper, we study the impact of the supervision structure and regulatory scrutiny on the risk-adjusted performance of banking institutions. To do so, we employ a novel empirical strategy with the application of the moderation analysis to

study intermediary effects based on the data set of 450 banks from 20 economies of the CESEE region. Our findings suggest that the supervision structure (i.e. national or supranational of SSM) matters mostly for larger banks with a status "too-big-to-fail" (TBTF) in the region of our interest. Supervision scrutiny does not affect their performance, while it is associated with lower riskiness. On the contrary, we do not observe a similar effect for bank units with lower capitalization. These findings provide important policy implications related to the banking regulation and supervisory mechanism of the largest and systemic banks. In particular, it is relevant for the supervision of the largest subsidiaries of multinational banking groups, which constitute a major portion of the systemically important banks in the national economies of the CESEE region.

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Appendix

Table 1.2 Proxies for the enhanced supervision attention and individual banks' performance

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	RAROC	RORWA	ROAE	RAROC	RORWA	ROAE
TBTF	0.076***	0.007***	0.032**			
	(0.026)	(0.003)	(0.014)			
CAP_low				−0.052**	−0.006**	−0.015
				(0.023)	(0.003)	(0.013)
TAlog	0.057***	0.007***	0.020***	0.062***	0.007***	0.024***
	(0.009)	(0.001)	(0.004)	(0.007)	(0.001)	(0.004)
DLR	0.235	0.027	0.085	0.199	0.022	0.073
	(0.202)	(0.021)	(0.065)	(0.196)	(0.020)	(0.081)
LDR	0.544**	0.069***	0.148*	0.457**	0.059***	0.154
	(0.225)	(0.022)	(0.076)	(0.226)	(0.022)	(0.099)
LOANTA	−0.883***	−0.111***	−0.358***	−0.782***	−0.099***	−0.335**
	(0.273)	(0.027)	(0.107)	(0.274)	(0.028)	(0.131)
NIM	0.043***	0.005***	0.021***	0.043***	0.005***	0.023***
	(0.010)	(0.001)	(0.004)	(0.010)	(0.001)	(0.004)
GDP	−0.005	−0.000	−0.000	−0.007	−0.000	0.000
	(0.009)	(0.001)	(0.003)	(0.009)	(0.001)	(0.003)
INF	−0.013	−0.002*	−0.014***	−0.013	−0.002*	−0.013***
	(0.011)	(0.001)	(0.005)	(0.011)	(0.001)	(0.005)
UNP	0.001	0.000	0.001	0.002	0.000	0.000
	(0.008)	(0.001)	(0.004)	(0.008)	(0.001)	(0.004)
HHI	−0.000**	−0.000*	−0.000*	−0.000*	−0.000	−0.000

(continued)

Table 1.2 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	RAROC	RORWA	ROAE	RAROC	RORWA	ROAE
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	−0.482	−0.066**	−0.079	−0.467	−0.064**	−0.125
	(0.299)	(0.031)	(0.140)	(0.295)	(0.031)	(0.148)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	881	881	1,209	872	872	1,123
R-squared	0.302	0.336	0.237	0.298	0.334	0.246
Adjusted R^2	0.274	0.309	0.215	0.270	0.307	0.222
F test	0.000	0.000	0.000	0.000	0.000	0.000

Note: Standard errors are shown in parenthesis FE stands for fixed effects. Stars indicate statistical significance levels: ***$p < 0.01$, **$p < 0.05$ and *$p < 0.10$

Table 1.3 Results for the outcome variable of risk-adjusted performance (RAROC)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	TBTF	TBTF_SSM	TBTF_SSM	CAP_low	CAP_low_SSM	CAP_low_SSM
TBTF (T)	0.076***	0.076***	0.144***			
	(0.026)	(0.026)	(0.045)			
TBTF (T x M)			−0.101*			
			(0.052)			
CAP_low (T)				−0.052**	−0.052**	−0.048
				(0.023)	(0.023)	(0.048)
CAP_low (T x M)						−0.004
						(0.055)
M		−0.179	−0.132		−0.143	−0.143
		(0.122)	(0.124)		(0.122)	(0.122)
Constant	−0.661***	−0.482	−0.539*	−0.611**	−0.467	−0.466
	(0.242)	(0.299)	(0.301)	(0.237)	(0.295)	(0.295)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	881	881	881	872	872	872
R-squared	0.302	0.302	0.305	0.298	0.298	0.298
Adjusted R^2	0.274	0.274	0.276	0.270	0.270	0.269
F test	0.000	0.000	0.000	0.000	0.000	0.000

Note: Standard errors are shown in parenthesis robust to heteroscedasticity. FE stands for fixed effects. ***$p < 0.01$, **$p < 0.05$ and *$p < 0.10$

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Chapter 2
The Income Velocity of Money – Determinants (Case of the Czech Republic)

Jan Bohacik

Abstract The income velocity of money expresses a unique relationship – what is the production that an economy can create with a given money stock or how much money is needed to create a given production. The aim of this chapter is to elaborate on the factors that are behind the money velocity. An overview of the potential determinants of money velocity will be presented together with a brief description of the determinants. Where available, data relevant for the Czech Republic are presented. The examined period is 2000–2018, when the money velocity experienced a gradual decline.

Keywords Velocity of money · Money supply · Household finance

2.1 Introduction

As one professor said, money velocity is like a goulash soup – too many different ingredients can be a part of it. Indeed, it is quite ambitious to express the relationship between money and production using a single variable. The velocity of money, however, historically had and still has its place in the economic theory (despite the fact that inflation targeting, which is a prevailing monetary policy today, does not rely on money much). The income velocity of money[1] expresses a unique relationship – what is the production that an economy can create with a given money stock or how much money is needed to create a given production. The remaining part of the template will introduce some basic requirements on the paper format.

This chapter is intended as a broad study of potential determinants of the money velocity. An overview of the potential determinants of money velocity will be

[1] To simplify, further only "money velocity" or "the velocity of money."

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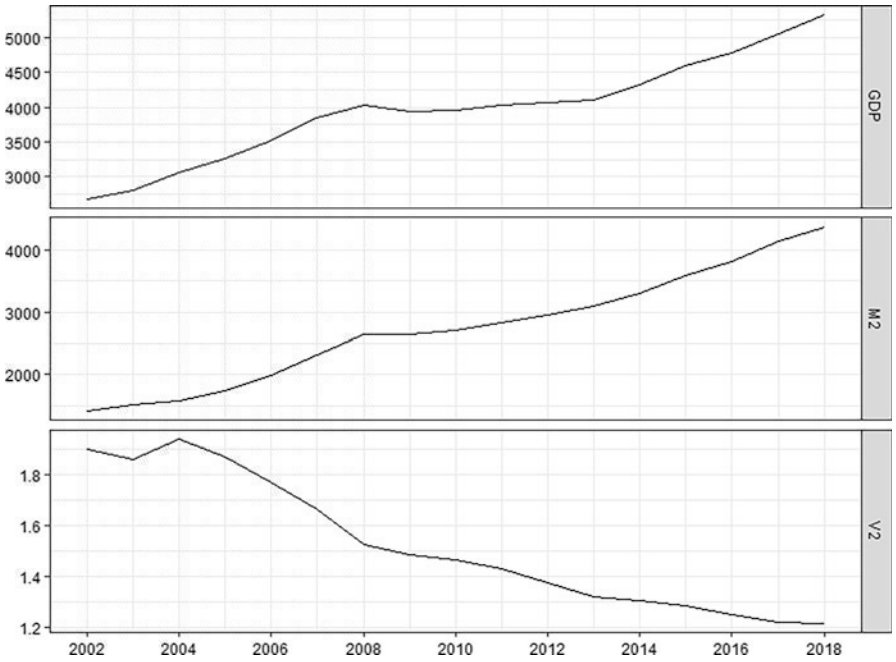

Fig. 2.1 GDP, M2 and V2 in the Czech Republic for the period 2002–2018. (Source: Czech National Bank, authorial computation)

presented together with a brief description of the determinants. Where available, data relevant for the Czech Republic will be presented. As for the money velocity determinants in general, a comprehensive historical overview can be found in (Humphrey, 1993). The velocity of broad money (M2, M3) in the Czech Republic was examined, for example, in (Jilek, 2015) or (Michl, 2019), where relationship with real GDP and inflation was examined.

2.2 Data and Methodology

The income velocity of money (V2[2]) in the Czech Republic, calculated as a ratio of 1-year GDP (measured in current prices) to the money stock (defined as M2) at the end of each year, was following (Fig. 2.1):

[2] V2 = Income velocity of money when money is defined as the monetary aggregate M2.

The income velocity of money had been showing a lasting decline since 2004. Each Czech koruna was used almost 2 times on average in 2004[3], but only 1.2 times in 2018. There is a real chance V2 is going to drop below 1 in a few years. The money stock would be lower than 1-year GDP. As time goes by, we need more and more money to achieve a certain level of GDP, that is, the productive capability of the money is worsening. This is an interesting phenomenon. The key question is: Which factors lie behind this drop?

2.3 Money Velocity Determinants

The potential determinants of money velocity may be split into:

1. Long-term structural:

Factors affecting components and structure of the economic system. These factors change over decades or even centuries. In the long run, economies experience evolution from barter (natural exchange) to monetized system, which is usually coupled with population shift from rural to urban areas and development of banking system and financial markets. Another factor that has an impact on the money balances is the degree of vertical integration of the economy.

2. Psychological:

Determinants that are subjective or personal and thus diverse among economic subjects. They are quite difficult to capture. The psychological determinants are: perception of uncertainty, mercantile confidence, tastes and preferences of the holders of money (especially liquidity preference), risk aversion or disposition to hoarding.

3. Financial:

Determinants connected to the financial situation of an individual or system as a whole. These are income (wealth), size of payments, frequency of income and payments, transaction costs and use of trade credit. Then there are factors like inflation expectations, domestic currency depreciation expectations and interest rate, which are heavily influenced by fiscal and monetary policy (Table 2.1).

Urbanization (population shift from rural areas to urban areas) leads to the decline of the natural exchange and the production for own consumption. It simultaneously leads to the expansion of the banking system and monetary sphere. Monetization of economic activity increases demand for money balances, which implicates the decline of the money velocity.

[3] In fact, each koruna was used more than 2 times on average if we talk about all economic transactions. However, when expressing the income velocity of money, we are concerned only about transactions that are used to calculate gross domestic product.

Table 2.1 Summary of money velocity determinants

Urbanization	–	Frequency of income	+
Banking development	–	Size of payments	–
Barter	+	Wealth	+
Trade credit	+	Distribution of income	+/–
Degree of vertical integration	–	Interest rate	+
Financial innovations	+	Inflation expectations	+
Uncertainty	–	Depreciation expectations	+
Hoarding	–		

Note: + means the rise of the determinant leads to the rise of money velocity; – vice versa
Source: Author

Table 2.2 Currency to M2

2002	2004	2006	2008	2010	2012	2014	2016	2018
14.03	15.00	14.88	13.88	13.20	13.18	13.09	13.49	13.06

Source: ARAD (Czech National Bank), authorial computation

The share of urban population in the Czech Republic increased from 70.6% to 73.4% during the period 2001–2011. In December 2018, the share of urban population was 73.3% (Czech Statistical Office).

Banking development (composition of the payment media) – only currency was considered money in the past[4]. This is equivalent to the situation when we define money as M0, which consists solely of the currency in circulation. The increased popularity of bank deposits relatively to currency causes M0 to fall and money velocity (calculated as GDP/M0) to increase. However, if we define money as M2, there should be no significant change to the money velocity when the economic subjects start to prefer bank deposits relatively more to currency. Nevertheless, this was not the case with the Czech Republic (Table 2.2):

In general, each payment medium (coins, banknotes, current deposits, etc.) can be attributed to its own velocity of circulation. The higher are the opportunity costs of holding a certain type of monetary asset, the higher is the motivation to pay with it. Therefore, for example, coins should circulate more than term deposits.

Barter (natural exchange) – economic subjects do not have to carry out trade by means of money. They may simply swap the goods. In practice, however, it is difficult to measure the volume of bartered trade.

Trade credit (non-interest, deferred payment) – if the popularity of trade credit rises, less money is needed. The ratio of trade credit (and advances) to GDP in the Czech Republic oscillated between 41% and 51% (Table 2.3).

Degree of vertical integration (number of production stages) – the longer it takes for the product to transform from raw material to the final product, respectively the

[4] Strictly speaking, only coins were considered money, not banknotes.

Table 2.3 Trade credits and advances to GDP

2002	2004	2006	2008	2010	2012	2014	2016	2018
50.9	46.8	45.1	41.3	46.5	49.7	48.4	49.0	46.1

Source: OECD – 720. Financial balance sheets – non-consolidated – SNA 2008, Total economy

Table 2.4 Financial derivatives and employee stock options to GDP (liabilities to GDP and total net position to GDP) in %

2002	2004	2006	2008	2010	2012	2014	2016	2018
0.85	1.16	1.27	4.12	2.50	2.77	2.16	1.57	2.71
0.32	0.27	0.48	−0.18	−0.10	−0.46	0.16	−0.12	−0.05

Note: Total net position is calculated as financial derivatives (assets) − Financial derivatives (liabilities)
Source: OECD – 710. Financial balance sheets – consolidated – SNA 2008, Total economy

more stages of production exist, the more money is needed to serve the production process. Integrated economy should therefore require less money balances.

The measurement of vertical integration is a rather demanding process. For instance, (Maddigan, 1981) or (Ponomarenko & Sergeev, 2016) measure the level of vertical integration for a group of companies, but the described procedures cannot be applied to an economy as a whole. Besides, there are not many studies of vertical integration relevant for the Czech Republic, and if any, they are focused on a specific sector or companies. Nevertheless, the observed drop in the money velocity in the period 2004–2018 would have to be caused by a massive de-integration of production, which is not very plausible.

Financial innovations usually act as accelerators of money velocity. Some examples of financial innovations are (a) clearing centers providing mutual settlements of receivables and liabilities; (b) new types of investment and savings accounts; (c) technical innovations like internet banking; (d) financial derivatives; etc. These innovations have the potential to lower transactions and precautionary money demand. For instance, if a bank uses a financial derivative to hedge against currency risk and closes its position in the currency, the risk is eliminated (or at least mitigated) and less precautionary money balances are needed. However, if used for speculative purposes, financial innovations may result in higher money demand. In the Czech Republic, the size of open derivatives is rather low (Table 2.4):

Uncertainty –economic agents cannot be certain about future development. They want their income to be at least as high as their expenses. To protect from unforeseen events, they hold (precautionary) money reserves. If the level of confidence in the business and financial system is high, economic subjects hold less precautionary balances. There are many measures that can be used as a proxy to estimate the level of uncertainty in an economy. For example, the European Commission issues the ESI index (economic sentiment indicator), which captures the market sentiment throughout the economy (Fig. 2.2).

Fig. 2.2 Economic sentiment indicator (CZ.ESI). (Source: European Commission, authorial computation)

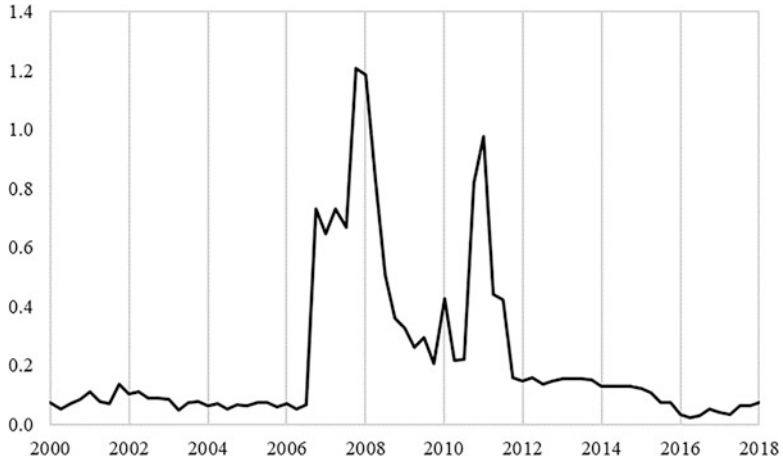

Fig. 2.3 3M EURIBOR – 3M EUR OIS. (Source: Refinitiv, authorial computation)

Another measure that aims more at the distress of financial markets is LIBOR-OIS spread. As the Czech Republic is closely linked to the eurozone, one can examine EURIBOR-OIS spread instead of PRIBOR-OIS spread, where shorter data history is available (Fig. 2.3).

Hoarding (money accumulation and its storage, without intention to use it). An example of hoarding from the past is gold buried in the ground. It is problematic to estimate the amount of hoarded money. In fact, observing money velocity is one of the methods to quantify the level of hoarding. However, (Cimburek & Rezabek, 2013) show that hoarding was present in 2008 in the Czech Republic.

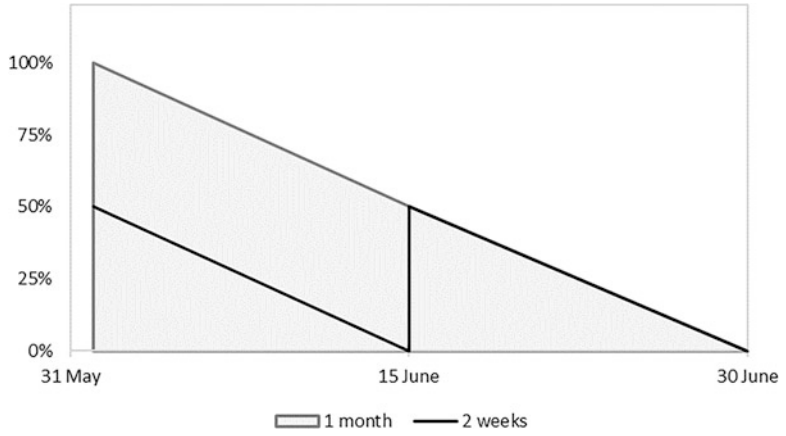

Fig. 2.4 2-week and 1-month income frequency. (Source: Author)

Frequency of income – if the economic subjects are paid more frequently, they hold lower money balances on average, as indicated on the graph (Fig. 2.4):

Let us assume that (a) the economic subjects are paid at the beginning of the period; (b) they keep their whole income in the form of money; (c) they spend the whole income linearly until the end of the income period; (d) the monthly income is 100%. Then:

- At monthly income frequency, the average money balance is 50%.
- At 2-week income frequency, the average money balance is 25%.

By shortening the income frequency by 50%, the average money balance fell by 50%. In reality, the assumptions do not hold, so the effect would be less than 50% (primarily due to savings creation). Additionally, households, corporations and governments have different income and outcome cycles.

Size of payment – the higher is the absolute value of the expense, the longer it takes to accumulate the targeted value (price). In the Czech Republic, the greatest concern is about real estate prices, which have been experiencing a significant increase over the last years (Fig. 2.5).

Distribution of income – socio-economic classes have various income cycles and transactions needs. Therefore, their money velocity may differ. The total income velocity of the money is then calculated as a weighted average of the individual velocities of various socio-economic classes, where the weights are the average money balances of the classes to the overall average money balances:

$$V = V1 * \frac{M1}{(M1 + M2)} + V2 * \frac{M2}{(M1 + M2)} \tag{2.1}$$

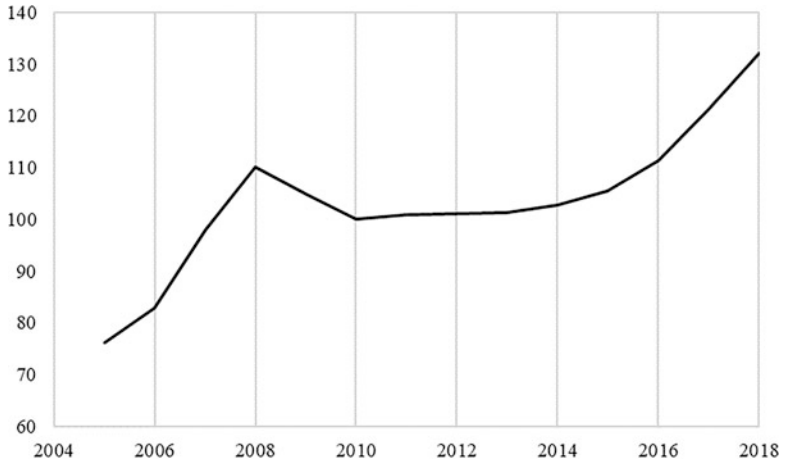

Fig. 2.5 Price indices of real estate – Czech Republic. (Note: Year of weighting scheme 2010, average 2010 = 2010. Source: Czech Statistical Office, authorial computation)

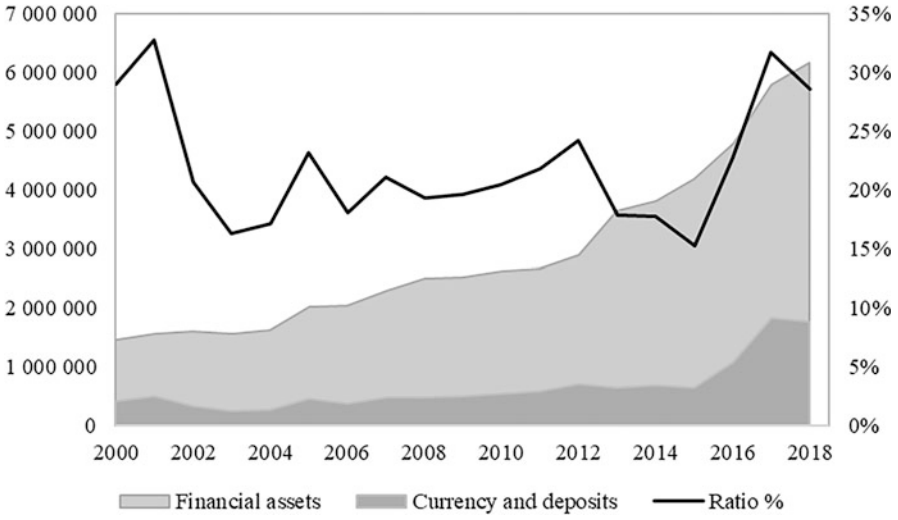

Fig. 2.6 Currency and deposits to financial assets. (Source: OECD – "710. Financial balance sheets – consolidated – SNA 2008", authorial computation)

Where V is the aggregate income velocity of money; V1 V2 are the income velocities of money of the socio-economic classes; M1, M2 express the average money balances of the socio-economic classes.

Wealth – it should be more rational for richer subjects to hold smaller cash balances relatively to the other assets, as money is a non-interest-bearing asset. However, if we look at the Czech Republic, the share of money to the financial assets does not show any discernible pattern (Fig. 2.6).

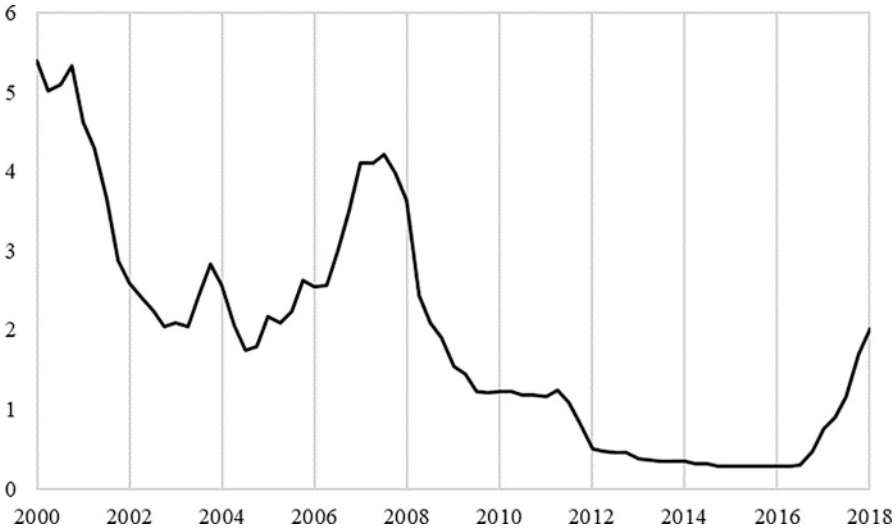

Fig. 2.7 3M PRIBOR (%). (Source: Refinitiv, authorial computation)

Interest rate – it is the opportunity cost of holding money. In case of interest rate decline, it is relatively cheaper to hold cash balances. The crucial point here is to define what money is – there are some interest-bearing deposits in M2 as well (Fig. 2.7).

Inflation expectations – high inflation expectations may lead to "run from cash" situation. If the future inflation is perceived to be high, the purchasing power of money is at risk and the expectations themselves (even if they are not eventually fulfilled) motivate economic subject to get rid of cash balances – either by increased consumption or by transformation of assets outside of M2. Moreover, inflation expectations may accelerate domestic currency depreciation.

The problem with the quantification of inflation expectations is there are many subjects in the economy and each of them has its own expectations. CNB currently publishes only the view of macro-financial analysts (employees of major financial institutions). Households' inflation expectations were published from 1999 to 2007. However, the measures became too volatile and difficult to interpret (CNB, 2007). The European Commission conducts some qualitative surveys on households' inflation expectations, and the discussion on its interpretation can be found in (Arioli et al., 2017).

Depreciation expectations – economic subjects may lose confidence in the domestic currency. Therefore, they are more inclined to get rid of it. Like inflation expectations, depreciation expectations vary across the economy. However, an estimate can be made comparing the forward and the spot CZK/EUR rate. As can be seen, the depreciation expectations were negligible (if any) (Fig. 2.8).

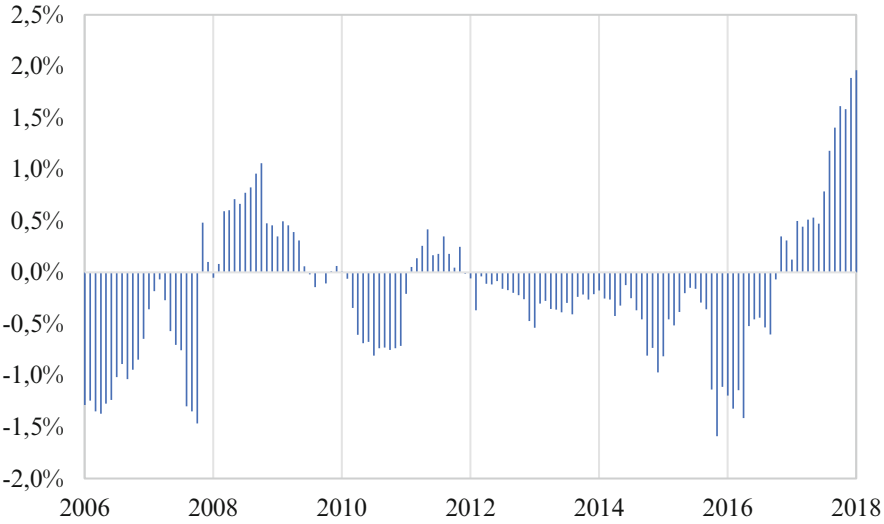

Fig. 2.8 CZK depreciation relative to EUR. (Note: Calculated as (1Y forward/spot rate – 1); + CZK depreciation; – CZK appreciation. Source: Refinitiv, authorial computation)

2.4 Conclusion

Potential determinants of the income velocity of money were discussed and their comprehensive overview was made. The determinants were classified into 3 groups: (a) structural; (b) psychological and (c) financial. Data for the Czech Republic were collected to analyze the determinants over the period 2002–2018, when the income velocity of money experienced a lasting decline.

Based on ratio analysis and graphical analysis, the major potential determinants of the velocity fall are: declining interest rates, increased real estate prices and shocks to economic sentiment. Other factors that should be also considered are: increased inflation and depreciation expectations, use of trade credit or the degree of vertical integration. More could be elaborated on the financial innovations, distribution of income or payment frequency.

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Chapter 3
The Impact of Central Bank Policy Rate on Financial Development: The Case of Europe

Korhan K. Gokmenoglu, Aysel Amir, and Mohamad Kaakeh

Abstract This study investigates the influence of central bank policy rate (CBPR) on financial development for a panel of fifteen European Union economies, utilizing annual data ranging from 2002 to 2017 inclusively. To this aim, an autoregressive distributive lag model was applied and Pooled Mean Group estimates were obtained. Economic growth, innovation, globalization index, and corruption perception index were incorporated within the empirical model as control variables to refrain from omitted variable bias. Our findings indicate that CBPR is a major driver of financial development alongside reduced corruption, increased economic growth, and increased globalization in the case of Europe. Based on the empirical findings we have obtained, we offer various policy recommendations such as; following the monetary policy which will support financial development, ensuring the central bank's independence, increasing trust in institutions, combating the informal economy, and encouraging innovations, especially in the financial sector. We discuss the policy implications of our findings in the conclusion section in more detail.

Key words Financial development · Central bank policy rate · Corruption · Innovation · ARDL-PMG

3.1 Introduction

The significance of financial development on a broad set of macroeconomic fundamentals, most notably economic growth (Calderón & Liu, 2003; Pradhan et al., 2018), has been predominately emphasized within the existing literature. The establishment of extensive literature devoted to the importance of financial development

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has resulted in the construction of research that investigates the determinants of financial development. Although a wide range of potential determinants, such as inflation (Rousseau & Yilmazkuday, 2009), interest rates (Roubini & Sala-i-Martin, 1992; Odhiambo, 2009), human capital (Calderón & Liu, 2003), and liquidity (Pagano, 1993; Alfaro et al., 2004), have been examined to see their effect on financial development, central bank policy rate (CBPR) has been overlooked thus far. Our study aims to fulfill this gap by inspecting the role of the CBPR on financial development for the case of the top fifteen European Union countries in terms of their nominal GDP.

Institutions are responsible for the completion of financial sector activities and the implementation of procedures and regulations that advocate financial sector advancement (Beck et al., 2010); hence, they are essential for financial development. As the central bank is one of the most influential financial institutions, a central banking measure has been frequently incorporated within financial development studies (King & Levine, 1993; Neyapti, 2003; Tayssir & Feryel, 2018). Although many central bank institutional characteristics have been used to investigate their contribution to financial development, the role of monetary policy has been less elaborated. Monetary policy tools used to stabilize prices have consequences on the activities carried out by financial institutions, thus affecting financial development progression. The CBPR is the rate utilized by the central bank to signal or implement its' monetary policy stance (IMF, 2019). Tayssir and Feryel (2018) argued that central banks use the CBPR to supply banks with short-term loans and banks take the CBPR as a reference point to set the offered credit rates to customers. Thereby, the CBPR enables central banks to control loan amounts and rates of the banking system, which can affect financial development. For the abovementioned reason, there is a need to test the relationship between CBPR and financial development.

In order to refrain from committing omitted variable bias, we opt to include control variables largely reflected within the existing literature devoted to analyzing the determinants of financial development. The most widely repeating control variable is economic growth within financial development literature. In his early study, Robinson (1979) suggested that a greater economic growth level increases the request for financial services and hence supports financial development. There is an abundance of findings on the causal relationship between economic growth and financial development. The existing literature stresses both a bidirectional (King & Levine, 1993; Hsueh et al., 2013; Pradhan et al., 2018) and a unidirectional (Zang & Kim, 2007) causal relationship between economic growth and financial development. Given the extensive evidence to support a significant positive impact of economic growth on financial development (Kar et al., 2011; Hsueh et al., 2013; Pradhan et al., 2018), an economic growth proxy in the form of the logarithm of gross domestic product (GDP) is integrated within our model.

The effect of globalization has also been considered when investigating financial development. Studies have found that globalization contributes to trade liberalization, reduces transactional cost (Daisaka et al., 2014), brings forth institutional reform advancement (Mishkin, 2009), and advances the demand for financial goods and services, resulting in greater financial deepening and financial development. Law et al. (2014) found that globalization Granger causes financial

development. Asongu (2014) suggested globalization forms financial liberalization, heightening financial development, in the case of Africa. Due to findings, which document the positive effect of globalization on financial development, a globalization measure—in the form of globalization index—is added to our model.

Especially recent research found evidence for the positive contribution of innovation to financial development (Pradhan et al., 2018; Zhu et al., 2020). Hsu et al. (2014) found innovation to be vital for the equity market and, therefore, financial development. Xiao and Zhao (2012) included an innovation measure when analyzing financial development from a banking perspective. They found innovation vital for increasing the inflow of resources, thus resulting in enhanced financial development. In this light, we incorporated an innovation measure in the form of research and development expenditure proportion of GDP within our empirical model. Corruption, considered to be an institutional quality proxy, has also been investigated as a hindering factor for financial development. Muye and Muye (2017) incorporated a corruption measure of institutional quality to analyze the causal relationship between globalization, institutions, and financial development. Naceur et al. (2014) indicated that corruption hinders financial development for MENA countries. This finding was also supported by Gazdar and Cherif (2015). Compatible with our interests, we find it fitting to incorporate corruption as an institutional quality measure within our model to prevent omitted variable bias. Following Gazdar and Cherif (2015) and Muye and Muye (2017), we chose to incorporate a corruption proxy in the form of a corruption perception index.

Our study analyzes the effect of CBPR on financial development for a panel of top 15 European Union countries according to nominal GDP (Austria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Spain, Sweden, and United Kingdom). Due to data limitation, three countries were not included, namely, Belgium, Greece, and Romania. We considered the top 15 European Union countries as our sample given that they have financial system structures that are of a similar trait and share the same set of rules and regulations in terms of the monetary and fiscal policy framework; thus, we omit any possible sample bias by focusing on cross-sections that share similar characteristics. Our data set consists of annual observations for sixteen years spanning from 2002 to 2017 due to data availability. To investigate the determinants of financial development, we used the autoregressive distributive lag (ARDL) model (Pesaran et al., 1999), given the fact that the variables utilized within the model are of mixed integration order. The finding of our study provides important information that helps derive crucial policy implications necessary for improving financial development further within the European region.

3.2 Literature Review

Although many financial development studies have given importance primarily to macroeconomic variables, institutional measures have increasingly been given attention following Fry (1997), who argued that institutional features play a pivotal

role in financial liberalization practices implemented on financial development. Institutional quality has been attributed to providing lucrative financial reforms (Acemoglu & Johnson, 2005). Institutional factors include a wide range of aspects such as legal origin (Beck et al., 2001), regulatory aspects, political conditions, bureaucracy, possible civil anarchy, governmental fundaments, political factors, democracy, taxation, and tax reformation (Fry, 1997). There is abundant evidence to show that institutional factors matter for financial development. For example, evidence suggests political instability diminishes financial development as investment opportunities are swindled (Roe & Siegel, 2011).

Financial institutions have a vital role in financial development. King and Levine (1993) extended the work of Schumpeter (1911) on financial intermediation by investigating the importance of financial institutions for both financial development and economic growth; for 80 countries. They found that central banks play a pivotal role in expanding financial depth, as the credits they provide to private firms enhance capital allocation efficiency. Due to the early supportive evidence and theoretical support that central banks have implications on the creation of financial development, studies started to elaborate on which central banking components matter the most in boosting financial development.

The literature devoted to investigating possible determinants of financial development has often incorporated some form of central bank measure. Most commonly, a central bank independence proxy is included within financial development models. Neyapti (2001) analyzed the role of independence of the central bank in the promotion of financial development for the case of Europe and found that it improves price stability and assists the maintenance of monetary policy fundamentals required to drive financial development. In continuation of this work, Neyapti (2003) found greater central bank independence brings forth heightened financial market development. The central bank assets variable is another frequently used central banking measure by researchers (Beck et al., 2010). Tayssir and Feryel (2018) explored how central bank aspects can influence financial development for various countries; by accounting for central banks' political role, transparency, inflation targeting, and monetary tools. Their findings indicate that central banking conditions can support financial sector development.

The existing literature on financial development emphasizes the importance of how monetary policies can expand financial development further. Past research has concluded that monetary policies and financial stability are closely linked (Yellen, 2014). Koenig (2013) reports that the close link between financial stability and monetary policy is crucial for price stability to mitigate risks associated with price volatility. Studies have also shown that financial intermediates are responsible for the creation of money and how this liquidity implicates monetary transmissions (Beck & Colciago, 2014). Research devoted to improving monetary targets in order to revamp the financial system notes that transparency is vital (Broaddus Jr, 2002). Ennis and Keister (2008) suggest it's of great importance to implement monetary policy efficiently. Thus, the literature supports the notion that monetary policies may affect financial development, as monetary tools strengthen financial market integration. Based on this information, we assess the potential impact of central banks' guiding the banking system through the CBPR on financial development for the

European region. Many important aspects of central banks have been incorporated when analyzing their role in driving financial development, and the role of the CBPR has been overlooked thus far.

3.3 Data

3.3.1 Definition of Data

This study utilizes a panel dataset of fifteen cross-sections (Austria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Spain, Sweden, and United Kingdom), with a time span of 16 years ranging from 2002 to 2017 due to data availability. All of the data is of an annual frequency. Financial development, denoted as FD, the dependent variable within our model, is proxied by the financial development index sourced from the International Monetary Fund (IMF). The study's main contribution is to analyze the impact of CBPR on financial development for Europe; this measure was gathered from the Bank for International Settlements (BIS). Control variables, consistent with the existing literature, are incorporated into the model to refrain from committing omitted variable bias. Such variables include: corruption perception index, denoted as LCT as a measure of institutional quality in which a larger observation implies less corruption—supplied by Transparency International, innovation denoted as INN, measured as a proportion of GDP spent on research and development sourced from Worldbank database; globalization index, denoted as GI, collected from Swiss Economic Institute (KOF); and Gross Domestic Product (GDP), obtained from Worldbank database, in logarithmic form denoted by LGDP. We expect all the regressors to exhort a positive impact on FD in the case of Europe.

3.3.2 Descriptive Statistics

Descriptive statistics, displayed in Table 3.1, indicate that we have a strongly balanced panel. The number of observations is the same, 240, for all variables utilized within the study; thus, there is no missing observation. The mean, standard deviation, minimum, and maximum observations imply that the data don't suffer from any outliers/extreme values.

Table 3.2 reports the pairwise correlations between the regressand and all regressors of the model. The table provides evidence that no multicollinearity exists as all of the explanatory variables are correlated to a degree less than 0.80.

Table 3.1 Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
FD	240	0.68	0.15	0.30	0.94
CBPR	240	1.91	2.03	−0.75	12.50
LCT	240	1.93	0.26	1.22	2.27
INN	240	1.91	0.86	0.54	3.91
GI	240	85.13	3.58	71.20	91.30
LGDP	240	27.14	1.05	25.48	28.99

Source: Authors' analysis of data

Table 3.2 Correlation matrix

Variables	CBPR	CT	INN	GI	GDP
CBPR	1.00				
CT	−0.27	1.00			
INN	−0.35	0.73	1.00		
GI	−0.37	0.76	0.71	1.00	
GDP	−0.24	0.12	0.55	0.19	1.00

Source: Authors' analysis of data

3.3.3 Unit Root Test Results

To check the integration order of variables used to construct the model, variables are investigated with the application of three different panel unit root tests, namely, Im et al. (2003), Breitung (1999), and Maddala and Wu (1999) Fisher ADF test, and the results are reported in Table 3.3. The results concerning the unit root tests are as follows: according to all three tests, the dependent variable (FD) is stationary at the first difference—I(1); majority of the tests imply that CBPR is stationary at level—I (0); LCT, INN, GI, and LGDP series are I(1) according to the majority of the results. Having stationary and nonstationary variables in the model makes the ARDL the most plausible estimation technique (Pesaran & Smith, 1995) to analyze cointegrating relationships. In addition, unit root tests confirm that none of our variables employed are I(2), which is a necessary condition to employ the ARDL method.

3.4 Econometric Method and Empirical Findings

3.4.1 Model and Methodology

This study investigates the link between financial development and CBPR in the case of Europe, while controlling for the impact of innovation, economic growth, globalization, and corruption. This model can be expressed by the following linear equation:

Table 3.3 Panel unit root test results

Level	FD	CBPR	LCT	INN	GI	LGDP
$\tau_{T\ \text{fisher ADF}}$	36.23	89.76*	42.82***	33.64	49.90**	35.19
$\tau_{\mu\ \text{fisher ADF}}$	45.58**	14.45	45.83**	22.18	39.04	19.64
$\tau_{\ \text{fisher ADF}}$	15.63	54.68*	30.02	8.88	1.16	2.14
$\tau_{T\ \text{IPS}}$	−1.31***	−5.92*	−1.15	−0.72	−2.29**	1.10
$\tau_{\mu\ \text{IPS}}$	−1.91**	1.03	−1.21	1.18	−0.74	0.91
$\tau_{T\ \text{BREITUNG}}$	−0.12	−5.89*	−0.16	−1.61***	−1.68**	−3.49*
First difference						
$\tau_{T\ \text{fisher ADF}}$	50.73**	88.09*	51.51*	37.07	70.23*	35.00
$\tau_{\mu\ \text{fisher ADF}}$	76.59*	132.80*	80.70*	61.46*	107.23*	63.97*
$\tau_{\ \text{fisher ADF}}$	144.88*	188.49*	133.62*	89.86*	123.80*	82.98*
$\tau_{T\ \text{IPS}}$	−2.50*	−5.76*	−2.53*	−1.17	−4.21*	−0.94
$\tau_{\mu\ \text{IPS}}$	−4.86*	−9.05*	−5.15*	−3.55*	−7.19*	−3.87*
$\tau_{T\ \text{BREITUNG}}$	−6.46*	−10.78*	−1.90**	−2.05**	−4.47*	−4.90*

Source: Authors' analysis of data
Note: ***p-value < 0.10; **p-value < 0.05; *p-value < 0.01

$$\begin{aligned} \text{FD}_{it} = &\beta_{0it} + \beta_{1it}\text{CBPR}_{it} + \beta_{2it}\text{LCT}_{it} + \beta_{3it}\text{INN}_{it} \\ &+ \beta_{4it}\text{GI}_{it} + \beta_{5it}\text{LGDP}_{it} + \varepsilon_{it} \end{aligned} \tag{3.1}$$

where i is the cross-sectional unit and t is the time element.

Our study focuses on investigating both the short- and long-run relationships between financial development and CBPR. Thus, conventional static panel estimations such as pooled OLS, fixed effects, and random effects are not applicable given that they are unable to distinguish between short- and long-run dynamics. Moreover, such estimations are only applicable to stationary variables, I(0). Since variables used within our model are of mixed integration order such estimations would provide spurious results. Likewise, panel cointegration methods such as Pedroni (1999) and Johansen-Fisher test), which requires all variables to be integrated in order of one, I(1), are not suitable given the dataset utilized within our study. The panel ARDL procedure is considered to be efficient and consistent within small samples (Haug, 2002). Thus, the empirical investigation is carried out with the use of the panel ARDL estimation framework, established by Pesaran et al. (1999), to analyze the short- and long-run relationships among the variables.

The ARDL model specification can be displayed as follows:

$$\Delta FD_{i,t} = \delta_i + \beta_{1i} FD_{i,t-1} + \beta_{2i} CBPR_{i,t} + \beta_{3i} LCT_{i,t} + \beta_{4i} INN_{i,t} + \beta_{5i} GI_{i,t} + \beta_{6i} LGDP_{i,t} + \sum_{i=1}^{p-1} \alpha_{1i} \Delta FD_{i,t-i} + \sum_{i=0}^{q-1} \alpha_{2i} \Delta CBPR_{i,t-i} + \sum_{i=0}^{q} \alpha_{3i} \Delta LCT_{i,t-i} + \sum_{i=0}^{q} \alpha_{4i} \Delta INN_{i,t-i} + \sum_{i=0}^{q} \alpha_{5i} \Delta GI_{i,t-i} + \sum_{i=0}^{q} \alpha_{6i} \Delta LGDP_{i,t-i} + \varepsilon_{i,t} \quad (3.2)$$

Where Δ is the difference operator, β_1 is error correction coefficient, α_1 *to* α_6 are the short-run coefficients of the variables, while β_2 to β_6 indicate the long-run coefficients of the equation. δ_i is the constant and ε_{it} is the residual term. Cross-sectional and time dimensions are subscribed by *i* and *t,* respectively.

The optimal lag specification order chosen using Akaike Information Criterion (AIC) was (2, 1, 1, 1, 1, 1) for financial development, CBPR, corruption, innovation, globalization, and LGDP, respectively.

The presence of a significant and negative error correction term (ECT), −0.796, suggests that any short-run deviations from the equilibrium amongst the regressand and regressors will converge back to the long-run equilibrium in the future. ARDL pooled mean group (PMG) estimation (Pesaran et al., 1999) was conducted, which is applied in the case of heterogeneous panels. PMG allows intercepts, short-run coefficients, and error variances to vary across groups, providing average long-run coefficients for all groups within the sample, which is practical when the long-run relationships are expected to be similar for each cross-section.

3.4.2 Empirical Findings

The short- and long-run coefficients obtained from the PMG estimator are reported in Table 3.4. The long-run ARDL coefficients indicate the following: The coefficient of CBPR is positive and highly significant, suggesting that this variable is a long-run driver of financial development for the case of European countries. This might happen due to several channels. First, a higher CBPR rate is expected to cause an increase in deposits. Higher deposits will increase the capacity of banks in terms of providing funds and causes a deepening of financial markets. Moreover, Tayssir and Feryel (2018) mentioned that lower interest rates are associated with restricted financial markets and lower financial development. Moreover, the primary target of a central bank is price stability. Higher CBPR helps the monetary authority reach its primary target, which may support a well-functioning financial system and, ultimately financial development. Previously, researchers investigated several central bank features on financial development and found that improving the efficiency of regulations and instruments applied by the central bank would have a positive

Table 3.4 Pooled mean group ARDL estimation results

D.FD	Coefficient	Std. err.	t-statistic
Long-run coefficients			
L.CBPR	0.017*	0.001	10.171
L.LCT	0.059**	0.025	2.384
L.INN.	0.044*	0.014	3.087
GI	0.007*	0.002	2.675
LGDP	0.035	0.034	1.032
Short-run coefficients			
ECT	−0.796*	0.094	−8.437
Dl.FD	0.067	0.112	0.599
D1.CBPR	0.005	0.006	0.800
D1.LCT	0.036	0.097	0.375
D1.INN	−0.009	0.061	−0.142
D1.GI	−0.003	0.005	−0.719
D1.LGDP	−0.076	0.283	−0.269
Constant	−0.816*	0.100	−8.147
Trend	−0.002**	0.001	−1.979

Source: Authors' analysis of data
Note: ***p-value < 0.10; **p-value < 0.05; *p-value < 0.01

effect (King & Levine, 1993; Beck et al., 2000; Tayssir & Feryel, 2018). Our study contributes to the literature by providing evidence for another aspect of the central bank which might support financial development.

Corruption has a positive significant coefficient, implying reduced corruption also enhances financial development within Europe in the long run (based on the measure used, a positive association is desired). This finding is supported by the existing literature (Muye & Muye, 2017), suggesting less corruption diminishes the number of informal economy activities, which will boost the use of financial instruments provided by financial intermediates, thus heightening financial development further. The innovation coefficient is positive and highly significant. This finding implies that spurs in innovation contribute to financial development for the panel of countries we investigated. Literature provides strong evidence on the positive relationship between innovation and financial performance of companies (Govindarajan & Kopalle, 2006; Jansen et al., 2006; Walker, 2004). Increased financial performance offers extra income that companies tend to invest, which will boost financial development. The notion that innovation enhances financial development is also supported by previous studies (Ang & Kumar, 2014; Belazreg & Mtar, 2020).

Likewise, the coefficient of globalization variable is positive and highly significant, indicating that globalization positively contributes to financial development within Europe as a more borderless marketplace creates an ideal environment for investment opportunities to thrive; this result is in line with that of Mishkin (2009) and Muye and Muye (2017). Economic growth is found to be insignificant; therefore, it does not provide any evidence that supports the hypothesized relationship between economic growth and financial development, for the case of Europe in the

long run. This result is compatible with the findings of Hsueh et al. (2013), where they found weak to no evidence on causality from economic growth to financial development. They claimed that financial development does not depend on economic growth but is enhanced by other indicators.

The error correction term is negative and highly significant. This finding indicates any short-run disequilibrium experienced is corrected within the long run. All short-run coefficients provided by ARDL are found to be insignificant; this suggests changes in any variable are unable to impact European financial development within the short run. Thus, said changes/adaptions will only be reflected by the European financial development in the long run.

3.5 Conclusion

Thus far, the financial development literature has overlooked how CBPR may affect the progression of financial development. Hence, to fulfill the mentioned gap, this study analyzes the short- and the long-run outcomes of CBPR on financial development enhancements for a panel of fifteen European Union countries from 2002 to 2017 inclusively due to data availability. To refrain from committing omitted variable bias, innovation, economic growth, globalization, and corruption were used as control variables. PMG estimators provide us with the long- and short-run cointegrating coefficients and error correction term. Obtained findings indicate that an increase in CBPR results in greater financial development for countries within the European region which is compatible with our a priori theoretical expectations. Results concerning control variables, in regards to long-run coefficients, are harmonious with that of the existing literature and indicate that a reduction in corruption perceptions, enhancements in globalization, and innovation induce greater financial development.

Based on our findings, we propose several policy implications. Matching the CBPR with the needs of the banking sector and the financial market would improve financial development, as it is a strong monetary policy tool. A higher CBPR rate is expected to result in more deposits in the banking system. If commercial banks can provide an integrated platform with multiple investment tools to link financial markets with the banking system and give depositors access to broader options, that will enhance financial development. Financial development is just one of many variables that corruption negatively affects. Therefore, fighting corruption is vital to building a sound financial infrastructure and contributing to financial development. Although there is a wide range of potential measures to mitigate corruption, increasing trust in institutions is particularly important (Sööt & Rootalu, 2012). In this context, reducing the informal economic activities by increasing the transparency of institutions; especially the transparency of the central bank; will be helpful (De Simone et al., 2017; Lopez, 2017). Globalization increases financial integration, which will result in higher resistance to possible shocks. This will ultimately help improve the financial system. To benefit from globalization, it is crucial to reduce

trade barriers (Peters, 2017), increase technological innovation (Naz & Ahmad, 2018), provide better education (Sahlberg, 2004), and create a healthy macroeconomic environment. The promotion of innovation is considered to be a driving force behind financial development. Thus, advancements in financial reforms (Aksoy, 2019) and support in technological innovation (Maradana et al., 2017), especially financial technology, are crucial for fostering financial development as they will result in a more efficient allocation of financial resources (Pradhan et al., 2016).

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