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Investigating the Factors Influencing Shadow Banking in EU Member States

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ABSTRACT

This paper investigates the driving forces of shadow banking in 27 EU Member States, using annual data for 1999–2020. To account for heterogeneity, the panel is split into two sub-groups labeled "old" Europe and Eastern Europe. The estimations provide evidence that bank assets, insurance corporation assets, interest rate spreads, and regulatory quality significantly determine shadow banking growth. Financial development also has a considerable influence. The strong link between shadow banking entities and insurance corporations highlights the need to create a framework to test the interconnectedness of financial institutions at the EU level.

KEYWORDS

Financial development; panel data models; shadow banking; traditional banking

JEL CLASSIFICATION

G21; E44; E50

Introduction

Shadow banking has become an increasingly popular mode of financial intermediation, providing market-based financing for many firms and households. This intermediation outside the traditional banking system happens through a broad range of non-bank financial intermediaries that now constitute an important component of modern financial systems (e.g., FSB 2011; EC 2012). Being less regulated, shadow banks may become a source of systemic risk, both directly and indirectly, through their links with the conventional banking system (FSB 2019). The rapid growth of shadow banking in the past two decades is a major concern not only for national authorities but also for international financial institutions, such as the International Monetary Fund (IMF), the Bank for International Settlements (BIS), and the European Central Bank (ECB).

Shadow banking recorded significant growth in Europe before the Global Financial Crisis of 2007/08. For example, in 2002/07, the total assets of shadow-banking institutions grew on average by 14.6% in the European Union (EU). After 2008, the total assets of shadow banks in the Euro area grew at sustained rates in the run-up to the crisis and continued to increase afterward, even though at a slow pace. They reached the maximum at the end of 2018, much higher than the 2002 level, when they approached nearly €10 trillion. In 2018, shadow-banking assets in the euro area amounted to almost €34.5 trillion, accounting for more than 40% of the financial sector assets. Total shadow-banking assets

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more than doubled between 2000 and 2008, and a similar boom was observed between 2009 and 2018 (Hodula, Melecký, and Macháček 2020).

Despite these exciting developments, there have not been many studies that empirically characterize the determinants of shadow banking. According to IMF (2014), this lacuna might be due to the ambiguity of the definition of shadow banking and the lack of statistical data. For instance, the Financial Stability Board (FSB 2011) offers two definitions of the shadow-banking system. According to the broad definition, shadow banking is "credit intermediation involving entities and activities outside the regular banking system." The narrow definition refers to "a system of credit intermediation that involves entities and activities outside the regular banking system, and raises (1) systemic risk concerns, in particular by maturity/liquidity transformation, leverage and flawed credit risk transfer, and/or (2) regulatory arbitrage concern."

Definitional ambiguities offer only a partial explanation for the scarce empirical literature. Most of the studies are still in an incipient or a working-paper stage and mainly focus on the United States and the United Kingdom, or include only the "old" EU member countries. The new EU Member States from Eastern Europe remained neglected in the empirical work. Today, they still invest significant efforts in establishing a well-functioning financial system, thus depriving shadow banking of an enabling environment for its institutions and activities to flourish (Du, Li, and Wang 2017).

This paper aims to fill an important gap in the literature, by analyzing the potential drivers of shadow-banking growth for a panel of 27 EU Member States, using the annual data for 1999–2020.[1] To account for the heterogeneity within the set of European countries, the panel is further split into two sub-groups labeled "old" Europe and Eastern Europe. The distinction is justified for several reasons. First, the periods of entry into the euro area differ, implying a varying degree of institutional capacity and financialisation in Europe. Second, numerous observations in the literature argue that less developed members may generally have worse institutional and regulatory frameworks and lower market discipline, capital capacity, and technical skills. Third, the new EU countries from Eastern Europe strongly dominate the banking system (Claessens et al. 2012; Petkovski and Kjosevski 2014).

A major question is the extent to which the shadow-banking systems of "old" and Eastern Europe differ. It is intertwined with the potential of Eastern Europe to foster financial development and abandon the legacy of East-West socio-economic polarization. Whether EU membership has been positive for the new EU Member States cannot be measured only in terms of economic output. The quality of economic development and societal changes are at least as important, if not more. That makes the overall picture "foggy." A smart, sustainable, and inclusive development path for the new EU Member States would also demand a convergence toward Western European social models, which extends beyond the proximity to the average EU-wide income level.

Our article advances our understanding of shadow banking, by informing about its development and driving forces in 27 EU Member States. Unlike precursor studies (e.g., Hodula, Melecký, and Macháček 2020), this study uses a longer and more recent period, more advanced empirical techniques, more countries, and potential factors. Some other potentially relevant variables have also been used, such as the penetration of insurance companies and some indicators of good governance. This study argues that a deeper understanding of shadow-banking determinants may help national policymakers mitigate

the related risks, while benefiting from their main advantages (e.g., Moreira and Savov 2017).

The paper is organized as follows. Section 2 surveys the existing cross-country studies of the determinants of shadow banking. Section 3 introduces the econometric model, presents data issues, and elaborates on the methodology. Section 4 demonstrates the empirical results from the dynamic panel data models, whereas section 5 presents a robustness analysis. The last section synthesizes the paper's findings and offers policy-relevant recommendations.

Literature Review

Given the primary objective of this study, the literature review has been confined only to cross-country investigations of the determinants of shadow banking in a European context and in the aftermath of the Global Financial Crises (GFC). It is important to note that a commonly agreed definition adopted by the European Systemic Risk Board (ESRB) satisfactorily resolved the definitional problems for EU Member States. Accordingly, Eurostat produces internationally comparable and reliable data on the size of the shadow-banking systems in the EU and the European Economic Area.

Analytical thinking on the determination of shadow-banking development emerged from the sizable literature on the driving forces of financial development. This strand of empirical literature incorporated the interdependencies between shadow banking and other financial market segments, particularly with regard to the traditional banking system.

The theoretical framework behind shadow banking is a complex network of concepts and approaches. Arora and Zhang (2019) as well as An and Yu (2018) comprehensively overview the existing theories. These studies develop their ideas around the following theories: regulation avoidance theory, moral hazard theory, risk diversification theory, market power theory, and scale economy theory. However, although theories explaining the reasons behind shadow-banking activities over the last decade abound, surprisingly little empirical work has been done to analyze the main driving factors. This suggests that obstacles or challenges to such research exist. Even when the study of shadow banking is viewed in terms of a collective endeavor, the various perspectives cannot easily be filtered into a consensus. In fact, most of the existing studies focus on the United States, mainly due to the lack of data.

The literature on shadow banking has identified several factors that might be behind the boom witnessed in the last decade. Older studies emphasize the fact that tighter reserves and other regulatory requirements encourage the use of alternatives to traditional bank loans (Duca, 1992). Edwards and Mishkin (1995) also accentuate changes in information costs; however, these have rarely been empirically assessed. More recent studies generally agree that increases in the securitization of residential mortgages supported the rise of the shadow-banking system prior to the Global Financial Crisis (Mehrling et al., 2013). They mostly analyze the effects of procyclical liquidity premia and leverage on repos and securitization in general (Adrian and Shin 2011).

On the basis of the U.S. data, Duca (2016) finds that in the long run, the capital and reserve requirements, coupled with rising information costs, mainly drive shadow-banking growth. Several studies highlight the relevance of a search for yield effect, which postulates that investors search for higher-yielding assets in the shadow-banking system (Goda et al.,

2013) explore the relationship between the credit to U.S. domestic entities and the growth of non-core liabilities. They find that the external debt liabilities of the financial sector are procyclical and closely aligned with domestic credit growth. Some country-specific papers also suggest a possibly large role of country-specific factors in explaining shadow-banking development, such as insufficient bank branch network development (Acharya et al. 2013) or central government measures (Acharya et al., 2016).

Due to the lack of reliable and comparable statistics on shadow banking and the ambiguity regarding its definition, few empirical studies on continental Europe provide the much-needed empirical insight. The IMF (2014) collects evidence from cross-country data, which covers some European countries. Specifically, it examines a large set of the 26 mostly developed economies and concludes that the search for yield, regulatory arbitrage, institutional cash pools, and financial development contribute to the growth of shadow banking.

Closer to this research, the study of Barbu, Boitan, and Cioaca (2016) evaluates the macroeconomic determinants of shadow banking for a panel of 15 EU countries over a time span of about eight years (2008Q1–2015Q3). Using the net value of the total assets of monetary funds as a proxy for shadow-banking activity, the authors find that GDP growth, short-term interest rates, liquidity, and development of investment funds and positively influenced by stock index dynamics and long-term interest rates negatively influence the dynamics of this sector. Additionally, Kjosevski, Petkovski, and Stojkov (2020) used macroeconomic and financial determinants for a panel of 11 New EU Member States by using the System GMM model. They found that the most important factors are the developments in the financial (insurance and pension) sector, the banking sector, and the money market rate, as well as the general economic growth. Hodula (2018) used a similar model with a panel of 24 EU countries for the 2004–2017 period. He found that more stringent capital regulation and faster financial development positively impact shadow-banking growth. Additionally, he found a difference between the "old" and the new EU Member States due to the missing legal framework for securitization in the new Hodula (2018, p1). Apostoaie and Bilan (2019) also investigated the 11 new EU Member States for the 2004–2017 period. In their study, they used two versions of the dependent variable – a broad and a narrow one. They used six macroeconomic and financial factors as explanatory variables. Their findings indicate that economic growth and traditional banking positively impact the shadow-banking sector in the selected countries. Furthermore, their results show that a higher demand for funds from institutional investors and low-interest rates support the expansion of the shadow-banking sector.

The core determinants selected in this eclectic model have been occasionally used in academic literature (e.g., Barbu, Boitan, and Cioaca 2016; Kim 2016; Apostoaie and Bilan 2019). The internationally comparable and reliable data originates from a variety of providers: Eurostat, European Systemic Risk Board (ESRB), IMF's International Financial Statistics and Monetary and Financial Statistics database, European Central Bank's (ECB) Statistical Data Warehouse database, and the World Bank's World Development Indicators.

Considering the definitional ambiguities of the shadow-banking system (SBS), empirically mapping the dependent variable is difficult. As already underscored, there has been no internationally harmonized definition of SBS for a sufficiently long period. Hence, when specifying the econometric model and selecting the variables, an "appropriate" measure of the size of shadow banking that would compare across this group of countries had to be

searched. In empirical terms, the size of the shadow-banking system has been defined as the value of the total assets of Other Financial Intermediaries (except Insurance Corporations and Pension funds), financial auxiliaries, captive financial institutions, and moneylenders. Eurostat is the official data source of comparable and reliable data. A strong advantage of the European statistics for OFIs is the high degree of international consistency, which implies that they can be compared and aggregated across countries (Broos et al. 2012).

On the basis of the theoretical guidance from the literature review, the following explanatory variables will be used:

- persistence of the time series of shadow-banking size: past values of total assets of Other Financial Intermediaries (OFIs)
- macroeconomic determinants: logarithm of real GDP per capita (Purchasing Power Parity) (*lgdppc*), the inflation rate (*infl*) and the size of the economy (*size*)
- financial determinants: asset size of banks as a percentage of GDP (*bank*), assets of insurance companies (*penetra)*, the interest rate spread (in percentage points), i.e., the lending rate less the deposit rate (*spread*), financial markets index (*finmarkind*) and financial development index (*findev*)
- institutional variables (regulatory quality (*rq*) and rule of law (*rl*)), and
- a set of dummy variables for the Global Financial Crisis 2008/09 (*crisis*), for Malta and Cyprus as outliers within the sample, and Eastern European countries (*eastern*) that became EU Member States from 2004 onwards.[2]

Past values of the shadow-banking size. In dynamic panel modeling, the past values of the dependent variable are used to capture the persistence or sluggishness of the time series. Put differently, a large shadow-banking sector in the previous period is likely to affect its present size.

Natural logarithm of GDP per capita. At the core of all previously mentioned studies, the variables related to the Gross Domestic Product (GDP) are among the main macroeconomic determinants of shadow-banking growth. This study follows Kim (2016) and uses the natural logarithm of real GDP per capita (based on Purchasing Power Parity, and in 2017 international dollars). Bearing in mind the procyclicality hypothesis by Adrian and Shin (2009) and studies by Duca (2016) and Malatesta, Masciantonio, and Zaghini (2016), this study expects a positive and significant impact on real GDP per capita.

The rate of inflation is defined as the annual growth rate of the Consumer Price Index. The justification for its inclusion in the model is to capture the effect of the loss of purchasing power among investors on their decisions to shift their investments toward shadow banking (e.g., IMF 2014).

Financial determinants. The model also includes variables representing other segments of the financial systems in the countries under investigation: assets of banks and insurance companies (and pension funds). Considering the institutional-cash-pool hypothesis and the empirical evidence by IMF (2014), Malatesta, Masciantonio, and Zaghini (2016) and Apostoaie and Bilan (2019), the noted variables are expected to be positively associated with the growth of the shadow-banking sector.

To capture the financial innovations or financial developments, this study follows Kim (2016) and includes a financial development index. Svirydzenka (2016) produces this measure of financial development, comprehensively considering the depth, access, and

efficiency of financial institutions or financial markets. Additionally, in an alternative specification, a financial market sub-index has been used to capture the depth and development of the financial markets. A positive association between these determinants and shadow-banking growth is expected.

Inspired by Kim (2016) and Martinez-Miera and Repullo (2016), this model also includes interest rate spread. It is the net interest margin of banks, computed as the difference between the lending and the deposit interest rates. This determinant aims to test the validity of the search-for-yield hypothesis in the banking approach. More precisely, in an environment of a lower net interest margin (interest spread), financial agents will have more incentives to shift their operations toward shadow banking and to expect higher returns.

Institutional variables. The quality of institutions might affect shadow-banking growth. Stronger institutions are commonly associated with an enabling environment for supporting financial development and attracting cross-border capital flows. Specifically, two good governance indicators published by the World Bank have been used: the regulatory quality and the rule of law indices.

Global Financial Crisis. A dummy variable for the emergence of the Global Financial Crisis (GFC) has also been included and a value of one assigned for the period from 2008 to 2009 and zero for all other periods. This approach is also consistent with the new European Financial Crises Database, provided by ESRB (Duca 2017).

Given the outsized shadow-banking systems in Malta and Cyprus, reaching even 20 times their respective GDP in some years, this study introduces dummy variables for these small jurisdictions.

In sum, the expansion of the traditional banking system, the growth of institutional investors, and the favorable macroeconomic conditions are likely to support the evolution of shadow banking. The so-called procyclicality hypothesis has received mixed empirical support, as there is mixed evidence that short-term interest rates impede shadow-banking growth. A general limitation in the academic literature on shadow banking is the problem of omitted variable bias, as the studies use a narrow list of determinants.

Model, Data, and Methodology

Driving Forces of Shadow Banking

Despite the macroeconomic similarities, the growing inter-connectedness of their economies and geographical and cultural proximity, European countries do not constitute a homogenous group. On the contrary, the aggregate pattern masks significant heterogeneities in terms of the key variables, such as the real GDP growth, the inflation rate, the financial development level, etc. Given that these countries vary considerably, this study classifies the 27 EU Member States into two more homogenous sub-groups: (1) EU-16 (EU-15 minus Luxembourg, plus Malta and Cyprus) comprising Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Malta, Netherlands, Portugal, Spain, and Sweden; and (2) 11 countries from Eastern Europe (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia). In this case, the term "Eastern Europe" can be interchanged synonymously with Central and Eastern Europe.

Data

This dataset refers to a sample of 27 EU Member States using annual data for the 1999–2020 period. Due to its outsized shadow-banking sector (8,106% of 2020 GDP), Luxembourg is excluded from the analysis. The entire sample is also split into two more homogenous sub-samples: (1) EU-16, which corresponds to "old" Europe (EU-15) minus Luxembourg, plus Malta and Cyprus; and (2) Eastern Europe or 11 new EU Member States. As elaborated before, due to the exceptionally outsized shadow-banking system, Luxembourg as a global offshore financial center is excluded from the analysis.

Figure 1 illustrates the unweighted country-group averages of the assets of conventional and shadow-banking systems in "old" and Eastern Europe, as well as Malta and Cyprus, expressed as percentages of GDP. After a period of rapid growth before the Global Financial Crisis in 2008/09, the assets of traditional and shadow-banking systems, as percentages of the GDPs of countries, gradually shrank until 2018 and then started to expand again. Table 1 also describes the statistics of the main variables of interest.

The dispersion of economic growth rates (*gdppc*) is remarkable: the GDP per capita (in constant 2017 international dollars and Purchasing Power Parity) varies from 10,203 U.S. dollars per capita to slightly over 91,000 U.S. dollars per capita. The size of the shadow-banking system (*ofi*) also displays large differences: from a minimum of 0.2% of GDP to a maximum of 2,057.2% of GDP. Such substantial differences among the selected countries justify classifying the sample countries into two more homogeneous sub-groups ("old" and Eastern Europe) and a separate treatment of Malta and Cyprus to more precisely investigate the determinants of shadow banking.

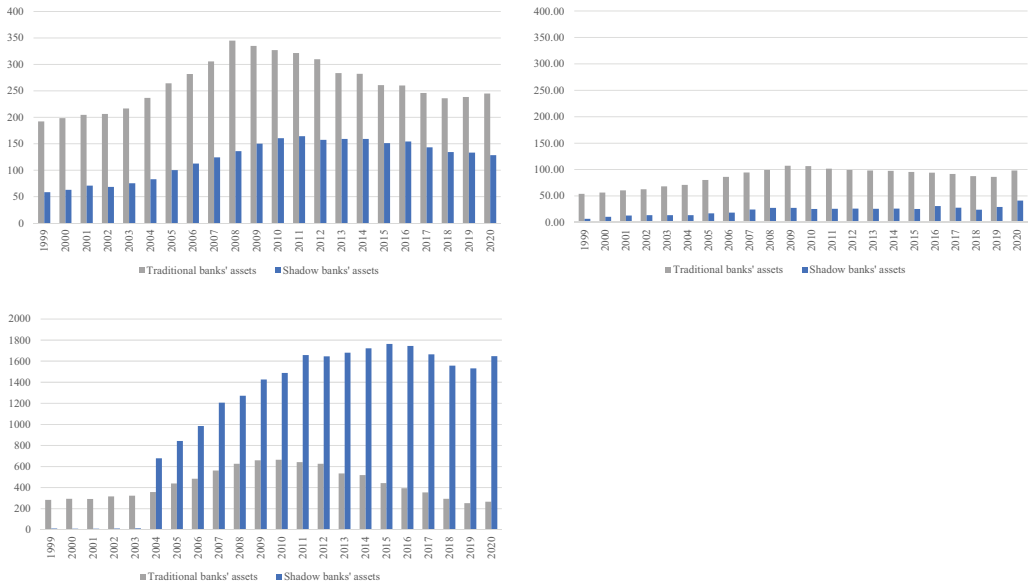

Figure 1. Size of traditional and shadow banking systems in Europe (in percent of GDP). Note: Unweighted group averages. *Source*: Authors' calculations based on data from Eurostat (2022).

Table 1. Descriptive statistics.

Explanatory variables	Obs.	Mean	Standard deviation	Minimum	Maximum
Assets of OFIs (in percent of GDP)	591	155.7	358.6	0.2	2,057.2
GDP per capita (PPP, in 2017 international dollars)	594	36,437	12,466	10,203.5	91,035.8
Inflation rate	594	2.58	3.72	−1.68	45.80
Interest rate spread	519	2.39	1.46	0.13	10.3
Assets of insurance companies (in percent of GDP)	556	7.74	15.28	0.70	140.5
Bank assets (in percent of GDP)	593	204.2	155.96	24.6	987.1
Financial development index	594	0.55	0.20	0.12	0.95
Regulatory quality index	594	1.16	0.45	−0.11	2.10

Methodology

To estimate what drives shadow banking in the countries selected from the EU, dynamic panel data models will be applied to account for the potential inertia (sluggishness) of the dependent variable – natural logarithm of the value of the total assets of Other Financial Intermediaries, including financial auxiliaries, captive financial institutions, and money lenders. The Eurostat definition has been employed, which excludes Insurance Corporations and Pension Funds from the scope of Other Financial Intermediaries.[3]

While the static panel data model is rather simple and intuitive, such an approach would be inappropriate for this paper due to the potential inertia of the dependent variable. Namely, the assets of OFI in this model can involve persistence in their movements over time, that is, their present values to a certain extent depend on past values. Bearing this in mind, this study is more inclined to employ a dynamic panel estimation (2) as follows:

$$y_{it} = \sum_{j=1}^{p} \alpha_j y_{i,t-j} + x_{it} + \beta + \delta_i + \varepsilon_{it}$$

The dynamic model includes lagged dependent variables, $y_{i,t-j}$. It also allows for the correlation between δ_i and x_{it} ($\mathrm{cov}(\delta_i, x_{it}) \neq 0$). To capture the persistence of the assets of OFI and eliminate the fixed effects (and their correlations), the model has been differenced and the difference Generalised Method of Moments adopted, including the lagged difference of the dependent variable, introduced by Arellano and Bond (1991). The one-step generalized method of moments estimator (GMM) developed by Arellano and Bond (1991) has been used because according to Judson and Owen (1999), this estimator outperforms the two-step estimator in terms of producing both a smaller bias and a smaller standard deviation. Then, the following has been obtained:

$$\Delta y_{it} = \sum_{j=1}^{p} \alpha_j \Delta y_{i,t-j} + \Delta x_{i,t}\beta + \Delta\delta_i + \Delta\varepsilon_{i,t}$$

In the differenced model (3), a correlation still exists between the lagged values of the dependent variable $\Delta y_{i,t-j}$ and the differenced errors, $\Delta\varepsilon_{i,t}$. According to Nickell (1981), the standard fixed effects estimator is not consistent, because this correlation produces biased estimates. Bearing this in mind, this study employs the system-GMM estimator based on Arellano and Bover (1991) and Blundell and Bond (1998), which addresses the endogeneity problem caused by the correlation.

Comprehensive diagnostic checks have been implemented, related to instrument validity and the use of system GMM as the main estimation method. Regarding the "steady state" assumption, this study follows Blundell and Bond (1998) and checks that the size of the

autoregressive coefficient is lower than one and that the difference-in-Hansen test does not reject the validity of additional instruments for system GMM. In line with the dominant practice, internal instruments have been used for the two endogenous variables (the lagged dependent variable and the level of economic development) to utilize one of the main strengths of the method and avoid the difficulty of finding valid external instruments.

To avoid the problem of too many instruments in comparison to the number of groups (Roodman 2009), the number of instruments is kept lower than the number of countries. In the standard (unrestricted) form, each instrumenting variable creates one instrument for each period and the lag available to that period, whereas – in the collapsed form – a single-column vector of instruments is created instead of a whole matrix of instruments. Although collapsing can reduce the statistical efficiency in large samples, it can be very helpful as a tool in avoiding the bias in finite samples, which are usually characterized by an instrument proliferation. This approach helps avoid any bias due to too many instruments in a relatively small sample. As an instrument, the lagged dependent variable will be used. The validity of the parameter estimation instruments selected can be tested using the Hansen test. Furthermore, serial correlations (first-order [AR1] and second-order [AR2] serial correlations) will be tested in the differenced residuals. According to Arellano and Bond (1991), the first-order autocorrelation in the differenced residuals does not imply inconsistent estimates. However, the second-order autocorrelation would imply that this is the case.

Empirical Results and Discussion

Before presenting the empirical results, this study begins by analyzing the results of multicollinearity. First, the data were subjected to statistical tests for collinearity in Table 2, which are considered necessary to test the multicollinearity of the variables before applying the linear regression analysis. Finding out whether the independent variables are correlated with the dependent variable is necessary (Hair et al. 2010). Multicollinearity occurs when two or more variables in a model are connected. This situation can lead to problems as it increases the standard error of estimates, and it can generate erroneous and confusing results in a study. Moderate multicollinearity may not be a problem but can increase the variance of the estimated coefficient and make it sensitive to small changes. If this happens, the results will be unstable and difficult to interpret.

From the results, the correlation coefficients showed that all the independent variables correlated with each other. Their relationships were positive and statistically significant,

Table 2. Results of the collinearity test.

Variables	Collinearity Statistics	
	Tolerance	VIF
Ln (GDP per capita)	0.18	5.40
Financial development index	0.21	4.70
Interest rate spread	0.23	4.21
Bank assets	0.37	2.69
Assets of insurance corporations	0.39	2.55
Inflation rate	0.61	1.64

Source: Authors' calculations.

from which the variables can be concluded to have a high level of tolerance and not have multicollinearity. This is because none of the Variance Inflation Factors (VIFs) for all variables exceeds 10, the threshold above which multicollinearity is a problem (Kock and Lynn, 2012). Therefore, these four independent variables will continue to be applied to the regression equation.

Furthermore, the results of the econometric analysis of the determinants of shadow-banking growth in the EU Member States are presented. The first empirical specification in Table 3[column 1] presents the initial specification, whereas the second specification introduces dummy variables for Malta, Cyprus, and Eastern Europe. In the third specification, an alternative index of financial development (*findev*) is tested. The fourth specification, instead of the assets of insurance corporations, includes the assets of both insurance corporations and pension funds (*icpf*). The fifth specification introduces the size of the economy instead of the level of economic development and introduces the rule of law index instead of the regulatory quality index. These indices are strongly correlated and are therefore included one at a time.

Dependent Variable: Ln (Assets of Other Financial Intermediaries)

On the basis of the results of the system GMM, evidence can be provided that financial and institutional variables play an important role in the development of shadow banking. During the entire period (1999–2020), the conclusion is that assets of banks (*bank*), assets of insurance corporations (*penetra*), interest rate spread (*spread)*, financial market index *(finmarkind)*, and regulatory quality *(rq)* are statistically and economically significant determinants with a positive coefficient.

Interest rate spread and the financial markets composite index are consistently significant across all specifications. The results for the interest margin of banks (*spread*) indicate that the coefficient is both positive and statistically significant. Higher interest rate margins in the banking sector motivate shadow-banking players to offer more competitive financial products. These results are broadly in line with Kim (2016), in which this determinant was statistically significant and had a positive sign with values between 0.5% and 4.5%. In this estimation, this coefficient is 0.1%.

A 1% increase in the financial markets index is likely to grow shadow banking by between 0.45 and 0.55%, ceteris paribus. Expansion of the traditional assets of banks is also associated with stronger shadow-banking growth: a 1% increase in the assets of banks is likely to be associated with a 0.2% increase in shadow banking. Asset growth of other financial intermediaries – such as insurance corporations – also complements shadow-banking growth by a similar magnitude. The shadow-banking growth is much more likely in a market economy that experiences financial development and improves financial literacy.

Surprisingly, most macroeconomic determinants turn out to be statistically insignificant, suggesting that their influence might be indirect, via the other explanatory variables. An important exception is the size of the economy, as shadow banking appears to be a competitive advantage of smaller European economies. This advantage is particularly important for small economies with a high degree of capital account liberalization, a low tax burden, and a shadow-banking system disproportionate to the size of the economy (e.g., Ireland, Malta, Cyprus). The empirical results indicate that a 1% smaller GDP of the

Table 3. Determinants of shadow banking in the European Union.

Explanatory variables	[1]	[2]	[3]	[4]	[5]
Lagged dependent variable	**0.89*** **	**0.84*** **	**0.81*** **	**0.81*** **	**0.80*** **
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Macroeconomic determinants					
Ln (GDP per capita)	0.03	0.07	0.10		
	(0.77)	(0.56)	(0.36)		
Ln (1+inflation rate/100)	−0.55	−0.56	−0.36	−0.66	−0.72
	(0.57)	(0.56)	(0.52)	(0.50)	(0.47)
Size of the economy [Ln (GDP)]				**−0.27*** **	**−0.31*** **
				(0.00)	(0.00)
Financial determinants					
Ln (Banks' assets)	−0.05	0.06	0.09	**0.19*** **	**0.21*** **
	(0.21)	(0.41)	(0.52)	(0.06)	(0.00)
Ln (Assets of insurance corporations)	**0.10*** **	0.06		**0.18*** **	**0.20*** **
	−0.004	−0.175		−0.004	(0.00)
Ln (Assets of insur. corp. and pens. funds)			0.03		
			(0.50)		
Financial markets index	**0.45** **	**0.46** **		**0.54** **	**0.55** **
	(0.03)	(0.05)		(0.05)	(0.03)
Financial development index			**0.58*** **		
			(0.00)		
Interest rate spread	**0.07***	**0.07** **	**0.08** **	**0.09*** **	**0.08*** **
	(0.06)	(0.05)	(0.02)	(0.01)	(0.01)
Institutional determinants					
Regulatory quality index	**0.13** **	**0.16*** **	**0.15** **	**0.14** **	
	(0.02)	(0.01)	(0.02)	(0.01)	
Rule of law index					0.03
					(0.49)
Other determinants					
Global Financial Crisis Dummy	**−0.05** **	**−0.06** **	**−0.07*** **	**−0.06*** **	**−0.07*** **
	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)
Dummy variable for Malta		**0.34** **	**0.45*** **	−0.15	−0.24
		(0.02)	(0.00)	(0.40)	−0.133
Dummy variable for Cyprus		**0.26** **	**0.38*** **	−0.12	−0.19
		(0.05)	(0.00)	(0.43)	(0.20)
Dummy variable for Eastern Europe		0.07	0.12	0.12	0.11
		(0.56)	(0.32)	(0.30)	(0.41)
Constant	0.19	−0.8	−1.09	**0.60*** **	**1.09*** **
	(0.86)	(0.58)	(0.47)	(0.00)	(0.00)
Number of observations	479	479	490	479	479
Number of countries	27	27	27	27	27
Number of instruments	33	33	33	33	33

[1] p-values are presented in parentheses. [2] Other financial intermediaries encompass other financial intermediaries, financial auxiliaries, captive financial institutions, and money lenders, but exclude insurance corporations and pension funds, in line with the Eurostat definition. Source: Authors' calculations.

economy is associated with a 0.3% increase in shadow-banking assets, other things being equal.

In the next stage, the same regression will be re-run for the Eastern European sub-sample of 11 countries (Table 4). The estimation results suggest that shadow banking in Eastern Europe complements traditional (or conventional) banking. Therefore, a 1% increase in the assets of banks is expected to increase shadow banking by between 0.25% and 0.39%, depending on the empirical specification. The results are in line with the existing body of empirical literature (e.g., Kim 2016; Lemma 2016; Hodula, Melecký, and Macháček 2020).

Table 4. Determinants of shadow banking in Eastern Europe.

Explanatory variables	[1]	[2]	[3]	[4]	[5]	[6]
Lagged dependent variable	**0.65*** **	**0.65*** **	**0.72*** **	**0.67*** **	**0.67*** **	**0.64*** **
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Macroeconomic determinants						
Ln (GDP per capita)	0.09	0.09	0.16			
	(0.72)	(0.72)	(0.50)			
Ln (1+inflation rate/100)	−0.66	−0.66	−0.62	−0.62	−0.62	−1.13
	(0.45)	(0.45)	(0.44)	(0.46)	(0.46)	(0.19)
Size of the economy [Ln (GDP)]				0.14	0.14	0.17
				(0.16)	(0.16)	(0.31)
Financial determinants						
Ln (Banks' assets)	**0.35** **	**0.35** **	**0.39*** **	**0.25** **	**0.25** **	**0.30*** **
	(0.02)	(0.02)	(0.09)	(0.04)	(0.04)	(0.06)
Ln (Assets of insurance corporations)	−0.09	−0.09		**−0.14***	**−0.14***	−0.18
	(0.20)	(0.20)		(0.06)	(0.06)	(0.14)
Ln (Assets of insur. corp. and pens. funds)			**−0.13***			
			(0.06)			
Financial markets index	**0.98** **	**0.98** **		**1.02** **	**1.02** **	**1.00***
	(0.01)	(0.01)		(0.01)	(0.01)	(0.07)
Financial development index			**1.00** **			
			(0.02)			
Interest rate spread	**0.08** **	**0.08** **	**0.08*** **	**0.05** **	**0.05** **	**0.05** **
	(0.02)	(0.02)	(0.00)	(0.03)	(0.03)	(0.01)
Financial determinants						
Regulatory quality index	**0.37*** **	**0.37*** **	**0.28*** **	**0.36*** **	**0.36*** **	
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	
Rule of law index						0.25
						(0.11)
Other determinants						
Global Financial Crisis dummy variable	−0.07	−0.07	**−0.11** **	−0.06	−0.06	−0.02
	−0.177	−0.177	−0.02	−0.152	−0.152	−0.739
Intercept		−1.5	−2.9	−0.87	−0.87	−0.9
		−0.56	−0.237	−0.154	−0.154	−0.363
Number of observations	194	194	198	194	194	194
Number of countries	11	11	11	11	11	11
Number of instuments	27	27	27	27	27	27

[1] p-values are presented in parentheses. [2] Other financial intermediaries encompass other financial intermediaries, financial auxiliaries, captive financial institutions, and money lenders, but exclude insurance corporations and pension funds, in line with the Eurostat definition. *Source*: Authors' calculations.

Dependent Variable: Ln (Assets of Other Financial Intermediaries)

The results for Eastern Europe also reveal significant persistence of shadow-banking growth, given the statistically significant coefficient of the lagged dependent variable. The main driving forces of shadow banking in Eastern Europe were the traditional banking growth, the interest rate spread, the regulatory quality, and the financial market and development indices. The ascent of insurance corporations is found to be a substitute or inhibiting factor of shadow-banking activities. This result should be taken with a grain of salt, as the coefficient is estimated at the 10% level of significance.

Lastly, limited evidence is found that the Global Financial Crisis negatively impacted shadow banking in Eastern Europe. These results are entirely consistent with Hodula, Melecký, and Macháček (2020) for almost the same group of countries, as this determinant was statistically significant and had a positive sign with a value of 2.24.

In the next step, the consistency of the results is investigated by excluding one EU member state at a time from the entire sample. It is preferable to observe whether some countries with either outsized shadow-banking sectors or outlying observations for the

explanatory variables affect the overall empirical results. As presented in Table 5, the empirical results are remarkably consistent across different specifications.

Despite the Delta test being more appropriate for large samples, it is applied for slope heterogeneity (Pesaran and Yamagata 2008; Bersvendsen and Ditzen 2021). The null hypothesis is that slope coefficients are homogenous across all European countries. The Delta test statistic is sufficiently large to reject the null hypothesis of slope homogeneity (p-value is zero). In contrast, the estimations for the sub-samples of Eu-16 and Eastern Europe display slope homogeneity, suggesting that they might be considered more reliable.

Discussion Section

The empirical results provide compelling evidence that financial and institutional factors play a significant role in explaining shadow-banking growth. The impact of financial factors is statistically significant and consistent across the different sets of specifications and countries. Moreover, these results indicate complementarity between the development of shadow banking and the rest of the financial system as well. In these economies, shadow banks provide alternative funding where traditional banking is not able to do so; especially, the complementarity could be viewed from the perspective of mortgage financing. Namely, where regulatory constraints do not permit traditional banks to provide mortgage on the full property value, shadow banks might step in to offer a way to finance the rest of the borrower's claims.

Shadow banking tends to be sensitive to the overall macroeconomic conditions, as economic growth has been positively influencing the expansion of this segment of the financial sector. Moreover, within the bank operations performed for enterprises, a significant number is devoted to processing payments, instead of credit provision. Therefore, as many companies are unobserved or underserved by the formal financial system (Wachtel, Haselmann, and Sobott, 2016), they are searching for finances outside their traditional suppliers.

The results also suggest that shadow-banking entities and insurance corporations are interconnected. For example, besides providing traditional insurance services, some insurance corporations may also enter into derivative transactions or underwrite collateralized debt obligations to invest their cash. In Europe, shadow banking complements the insurance sector. However, given the limited number and assets of other financial intermediaries in Eastern Europe, limited evidence is found that insurance corporations compete for the same assets with the shadow-banking entities.

Such results are opening new issues for macroprudential policy, for the current policy debate and for financial stability. They point to the need to consider risk factors in analyzing monetary policy effectiveness. The resilience of the financial sector affects the pass-through strength of monetary policy rates through the non-bank financial sector and the banking sector. These results may also consider bearing in mind the Basel III norms, given that one of the main goals of Basel III is to reduce the procyclicality of bank lending, and the rise of shadow banking may impact both capital-based regulation and income-based limits. The strong link between shadow-banking entities and insurance corporations points to a need to create a framework for testing the interconnectedness of financial institutions at the EU level.

Table 5. Robustness analysis: Exclusion of one country at a time.

Explanatory variables	w/o Austria	w/o Belgium	w/o Bulgaria	w/o Croatia	w/o Czechia	w/o Denmark	w/o Estonia	w/o Finland	w/o France
Lagged dependent variable	**0.89*** **	**0.90*** **	**0.89*** **	**0.90*** **	**0.89*** **	**0.88*** **	**0.89*** **	**0.89*** **	**0.89*** **
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Macroeconomic determinants									
Ln (GDP per capita)	0.05	0.00	0.04	0.01	0.03	0.04	0.03	0.03	0.04
	(0.71)	(0.98)	(0.77)	(0.92)	(0.77)	(0.74)	(0.83)	(0.78)	(0.747
Ln (1+infl. rate/100)	−0.54	−0.59	−0.64	−0.62	−0.61	−0.58	−0.58	−0.43	−0.57
	(0.579	(0.552	(0.522	(0.539	(0.533	(0.551	(0.568	(0.655	(0.559
Financial determinants									
Ln (Bank assets)	−0.05	−0.06	−0.05	−0.05	−0.06	−0.05	−0.05	**−0.06***	−0.05
	(0.212	(0.166	(0.234	(0.205	(0.161	(0.233	(0.204	(0.078	(0.218
Ln (Assets of insurance corporations)	**0.10*** **	**0.10*** **	**0.10*** **	**0.10*** **	**0.11*** **	**0.11*** **	**0.11*** **	**0.11*** **	**0.10*** **
	(0.007	(0.006	(0.005	(0.005	(0.003	(0.004	(0.007	(0.002	(0.007
Financial markets index	**0.45** **	**0.49** **	**0.45** **	**0.45** **	**0.44** **	**0.46** **	**0.45** **	**0.50** **	**0.45** **
	(0.032	(0.021	(0.035	(0.034	(0.031	(0.031	(0.03	(0.014	(0.034
Interest rate spread	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.06***	**0.07***
	(0.067	(0.053	(0.063	(0.055	(0.054	(0.054	(0.088	(0.094	(0.06
Institutional determinants									
Regulatory quality index	**0.12** **	**0.14*** **	**0.13** **	**0.15*** **	**0.13** **	**0.14** **	**0.13** **	**0.16*** **	**0.13** **
	(0.022	(0.007	(0.018	(0.004	(0.017	(0.014	(0.023	(0.002	(0.019
Other determinants									

(*Continued*)

Table 5. (Continued).

Explanatory variables	w/o Austria	w/o Belgium	w/o Bulgaria	w/o Croatia	w/o Czechia	w/o Denmark	w/o Estonia	w/o Finland	w/o France
Global Financial Crisis dummy	**−0.05***	**−0.06****	**−0.05****	**−0.05****	**−0.05****	**−0.05****	**−0.05****	**−0.05****	**−0.05****
	(0.053	(0.014	(0.02	(0.029	(0.038	(0.036	(0.029	(0.021	(0.036
Constant	0.05	0.55	0.17	0.35	0.18	0.14	0.27	0.34	0.15
	(0.97)	(0.59)	(0.88)	(0.76)	(0.87	(0.906	(0.823	(0.758	(0.892
Number of observations	461	461	461	461	461	463	463	461	461
Number of countries	26	26	26	26	26	26	26	26	26

	w/o Hungary	**w/o Ireland**	**w/o Italy**	**w/o Latvia**	**w/o Lithuania**	**w/o Netherlands**	**w/o Poland**
	0.90***	**0.90*****	**0.89*****	**0.89*****	**0.89*****	**0.89*****	**0.90*****
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	0.04	0.00	0.03	0.03	0.03	0.02	−0.01
	(0.76)	(0.98)	(0.77)	(0.805	(0.805	(0.837	(0.941
	−0.63	−0.61	−0.53	−0.82	−0.70	−0.59	−0.69
	(0.52	(0.548	(0.59	(0.413	(0.499	(0.55	(0.474
	−0.05	−0.06	−0.05	−0.06	−0.05	−0.06	−0.06
	(0.225	(0.163	(0.199	(0.107	(0.22	(0.107	(0.14
	0.10***	**0.10*****	**0.11*****	**0.12*****	**0.11*****	**0.12*****	**0.11*****
	(0.007	(0.006	(0.005	(0.002	(0.005	(0.00)	(0.003
	0.42*	**0.47****	**0.45****	**0.49****	**0.48****	**0.43****	**0.43****
	(0.053	(0.021	(0.027	(0.022	(0.03	(0.034	(0.032
	0.07*	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.07****
	(0.051	(0.06	(0.069	(0.057	(0.067	(0.063	(0.046
	0.13**	**0.12****	**0.12****	**0.13****	**0.13****	**0.12****	**0.14*****
	(0.015	(0.016	(0.032	(0.019	(0.019	(0.039	(0.007
	−0.06**	**−0.06*****	**−0.05****	**−0.05****	**−0.05****	**−0.05****	**−0.05****
	(0.023	(0.006	(0.025	(0.034	(0.034	(0.02	(0.041
	0.1	0.48	0.19	0.24	0.23	0.33	0.55
	(0.933	(0.671	(0.868	(0.832	(0.842	(0.774	(0.626
	461	463	461	461	461	461	461
	26	26	26	26	26	26	26
Lagged dependent variable	**0.89*****	**0.89*****	**0.91*****	**0.88*****	**0.89*****	**0.88*****	**0.89*****

								0.87***	
									0.83***

(*Continued*)

Table 5. (Continued).

Explanatory variables	w/o Austria	w/o Belgium	w/o Bulgaria	w/o Croatia	w/o Czechia	w/o Denmark	w/o Estonia	w/o Finland	w/o France
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Macroeconomic determinants									
Ln (GDP per capita)	0.03	0.03	−0.01	0.09	0.04	0.04	0.05	0.08	0.04
	(0.77	(0.778	(0.933	(0.422	(0.709	(0.76	(0.676	(0.551	(0.752
Ln (1+infl. rate/100)	−0.52	−0.31	−0.36	−0.49	−0.62	−0.60	−0.58	−0.68	0.19
	(0.604	(0.811	(0.713	(0.614	(0.538	(0.533	(0.559	(0.491	(0.727
Financial determinants									
Ln (Bank assets)	−0.05	−0.05	−0.06	−0.06	−0.05	−0.06	−0.06	−0.01	−0.01
	(0.19	(0.249	(0.112	(0.116	(0.229	(0.173	(0.126	(0.94	(0.915
Ln (Assets of insurance corporations)	**0.10*** **	**0.10*** **	**0.09*** **	**0.11*** **	**0.11*** **	**0.11*** **	**0.11*** **	**0.08***	**0.13** **
	(0.006	(0.005	(0.005	(0.004	(0.008	(0.007	(0.004	(0.077	(0.03
Financial markets index	**0.46** **	**0.45** **	**0.45** **	**0.47** **	**0.45** **	**0.53** **	**0.46** **	**0.46** **	**0.28***
	(0.026	(0.035	(0.034	(0.026	(0.04	(0.011	(0.024	(0.036	(0.064
Interest rate spread	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.07***	**0.08** **	**0.04** **
	(0.072	(0.079	(0.071	(0.065	(0.066	(0.058	(0.075	(0.04	(0.016
Institutional determinants									
Regulatory quality index	**0.13** **	**0.13** **	**0.13** **	**0.10***	**0.13** **	**0.15*** **	**0.12***	**0.14** **	**0.16** **
	(0.02	(0.019	(0.014	(0.057	(0.022	(0.009	(0.062	(0.011	(0.011
Other determinants									
Global Financial Crisis dummy	**−0.06** **	**−0.06** **	**−0.05** **	**−0.05** **	**−0.05** **	**−0.05** **	**−0.06** **	**−0.05** **	**−0.05** **

(*Continued*)

Table 5. (Continued).

Explanatory variables	w/o Austria	w/o Belgium	w/o Bulgaria	w/o Croatia	w/o Czechia	w/o Denmark	w/o Estonia	w/o Finland	w/o France
	(0.026	(0.028	(0.03	(0.032	(0.028	(0.02	(0.014	(0.025	(0.016
Constant	0.18	0.16	0.60	−0.27	0.08	0.23	0.08	−0.41	0.00
	(0.878	(0.888	(0.557	(0.814	(0.943	(0.836	(0.949	(0.743	(0.998
Number of observations	461	461	463	461	461	461	463	458	458
Number of countries	26	26	26	26	26	26	26	26	26

These results advance the understanding of the empirical link between monetary policy and financial intermediaries and have non-trivial implications for policy practitioners. The empirical evidence casts doubt on the ability of monetary policy to effectively "lean against the wind." In this respect, the findings support the literature that recommends maintaining close cooperation between monetary policy and macroprudential and supervisory authorities.

Conclusions

In this paper, the driving forces of shadow banking for a panel of 27 EU countries have been analyzed. From an empirical perspective, the system-generalized method of moments has been used, with data ranging from 1999 to 2020. To account for the heterogeneity within the set of European countries, the panel is further split into two sub-groups, labeled: (1) the EU-16 and (2) Eastern Europe (11 new EU Member States). The findings are largely consistent with the existing body of empirical literature but also provide new evidence on the importance of other financial and institutional factors.

In contrast to the existing studies on Europe, evidence is not found favoring the procyclicality hypothesis of shadow banking – at least, for the selected group of European economies. Among macroeconomic determinants, size is found to matter: small economies tend to experience higher shadow-banking growth. Furthermore, shadow banking is also found to complement the traditional (conventional) banking and insurance sectors. The complementarity hypothesis between the development of shadow banking and of the rest of the financial system is also supported, probably with stronger evidence, given the nature of the bank-based economy in the EU countries. In these economies, shadow banks provide alternative funding where traditional banking is not able to do so.

The aggregate pattern for Europe masks a much weaker relationship between the insurance corporations and shadow-banking entities in Eastern Europe, suggesting that they may compete for the same assets. Other significant driving forces are the composite financial development and financial markets indices, which capture the depth, access, efficiency, and stability of financial systems. Moreover, the results indicate that the Global Financial Crisis of 2007/08 had a significant negative impact on shadow banking.

Two new stylized facts have been identified for "old" and new EU Member States. First, from a macroeconomic perspective, the results for the interest margin of banks (*spread*) indicate that this determinant has a positive sign. It implies that financial market players are shifting their operations toward shadow-banking products. Second, the results for the inflation rate are in line with the expectations and are negative. However, this determinant was insignificant. This implies that an increased inflation rate will negatively impact the size of the shadow-banking system.

The results of the study address several aspects that regulatory authorities should keep in mind. Namely, the latter should work on possible regulatory options, which may concern either the key components of shadow banking, addressing of relevant activities and/or entities (direct regulation), or the interaction of the regulated banking sector with shadow banking (indirect regulation). As the activities of shadow-banking entities interconnect with the other non-bank segments of the financial institutions (e.g., insurance corporations and pension funds), the authorities in Eastern Europe should consider models of integrated non-bank supervision.

There are a number of future research avenues for this examination. First, there has been a lack of available data on the determinants selected for a longer period. The existence of a long time series of data would facilitate more accurate and reliable results to be obtained. Second, future research could also consider some other Eastern European countries that are EU candidate countries. Third, other inquiries may use both the broad and the narrow definition of shadow banking. Finally, the research may be improved by including other macroeconomic determinants (monetary aggregates, stock prices, and exchange rate developments) or financial factors (size, loans-to-assets ratio, etc.).

Notes

1. Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, and Sweden.
2. The financial crises periods were selected based on the new European financial crises database (please refer to Duca, 2017, for the underlying paper describing the methodology).
3. Hsiao (2014) convincingly provides the justification for the panel data analysis. It provides several benefits: (1) the use of panel data enables control for individual heterogeneity; (2) panels provide more informative data, more variability, less collinearity among the variables, greater degree of freedom, and higher efficiency; (3) with panel data, one is better equipped to study the dynamics of adjustment; (4) panel data are more suitable for identifying and measuring effects that are simply not detectable in pure cross-sections or pure time-series data; and (5) panel data models allow for constructing and testing more complicated behavioral models than pure cross-section or time data models do.

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No potential conflict of interest was reported by the author(s).

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