Measuring shadow banking in Central and Eastern European countries: A new dataset, 2004–2019

András Bethlendi
(corresponding author)
Finance Department,
Faculty of Economic and Social Sciences,
Budapest University of Technology and Economics,
Budapest, Hungary
E-mail: bethlendi.andras@gtk.bme.hu

Katalin Mérő
Department of International Trade and Logistics,
Faculty of International Management and Business,
Budapest Business School,
Budapest, Hungary
E-mail: mero.katalin@uni-bge.hu.

Keywords:
shadow banking,
financial structure,
Central and Eastern Europe,
statistical dataset

There is hitherto no consensus on the measurement of shadow banking phenomena. The differences can be attributed to the various conceptual definitions of the shadow banking system, lack of data, and difficulties of data compilation. This study developed a unique dataset for measuring the size and main structural characteristics of the shadow banking systems of 11 Central and Eastern European Union (EU) member states. Using several publicly available datasets, the authors constructed an annual database for 2004–2019 as a tool to reliably analyse the region's shadow banking system. To compare these data with those of Western European countries, the study compiled a dataset using the same methodology for three developed Western European countries. The findings show that the size of shadow banking in Central and Eastern European countries relative to their gross domestic product (GDP) is much smaller and its structure significantly different from that in developed EU countries.

Introduction

Shadow banking (SB) is a new concept that has emerged in the 21st century. McCulley (2009) first used the expression in 2007 at the United States (US) Federal Reserve's annual conference in Jackson Hole, where he drew attention to the rise of short-term market-based housing loan finance outside the regulated banks, that is, in the 'shadow' of regulated banking activities. Since then, the term „shadow banking" been widely used in professional finance and the general press. Many analysts have blamed the emergence of the SB system on the US subprime crisis and the subsequent global financial crisis (GFC). SB has resulted in rapid credit expansion without sufficient control mechanisms because of the opaqueness of risks and risk transfer mechanisms, lack of regulation, and bad incentive structures (Adrian–Ashcraft 2012, Lysandrou–

Nesvetailova 2015, Ban–Gabor 2016). Accordingly, in the wake of the GFC, SB has appeared at the forefront of academia and financial policymaking.

However, to date, there is neither a generally accepted definition nor measurement methodology for SB. The SB systems of Central and Eastern European (CEE) countries are especially under-researched, as the financial systems of these countries are less developed and market-based than those of the developed world. Accordingly, financial system-related problems during and after the GFC have not been linked to the SB system. However, measuring the SB systems of these countries can contribute to a better understanding of the structure and vulnerabilities of the CEE financial system. Accordingly, based on an overview of the concepts, measurement methodologies, and available data, we constructed a dataset for 11 Central and Eastern European Union (EU) member states for the period 2004–2019. We covered Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia, all of which joined the EU in 2004 or later. To compare their data with those of their Western European peers, we also compiled a dataset representing the same methodology for three Western European countries: Austria, France and Germany. We aimed to provide a publicly available dataset for an in-depth analysis of the region's SB system. We used data from Eurostat for the initial analysis, supplemented by quality checks, corrections, and amendments based on other data sources. A first, quick overview of the data has been provided. However, in line with the aim of this study, we did not conduct an in-depth analysis; the dataset presents scope for future research in this regard.

The remainder of this paper is structured as follows: we present literature review of SB, as a concept, the measurement challenges and existing methodologies, the methodology for the compilation of our dataset, and the main characteristics of CEE SB based on our database. Finally, we summarize the key conclusions. Appendix and Internet appendix contain the data sources used to construct the dataset and the entire dataset, respectively. Internet appendix is only available online separately.

Shadow banking: definition

Pozsar et al. (2010) developed the first comprehensive map of SB-related activities and institutions and the definition of SB. They used an activity-based approach and defined SB as follows: 'Shadow banks intermediate credit through a wide range of securitization and secured funding techniques such as asset-backed commercial paper (ABCP), asset-backed securities (ABS), collateralized debt obligations (CDOs) and repurchase agreements (repos) (Pozsar et al. 2010: 1.) SB is thus characterised by its relationship with credit origination funded by other market-based funds rather than traditional deposit-taking. The authors also identified the intermediation steps and participating institutions involved in SB. Based on the map of activities, they identified three SB groups: 1) the government-sponsored subsystem, which is typical only for the US, as it is related to the three US government-sponsored enterprises[1]; 2) the internal SB subsystem, where the whole process takes place within a bank holding company, including a traditional bank that grants loans and several other financial companies that conduct the securitisation and selling processes; and 3) the external SB subsystem, where even credit is granted through a non-bank financial intermediary. The main difference between the internal and external subsystems is that the second does not contain any institutions subject to the government's safety net, that is, the deposit insurance system and the central bank's lender-of-last-resort facility.

In the wake of the GFC, international organisations responsible for financial stability began working on a comprehensive definition of SB. The Financial Stability Board (FSB) – established in 2010 with the aim of monitoring the vulnerabilities of the global financial system and issuing recommendations for maintaining financial stability – has emphasised dealing with the SB system since its establishment. In 2011, the FSB (2011) issued a background note that described the main features of SB from a financial stability perspective and defined it as follows: 'The system of credit intermediation that involves entities and activities outside the regular banking system' (p. 2). This broad definition is entity- and activity-based. As a second step, the FSB narrowed the scope of SB, thereby emphasising the activity-based approach, when it stated that the authorities responsible for financial stability should focus on the institutions that can create systemic risk and/or regulatory arbitrage. This implies that Pozsar et al. (2010) started from an activity-based definition and then defined the institutional setup, whereas the FSB (2011) began with an entity-based definition and specified it based on activity-based aspects. International financial institutions and standard-setting bodies that are FSB members also use its definition (IMF 2014, Grillet-Aubert et al. 2016). In other words, the FSB definition has emerged as the widely accepted definition for official use.

However, several other definitions and approaches are used in the academic literature depending on the aim of the study. Nesvetailova (2018) distinguished between three different SB approaches. First, the entity-based approach draws from the FSB definition and is predominantly used by regulatory authorities. Second, the activity-based approach begins, not with the institution, but with the activity itself. Within this approach, several banking activities can be defined as SB activities, conditional on the fact that they are funded by non-core banking liabilities (Harutyunan et al. 2015).[2] Third, the network-based approach is important for the interconnectedness of traditional and non-traditional banking activities (Abad et al. 2017, Guttmann 2018).

[1] These enterprises (the Fannie Mae, the Freddie Mac, and the Ginnie Mae) were established to promote mortgage finance in the US. They were pioneers in the introduction and spread of securitisation.

[2] In line with this definition, the pre-GFC CEE FX loans funded by short-term foreign wholesale liabilities can also be defined as SB activities.

SB has a pejorative connotation. One of the main efforts of the FSB has been to initiate regulations that mitigate the systemic risk caused by the SB system and transform it into an appropriately regulated, stable, and resilient market-based finance system (FSB 2015a). By 2018, the FSB assessed that it had reached this goal (Carney 2017) and discontinued using the term SB. Instead, the term 'non-bank financial intermediation' (NBFI) began to be used for the same entities and activities (FSB 2018). However, owing to its importance from a financial stability perspective, the FSB continued to undertake regular NBFI analyses. Institutions responsible for financial stability, including the European Systemic Risk Board (ESRB), generally use the revised name. However, the use of the term SB has remained widespread in the academic literature.

Shadow banking: measurement

Notwithstanding the diverse approaches to defining SB, its measurement relies on an entity-based approach. In line with its mandate, the FSB developed a methodology to measure and analyse the SB system. However, in addition to the entity-based approach, it incorporated several activity-based items (FSB 2013). The FSB's starting point is the monitoring universe of NBFI (MUNFI), which includes the entire financial sector except for central and commercial banks. Thereafter, it excludes institutions (insurance and pension) that do not participate in credit intermediation. The resulting measure is termed other financial intermediaries (OFIs) and is used as the broadest measure of SB systems (see Figure 1).

To obtain a narrow entity-based measure for the SB system, the FSB methodology deducts several entities from a broad measure of OFIs. These entities are uninvolved in credit intermediation and do not conduct maturity or liquidity transformations, leverage, or risk transfers. The most important institutions deducted by the FSB include the captive financial institutions and equity investment funds. Finally, the OFIs that are prudentially consolidated into a commercial bank are also deducted. The underlying logic is that these entities' risks are monitored from the banking side, rendering double monitoring unnecessary (FSB 2019).

In 2015, the FSB (2015b) introduced an activity-based measure of the SB system, the so-called economic function (EF) approach. The EF-based measurement is not evaluated mechanically because of the lack of data on these functions; it is prepared by the national financial supervisory authorities using their expertise. Therefore, the FSB methodology represents a definite move from the entity-based approach towards the activity-based approach, which is more appropriate for analysing the risks and vulnerabilities of related institutions.

Figure 1

Comparison of ESA financial institutions' subsectors with the SB measure of the FSB and ESRB

<table>
<tr><th colspan="2">ESA subsectors</th><th>FSB starting point</th><th>FSB broad measure</th><th>FSB narrow measure 1</th><th>FSB narrow measure 2 (economic narrowing)</th><th>ESRB broad measure</th></tr>
<tr><td>S. 122</td><td>Deposit taking corporations except central bank</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>S. 123</td><td>Money Market Funds (MMFs)</td><td rowspan="7">Monitoring Universe of Non-bank Financial Intermediation</td><td rowspan="5">Other financial intermediaries (OFIs)[a]</td><td rowspan="4">Exluded items: equity investment funds and OFIs consolidated into a commercial bank</td><td rowspan="5">Based on institutional approach and 5 economic functions</td><td rowspan="5">Non-bank financial intermediation</td></tr>
<tr><td>S. 124</td><td>Non-MMF investment funds (non-MMFs)</td></tr>
<tr><td>S. 125</td><td>Other financial institution (OFIs)[a]</td></tr>
<tr><td>S. 126</td><td>Financial auxiliaries</td></tr>
<tr><td>S. 127</td><td>Captive financial institutions</td><td></td></tr>
<tr><td>S. 128</td><td>Insurance corporations</td><td></td><td></td><td></td><td></td></tr>
<tr><td>S. 129</td><td>Pension funds</td><td></td><td></td><td></td><td></td></tr>
</table>

a) The abbreviation OFI is used by both the FSB and by the ESA, although with different meanings. In the European context, we used the abbreviation OFI for ESA S.125 subsector.

Note: ESA: European System of Accounts; FSB: Financial Stability Board; ESRB: European Systemic Risk Board; SB: Shadow Banking.

Source: Authors' own creation.

As the FSB comprises member countries with the largest and most advanced financial systems, which are also important for global financial stability, there is no other institution for which making such efforts to measure the SB system is worthwhile. The FSB covers eight EU countries[3], and the remaining countries are less-dominant participants in the global and EU financial markets. Accordingly, the ESRB – the institution responsible for the financial stability of the EU – applies a broad entity-based approach, which is a less sophisticated and less expert- and work-intensive method for measuring the EU's SB system. The ESRB (2016)'s measurement approach is based on financial accounts and monetary statistics, both of which use the method prescribed in the European System of Accounts (ESA) (Eurostat 2013). However, at the EU level, data collection faces several limitations. The financial accounts of individual countries have different levels of separation because several countries lack sufficiently detailed data (Agresti–Giron 2018). In addition, the ESRB methodology does not exclude prudentially consolidated entities from the SB sector because of the lack of available data (Agresti–Brence 2017). Figure 1 shows a comparison of the FSB and ESRB measurement methodologies.

In addition to the FSB and ESRB methodologies, the European Banking Authority (EBA 2021) has also established its view on SB measurement. It aims to enable commercial banks to measure their large exposures to SB entities and the associated capital requirements. Notably, it neither seeks nor allows the measurement of the entire universe of the SB system.

Overall, the measurement of the SB sector is subject to several methodological and data availability constraints. Some international initiatives have attempted to overcome these shortcomings. Among these, the most important is the Data Gaps Initiative (DGI-2) of the G20, conducted by the International Monetary Fund (IMF) and the FSB (Heath 2013), which aims to further disaggregate the ESA (2010) subsectors and introduce the related data provision. According to the DGI-2 Sixth Progress Report (FSB–IMF 2021), this work is still in progress.

Harutyunan et al. (2015) suggested an alternative measure of SB systems. They distinguished between the core and non-core liabilities of banks, wherein the two represent traditional deposits and wholesale market-based funds, respectively. Non-core liabilities are those that fund SB activities. The premise is that all institutions that participate in the credit granting process can issue non-core liabilities, including deposit-taking commercial banks; thus, the liability-based measure is more appropriate than the entity-based approach.

This study did not aim to explore data measurement issues for the entire EU. In general, the available statistical data on other financial intermediaries in European countries are often insufficiently granular for a deeper SB investigation (Hodula et al. 2020). In this study, we focused on the CEE region. Researchers who have attempted

[3] Belgium, France, Netherlands, Ireland, Luxembourg, Italy, Germany, and Spain.

to build and analyse a CEE SB dataset have used an entity-based approach that is marked by data distortion problems. Apostoaie–Bilan (2020) used two types of SB-measuring proxies: (1) the FSB/ESRB broad measure, but without money market funds (MMFs); and (2) a narrower measure of the first, excluding non-MMFs. The problem with this approach is that MMFs and some non-MMFs are part of the SB system. Moreover, the study does not exclude the captive sector from Hungarian data, which provides a misleading picture of the size of the Hungarian SB system. Hodula (2022) compared the old and new EU member states' SB systems, wherein the new member states comprised those that joined the EU in 2004 and 2007, including Malta and Cyprus. His approach implements the FSB broad measure with some corrections. None of the above-mentioned authors have published their datasets.

The next section focuses on the development of the dataset. Our approach was entity-based; however, we successfully narrowed down the FSB/ESRB broad measure by combining multiple data sources.

Methodology for compiling the new dataset for CEE countries

Our main data sources, in line with the ESRB methodology, were the Eurostat financial accounts and monetary statistics [1]. However, we complemented instances of missing data with other national sources, such as central banks, financial supervisory authorities, and national associations. The data sources used for database compilation are listed in Appendix Table A1.

The starting point for data compilation was the ESRB's broad definition (S.123–S.127); however, we imposed several corrections to compile a more appropriate dataset for comparative analysis. The corrections were in line with the FSB's entity-based narrowing-down approach. However, they were much less complete owing to data availability, which implies that our CEE SB measure can be positioned between the FSB's narrow entity-based definition and the ESRB's broad definition. The following steps were taken to correct the Eurostat data to compile our SB dataset:

1. The ESRB does not filter out equity funds from its entity-based SB data. However, its SB (or later, NBFI) reports include an equity market analysis to separate equity market trends from SB trends. In line with the SB definition and FSB deductions, we decreased the value of assets managed by non-MMF investment funds through equity investments because these assets were not involved in credit intermediation. We deducted equities from not only equity funds but also mixed and absolute return funds.
2. The Estonian financial accounts did not contain separate data for MMFs. Nevertheless, the other data on the Estonian SB system were available. Accordingly, our dataset is likely to have underestimated the size of Estonian SB.

3. Captive financial institutions (S.127) are excluded from the FSB's narrow dataset but included in the ESRB's broad data. Generally, captives represent a marginal part of SB and mainly engage in intra-group transactions. Moreover, only a few countries have disaggregated the data for this segment. However, in the case of Hungary and Austria, captives represent a very high asset volume.[4] We deducted the assets of captives from the Austrian and Hungarian SB data in line with Koroknai–Lénart-Odorán (2011), who demonstrated that Hungarian captives have about a zero net lending capacity and are not connected to financial markets.
4. For Slovakian MMFs, we found data inconsistencies in the Eurostat database. The total assets of the MMFs jumped from 984 million euros in 2002 to 5,881 million euros in 2003 and 6,992 million euros in 2004, followed by a return to 1,093 million euros by 2005. The Slovakian central bank has published data on MMFs since 2004, disclosing a figure of 882 million euros. We replaced the Eurostat data for 2004 with that of the central bank, whereas for 2003, we averaged the 2002 and 2004 data.
5. In contrast to developed countries, the SB systems of the CEE region are dominated by financial corporations engaged in lending (FCLs; Bethlendi–Mérő 2020a). Accordingly, we collected data on this sub-sector S.125. Of the CEE11, we found relevant data for eight countries.

As peer countries, we choose Austria, France, and Germany, three core EU countries that are home to financial institutions with dominant market shares in CEE financial systems. Deloitte's (2019) data show that Austrian banking groups have the largest CEE presence, followed by Italian and French institutions. Owing to the home country problem of the Italian banking sector[5], we replaced Italy with Germany as a peer country. However, after the GFC, the CEE market share of German banks decreased substantially because of the significant deleveraging of their activities. Furthermore, Scandinavian banking systems play a dominant role in the Baltic states. However, as their presence is minimal in the other eight countries, we excluded them. Of the three countries, Germany and France, as FSB member states, had more precise SB data. However, to conduct an accurate comparison, we constructed their data using the same methodology used to measure the CEE SB system.

Academic researchers and market players frequently investigate banking sector ownership. However, there is no available information on SB or OFIs' ownership. Therefore, we chose peer countries based solely on banking sector data.

[4] Within the EU, Luxembourg (Duclos–Morhs 2017) and Belgium (Durant–Cappoen 2017) show similar patterns. In line with the FSB's definition, both countries deduct the captives' assets from SB assets.

[5] The GFC and the following Eurozone sovereign debt crisis rendered the Italian banking sector vulnerable. As a result of the restructuring efforts, capital adequacy was strengthened and the non-performing ratio of Italian banks decreased below 10% by 2018. However, the Italian banking sector continued to be in the high non-performing loan (NPL) countries' category of the European Central Bank (ECB 2019).

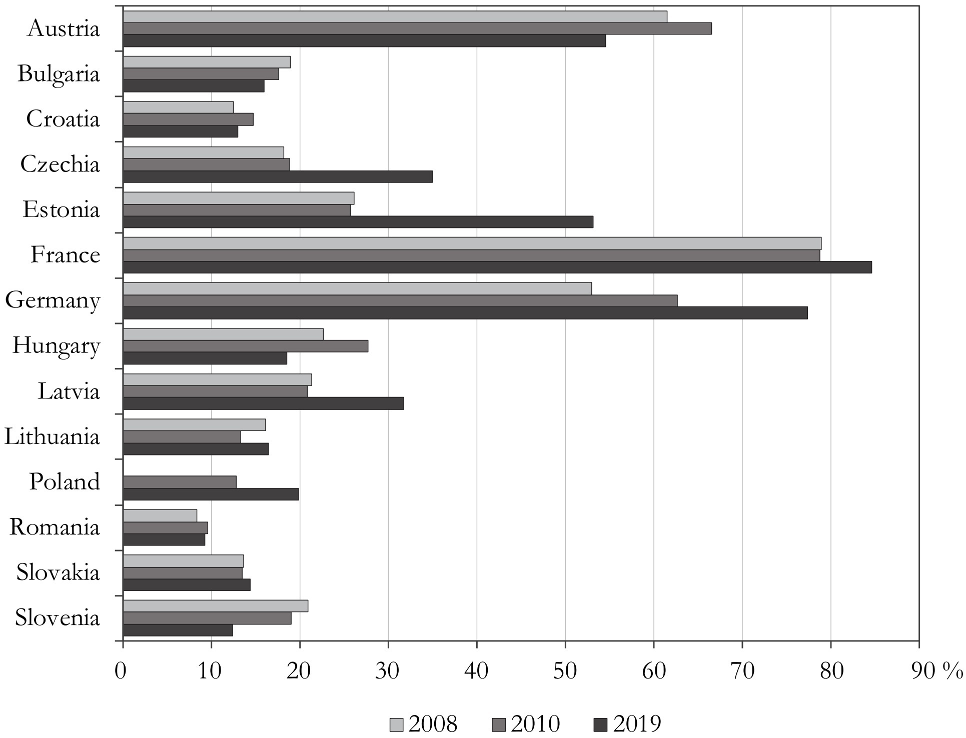
Main characteristics of the CEE SB system

In general, CEE is not a homogenous region in terms of the level of economic development, monetary policy (euro era member or not), fiscal policy (e.g. level of redistribution/debt), income, or wealth inequalities (Kocziszky et al. 2018). This study presented some structural heterogeneity issues in the financial sector. However, a relatively high level of integration of the CEE financial sector into developed markets was observed.[6]

The data showed that the relative size of the CEE SB system is small. Since 2008, some catching-up processes have been observed in only three CEE countries. The other SB systems in the CEE region have remained underdeveloped.

Figure 2

The relative size of SB (total assets to nominal GDP)



Note: SB: shadow banking.
Source: Sources listed in Appendices 1, data available in Internet appendix.

[6] For instance, through foreign ownership in the banking sector (Bethlendi–Mérő 2020b) or interrelatedness among the CEE and global stock markets (Hung 2022).

The structures of CEE SB systems differ significantly from those of developed countries in Europe. The only similarity is that MMFs have played a weak and declining role in both regions because of regulatory changes.[7] Notably, MMFs played a more significant role in the pre-GFC period in Croatia, Hungary, Romania, Poland, and Slovakia. After the GFC, they remained significant only in Croatia and Poland. MMFs' role remained marginalised in the rest of the CEE countries. Moreover, non-MMFS, without equity investments, represented a much smaller share in the financial intermediation and SB of the CEE11 than in developed countries, resulting from underdeveloped CEE capital markets and the related assets management markets. After the GFC, some catching-up processes were observed in this field (Table 1).

Table 1

The structure of the SB system

(%)

Countries \ ESA categories	2008				2010				2019			
	MMFs	Non-MMFs	OFIs	Total	MMFs	Non-MMFs	OFIs	Total	MMFs	Non-MMFs	OFIs	Total
Austria	2	54	44	100	1	53	46	100	0	59	41	100
France	26	26	48	100	23	30	48	100	15	36	49	100
Germany	1	50	49	100	1	51	48	100	0	67	33	100
Average developed	10	43	47		8	45	47		5	54	41	
Bulgaria	NA	1	99	100	NA	1	99	100	0	9	91	100
Croatia	2	14	84	100	15	7	78	100	0	42	58	100
Czechia	7	10	82	100	6	13	81	100	0	23	77	100
Estonia	NA	8	92	100	NA	7	93	100	NA	9	91	100
Hungary	13	21	66	100	18	24	58	100	1	47	52	100
Latvia	2	1	97	100	3	3	94	100	0	3	97	100
Lithuania	0	1	99	100	1	3	96	100	0	7	93	100
Poland	5	36	58	100	8	39	53	100	0	50	50	100
Romania	1	2	97	100	10	5	85	100	0	24	76	100
Slovakia	16	16	68	100	19	17	64	100	0	41	59	100
Slovenia	0	7	93	100	0	9	91	100	2	15	83	100
Average CEE11	5	11	85		9	12	79		0	25	75	

Note: ESA: European System of Accounts; MMFs: money market funds; OFIs: other financial intermediaries; SB: shadow banking; CEE11: eleven Central and Eastern European countries.

Source: Sources listed in Appendix Table A1, data available in Internet appendix.

[7] To reduce the risks arising from the SB activities of MMFs, the EU adopted Regulation 2017/1131. According to this regulation, MMFs must comply with much stricter investment, risk management, and disclosure rules entailing a radical decline in their numbers and assets.

Based on the statistics of the European Fund and Asset Management Association [2], the composition of non-MMFs is country-specific, with bonds and multi-asset funds mostly dominating this segment. Hungary is an outlier in terms of its large real estate funds. Securitisation is of minimal importance in this region. According to a survey by the World Bank (2019), there was no residential real estate loan securitisation in the region between 2011 and 2016. The securitisation of small and medium-sized enterprise (SME) loans in the EU, and thus, in the region, was evaluated by the European Investment Bank (EIB) for 2004–2015. The EIB placed eight CEE11 countries into the 'minimally active market' category, which implied that there was essentially no SME loan securitisation in these countries, whereas Bulgaria, Czechia, and Poland were placed into the 'less active market' category (EIB 2017). In line with this, according to David–Sebesta (2007), the first securitisation of a banking portfolio in the CEE region was the joint issuance of the Czech and Polish Raiffeisen banks in 2006 when they securitised SME loans worth 450 million euros. Securitisation plays a special role in Poland, where, primarily, non-performing assets are securitised, and the resulting securities are purchased by investment funds specialised in securitisation (Buszko–Krupa 2016). Thus, the debt collection market in Poland operates through these special investment funds rather than debt collection companies.

Table 2

Loans and total assets of OFIs compared with the banking sector

(%)

Countries	2008		2010		2019	
	Loans	Total assets	Loans	Total assets	Loans	Total assets
Austria	3	10	3	12	2	12
France	6	15	7	14	10	14
Germany	6	8	6	10	10	11
Average developed	5	11	5	12	7	12
Bulgaria	18	20	11	17	13	15
Croatia	9	10	7	10	7	7
Czechia	15	15	12	15	11	20
Estonia	18	18	15	17	26	49
Hungary	16	14	15	14	13	12
Latvia	16	16	10	12	32	42
Lithuania	17	20	11	14	15	23
Poland	NA	NA	2	8	5	11
Romania	18	16	13	12	15	15
Slovakia	16	10	12	10	10	9
Slovenia	15	15	13	12	11	12
Average CEE11	16	15	11	13	14	20

Note: OFIs: other financial intermediaries; NA: not available; CEE11: eleven Central and Eastern European countries.

Source: Sources listed in Appendix Table A1, data available in Internet appendix.

In the context of the relative underdevelopment of the asset management market, OFIs play a more influential role in the region's SB system than in developed countries, wherein OFIs include special institutions that participate in securitisation and FCLs. In CEE countries, FCLs dominate OFIs. Comparing OFIs based on not only their total assets but also their loan portfolios, the structural differences between developed European countries and the CEE11 become evident (Table 2). In developed countries, the loan volume and total assets of OFIs represent, on average, 5–7% and 11–12% of those of banks, respectively. In CEE countries, OFIs are more important and involved in lending to a greater extent.

Conclusions

To analyse and compare the SB system of the CEE region, we constructed a new annual dataset for eleven CEE and three developed Western EU member states for 2004–2019. We adopted an entity-based measurement approach. However, to refine this approach, we narrowed the scope of the entities subject to data availability. The more risk- and activity-based approaches require additional qualitative information, which, in line with FSB practices, can only be compiled by supervisory authorities.

The preliminary data analysis showed that the region's SB system had already been established and started to grow prior to the GFC. However, its present size is much smaller, and its structure is significantly different from that of the SB systems of developed European countries. In practice, the securitisation of loans failed to gain ground in the region, except for a few transactions in certain countries. Instead, OFIs originating loan-type receivables (credit, leasing, factoring, and debt management) have dominated the sector. The importance of investment funds falling within the scope of SB is also below the level of developed countries, and the instruments that represent developed countries' SB activity pursued by their asset management industries also vary.

The public availability of our compiled data can facilitate a more in-depth analysis of the financial sector of the CEE region, including the SB system. Potential directions for further research may entail the investigation of the interconnectedness of banking and SB systems, the region-specific structural- and risk-based characteristics of the CEE SB system, and the country-specific differences within the CEE region.

Appendix

Table A1

Description and sources of the SB dataset

Countries	Banks (S122)					MMFs S123				
	Loans	Bonds	Total assets	Period	Source	Loans	Bonds	Total assets	Period	Source
Austria	x	x	x	1995–2019	Eurostat	x	x	x	2003–2019	Eurostat
Bulgaria	x	x	x	2006–2019	BNB			x	2012–2019	BNB
Croatia	x	x	x	2001–2019	Eurostat	x	x	x	2002–2019	HNB
Czechia	x	x	x	2008–2019	Eurostat CNB	x	x	x	2004–2019	CNB
Estonia	x	x	x	1995–2019	Eurostat					
France	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Germany	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Hungary	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Latvia	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Lithuania	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Poland	x	x	x	2010–2019	KNF			x	2008–2019	IZFA
Romania	x	x	x	1995–2019	Eurostat	x	x	x	2007–2019	Eurostat
Slovakia	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat, NBS
Slovenia	x	x	x	1995–2019	BSI	x	x	x	2006–2019	ECB

(Table continues the next page.)

(Continued.)

	Non-MMF investment funds (S124)						OFIs (S125–S127)				
	Loans	Equities	Bonds	Total assets	Period	Source	Loans	Bonds	Total assets	Period	Source
Austria	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat modified
Bulgaria	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Croatia	x	x	x	x	2002–2019	Eurostat	x	x	x	2001–2019	Eurostat
Czechia	x	x	x	x	1995–2016 2004–2019	Eurostat CNB	x	x	x	1995–2016	Eurostat
Estonia	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
France	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Germany	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Hungary	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat modified
Latvia	x	x	x	x	2001–2019	Eurostat	x	x	x	1995–2019	Eurostat
Lithuania	x	x	x	x	2003–2019	Eurostat	x	x	x	1995–2019	Eurostat
Poland	x	x	x	x	1997–2019	Eurostat	x	x	x	1995–2019	Eurostat
Romania	x	x	x	x	1998–2019	Eurostat	x	x	x	1995–2019	Eurostat
Slovakia	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat
Slovenia	x	x	x	x	1995–2019	Eurostat	x	x	x	1995–2019	Eurostat

(Table continues the next page.)

(Continued.)

	FCLs		
	Loans / total assets	Period	Source
Austria			
Bulgaria	x	2007–2019	BNB
Croatia	x	2007–2019	HANFA
Czechia	x	2005–2019	CNB
Estonia	x	2001–2019	EeP
France			
Germany			
Hungary	x	2001–2019	MNB
Latvia	x	2009–2019	LB
Lithuania	x	2015–2019	BL
Poland			
Romania			
Slovakia	x	2007–2019	NBS
Slovenia			

Note: MMF: money market funds; OFIs: other financial intermediaries; FCLs: financial corporations engaged in lending; BNB: Bulgarian National Bank; CNB: Czech National Bank; KNF: Komisja Nadzoru Finansowego (Polish Financial Supervisory Authority); BSI: Banka Slovenije; IZFA: Izby Zarządzających Funduszami i Aktywami (Polish Chamber of Fund and Asset Management); ECB: European Central Bank; HNB: Hrvatska narodna banka (Croatian National Bank); HANFA: Hrvatska Agencija za Nadzor Financijskih Usluga (Croatian Financial Services Supervisory Agency); EeP: Eesti Panga (National Bank of Estonia); MNB: Magyar Nemzeti Bank (Hungarian National Bank); LB: Latvijas Banka (Bank of Latvia); BL: Bank of Lithuania (Lietuvos Bankas); NBS: National Bank of Slovakia.

Internet appendix

CEE shadow banking dataset by entity type (in EUR)

Table 1. Deposit taking corporations, except the Central Bank

1.1. Total financial assets/liabilities
1.2. Debt securities
1.3. Loans

Table 2. Money market funds

2.1 Total financial assets/liabilities
2.2. Debt securities
2.3. Loans

Table 3. Non-MMF investment funds

3.1. Total financial assets/liabilities
3.2. Debt securities
3.3. Loans
3.4. Equity

Table 4. Other financial intermediaries (insurance companies and pension funds excluded), financial auxiliaries, captive financial institutions (excluded at Austria and Hungary), and money lenders

4.1. Total financial assets/liabilities
4.2. Debt securities
4.3. Loans

Table 5. Financial corporation engaged in lending

5.1. Total financial assets/liabilities
5.2. Debt securities
5.3. Loans

Acknowledgments

This work was supported by National Research, Development and Innovation Office: [grant number NKFIH 138562].

REFERENCES

ADRIAN, T.–ASHCRAFT, A. B. (2012): Shadow banking regulation *The Annual Review of Financial Economics* 4: 99–140. https://doi.org/10.1146/annurev-financial-110311-101810

APOSTOAIE, C. M.–BILAN, I. (2020): Macro determinants of shadow banking in Central and Eastern European countries *Economic Research – Ekonomska Istrazivanja* 33(1):1146–1171. https://doi.org/10.1080/1331677X.2019.1633943

BAN, C.–GABOR, D. (2016): The political economy of shadow banking *Review of International Political Economy* 23 (6): 901–914. https://doi.org/10.1080/09692290.2016.1264442

BETHLENDI, A.–MÉRŐ, K. (2020a): Árnyékbankrendszer a közép-és kelet-európai régióban *Statisztikai Szemle* 98 (10): 1151–1184. http://doi.org/10.20311/stat2020.10.hu1151

BETHLENDI, A.–MÉRŐ, K. (2020b): Changes in the structure of financial intermediation–Eastern-Central European developments in the light of global and European trends *Danube* 11 (4): 283–299. https://doi.org/10.2478/danb-2020-0017

BUSZKO, M.–KRUPA, D. (2016): Discussion about developing securitization in Poland with participation of securitization investment funds *Ekonomia I Prawo. Economics and Law* 15 (3): 279–294. http://dx.doi.org/10.12775/EiP.2016.018

GUTTMAN, R. (2018): The transformation of banking. In: NESVETAILOVA, A. (ed.): *Shadow banking, scope, origines and theories* pp. 25–39., Routledge, Oxon and New York.

HODULA, M. (2022): Bringing the flashlight: Shadow banking in European Union countries *Finance Research Letters* 47: 102668. https://doi.org/10.1016/j.frl.2021.102668

HODULA, M.–MELECKY, A.–MACHACEK, M. (2020): Off the radar: factors behind the growth of shadow banking in Europe *Economic Systems* 44 (3): 100808. https://doi.org/10.1016/j.ecosys.2020.100808

HUNG, N. T. (2022): Return equicorrelation and dynamic spillovers between Central and Eastern European, and World stock markets, 2010–2019 *Regional Statistics* 12 (1): 159–192. https://doi.org/10.15196/RS120108

KOCZISZKY, G.–BENEDEK, J.–SZENDI, D. (2018): The impact of the 2008 financial crisis on household income and wealth in Visegrad countries *Regional Statistics* 8 (1): 141–167. https://doi.org/10.15196/RS080102

LYSANDROU, P.–NESVETAILOVA, A. (2015): The role of shadow banking entities in the financial crisis: a disaggregated view *Review of International Political Economy* 22 (2): 257–279. https://doi.org/10.1080/09692290.2014.896269

MCCULLEY, P. (2009): The shadow banking system and Hyman Minsky's economic journey. In: SIEGEL, L. (ed.): *Insight into the Global Financial Crisis* pp. 257–268., The Research Foundation of CFA Institute, Charlottesville, VA.

NESVETAILOVA, A. (2018): Conclusion – Shadow banking into the limelight. In: NESVETAILOVA, A. (ed.): *Shadow Banking, Scope, Origines and Theories* pp 238–243., Routledge, Oxon and New York.

INTERNET SOURCES

ABAD, J.–D'ERRICO,M.–KILLEN, N.–PELTONEN, T.–PORTES, R.–URBANO, T. (2017): *Mapping the interconnectedness between EU banks and shadow banking entities* ESRB Working Paper, No. 40. https://www.eba.europa.eu/sites/default/documents/files/documents/10180/1431348/5a5b092b-dc8b-4816-89e0-9673bd75d304/Mapping%20the%20interconnectedness%20between%20EU%20banks%20and%20shadow%20banking%20entities_paper.pdf?retry=1 (downloaded: January 2022)

AGRESTI, A. M.–BRENCE, R. (2017): *Statistical work on shadow banking: development of new dataset and indicators for shadow banking* IFC- National Bank of Belgium Workshop on „Data needs and statistics compilation for macroprudential analysis, Brussels, 18–19 May. https://www.bis.org/ifc/publ/ifcb46p.pdf (downloaded: January 2022)

AGRESTI, A. M.–GIRON, C. (2018): *Challenges for macro data on non-bank financial intermediaries* Lecture on 9th IFC Conference on „Are post-crisis statistical incentives completed?" Basel, 30–31 August. https://www.bis.org/ifc/publ/ifcb49_16.pdf (downloaded: January 2022)

CARNEY, M. (2017): *The FSB's Chairman's letter to G20 Leaders 3 July* https://www.fsb.org/wp-content/uploads/P030717-1.pdf (downloaded: January 2022)

DAVID, R.–SEBESTA, P. (2007): Securitization in the Czech Republic: the legal regime and the transactions to date. In: Global Securitization and Structured Finance pp. 241–246., Deutsche Bank, Frankfurt am Main. http://www.globalsecuritisation.com/07_emea/DB07_241_246_Czech.pdf (downloaded: January 2022)

DELOITTE (2019): *CEE banking consolidation perking up* https://www2.deloitte.com/content/dam/Deloitte/ce/Documents/finance/ce-banking-study-2019.pdf (downloaded: January 2022)

DUCLOS, C.–MORHS, R. (2017): *Analysis on the shadow banking content of captive financial companies in Luxembourg* Working document in preparation of the report of the Comité du Risque Systémique on the shadow banking system, Banque centrale du Luxembourg. https://www.bcl.lu/fr/stabilite_surveillance/CRS/Shadow-Banking_CRS-report.pdf (downloaded: January 2022)

DURANT, M.–CAPPOEN, S. (2017): *The Belgian shadow banking sector with a focus on other financial intermediaries (OFIs)* IFC- National Bank of Belgium Workshop on „Data needs and statistics compilation for macroprudential analysis, Brussels, 18–19 May. https://www.bis.org/ifc/publ/ifcb46v.pdf (downloaded: January 2022)

EUROPEAN BANKING AUTHORITY (EBA) (2021): *Draft Regulatory Technical Standards on criteria for the identification of shadow banking entities under Article 394(4) of Regulation (EU) No 575/2013,* Consultation Paper EBA/CP/2021/30 https://www.eba.europa.eu/calendar/consultation-draft-rts-criteria-identification-shadow-banking-entities (downloaded: January 2022)

EUROPEAN CENTRAL BANK (ECB) (2019): *Financial Stability Review. November 2019.* https://www.ecb.europa.eu/pub/financial-stability/fsr/html/ecb.fsr201911~facad0251f.en.html (downloaded: January 2022)

EUROPEAN INVESTMENT BANK (EIB) (2017): *Operation evaluation – Evaluation of the EIF's SME securitization activities, 2004–2015* https://www.eib.org/en/publications/evaluation-of-the-eifs-sme-securitisation-activities (downloaded: January 2022)

EUROPEAN SYSTEMIC RISK BOARD (ESRB) (2016): *EU Shadow Banking monitor No 1 July* https://www.esrb.europa.eu/pub/pdf/reports/nbfi_monitor/20160727_shadow_banking_report.en.pdf (downloaded: January 2022)

EUROSTAT (2013): *European System of Accounts, ESA 2010* https://ec.europa.eu/eurostat/documents/3859598/5925693/KS-02-13-269-EN.PDF/44cd9d01-bc64-40e5-bd40-d17df0c69334 (downloaded: January 2022)

FINANCIAL STABILITY BOARD (FSB) (2011): *Shadow banking: Scoping the issues A background note of the Financial Stability Board, 12 April* https://www.fsb.org/wp-content/uploads/r_110412a.pdf (downloaded: January 2022)

FINANCIAL STABILITY BOARD (FSB) (2015a): *Transforming shadow banking into resilient market-based finance, An overview of progress, November* https://www.fsb.org/2015/11/transforming-shadow-banking-into-resilient-market-based-finance-an-overview-of-progress/ (downloaded: January 2022)

FINANCIAL STABILITY BOARD (FSB) (2015b): *Global shadow banking monitoring report 2015* https://www.fsb.org/wp-content/uploads/global-shadow-banking-monitoring-report-2015.pdf (downloaded: January 2022)

FINANCIAL STABILITY BOARD (FSB) (2018): *FSB reviews financial vulnerabilities and deliverables for G20 Summit* Press release Ref no. 35/2018 22 October https://www.fsb.org/2018/10/fsb-reviews-financial-vulnerabilities-and-deliverables-for-g20-summit/ (downloaded: January 2022)

FINANCIAL STABILITY BOARD (FSB) (2019): *Global monitoring report on Mon-Bank Financial Intermediation 2018* https://www.fsb.org/2019/02/global-monitoring-report-on-non-bank-financial-intermediation-2018/ (downloaded: January 2022)

FINANCIAL STABILITY BOARD AND IMF (FSB–IMF) (2021): *G20 data gaps initiative (DGI-2)* The sixth progress report – Countdown to December 2021, October https://www.fsb.org/2021/10/g20-data-gaps-initiative-dgi-2-the-sixth-progress-report-countdown-to-december-2021/ (downloaded: January 2022)

GRILLET-AUBERT, L.–HAQUIN, J-B.–JACKSON, C.–KILLEN, N.–WEISTROFFER,C. (2016): *Assessing shadow banking – non-bank financial intermediation in Europe* No. 10, ESRB https://www.esrb.europa.eu/pub/pdf/occasional/20160727_occasional_paper_10.en.pdf (downloaded: January 2022)

HARUTYUNAN, A.–MASSARA, A.–UGAZIO, G.–AMIDZIC, G.–WALTON, R. (2015): *Shedding light on shadow banking* IMF WP/15/01 https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Shedding-Light-on-Shadow-Banking-42579 (downloaded: January 2022)

HEATH, R. (2013): Why are the G20 data gaps initiative and the SDDS Plus relevant for financial stability analysis? *IMF Working Paper* WP/13/6, January https://unstats.un.org/unsd/ccsa/isi/2013/Paper-IMF.pdf (downloaded: January 2022)

INTERNATIONAL MONETARY FUND (IMF) (2014): *Global financial stability report, October 2014: Risk taking, liquidity, and shadow banking: Curbing excess while promoting growth* https://www.imf.org/en/Publications/GFSR/Issues/2016/12/31/Risk-Taking-Liquidity-and-Shadow-Banking-Curbing-Excess-While-Promoting-Growth (downloaded: January 2022)

KOROKNAI, P.–LÉNART-ODORÁN, R. (2011): *The role of special purpose entities in the Hungarian economy and statistics* MNB Bulletin, October https://www.mnb.hu/letoltes/koroknai-lenartodoran-en.pdf (downloaded: January 2022)

POZSAR, Z.–ADRIAN, T.–ASCHCRAFT, A.–BOESKY, H. (2010): *Revised February 2012* Shadow banking, Staff Report No.458., Federal Reserve Bank of New York. https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr458.pdf (downloaded: January 2022)

WORLD BANK (2019) *Bank regulation and supervision survey* https://datacatalog.worldbank.org/dataset/bank-regulation-and-supervision-survey#tab2 (downloaded: January 2022)

DATABASES/WEBSITES

[1] EUROSTAT: https://ec.europa.eu/eurostat/web/main/data/database (downloaded: June 2021)

[2] EFAMA: https://www.efama.org/node/501 (downloaded: June 2021)