

DRIVERS OF SHADOW BANKING SYSTEM: A PANEL EMPIRICAL APPROACH FOR DEVELOPED COUNTRIES³

In the current paper, we aim to examine the Shadow Banking System (SBS) in a number of developed countries, more precisely nine countries from Europe and the United States for the period 2002-2018. The goal is to define which are the key determinants that drive the SB processes. To this end, we run simple robust panel estimations. As a result of this analysis, we have reached a number of conclusions: 1/ the roles of banks, insurance companies and pension funds are important, 2/ changes in banking variables, such as the capital ratios, lead to an increase in shadow banking activity, 3/ there is a negative relation between banking interest margins and shadow banks, and 4/ developments on the stock market affect shadow banking positively. However, given the limitations in terms of data size and evolving definitions, our findings are not generalizable. Our main recommendation is to develop a more granular and reliable approach to improve the quality of empirical research and reduce the literature gap.

Keywords: Shadow Banking System; Robust panel estimations; macro-prudential policy.

JEL: C1; E5; G2

Introduction

At the G20 Summit 2011, the Financial Stability Board (FSB) was assigned to study a potential Shadow Banking regulation. It was charged with defining and monitoring risks that could threaten financial stability in order to avert systemic risks. The FSB therefore proposed a definition of Shadow Banks. However, since some countries were not satisfied with the initial definition, which was considered too general and therefore misleading, the FSB introduced new definitions: a broad one and a narrow one. These definitions are being regularly improved in order to more accurately measure the extent of non-banking funding. It is worth noting that throughout the years, there have been changes in Shadow Banking terminology. In fact, in 2019 the FSB completely ceased using the term “Shadow Banks” due

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³ *This paper should be cited as: Goldman, S., Zhelyazkova, V. (2023). Drivers of Shadow Banking System: A Panel Empirical Approach for Developed Countries. – Economic Studies (Ikonomicheski Izsledvania), 32(8), pp. 95-122.*

to its negative connotation, replacing it with “non-bank financial intermediation” or “other financial intermediation”.

From a statistical point of view, SB is expanding, despite an initial decline following the subprime turmoil. From 2002 to 2020, total financial bank sector assets increased by 213%, while Other Financial Intermediaries (OFIs) increased by 967%. Such a trend is a subject of concern, since OFIs are not all regulated.

According to the FSB Report 2020, the Monitoring Universe of Non-Bank Financial Intermediation (MUNFI) rose to \$184.3 trillion in 2017. This was a 7% increase over 2016, which is rather insignificant. For OFIs, the growth rate has been the same. It reached \$116.6 trillion for the benchmark period.

These trends show that a transition is taking place between bank intermediation and non-bank intermediation. To ensure an optimal transition and avoid financial turbulence, the non-bank system must first of all become transparent. In addition, a good understanding of the SBS and its interlinkages with the monetary, banking and production spheres is absolutely necessary.

The scope definition of the SBS is at the heart of any study that hopes to analyze the development of non-bank intermediation. Several reports produced by the FSB have attempted to define the Shadow Banking (SB) notion and the risks related to this unregulated financing.

The FSB provides a harmonized database making comparisons between several countries possible. Note that the definition of the FSB is not universal and has continuously been upgraded. Therefore, the database may have been modified because of definition changes. To illustrate this, in 2013 the FSB tried to narrow the broad definition by removing entities without credit intermediation tasks or those that had already been consolidated into banks. Moreover, the recorded database shows several limitations. One of the most important limitations is the lack of available data and the extended time lapse between data points. Only annual data have been published on the website. These data run for the period 2002-2018 and only for some countries.

At present, two definitions of SB, the broad and the narrow one, are in use. The first one is a general definition based on this simple rule: Shadow Banks are all financial entities that act like banks but are less regulated than banks. The name used by the FSB to qualify these entities is “Other Financial Intermediaries (OFIs)”. OFIs comprise all financial institutions that are not classified as banks, insurance corporations, pension funds, public financial institutions, central banks, or financial auxiliaries. It can be considered as a conservative proxy or broad measure of shadow banking” (FSB, 2015). This definition does not really capture what the SBS is. Following discussions with several competent national authorities, the FSB introduced a narrow definition based on the occurrence of systemic risk and tied to the size of entities. Thus the narrow definition covers all non-bank entities assumed to be presenting a systemic risk for financial stability, as well as entities considered to be

systemically risky, i.e. according to the narrow definition shadow banking is the non-banking, per se banking activity, done by large, systemically important institutions only⁴.

Finally, to be exhaustive, the FSB reports also mention the Monitoring Universe of Non-Bank Financial Intermediation. This “is a measure of all non-bank financial intermediation, which is comprised of OFIs, insurance corporations and pension funds. It provides the starting point for authorities’ assessment of their non-bank financial entity types’ involvement in shadow banking” (FSB reports 2015-2022, Table A1, Appendices).

It is worth emphasizing the importance of accurately defining and measuring the SBS in order to correctly evaluate its size, its trend, and its perspectives. For this study, both definitions are used. However, for the empirical estimations, only the broad definition is taken into account (OFIs) because of the data availability for them from 2002 to 2018.

Applying this approach to the use of definitions, we go on to discuss the determinants of the SBS.

Several variables contribute to the growth of the SBS. Regulatory variables play an important role as supply-side drivers. Some macroeconomic variables affect the evolution of non-bank financial intermediation.

The academic literature dealing with SB drivers is not abundant despite their crucial importance.

Empirical studies are scarce for at least two reasons. Before the global financial crisis (GFC) of 2007-2008, the literature had little or no interest in SB activities. These activities were viewed as simply representing an alternative means of funding for investors. Today, the SBS has captured policymakers’ attention because developments showed that regulation of this alternative funding is insufficient. The second reason for the lack of sufficient studies is the scarcity of data. Despite the efforts of the FSB to produce a harmonized database, the lack of data remains a problem. The available data published by the FSB is annual and is still extremely recent, which could invalidate the results of empirical estimations. Robustness limits can appear and most of the time it may not be suitable to extrapolate general policies from the empirical estimations. To tackle the issue of limited data, panel analysis is an alternative to increasing the number of observations. After some preliminary tests, we have selected a number of key variables to be incorporated in the robust panel models. We chose a robust estimation model because of outliers.

Given the situation outlined above, this study raises the following thorny question: what are the drivers of the Shadow Banking System despite the complexity to assess this phenomenon?

The paper is structured as follows. Section 1 presents the definition of the SBS and its limits. Section 2 supplies a theoretical explanation of the drivers of the Shadow Banking System. Section 3 lays out empirical models related to the drivers of non-bank financing intermediaries for the panel sample. It also discusses the main results. Section 4 presents robustness tests. The last section concludes and suggests policy implications.

⁴ For more details, cf. <https://www.fsb.org/2017/05/global-shadow-banking-monitoring-report-2016>.

1. The Non-Banking System: Definitions, Risks, and Limitations

This section provides an overview of the Shadow Banking System. Broadly speaking, the SBS is a set of specialized financial entities that carry out liquidity credit transformations without public safety nets. The fact that they do not have government backstops makes them unstable and risky. Most SB activities have ties to regulated institutions such as banks and insurance companies. This interconnectedness with regulated companies can impact the real economy and provoke a systemic crisis. Here we attempt to capture the rapid evolution of the SBS in terms of both definitions and statistics. We then analyze the transmission channels between the regulated system and the “less” regulated (or completely unregulated) system. Finally, we show the limits of the SBS and recommend some guidelines for the future.

Since 2008, interest in the SBS has grown in worldwide financial institutions. There have been several attempts to define and measure the SBS but there is currently no consensus. The great challenge for the prudential authorities is to develop analytical instruments to measure and accurately define the SBS; it is not an easy one. Indeed, the most important task is to establish a harmonized and sufficiently flexible definition, yet one that is applicable to all countries. Of course, this is not simple because of the variety of business models for each SBS entity.

There are different ways to define the SBS. The most common way is to assume that SBS activities can be deduced exclusively from regulated activities. This kind of approach is based on binary reasoning. Intermediation activities are shadow banking, if they go beyond the scope of traditional banking activities. For instance, Pozar, Adrian, Ashcraft, and Boesky (2010) emphasize the idea of a systemic risk since SB activities are “inherently fragile” due to their lack of safety nets in case of financial turbulence. In addition, banks are tied to non-banking activities which can be part of shadow banking.

Over time, two different definitions for the SBS have emerged: the broad and the narrow approaches. The first one is older and deals with shadow banking activity as a residual concept. The paragraphs below present this definition. Later, we will explain the more limited definition. After 2009, the Financial Stability Board (FSB) began serious studies of SBS phenomena. Today the FSB is the main contributor to Shadow Banking studies.

1.1. OFIs and Shadow Banking: The broad definition

The Financial Stability Board was created to replace the Financial Stability Forum (FSF) in 2009. The FSB is based in Basel and its first Chair was Mario Draghi. The main purpose of the FSB is to build bridges between the work of national financial authorities and international standard-setting bodies (SSBs) at the international level in order to boost and promote the implementation of effective regulatory, supervisory, and other financial sector policies. The FSB is made up of the national bodies responsible for financial stability (24 countries) and jurisdictions (including the members of the G20). These bodies include international financial institutions, sector-specific international groupings of regulators and supervisors, and committees of central bank experts.

The aim of this nonprofit association under Swiss law is also to provide accurate information about the shadow banking system. Through workshops and discussions between all regulating actors, the FSB annually produces reports to explain the definitions, the size, and the scope of the SBS.

The broad definition is built on several national accounts according to ESA2010⁵ (the European System of Accounts). The national accounts have been used to evaluate the size of the shadow banking system. Table S123 analyzes all transactions related to Money Market Funds (MMFs). Financial institutions and governments use them to finance short-term operations⁶. Table S124 deals with operations in non-MMF investment funds. Table S125 reports the transactions of non-monetary financial intermediaries other than insurance corporations and pension funds (OFIs). Finally, table S127 covers captive financial institutions and moneylenders, excluding public units (which have been reported in Tables S125 and S127). Note that the equity investment funds are not considered SB since they do not participate primarily in the credit intermediation process. Moreover, most equity funds are held by banks and are therefore not considered to be sources of systemic risk. Banks use their central bank collateral in case of financial turbulence. This means that there is no transfer of risk outside the regulated system but it does not exclude the anti-selection risk.

This point coincides with the view of the ESRB (European Systemic Risk Board) joint ATC-ASC Expert Group on Shadow Banking (JEGS). That expert group emphasized the limits of the broad definition because of its lack of indicators for each entity. Analysis of off-balance sheets seems to be the cornerstone of a good approach to the SBS since it provides information on mitigation risks, for example.

These ESA tables are valid only for the European area. For the US area, a different accounting system is used. Several tables measure the SBS. From the Federal Reserve Flow of Funds, it is possible to extract tables L107 and L212 and to obtain a good view of SB activities (Adrian and Ashcraft, 2012; Adrian, Ashcraft, and Cetorelli, 2013).

The FSB provides some statistics on OFIs and other actors that participate in financing the economy. We use them to analyze the trend and the composition of the SBS in the Euro area and the US.

The first step is to rank the actors of financial intermediation. The following chart provides some interesting results. In terms of assets, banks and OFIs are the most important actors in the financial intermediary landscape.

Banks make up more than 40% and OFIs less than 30% of financial intermediaries.

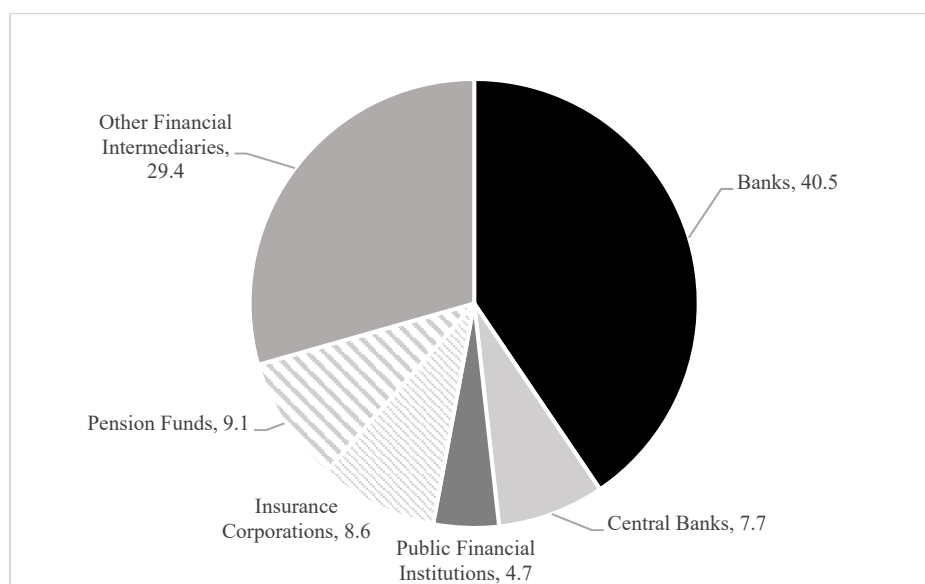
The role of the banks in this type of activity is quite normal since traditionally they finance economic development. We observe a growth in the share of both OFIs and banks. This testifies to the role of banks in SBS growth (cf. Figure 1). These features confirm the rise of

⁵ <https://ec.europa.eu/eurostat/documents/3859598/5925693/KS-02-13-269-EN.PDF/44cd9d01-bc64-40e5-bd40-d17df0c69334>.

⁶ <https://eur-lex.europa.eu/eli/reg/2017/1131/oj>.

the Originate-to-Distribute Model and the role of Banks in Financial Intermediation. This point is validated by the panel estimation run in sections 3 and 4.

Figure 1. Shares of financial intermediaries (% of total assets, 2016)



Source: FSB

1.2 OFIs and Shadow Banking: The narrow definition

This approach tends to monitor entities involved in liquidity/maturity transformation and/or leverage. Table 1 from the 2022 FSB report displays the different functions.

Table 1: Classification per Economic Function (EF)

EF	Definition	Typical entity types
EF1	Management of collective investment vehicles with features that make them susceptible to runs	MMFs, fixed income funds, mixed funds, credit hedge funds, real estate funds
EF2	Loan provision that is dependent on short-term funding	Finance companies, leasing/factoring companies, consumer credit companies
EF3	Intermediation of market activities that is dependent on short-term funding or on secured funding of client assets	Broker-dealers, securities finance companies
EF4	Facilitation of credit creation	Credit insurance companies, financial guarantors, monolines
EF5	Securitization-based credit intermediation and funding of financial entities	Securitization vehicles, structured finance vehicles, asset-backed securities

Note: “The FSB Policy Framework acknowledges that the narrow measure may take different forms across jurisdictions due to different legal and regulatory settings as well as the constant innovation and dynamic nature of the non-bank financial sector. It also enables authorities to capture new structures or innovations that may create financial stability risks from NBFIs, by looking through to their underlying economic functions and risks. Thus, the entity types listed should be taken as typical examples. For details, see FSB (2022)”

The increasing evolution and the size of the SBS raise some concerns. Financial sector interconnectedness is the most important problem related to non-banking activities. Moreover, it is worth noting that there are several levels (Banks, Cross borders and Insurance and pension funds) to analyze to deeply cover the SB scope.

1.3 Limitations

This last sub-section is devoted to limitations on measuring the scope of the SBS.

One of the most crucial limitations is data. Not all the variables have been recorded for various reasons. There is a need for granular data collection, but the cost of properly operating a national statistical organization, particularly for smaller countries, is not insignificant. Another limitation relates to legal frameworks. All countries are not authorized to provide granular data.

Currently, definitions of the SBS are not universally accepted. Often several rounds of discussion between the main interlocutors of the SBS are necessary in order to improve definitions that usually lead to new calculations or to more granular data collection. They can be confidential; disclosure is limited. Granular data also raise other problems. The most important concern is the heterogeneity of entities' business models. It is not always easy to have all the information about the building of complex financial products and to classify them, since there is a huge variety of financial packages. Finally, opacity is a trademark of this sector, making the work of statistical institutions more difficult. Thanks to the outstanding work of the FSB, there has been significant improvement. However, one of the problems for researchers is a lack of complete and high-frequency databases. It is impossible to study both the short-term and long-term processes with only annual variables covering short periods.

Building a good qualitative database takes time. There is also a lack of complete and high-frequency databases. This is a major problem for statistical practitioners since the choice to use different empirical methods is conditioned by the availability of variables according to their frequencies and time spans. In fact, it is impossible to study both short-term and long-term processes with only annual variables covering a short period. The number of observations determines which models can be used.

The study of interconnectedness is important. Putting together an indicator that takes into account the multifaceted nature of shadow banking is crucial, but in order to do that we need to understand the ins and outs of SBS development.

2. Empirical Survey of SB Drivers for Developed Countries

2.1 Usual Suspect Shadow Banking Drivers

The purpose of this section is to present the role of several variables in the development of the shadow banking system. Variables have been selected because they are assumed to affect the evolution of non-bank credit activities.

With the last financial crisis, the need to understand the origins and the development of the SBS grew in importance. Many empirical studies have looked at SBS determinants. Some of them have shed light on the banking system, others on stock markets. These studies contribute to a better understanding of key variables in SBS development. However, they often give only a partial view of the SBS. For example, the European SBS is frequently ignored.

Our key variables are macroeconomic, financial, monetary, and banking factors. The drivers of the SBS listed in Table 2 are not exhaustive. Only the most relevant variables “suspected” of affecting the SBS are described here. They are outlined in Table 1. SBS is multifaceted and relatively complex to deal with. It comprises a multitude of banking and financial operators interconnected via financial intermediation chains of varying lengths and with several degrees of sophistication. Credit intermediation also requires maturity and liquidity intermediation and the creation of leverage, all of which may raise the question of systemic risk. In addition, the SBS introduces the contagion risk notion, which may amplify systemic risk. Contagion risk is both sectoral (from banks to insurance companies, to stock markets, to industry) but also cross-border, via current account balance channels, for example. The sophistication of the assets makes the repo market more and more opaque. Finally, because of the lack of guarantees in case of failure, non-banking bank entities are compelled to rely on securities financing transactions (SFTs). SFTs are, roughly speaking, transactions that put up securities in order to borrow cash. They include sell/buy-back transaction lending activities and repurchase agreements (repos). Let us recall that repurchase agreements are recorded as collateralized deposits on the liability side of the balance sheet, whereas securities sold under such agreements remain on the balance sheet of the central bank. Repos are procyclical in the sense that they amplify credit growth rate in boom periods and exacerbate credit shrinkage in recession phases. The role of central banks in the development of the SBS is not neutral. The total reserves of the central banks are a good proxy for collateral. They are positively related to SB activities. In our case, the correlation coefficient between OFIs (assumed to measure the broad definition of the SBS) and the total reserves including gold is about 0.68.

Table 2 describes the main variables supposed to affect the evolution of the shadow banking system. Table 2 summarizes the variables selected for the panel estimation and describes the main mechanisms and channels that may distort SBS evolution. It also proposes a literature survey for each driver. The list of drivers is not exhaustive.

Table 2. Usual suspect SBS drivers and expected signs

Variables		Sources	Unit	Theoretical and empirical Survey	Expected signs
OFIs	Dependent variable	FBS	% GDP	Pozsar, Adrian, Ashcraft, and Boesky (2010) have done important studies on the characteristics of the shadow banking system. They explained in detail the transformation channels of loans into marketable securities. Soon afterwards, the FSB developed metrics and tools to measure SBS size and started publishing an annual report to monitor the evolution of SB and its main trends. Today the FSB is a reliable provider of databases and most of the recent empirical studies use its time series relative to SBS to analyze the SBS.	

Variables		Sources	Unit	Theoretical and empirical Survey	Expected signs
Lagged dependent variables (t-1 to 2)	Independent variable	FSB		The value of lagged dependent variables affects positively the evolution of SB. The OFI process is autoregressive. This means that the process has a memory.	+
Banks	Independent variable	FBS	% GDP	The linkage between the banking system and shadow banking is obvious. The collapse of huge banks such as Lehman Brothers, followed by the massive bailout of AIG during the crisis, are perfect illustrations (FSB reports since 2015). Shadow banking is correlated to the traditional banking system. Moreover, several studies (Noeth and Sengupta 2011; Pozsar et al 2013; Ceterolli et al.2014a; Ceterolli and Goldberg 2014b; Acemoglu et al, 2015; Unger 2016; Abad et al2017; and Martinez-Miera and Repullo 2019) show how the banking system and the SBS are interconnected.	+
Pension Funds	Independent variable	FSB	% GDP	Pension funds and stock markets are interrelated. With the increase in life expectancy, securitization is growing and this trend feeds the shadow banking system (Ordóñez and Piguillemz 2021; FSB since 2015).	+
Insurance	Independent variable	FSB	% GDP	As pension funds, insurance companies tend to develop shadow banking (Brooks et al.2012; Singh and Aitken 2010; Noeth and Sengupta 2011; Pozsar et al 2013; Aramonte et al 2015; Paces and Nabilou 2017; FSB reports since 2015).	+
Log(GDP per capita)	Independent variable	World Bank		The most important macroeconomic variable is GDP because it is the most used and evaluated in economic studies. Furthermore, it is obvious that GDP growth boosts the development of non-bank financial intermediation. We must bear in mind that the SBS is a component of financial innovation. Some studies demonstrate that above a certain threshold of financial development, there is a negative link between GDP and financial intermediation development (Acharya et al, 2011; Aghion et al 2010; Demirgüç-Kunt et al 2013; Arcand et al 2015, FSB report 2019). The uncontrolled development of SBS can create a systemic crisis (Goodspeed, 2011; Battiston et al 2012; Adrian, 2014; Shekhar et al. 2015; Langfield and Pagano 2016. Tasca et al. 2017).	+
Public debts	Independent variable	SDW ECB	% GDP	For public debt, the link is obvious because of the non-banking practices of securitization (Munteanu, 2010; Pakravan, 2011; Pozsar, 2008).	+
Current account balances	Independent variable	SDW ECB	% GDP	A negative current account is associated with a high level of shadow banking. For example, in many advanced economies with current account deficits, including the United States, shadow banking is quite developed. European banks also play a role in the SBS. Their off-balance sheet conduits and SIVs, and their asset management operations have been alternative sources for financing the U.S. deficit. The most famous case	+/-

Goldman, S., Zhelyazkova, V. (2023). *Drivers of Shadow Banking System: A Panel Empirical Approach for Developed Countries.*

Variables		Sources	Unit	Theoretical and empirical Survey	Expected signs
				is the German Landesbank case (Pozsar et al 2010).	
Total reserves	Independent variable	World Bank	% GDP	Total reserves may be a component of shadow banking since they seem to be good collateral. Collateral is necessary to ensure the intermediation between savers and borrowers. The use of collateral rose substantially after the last financial crisis, which may have “enhanced” SB activities. Repo is an illustration.	+
Bank net interest margin	Independent variable	SDW ECB	% Total income	The link between bank interest margins and OFIs is negative. Bank interest margins area kind of measure of the efficiency of financial intermediation (Saunders and Schumacher 2000; Arnold and van Ewijk 2014). This means that when the banking system deteriorates, alternative funding appears, particularly from SB finance.	-
Bankcapital ratio	Independent variable	World Bank	% Total assets	Increasing bank reserve requirements may result in boosting non-regulated financial activity. During the bank prudential regulation periods, banks find alternative solutions to finance economic growth (Fahri and Tirole 2017; Martinez-Miera and Repullo 2019) Plantin (2015) develops the idea that increasing capital regulation has driven the explosion of shadow banking activities. Gebauer and Mazelis (2018) find thanks to the DGSE model that tighter capital requirements on banks increase shadow bank intermediation activities. This result gives weight to the idea of a positive link between the bank capital ratio and the SBS.	+
Non-Performing loans	Independent variable	World Bank	% Total gross loans	“Bad debts are associated with companies experiencing serious financial difficulties” (Taseva, 2019).The stock of non-performing loans (NPLs) of banks leads to increasing lending rates on new loans. NPLs have been used to build financial diversified and complex instruments to alleviate regulatory burdens, such as non-performing loan provisions. These two facts contribute to the expansion of the shadow banking system (Ehlers et al 2018; Zhuang 2018, Zhu, 2021). Finally, NPLs maybe a relatively good proxy of credit quality. “After the credit crisis, securitization was blamed for allowing the ‘hot potato’ of bad loans to be passed to unsuspecting investors” (Shin, 2009).	+
Domestic credit provided by financial sector	Independent variable	World Bank	% GDP	During domestic credit booms, non-bank credit channels become more and more visible in the funding landscape, as the experience with the shadow banking system in the United States and in Europe testifies to (Mian and Sufi, 2009; Keys, Mukherjee, Seru, and Vig,2010; Borio and Disyatat, 2011;; Duca 2014; Jakab and Kumhof, 2015; Unger, 2016).	+

Variables		Sources	Unit	Theoretical and empirical Survey	Expected signs
				Moreover, direct cross-border (“offshore”) lending to non-banks and the cross-border components channeled by resident banks increase dramatically in the US and Europe during the credit boom phases. The best illustration of this is Ireland. According to the BIS, “cross-border claims on non-banks and net cross-border borrowing by banks accounted for more than half of total bank credit to non-banks in the country in 2008”.(BIS, 2011) ⁷ Credit booms tend to develop leverage and can lead to financial and systemic crises.	
Short-term interest Long-term interest	Independent variable	SDW ECB	%	For long-term and short-term interest rates, the link with SB activity is negative. Theory suggests that a decrease in interest rates has a positive impact on the banking sector. According to theory, monetary easing fosters increased loans since their cost is thus lowered. According to Beck and Kotz (2016), the low-interest rate environment also contributes to the expansion of the SBS.	-
Spread	Independent variable	SDW ECB	%	The spread is assumed to have a positive impact on SB development. This relationship indicates a search for higher yields (Chrétien and Lyonnet 2016).	+
Stock markets	Independent variable	World Bank	% GDP	The link between stock markets and the shadow banking system is positive. Sophisticated and complex financial products are traded on markets. The stock market is related to the SBS via the security channels (Ghosh et al, 2012; Gordon and Metrick 2012; Gorton 2007-2008; Acharya and Öncü 2013; Duca 2014; FSB report 2018).	+
Financial development	Independent variable	IMF	Index	The development of financial innovations boosts shadow banking activities. Duca (2014) notes that financial innovation contributed to developing the shadow banking system.	+
Banking crisis dummy	Independent variable	World Bank	Binary variable	Currently, we observe a significant change towards more simplicity and transparency for the intermediation of non-bank credit activities. We are far from the opaque nature of shadow banking during the pre-crisis period. Since the financial crisis, several measures have been taken to limit the development of shadow banking. The financial authorities require more and more details from complex business plans. This may explain the negative link between SB and the financial crisis. (Diamond and Dybvig 1983; Shin 2009).	+/-

Source: Authors.

⁷ <https://www.bis.org/publ/arpdf/ar2011e3.pdf>.

Undoubtedly, the importance of the shadow banking system cannot be underestimated, since it is systemically risky. To fully understand the phenomenon, it is crucial to evaluate the role of some relevant variables in the development of SB. Understanding the mechanisms of shadow banking and the interactions with other variables requires analytical models and tools. The first challenge in doing so is to present panel estimations with several variables assumed to theoretically affect the SBS. Most of the choices of the variables and countries are based on their role in the development of non-banking activities.

The (10) selected countries are: Belgium (BE), Germany (DE), Spain (SP), France (FR), United Kingdom (UK), Ireland (IE), Italy (IT), Luxembourg (LU), Netherlands (NL), and the United States (US). They have been chosen as they represent an important part of the developed financial markets and for this reason, the trends observable in them hold validity. The period which has been researched and analyzed starts in 2002 and ends in 2018. The number of observations is 170.

The variables selected, their definitions, and their sources are summarized in Table A2 in Appendices.

We explain below the determinants of shadow banking by means of empirical panel tests.

As emphasized by the traditional literature, the links between OFIs/GDP and other variables are not obvious, but some basic statistical tools suggest interesting directions for research. To keep the length of this article within reason, we will not report all the pre-tests used to select the signs of the variables, only the scatter plots that are reproduced in the Appendices (Figure A1 Scatter plots OFIs and Drivers).

Before running the estimation models, we first analyze the panel unit root results to verify the stationarity of all series. We choose the maximum lag length based on the Schwartz Information Criterion. The different methods are those traditionally used for panel stationary tests. Levin, Lin & Chu tests (LLC) assume a common unit root process where the Im, Pesaran and Shin test (IPS), ADF test and PP test assume individual unit root processes. All non-stationary variables are filtered. Table A3 in the Appendices reports all the results.

2.2 Empirical Model Presentation

Drivers cited in the previous section have been largely analyzed by the theoretical literature but seldom by econometric literature. The list of determinants is not exhaustive but it is sufficiently relevant to fit our first goal, namely describing the impact of variables on the expansion of non-banking finance. However, only a few empirical studies attempt to empirically explain the role of SB drivers. This lack of econometric analysis is likely related to the lack of qualitative and harmonized databases for countries and the limited time spans for the data that does exist. This paper intends to help fill this gap.

When the number of observations is low, it is delicate to interpret empirical results. This is the case for shadow banking given that researchers have only recently begun studying it. That is why it is helpful to use both panel and pool model estimations in order to highlight the role of various macro and micro economic variables and the place of each country in the development of the SBS.

For decades, the panel data approach has been very popular with the development of quantitative studies. It makes it possible to simultaneously analyze individual and time effects. It also provides information on model endogeneity and independent regressors. There are two kinds of panels: the static panel and the dynamic panel. Note that it is possible to use a panel approach and/or a pooled approach. Without going into too much detail, it may be said that these two approaches are complementary and provide different information. Panel analysis is more flexible in terms of methodology, which is not the case with pooling regressions. However, the pooling optic provides a detailed analysis of the importance of various cross-sections. When studying phenomena among countries/regions/cities, etc., and need to obtain a precise picture of the role of each country according to the selected variable, it is preferable to choose a pooled cross-section. In this section, we use both approaches to explain several results – general results (panel) and specific results (pooling).

We have begun this sub-section with the traditional panel approach.

With time, we observe that the number of time dimensions increases, but not necessarily the number of individuals. This point is sensitive since some panel tools are not always suitable to use in the case of long panels ($T > N$). Indeed, we observe several limitations on the use of the most famous tools, namely Arellano and Bond estimators. For $T > N$, a country's fixed effect shock will decrease with time and the lagged dependent variable will likely not be significant. Therefore, the Arellano-Bond estimator is not robust. When $T > N$ the over-identification risk is high (Ruiz-Porras, 2012).

Numerous empirical analyses use long panel databases to understand the effects of key factors on another variable, but most of the methodologies are valid for $N > T$.

For the static approach, we first used an OLS panel model. However, we have seen that least squares methods are not appropriate for this kind of database. Results are biased because of the presence of outliers. To tackle this problem, we run a static robust model. This class of estimators can be interpreted as a generalization of maximum-likelihood estimation. Due to space concerns, we will not report all the specifications tested. Only the most relevant specifications are displayed in Table 3.

Ordinary Least-Squares (OLS) has been the most used approach in analysis tools to explore drivers of phenomena. We traditionally assume that there are linear relations between variables and write the following linear regression:

$$y_i = x_i^T \beta + \varepsilon_i, i = 1, \dots, n \quad (1)$$

(x_i, y_i) is the independent and identically distributed (*iid*) vector and $E(\varepsilon_i | x_i) = 0$. β is a $p \times 1$ vector which minimize the sum of squared residuals.

$$\sum_1^n (y_i - x_i^T \beta)^2 \quad (2)$$

However, since years we have admitted that the OLS estimators are sensitive to outliers, even a unique outlier can be sufficient to distort estimations. By outliers, we mean an observation, which is not consistent with another set of data. Several works try to provide more detailed definitions (Krasker, 1980; Krasker et al. (1985); Hampel et al. (1986); Rousseeuw and Leroy

(1987); Judge et al. (1988)). Nowadays, we have a topology of outliers. Concisely, two types of errors appear: gross errors and outliers related to model failure.

In this paper, we choose to use a robust method to tackle the problem of outliers. Instead of using (2) we introduce the following optimization:

$$\beta^e = \arg \min_{\beta} \sum_1^n \rho \left(\frac{y_i - x_i^T \beta}{\sigma^e} \right) \quad (3)$$

With $\rho(\cdot)$ is assimilated to a robust loss function and σ^e is an estimated error scale. Commonly, the Huber's function is used for estimations. To run our models, we utilize E-views software.

We estimate the following equation (1) with several independent variables:

$$y_{it} = \sum_{i=1}^2 \alpha_{i,t} y_{i,t-i} + x_{i,t}^T \beta + dum_{i,t}^T \pi + \varepsilon_{i,t} \quad (4)$$

$y_{i,t}$ is the share of OFIs in relation to GDP (lhs)

$x_{i,t}^T$ is the explicative variable (rhs)

$dum_{i,t}$ is a binary variable assumed to materialize the crisis effect

$\varepsilon_{i,t}$ random errors

Table 3 provides estimation results according to different specifications.

The interpretation of the results is not obvious and the description of the interlinkage is of course partial and limited. Interlinkages could be complementary or show a certain degree of substitution, then, from this simple approach, it is delicate to measure in an accurate manner the relationship between the variables. For most of the specifications, the variable coefficients are significant and have the expected signs. The estimated results show that the bank-to-GDP variable has a big impact on the development of shadow banking. A 1% increase in the bank-to-GDP ratio leads to a 0.58–0.76% increase in OFI to GDP. Whatever the specification, the bank variable affects positively the development of SB.

For pension funds and insurance assets related to GDP, we have found interesting results. The insurance variable affects weakly and positively the OFI variable (from 0.02 to 0.07), whereas the impact of the pension funds variable is relatively more important (from 0.12 to 0.19). For instance, a 1% increase in the pension funds variable leads to a 0.15% increase (on average) in the OFI variable. As expected, the GDP per capita has a positive impact on the development of non-banking activity (from 0.26 to 0.35). This means that GDP growth involves the need for funding via non-banking activity.

Table 3. Estimation results

OFI/GDP (dependent variable)	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.02*** (0.00)	0.03*** (0.00)	0.05*** (0.00)	0.03*** (0.00)	0.04*** (0.07)
Bank/GDP	0.58*** (0.00)	0.76*** (0.00)	0.68*** (0.00)	0.71*** (0.00)	0.76*** (0.00)
Insurance/GDP	0.07*** (0.00)	0.03*** (0.00)	0.04*** (0.00)	0.02*** (0.23)	0.03*** (0.00)
Pension fund/GDP	0.19*** (0.00)	0.15*** (0.00)	0.12*** (0.00)	0.14*** (0.00)	0.15*** (0.00)
Spread		0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
Long-term interest		-0.01*** (0.00)		-0.02*** (0.00)	-0.01*** (0.00)
Short-term interest			-0.003*** (0.00)		
Per capita GDP		0.28*** (0.00)	0.20*** (0.00)	0.35*** (0.00)	0.34*** (0.00)
Public debts/GDP		-0.07*** (0.00)	-0.10*** (0.00)	-0.05*** (0.00)	-0.06*** (0.00)
Current account balances/GDP		0.01*** (0.00)	0.01*** (0.00)		0.01*** (0.00)
Total reserves/GDP				0.001 (0.57)	
Bank interest margin ratio		-0.02*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)
Bank capital ratio		0.18*** (0.00)	0.13*** (0.00)	0.15*** (0.00)	0.18*** (0.00)
Non-performing loans ratio		0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
Credit/GDP		-0.10*** (0.00)	-0.10*** (0.00)	-0.9*** (0.00)	-0.10*** (0.00)
Stock Market/GDP			0.06*** (0.00)	0.06*** (0.00)	
Financial development					0.07*** (0.00)
OFI/GDP lag=1	0.19*** (0.00)	0.09*** (0.00)	0.10*** (0.00)	0.09*** (0.01)	0.10*** (0.00)
OFI/GDP lag=2	0.09*** (0.00)	0.09*** (0.00)	0.10*** (0.00)	0.12*** (0.00)	0.10*** (0.00)
Crisis dummy		-0.01*** (0.00)	-0.004*** (0.00)	-0.003 (0.12)	-0.01*** (0.00)
Number of observations	126	126	126	126	126
Sample adjusted	2005-2018	2005-2018	2005-2018	2005-2018	2005-2018
Number of countries	10	10	10	10	10
Diagnostic Residuals (Autocorrelation/Partial Correlation)	MA(1)	MA(1)	MA(1)	MA(1)	MA(1)

Source : Authors

The role of interest rates is relatively weak but all the coefficients are significant. Both long interest rate (or short interest rate) and spread have the expected signs. For the banking variables such as interest margin and capital ratio, the signs are in line with the empirical

literature. The banking capital ratio tends to favor non-banking activity. A tightening of capital requirements has two effects. The first is to reduce the risk of loans to regulated institutions going bad, but loans granted from the non-regulated system increase and may raise the risk to the financial system since they have a lower (or no) capital requirement. According to estimations, a 1% increase in capital ratios leads to a 0.15-0.18% increase in OFIs. This point emphasizes the fact that forcing greater capital requirements on banks leads to the appearance of non-regulated financial innovations.

The current account balances affect positively the development of nonbanking activity. Unfortunately, for the total reserves reported to GDP, the coefficient is not significant.

For the credit variable, the sign is negative and significant. This result can be explained by the presence of the bank's total assets. They likely annihilate the role of the credit variable. For the non-performing loans, the sign is significant and positive as expected.

The stock market and the financial development (all entities except for the market, i.e. bank insurance, etc.) affect positively the non-banking funding. This result is not surprising.

For the lagged OFI variables, they are positive and significant. This signifies that the other financial intermediaries have memory. Hence, they depend on their past levels.

The dummy variable assumed to materialize the financial crisis has a negative impact. The coefficient is negative, significant and weak. This result may show that after the financial crisis, the size of SBS evolved sluggishly. According to the ESRB 2018 report, “the EU (EA) shadow banking system stood at €42.3 (€33.8) trillion at the end of 2017 compared with €42.3 (€33.4) trillion at the end of 2016”.⁸

4. Robustness

To be complete, we present in this section several estimations to verify the specifications' robustness. We propose to re-estimate the model 1 to 5 with a restrictive sample. Indeed, this time we exclude Luxembourg and the US because of their role in the development of non-banking activities. These exclusions reduce drastically the number of observations and may provide weaker interpretative results. However, some results persist.

Whatever the specification, the banking originate-distribution model dominates. These results reinforce the interlinkage of the banking system and the non-banking system. We have to underline the role of pension fund and the stock market in the non-banking activities booms.

⁸https://www.esrb.europa.eu/pub/pdf/reports/esrb.report180910_shadow_banking.en.pdf

Table 4. Estimation results without Luxembourg and the US

OFI/GDP (dependent variable)	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.02*** (0.00)	0.01 (0.34)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
Bank/GDP	0.62*** (0.00)	0.67*** (0.00)	0.46*** (0.00)	0.43*** (0.00)	0.68*** (0.00)
Insurance/GDP	0.05*** (0.00)	0.08 (0.15)	0.13*** (0.00)	0.12*** (0.00)	0.07*** (0.00)
Pension fund/GDP	0.27*** (0.00)	0.17** (0.02)	0.03*** (0.00)	0.05*** (0.00)	0.12*** (0.00)
Spread		-0.001 (0.21)	-0.001* (0.07)	-0.001*** (0.00)	-0.001*** (0.00)
Long-term interest		-0.003 (0.83)		0.004 (0.15)	-0.01*** (0.00)
Short-term interest			-0.003*** (0.01)		
Per capita GDP		0.13 (0.67)	-0.17 (0.37)	-0.15*** (0.00)	0.14*** (0.00)
Public debts/GDP		-0.18* (0.08)	-0.54*** (0.00)	-0.56*** (0.00)	-0.19*** (0.00)
Current account balances/GDP		0.01** (0.04)	0.01*** (0.00)		0.01*** (0.00)
Total reserves/GDP				0.04*** (0.00)	
Bank interest margin ratio		0.14*** (0.00)	0.07*** (0.00)	0.07*** (0.00)	0.15*** (0.00)
Bank capital ratio		0.21*** (0.00)	0.11*** (0.01)	0.09*** (0.00)	0.23*** (0.00)
Non-performing loans ratio		0.07*** (0.1)	0.08*** (0.00)	0.08*** (0.00)	0.06*** (0.00)
Credit/GDP		-0.26*** (0.00)	-0.13*** (0.01)	-0.12*** (0.00)	-0.26*** (0.00)
Stock Market/GDP			0.19*** (0.00)	0.20*** (0.00)	
Financial development					0.47*** (0.00)
OFI/GDP lag=1	-0.01*** (0.00)	-0.03 (0.56)	-0.02 (0.50)	-0.02*** (0.01)	-0.02*** (0.00)
OFI/GDP lag=2	0.03*** (0.00)	-0.08* (0.07)	-0.04 (0.33)	-0.001 (0.91)	-0.11*** (0.00)
Crisis dummy		0.01 (0.27)	0.04*** (0.00)	0.04*** (0.00)	0.02*** (0.00)
Number of observations	75	63	53	53	62
Sample adjusted	2006-2016	2006-2016	2006-2016	2006-2016	2006-2016
Number of countries	8	8	8	8	8
Diagnostic Residuals (Autocorrelation/Partial Correlation)	MA(1)	MA(1)	MA(1)	MA(1)	MA(1)

Source: Authors

5. Concluding remarks and policy implications

According to our panel and pooled estimations, a number of salient and common conclusions emerge. Whatever the specification, the Banks/GDP variable has a huge impact on the

development of SB. This means that banks dominate SB financing of the economy and validate the banking originate-distribution model assumptions. This point highlights the importance of monitoring the banking system. As for pension funds and insurance companies over GDP, the estimation results are more or less uneven. However, we cannot exclude their positive impact on the development of the SBS.

The introduction of non-performing loans (NPL) in the different specifications shows that this variable has a positive impact on the development of the SB. This is not surprising since NPLs are often incorporated in sophisticated financial products, such as special purpose vehicles. For the credit variable, there is no consensual result. In general, the coefficient is not significant or does not have the expected sign. The bank capital ratio and bank interest margin variables seem to impact the development of the SBS. The bank capital ratio compels banks to find solutions to avoid this capital constraint.

Despite these interesting results, we have to point out the limitations of our estimations. Leaving aside the database and definition limits, we would like to insist on the necessity of improving the quality and the harmonization of the existing and future database. Until now, the scalable definition of the Shadow bank (then a non-banking system) is based on a residual approach. OFIs are a kind of black box that measures our ignorance.

Finally, this paper is only the first step in analyzing the role of several variables in the development of the SBS. This topic is crucial to understanding the SBS. The non-banking system raises several questions barely touched on by our paper, namely the lack of transparency and regulation. The number of regulatory variables is not sufficient and the results cannot be generalized.

The most important policy recommendation is to develop more and more qualitative granular data and fix the definition issues to facilitate a reduction in the literature gap which will allow for a better understanding of SB and the design of the proper system for its management

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APPENDICES

Table A1. Key terms Used by the FSB

-	MUNFI (or Monitoring Universe of Non-bank Financial Intermediation, also referred to as non-bank financial intermediation) is a measure of all non-bank financial intermediation, comprising insurance corporations, pension funds, other financial intermediaries (OFIs) and financial auxiliaries.
-	OFIs comprise all financial institutions that are not central banks, banks, insurance corporations, pension funds, public financial institutions, or financial auxiliaries.
-	Narrow measure of shadow banking (or the “narrow measure”) includes non-bank financial entity types that authorities have assessed as being involved in credit intermediation that may pose financial stability risks, based on the FSB’s methodology and classification guidance

Source: p.2 Global Shadow Banking Monitoring Report 2017, FSB March 2018.

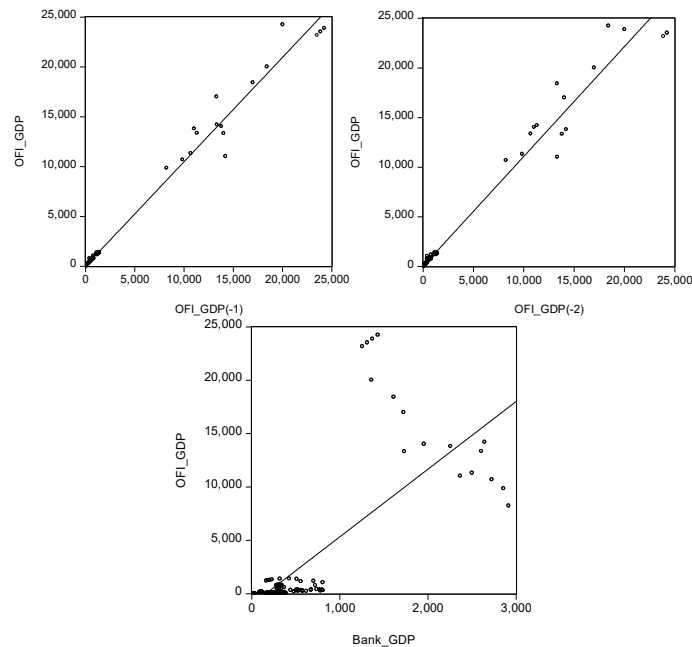
Table A2. Definitions variables and Sources

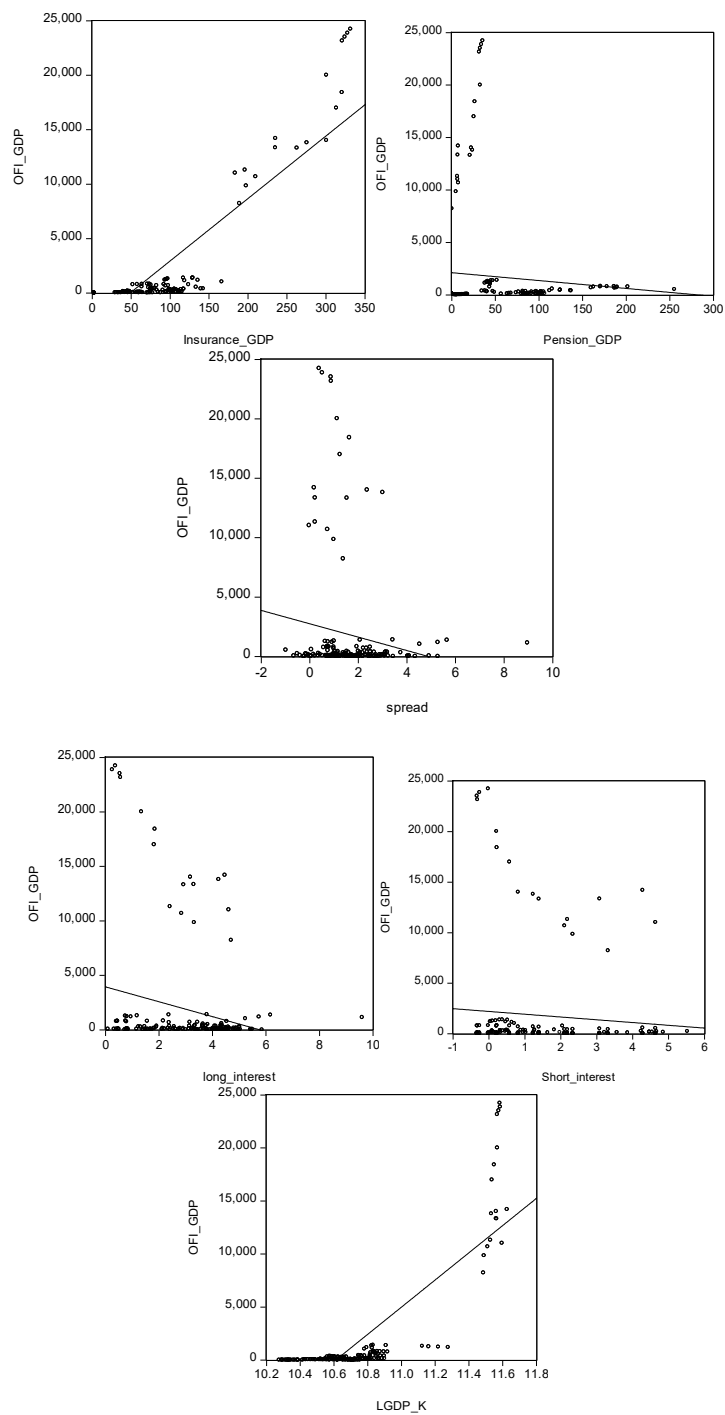
Variables	ID Codes	Definitions
OFI/GDP	NA /FSB	OFI - Other Financial Intermediaries OFI statistics currently contain selected balance sheet items for financial corporations engaged in lending to households and non-financial corporations (FCLs). FCLs resident in the euro area, which is a sub-sector of “Other financial intermediaries, except insurance corporations and pension funds” (OFIs), S.125, in the European System of Accounts 2010 (ESA 2010).
banks/GDP	NA/FSB	Assets of banks. Banks is defined as all deposit-taking Corporations
Insurance/GDP	NA/FSB	Assets of insurance corporations
Pension funds/GDP	NA/FSB	Assets of pension funds
Spread	FR.INR.LNDP	Interest rate spread is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits. The terms and conditions attached to these rates differ by country, however, limiting their comparability
Short Interest rate	OECD (2019), Short-term interest rates (indicator). doi: 10.1787/2cc37d77-en (Accessed on 05 July 2019)	Short-term interest rates are the rates at which short-term borrowings are effected between financial institutions or the rate at which short-term government paper is issued or traded in the market. Short-term interest rates are generally averages of daily rates, measured as a percentage. Short-term interest rates are based on three-month money market rates where available

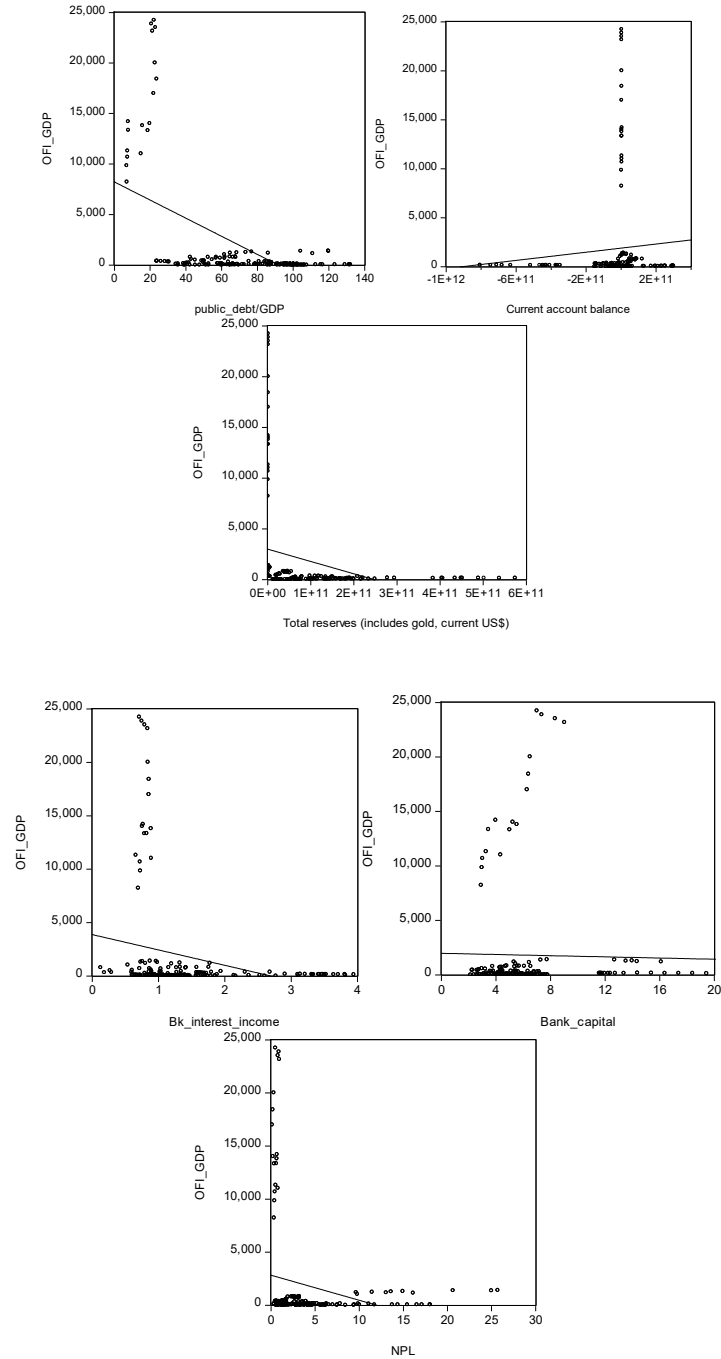
Variables	ID Codes	Definitions
Long term interest	OECD (2019), Long-term interest rates (indicator). doi: 10.1787/662d712c-en (Accessed on 05 July 2019)	Long-term interest rates refer to government bonds maturing in ten years. Rates are mainly determined by the price charged by the lender, the risk from the borrower and the fall in the capital value. Long-term interest rates are generally averages of daily rates, measured as a percentage. These interest rates are implied by the prices at which the government bonds are traded on financial markets, not the interest rates at which the loans were issued. In all cases, they refer to bonds whose capital repayment is guaranteed by governments. Long-term interest rates are one of the determinants of business investment.
GDP per capita	NY.GDP.PCAP.KD	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources
Public Debts/GDP	GFS.Q.N.COUNTRY.W0.S13.S1.C.L.LE.GD.T.Z.XDC_R_B1GQ_CY.T.F.V.N.T FRED	Closing balance sheet/Positions/Stocks - Maastricht debt - Liabilities (Net Incurrence of) - maturity: All original maturities - counterpart area: World (all entities, including reference area, including IO), counterpart sector: Total economy - Consolidated, Current prices, Face value - Domestic currency (incl. conversion to current currency made using a fixed parity); ratio to the annual moving sum of gross domestic product, Neither seasonally adjusted nor calendar adjusted - ESA 2010 (Government Finance Statistics)
Current account balances	BP6.Q.N.COUNTRY.W1.S1.S1.T.B.CA.Z.Z.Z.EUR.T.X.N FRED	Quarterly- Neither seasonally adjusted nor calendar adjusted data- Country vis-a-vis Rest of the World- sector: Total economy vis-a-vis Total economy- Transactions- Balance (Credits minus Debits)- Current account- Euro- All currencies- Compilation methodology based on international standards (Balance of Payments and International Investment Position (BPM6))
Total reserves	FI.RES.TOTL.CD	Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end (December 31) London prices. Data are in current U.S. dollars.
Non Performing Loans	FB.AST.NPER.ZS	Bank nonperforming loans to total gross loans are the value of nonperforming loans divided by the total value of the loan portfolio (including nonperforming loans before the deduction of specific loan-loss provisions). The loan amount recorded as nonperforming should be the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue.
Market capitalization	CM.MKT.LCAP.GD.ZS	Market capitalization (also known as market value) is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end of year values.
Credits	FS.AST.DOMS.GD.ZS	Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies.

Variables	ID Codes	Definitions
Bank capital ratio	FB.BNK.CAPA.ZS	Bank capital to assets is the ratio of bank capital and reserves to total assets. Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Capital includes tier 1 capital (paid-up shares and common stock), which is a common feature in all countries' banking systems, and total regulatory capital, which includes several specified types of subordinated debt instruments that need not be repaid if the funds are required to maintain minimum capital levels (these comprise tier 2 and tier 3 capital). Total assets include all nonfinancial and financial assets
Bank net interest margin	GFDD.EI.01	Raw data are from Bankscope. $\text{Data2080}[t] / ((\text{data2010}[t] + \text{data2010}[t-1])/2)$. Numerator and denominator are aggregated on the country level before division. Note that banks used in the calculation might differ between indicators. Calculated from underlying bank-by-bank unconsolidated data from Bankscope.
Financial development index	FD_FD_IX	The financial development index is constructed using a standard three-step approach found in the literature on reducing multidimensional data into one summary index: (i) normalization of variables; (ii) aggregation of normalized variables into the sub-indices representing a particular functional dimension; and (iii) aggregation of the sub-indices into the final index. This procedure follows the OECD Handbook on Constructing Composite Indicators (OECD, 2008), which is a good reference for methodological suggestions.

Figure A1. Scatter plots OFIs and drivers







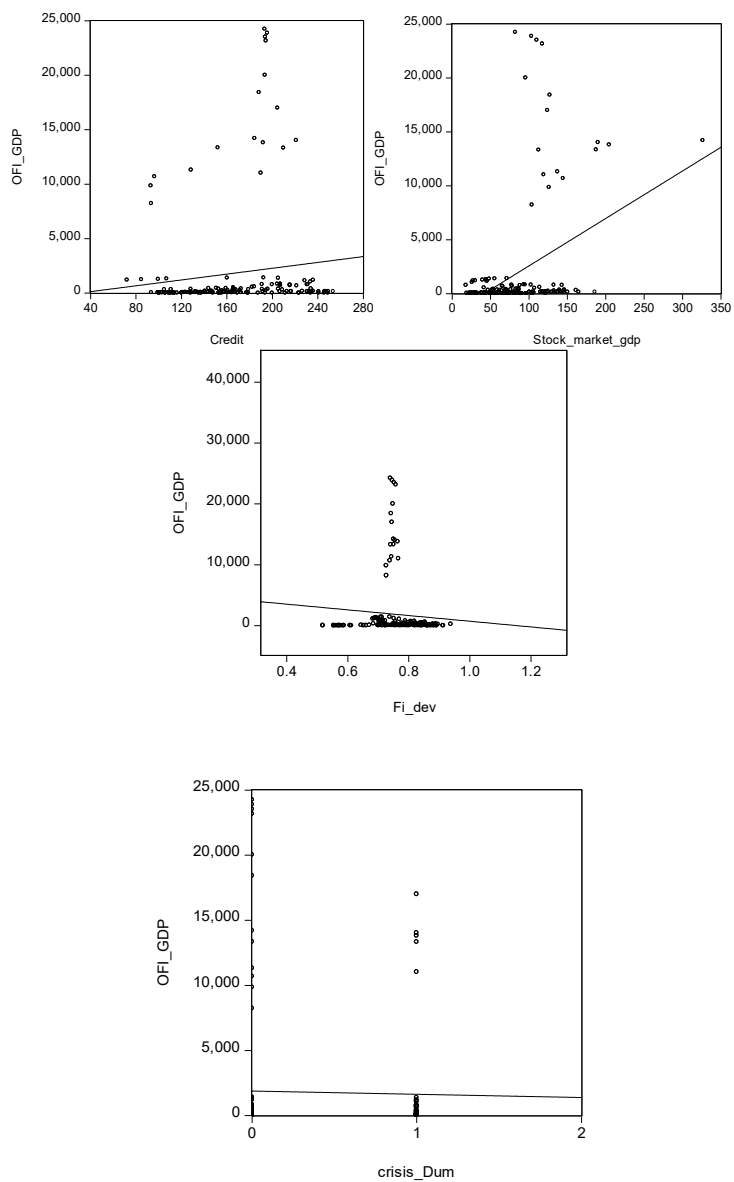


Table A3. Panel unit root results

Variables	Levin, Lin & Chu	Im, Pesaran and Shin	ADF - Fisher Chi-square	PP - Fisher Chi-square
OFI Level	-2.20 (0.01)	-0.51 (0.30)	20.06 (0.45)	24.63 (0.21)
OFI Δ	-7.93 (0.00)	-6.80 (0.00)	79.37 (0.00)	120.23 (0.00)
BANK Level	-0.96 (0.17)	0.85 (0.80)	13.08 (0.87)	18.16 (0.57)
BANK Δ	-4.91 (0.00)	-4.58 (0.00)	58.10 (0.00)	93.31 (0.00)
INSURANCE Level	-1.73 (0.04)	-0.26 (0.39)	19.71 (0.4)	34.23 (0.02)
INSURANCE Δ	-16.23 (0.00)	-13.63 (0.00)	150.10 (0.00)	222.15 (0.00)
PENSION Level	-0.98 (0.16)	0.92 (0.82)	15.11 (0.65)	16.33 (0.57)
PENSION Δ	-12.08 (0.00)	-9.86 (0.00)	109.19 (0.00)	178.05 (0.00)
SPREAD Level	-3.48 (0.00)	-3.23 (0.00)	42.47 (0.00)	28.71 (0.00)
SHORT INTEREST	-2.21 (0.01)	0.49 (0.69)	12.48 (0.90)	9.10 (0.98)
SHORT INTEREST Δ	-9.12 (0.00)	-6.26 (0.00)	75.46 (0.00)	85.52 (0.00)
LONG INTEREST	-5.11 (0.00)	-4.03 (0.00)	50.77 (0.00)	77.23 (0.00)
GDP per capital (log)	-1.07 (0.14)	0.42 (0.66)	16.18 (0.67)	11.01 (0.94)
GDP per capital (log) Δ	-5.99 (0.00)	-4.16 (0.00)	52.99 (0.00)	66.57 (0.00)
PUBLIC DEBT Level	-2.40 (0.01)	0.21 (0.58)	14.24 (0.81)	7.80 (0.99)
PUBLIC DEBT Δ	-2.75 (0.00)	-2.01 (0.02)	30.55 (0.06)	37.54 (0.01)
CURRENT ACCOUNT Level	-2.11 (0.01)	-0.44 (0.33)	24.89 (0.20)	21.61 (0.36)
CURRENT ACCOUNT Δ	-4.25 (0.00)	-4.16 (0.00)	53.23 (0.00)	95.07 (0.00)
TOTAL RESERVES Level	0.50 (0.69)	1.79 (0.96)	8.95 (0.98)	9.69 (0.97)
TOTAL RESERVES Δ	-1.60 (0.05)	-1.55 (0.06)	26.68 (0.14)	48.27 (0.00)
BANK INTEREST MARGIN Level	-2.47 (0.00)	-2.31 (0.01)	33.74 (0.03)	41.84 (0.00)
BANK CAPITAL Level	0.12 (0.54)	3.91 (1.00)	8.49 (0.99)	15.91 (0.72)
BANK CAPITAL Δ	-6.20 (0.00)	-6.20 (0.00)	76.94 (0.00)	155.46 (0.00)
NPL Level	-2.70 (0.00)	-0.289 (0.39)	17.54 (0.62)	19.67 (0.48)
NPL Δ	-2.51 (0.00)	-1.73 (0.04)	28.87 (0.09)	54.47 (0.00)

Goldman, S., Zhelyazkova, V. (2023). *Drivers of Shadow Banking System: A Panel Empirical Approach for Developed Countries.*

Variables	Levin, Lin & Chu	Im, Pesaran and Shin	ADF - Fisher Chi-square	PP - Fisher Chi-square
CREDIT Level	-3.57 (0.00)	-1.24 (0.11)	26.13 (0.16)	18.38 (0.56)
CREDIT Δ	0.26 (0.60)	-1.30 (0.10)	28.44 (0.10)	74.29 (0.00)
STOCK MARKET Level	-0.26 (0.40)	-0.23 (0.41)	17.17 (0.65)	57.18 (0.00)
STOCK MARKET Δ	-6.32 (0.00)	-7.08 (0.00)	85.10 (0.00)	146.28 (0.00)
FINANCIAL DEV Level	0.06 (0.52)	-0.48 (0.31)	23.42 (0.27)	23.14 (0.28)
FINANCIAL DEV Δ	-3.03 (0.00)	-3.51 (0.00)	45.15 (0.00)	92.02 (0.00)

Note: Δ is the first difference operator; Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution and are reported parentheses. All other tests assume asymptotic normality.