

Master Thesis

# **Which Factors drive Shadow Banking?**

**– an Empirical Study**

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## **Abstract**

This thesis is an empirical analysis of the factors that drive the size of the shadow banking sector. Shadow banking, in this analysis, uses the flow of fund measure. Two-way fixed-effects panel regression for a cross section of 26 jurisdictions reveals that shadow banking in emerging and developed markets is driven by different factors. In emerging countries, the growth in shadow banking is mainly associated with increased demand of institutional investors for low risk, high yield investments. In developed countries, the size of shadow banking is related with the state of the traditional banking system. The explanatory power of these variables was much greater before the Financial Crisis of 2007/2008 than after, which could be explained by tighter regulation and related changes in the shadow banking sector.

## **Abstrato**

Esta tese é uma análise empírica dos fatores que impulsionam o tamanho do setor sistema bancário paralelo. Bancos sombra, nesta análise, utiliza o fluxo de medida fundo. Two-way fixed-effects panel regression para uma seção transversal de 26 jurisdições revela que o sistema bancário paralelo em mercados emergentes e desenvolvimentos é impulsionado por diversos fatores. Nos países emergentes, o crescimento do sistema bancário paralelo está associado principalmente ao aumento da demanda de investidores institucionais para investimentos de baixo risco e alto rendimento. Nos países desenvolvidos, o tamanho do sistema bancário paralelo está relacionada com o estado do sistema bancário tradicional. O poder explicativo destas variáveis era muito maior antes da crise financeira de 2007/2008 do que depois, o que pode ser explicado por uma maior rigidez da regulação bancária no pós crise.

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## Content

1	Introduction .....	6
2	Shadow Banking Characteristics.....	9
2.1	Shadow Banking Definitions and Measures .....	9
2.2	Shadow Banking versus Traditional Banking.....	12
2.3	Shadow Banking Entities .....	16
2.4	Shadow Banking Instruments .....	19
2.5	Shadow Banking Activities.....	22
3	Shadow Banking Evolution.....	25
3.1	Emergence of Shadow Banking.....	25
3.2	Growth of Shadow Banking.....	26
3.3	Drivers of Shadow Banking.....	27
4	Data .....	32
5	Methodology .....	34
6	Results .....	36
6.1	Results Presentation .....	36
6.2	Discussion.....	42
6.3	Limitations .....	44
7	Conclusion.....	44
8	References .....	46
9	Appendix .....	52
9.1	Appendix 1: OFI's and Bank's Assets Development in each Country.....	52
9.2	Appendix 2: Country Comparison .....	52
9.3	Appendix 3: OFI and Economic Function Measure .....	54
9.4	Appendix 4: Complete list of variables .....	55
9.5	Appendix 5: Correlation Matrix.....	57
9.6	Appendix 6: Preliminary thesis report .....	58

## Abbreviations

ABCP	Asset Backed Commercial Paper
ABS	Asset Backed Security
BIS	Bank of International Settlement
BP	Banco de Portugal
CDO	Credit Default Obligation
CDS	Credit Default Swap
CP	Commercial Paper
ECB	European Central Bank
ESRB	European Systemic Risk Board
FDIC	Federal Deposit Insurance Corporation
FHLB	Federal Home Loan Bank
FSA	Financial Stability Authority
FSB	Financial Stability Board
OBSV	Off-balance Sheet Vehicle
OECD	Organisation for Economic Co-operation and Development
OFI	Other Financial Intermediary
OIS	Overnight Index Swap
LIBOR	London Interbank Offered Rate
MMF	Money Market Fund
Repo	Repurchase Agreement
SIV	Structured Investment Vehicle
SME	Small-medium Enterprise
SPV	Special Purpose Vehicle

## 1 Introduction

Shadow banking, defined as “credit intermediation involving entities and activities outside of the regular banking system” (FSB, 2015), has received increased attention during and after the Financial Crisis of 2007/2008. For good reason, since its risk and sheer magnitude in some countries can have a negative impact on the traditional banking system and the real economy, as the Financial Crisis has shown.

Between 2000 and 2008 shadow banking experienced a particular expansion in USA and Europe, playing an important role in lending within the international financial system (Alworth and Arachi, 2012; IMF, 2014, p.74). As can be depicted from the graph in Figure 1a, shadow banking, quantified by assets of Other Financial Intermediaries (OFIs), grew at a rate of 192% on a global basis from 2002 to 2014, with almost all countries experiencing starker growth before the Financial Crisis. In 2014, the global growth of shadow banking assets exceeded the growth of banks, insurances, pension funds and public financial intermediaries, respectively. U.S. shadow banking accounted for 40% of global shadow banking in 2014. Hence, U.S. shadow banking is not only the largest market, but its size also exceeds the size of traditional banking by 120% (Figure 1b). This might be due to a general stronger demand for market-based funding in the U.S.

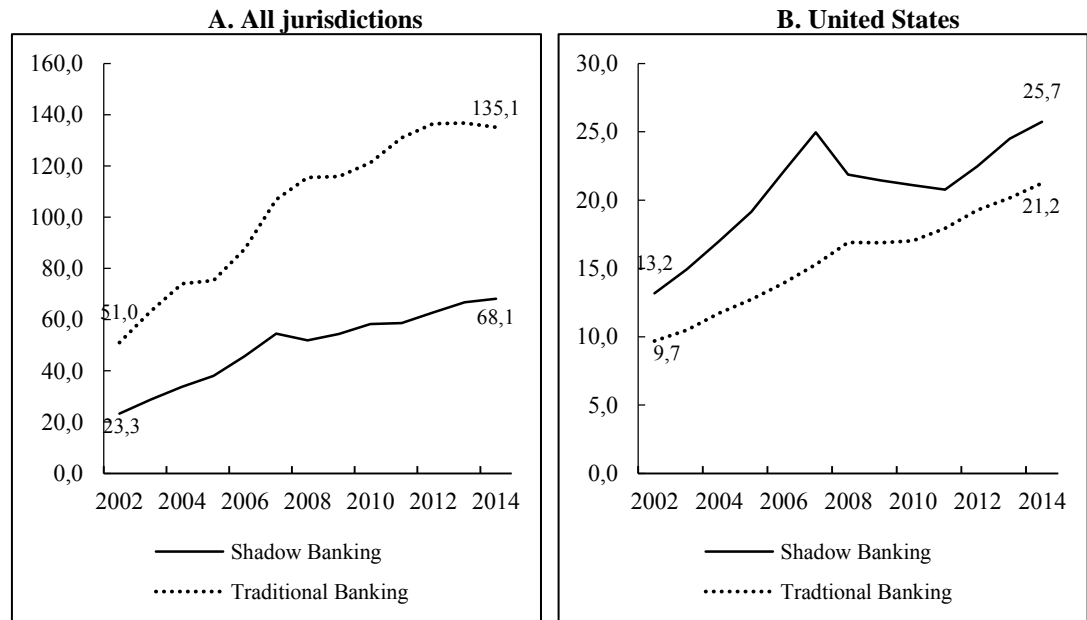
Even though U.S. shadow banking is the most relevant for the global economy, there are also other countries which have shadow banking that can be harmful to their economies. In Ireland, for example, shadow banking is four times as big as traditional banking. In 2014, jurisdictions such as China, Argentina, Hong Kong and Russia had the fastest growing shadow banking sector with growth rates of 32-49% exceeding by far GDP growth. Appendix 2 gives a complete overview of the relevance of shadow banking for some countries.

Shadow banking is nowadays widely discussed; however, considerable research only emerged in the aftermath of the Financial Crisis. Shadow banking’s significant role in the Financial Crisis, and the limited knowledge about it have pushed researchers and regulators to analyse and monitor the system closer. In the years following the financial crisis, global institutions, such as the Financial Stability

Board (FSB), emerged to watch over the stability of the financial system and to tackle “weaknesses, spill-overs and systemic risk in shadow banking” (Claessens et al 2012, p. 21).

**Figure 1: Shadow Banking and Traditional Banking Development**

The graph displays the evolution of shadow banking and traditional banking assets from 2002-2014 in USD trillion for 26 jurisdictions in 1a and the United States in 1b.



Shadow banking’s activities, mainly securitization and secured wholesale funding, enable risk sharing, enhance maturity transformation and provide market liquidity through products such as asset backed securities (ABSs), credit default obligations (CDOs), repurchase agreements (repos), and securities lending. Hence, literature, in general, presumes that shadow banking has the ability to contribute to a more efficient financial market (Claessens and Ratnovski, 2014; Poszar et al, 2013). However, the Financial Crisis showed that the shadow banking system was not sufficiently equipped to ensure the necessary trust in the system. The high uncertainty about shadow banking entities’ assets led to withdrawals of repos and securities lending; shadow banking’s main funding. The subsequent ample liquidation of assets triggered a liquidity spiral in which money market funds withdrew even more funds from the shadow banking system; thereby causing a bank run on the repo market. This run not only led to defaults of shadow banking entities such as Bear Stearns and Lehman Brothers, but also spilled over to

traditional banking (Gorton and Metrick, 2012; Pedersen (2015). For example, Antoniadou (2015) states that the Federal Deposit Insurance Corporation reported 462 defaulted commercial banks from 2008Q3 until 2013. Measures aiming to ensure liquidity and trust, such as collaterals and portfolio restrictions for money market funds, failed to compensate for the lack of deposit insurance and the Fed's discount window, as pointed out by Bernanke (2012).

Since shadow banking has the attributes to enhance the financial system's efficiency it is important to preserve those positive characteristics while minimizing its destructive effects on the financial system and real economy. The right solutions can only be created with a thorough understanding of shadow banking and its drivers. Such an understanding enables the anticipation of expanding and innovating periods in shadow banking; therefore, permit preventive measures. Even though reasons for the emergence of shadow banking, like regulatory arbitrage, are known and have been studied, the literature is limited on factors that drive short-term fluctuations of shadow banking's size.

Two reasons for the deficiency in empirical research are the lack of a common agreed definition and incomplete data. The absence of a shared definition is attributable to the high complexity of shadow banking, interconnectedness with traditional institutions, and heterogeneity across countries, which make an isolation of shadow banking difficult. However, the collection of more data enables better investigation of shadow banking, and the refining of its definition. FSB (2015) approximates the size of shadow banking entities by aggregated assets of OFIs, also called flow of funds measure. This measure is only an approximation because it overstates shadow banking in most countries due to its inclusion of non-shadow banking activities (Appendix 3). The thesis uses OFI data nevertheless since it is the best available measure to date with a long enough times series. The annual time series ranges from 2002 to 2014 and is available for 26 countries. The limited expressiveness of the OFI measure is acknowledged in this analysis.



This thesis provides a comprehensive analysis of shadow banking's size drivers by presenting existing literature<sup>2</sup> on shadow banking's short-term and long-term size drivers and structures them in a theoretical framework. In a regression analysis, the initially identified financial and macro-economic explanatory variables are tested for their performance and robustness. The analysis uses two-way fixed-effect panel regression methodology. Next to the complete data set, subsets of the data, that distinguish between developed and emerging countries, pre- and post-crisis, are tested.

The thesis continues as follows: The first part gives the reader an overview of shadow banking characteristics, including entities, activities, and credit intermediation. The second part proceeds to explain shadow banking's origin, size measures, and drivers of its size. In this part, the conceptual model for the subsequent empirical analysis is presented as well. The third part is dedicated to testing the model and describes data and methodology. In the final section, the results are presented. The thesis finishes with limitations, a conclusion, and suggestions for future research.

## **2 Shadow Banking Characteristics**

The following sections introduce shadow banking. The initial comparison to traditional banking shall help to understand shadow banking's objectives and outline the similarities and differences towards traditional banking. To comprehend shadow banking credit intermediation, the different activities, such as securitization and collateral intermediation, entities, like special purpose vehicles and conduits, and products, such as asset-backed securities and repos, are explained.

### **2.1 Shadow Banking Definitions and Measures**

Shadow banking growth is in part due to the general shift in allocation of private savings. Private savings are no longer solely channelled to saving deposits, leading to *bank-based finance*, but are more frequently directed towards institutional investors like pension and money market funds (MMFs), leading to *market-based finance*. Since the 1960s, market-based finance has increased in size.

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<sup>2</sup> The literature review is mainly based on the United States since majority of the literature has focused on this country.

In particular, shadow banking has contributed to this growth (Poszar, 2010). Adrian and Shin (2009b) point out that market-based financing is substituting traditional banking; at least in the U.S. The general trend of increased market-based financing is important to consider when it comes to the analysis of the drivers of shadow banking's size since it points to a completely different universe of literature. Viewing shadow banking from the perspective of market-based funding also frees up the negative connotations associated with the term shadow banking. As already pointed out earlier, shadow banking may contribute to the efficiency of the financial system. Market-based financing, however, is even explicitly desired by the real economy. OECD (2015) promotes that small-medium enterprises (SME) benefit through market-based funding, and specifically securitization because it accounts for the disadvantages SMEs encounter with bank-based financing.<sup>3</sup>

The term shadow banking has been coined by McCulley (2007) and originally refers to securitization based credit intermediation. However, the term has subsequently been applied to a much broader range of entities and activities. A precise definition does not yet exist because of the complexity and interconnectedness of the financial sector, heterogeneity between countries, and a lack of data; altogether making it difficult to isolate shadow banking. An often cited definition is by FSB (2015), which defines shadow banking as “credit intermediation involving entities and activities outside of the regular banking system.” FSB further limits this definition to institutions and activities that propose a systemic risk to the system through credit risk, maturity and liquidity transformation. Thereby, FSB excludes many other non-bank credit intermediating institutions (e.g. crowdfunding or private equity activities). Furthermore, FSB relates this definition to entities that are involved in regulatory arbitrage, thereby pointing to traditional, regulated banks. In order to generalize, it can be stated that shadow banking is “wholesale funded credit intermediation, sponsored by specialised intuitions that issue non-depository instruments and finance the financial and non-financial sector (Gridseth, 2014).”

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<sup>3</sup> Hence, it is doubtful if the term shadow banking is appropriate since it creates negative associations. Mehrling et al (2013) avoid the term shadow banking at all and refer to it as market-based credit system (versus bank based credit system).

Based on the just stated definition, FSB (2015) developed the so-called *flow of fund measure*<sup>4</sup>, consisting of aggregated assets of OFIs. OFIs are defined as assets of financial institutions not classified as banks, insurers, pension funds, financial institutions, central banks, or financial auxiliaries and therefore the measure is *entity-based*. FSB (2015) further distinguishes between subsectors of OFIs, which are split up into money market funds, finance companies, structured finance vehicles, hedge funds, other funds, broker-dealers, real estate, investment trusts, and funds. However, the short coming of such entity measures is that they do not account for the high complexity and interconnectedness of shadow banking entities with traditional banks. The entity-based measure, for example, accounts for entities that are not engaged in shadow banking activities and therefore overstates the size of shadow banking compared to the more correct economic function measure (Appendix 3).<sup>5</sup> This limitation is only a natural consequence of regulation, which is itself entity-based.

It has been an attempt to create a *functional* (or *activity-based*) measure, which only accounts for shadow banking activities. In 2015 FSB presented the *economic function* measure, which narrows down the assets of OFIs to those parts of non-bank credit intermediation where shadow banking risk can occur. Specifically, the measure considers five economic functions: “(1) management of collective investment vehicles with features that make them, (2) loan provision that is dependent on short-term funding, (3) intermediation of market activities that is dependent on short-term funding or on secured funding of client assets, (4) facilitation of credit creation and (5) securitisation-based credit intermediation and funding of financial entities susceptible to runs” (FSB, 2015 p. 8). The broad structure of this definition makes a more dynamic and flexible application, across entities, countries, and time possible. However, due to limited data on this measure the empirical analysis is conducted with the OFI measure.

Another activity-based approach is currently developed by the European Systemic Risk Board (ESRB). This measure contends that the systemic relevant part of

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<sup>4</sup> The measure is also known as broad or OFI measure (IMF, 2014).

<sup>5</sup> Hence, the term *shadow bank* is not applicable since entities conduct not only shadow banking activities but also other activities.

shadow banking stems from collateral transactions and collateral reuse, contributing to higher interconnectedness and fragility. ESRB, hence, aims to measure more closely “securities financing transactions (ESRB, 2014).” However, data and further information are not yet published.

Despite the difference between the OFI and Economic Function measure, FSB (2015) considers OFI as an important device as it identifies shadow banking risks associated with innovations and changes in the system. To further justify the usage of OFI measure, its development is compared with the economic function measure. In Appendix 3, it can be clearly seen that the absolute value for OFI institutions is almost twice as big as the Economic Function measure. This is due to the fact that OFI considers for non-shadow banking activities. The relative relationship between OFI and economic function is however much closer with growth rates over the period of 2010-2014 of 17.0% and 14.6%, respectively. Also the correlation, though only for 4 years, is high with 0.99. Together with the qualitative argument, that shadow banking is the main contributor to market based funding growth, this is taken as a justification to approximate shadow banking by the OFI measure.

Measuring shadow banking will remain a difficult task even with a common definition and monitoring in place. Since the definition itself embraces financial innovations, which are constantly changing and vary across countries, it becomes difficult to apply a measure across countries and time. Therefore, it might be necessary to not only focus on the now identified areas, but observe and eventually consider new developments (e.g. cryptocurrencies, crowd funding) in the measure in order to constantly account for shadow banking (Barghini, 2009). The economic function measure is therefore a good start to consider for the dynamic nature of shadow banking.

## **2.2 Shadow Banking versus Traditional Banking**

The following section highlights the differences and similarities between shadow banking and traditional banking. This section is not only relevant to understand shadow banking, but also to recognise the vulnerable parts of shadow banking.

Just like traditional banking, shadow banking involves credit intermediation, and thereby, both accomplish maturity, credit and liquidity transformation (FSB, 2011; Lutrell et al, 2008). These activities can result in an efficient allocation of resources and therefore stimulate the real economy. In turn, traditional and shadow banking entities concentrate credit, interest, and liquidity risk.

Traditional and shadow banking institutions contribute to efficient fund allocation through banks' skills in assessing credit risk and collecting deposits. The usage of different interest rates and collateral help banks to overcome adverse selection and minimize non-performing loans. Economies of scale let banks perform this activity more efficiently than direct lenders. The pooling of deposits diversifies the credit portfolio and hence mitigates risk. Since banks accumulate credits from different parts of the economy, they concentrate credit risk (Lutrell et al, 2008).

Maturity transformation is performed in both shadow and traditional banking (Edwards & Mishkin, 1995). In traditional banking, funding is collected from depositors, other banks and equity investors, and then invested in more long-term loans. The maturity of funding ranges from demand deposits, which have to be available whenever depositors want to withdraw money, to saving deposits, which often have a cancellation period. In shadow banking, assets like ABSs have a maturity period of about 150 days, while repos and securities lending are often rolled over on a daily basis, and therefore represent a clear maturity risk. Through the maturity mismatch, banks assume interest rate risk, which is, however, of lower importance nowadays due to hedging possibilities (Lutrell et al, 2008).

The mismatch of maturities is also closely linked to liquidity transformation. Depositor's short-term funds finance larger, less liquid and often long-term investments of creditors. Regulation requires banks to be able to provide sufficient cash to depositors who want to withdraw money. The remaining can be invested into e.g. loans and thereby creates money. For that account, it is assumed that not all depositors want to withdraw their money at the same time, which would cause banks to collapse because their assets are rather illiquid. This is a very strong assumption, which requires that depositors have trust in the banking system. Previous banking crises have shown that this trust is not always present. This is the

reason why central banks act as a lender of last resort; providing traditional banks with a discount window. Governments, thrifts, and private banks additionally organise deposit insurances to maintain the trust in the system during banking crises. Since shadow banking entities are not funded with saving deposits but with wholesale funding, they do not have access to the discount window of the central bank and deposit insurance (Noeth, 2012). Wholesale funding assumes repos and securities lending; both attempting to increase trust through collateralised transactions. Other safety measures in shadow banking include credit guarantees, credit insurance, and lines of credit. However, as the Financial Crisis has shown, those measures do not serve sufficiently to maintain trust during liquidity crises and hence do not conceal the vulnerability of shadow banking to runs on wholesale deposits (Gandhi, 2014).

Apart from the already mentioned differences, one important one is that the above-stated activities are conducted by only a single institution in traditional banking, but involve several in shadow banking (Poszar et al, 2010; Lutrell et al, 2008). The separation of those activities leads to traditional banks, which hold all their loans on their balance sheet until maturity. This business model is also called the *originate-and-hold model*. Shadow banking entities, however, in the *originate-and-distribute model*, securitize the loans and promote them to investors. The process itself and the resulting products can become more complex than in traditional banking. Opacity is further fostered by a lack of transparency and leads to unclear responsibilities, giving ground for moral hazard.

The differing credit intermediation processes also lead to different revenue sources. In the originate-and-hold model, traditional banks' profits are generated through interest margins; charging a higher interest for creditors and paying a lower interest to depositors. Shadow banking entities, within the originate-and-distribute model, earn fees through originating and servicing loans. Since they do not have to hold capital for the sold loans, they can use the money for other purposes while still benefiting from the fee income (DeYoung & Rice, 2004).

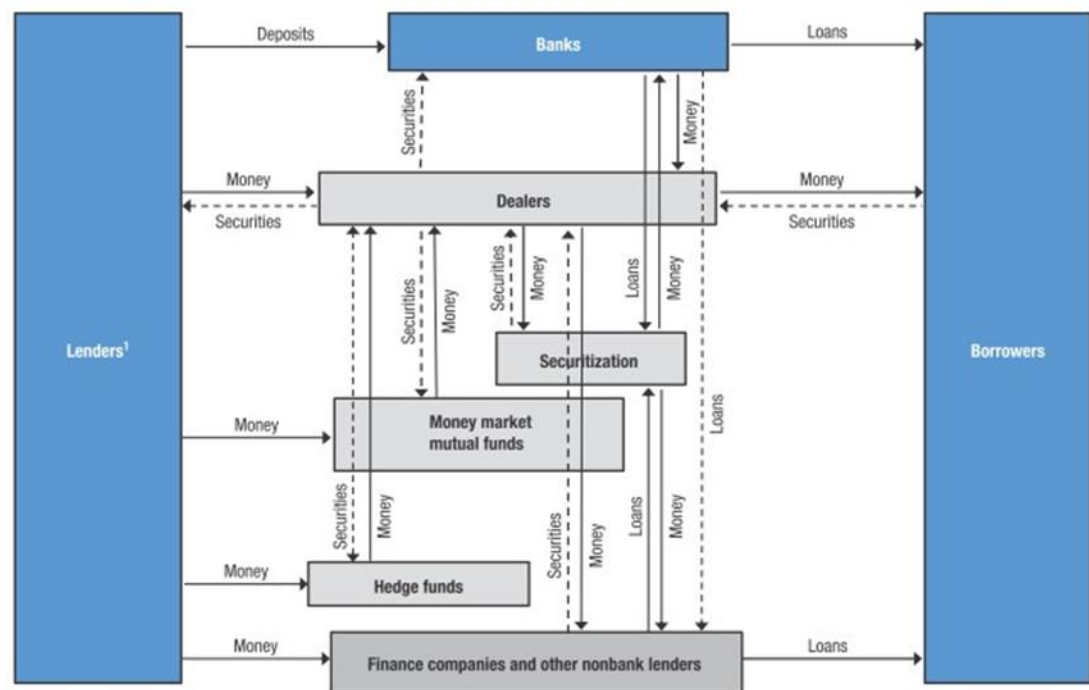
Next to very different credit intermediation processes, shadow banking entities experience less regulation as they are not funded by saving deposits. This has been

the reason for many traditional banks to engage in regulatory arbitrage. Banks set up Off-balance Sheet Vehicles (OBSVs) in order to engage in shadow banking activities. Namely, it enables banks to offer financial innovations or fund credits with lower ratings at fewer costs since they are not subject to rigid capital requirements (PWC, 2011). This link might be less direct when banks only support their SPVs through lines of credit. Even though OBSVs are separate legal entities, reputational risk might force banks to assume liability; leading to a spill-over effect. Furthermore, OBSVs indirectly benefit from the safety net of traditional banks; meaning that potential negative externalities are shared publicly with taxpayers through e.g. deposit insurance, whereas profits stay with the OBSVs. This structure leads to moral hazard, as will be pointed out later.

**Figure 2: Flow of Funds in Shadow and Traditional Banking**

The graph presents the flow of funds from lenders to borrowers. Blue boxes are related to traditional banking credit intermediation. Grey entities and activities belong to shadow banking credit intermediation. Credit origination can be initiated through dealer banks, traditional banks, but also finance companies. Funds are channelled from lenders or savers to different parties of the shadow banking system, including MMFs, hedge funds, finance companies and dealer banks.

Source IMF (2014)



Direct links between the institutions extend to bilateral activities like exchange of money, securities and loans, as can be depicted in Figure 2. In the graph, blue boxes show traditional banking credit intermediation. Grey entities and activities belong to

shadow banking credit intermediation. It shows that there are entities that exclusively conduct shadow banking activities, but also traditional banks are involved in shadow banking activities. The figure visualises that funds are channelled from lenders or savers to different parties of the shadow banking system; including MMFs, hedge funds, finance companies and dealer banks. Credit origination can be initiated by dealer banks and finance companies, but also traditional banks.

Next to the bilateral and direct interconnection, entities can be further linked through common risk (BP, 2014). The link through common risk refers to, for example, liquidity spirals. Investments into similar assets and markets or the exposure to common counterparties can lead to widespread redemptions when single defaults lead to a liquidity spiral (Gosh, 2012).

The interconnectedness of those two markets frees the way for spill-over effects from one system to the other, as occurred in the Financial Crisis (Comotto, 2012).

Hence, the weaknesses of shadow banking can be summarized as follows. Financial innovations can evolve in shadow banking without the supervision of regulators. Furthermore, those innovations might structure risk and return to the disadvantage of parties due to moral hazard. Inconsistencies and a lack of understanding of financial innovations can be the sticking point for increasing mistrust in shadow banking institutions. The weak security system of shadow banking funds through collateral might not withstand the increasing mistrust and hence collapse, leading to a run on their wholesale funding. If shadow banking was an isolated system, the associated risks would not be as relevant for traditional banking and the real economy. However, due to direct and indirect linkages between shadow and traditional banking, the distress of shadow banking institutions can also affect traditional banks. The complexity and opacity of those interconnections further increase the mistrust in traditional banks and therefore can lead to a collapse of the whole financial system – especially, if shadow banking has a significant size.

### **2.3 Shadow Banking Entities**

Shadow banking involves several different parties as shown in Figure 2. The loan origination is completed by banks, financial companies, and mortgage



companies. Funds for shadow banking entities are usually provided by MMFs and hedge funds, which collect money from investors and then fund shadow banking OBSVs through repos and securitised lending (FSB, 2012). Those entities are also the ones mainly involved in securitization. Broker-dealers and securities lenders, on the other hand, are heavily involved in collateral intermediation (Lutrell et al, 2008). The following section will give a brief overview of the just mentioned shadow banking parties.

The wholesale funding of shadow banking entities is provided by hedge funds and MMFS. MMFs invest in short-term, safe assets like treasury bills, commercial papers and asset-backed commercial papers (ABCPs), and lend cash through repos (Poszar et al, 2010). Thereby, MMFs supply liquidity to the shadow banking system (FSA, 2011). They are open-ended and usually offer deposit like investments at a higher interest rate. MMFs usually invest in government securities, but also in riskier investments and hence represent an important source of funding (Classens et al, 2012). Hedge funds, engaged in shadow banking, focus on credit as investment (Poszar et al, 2010). Since the funds are open-ended, investors can withdraw their money on demand, and thereby contribute to funding instability (Adrian and Shin, 2009b). However, unlike investors in MMFs, hedge fund investors do not necessarily want to avoid risk (Classens and Ratnovski, 2014).

Security broker-dealers and security lenders play significant roles in the collateral intermediation process and therefore are essential in obtaining funding for the shadow banking system. The general function of broker-dealers is to provide liquidity to the market by performing market-making and trading activities. Furthermore, they represent important intermediaries for smaller institutions and are primarily funded by repos. Often broker-dealers are subsidiaries of commercial banks (Dive et al., 2011; Cetorelli & Peristiani, 2012). Security lenders, on the other hand, are institutions that lend out securities, which they manage. There to belong, for example, asset management funds and custodian banks. Their clients are usually hedge funds and trading desks of banks, which borrow securities against cash. The proceeds of these transactions are often reinvested in the collateral intermediation chain in order to obtain new assets through securities lending (Singh and Aitken, 2010).

OBVSSs constitute the core of the shadow banking system since they carry out major parts of securitization. PWC (2011) points predominantly to Special Purpose Vehicles (SPVs), Structured Investment Vehicles (SIVs) and conduits. These entities are created by their sponsor, mainly banks, to achieve a temporary goal. In the case of shadow banking, the goal is to raise funding for the securitization of assets. They are vital in the securitization process since they enable the disaggregation of risk, which is then passed on to investors willing to bear the risk.

SPVs help raising funds by issuing, for example, notes. The proceeds are used to buy assets or loans, which are grouped into tranches according to the investor's preference and sold to investors (PWC, 2011).

Conduits are engaged in the securitization process at various stages. They can be classified into single- and multi-seller conduits. Single-seller conduits fund the working capital of non-bank institutions and in turn receive support from one single institution. Multi-seller conduits, which make up the majority of conduits, are supported by several institutions (Adrian and Ashcraft, 2012). In the securitization process, conduits focus on issuing different products and are usually labelled according to its product (e.g. asset-backed commercial paper conduits issue ABCPs).

SIVs were common until the Financial Crisis, at which point they stopped operating. They were funded through ABCPs, medium-term and long-term notes and hold assets such as ABSs, CDOs and financial sector debt. They had backup lines of credit from commercial banks, but were tied to different extent to specific banks (PWC, 2011).

PWC (2011) explains that the complex structure of OBSVs and products give ground for moral hazard for both banks and investors. Since the entities are bankruptcy remote sponsors do not have an incentive to investigate and monitor credit risk. On the other hand, it is argued that banks do not want to let their OBSVs go bankrupt since it would affect negatively their reputation. Because this is known by investors they might exploit this knowledge by relying on financial support in case of collapse. Therefore, the incentive for investors is also low to conduct proper risk investigation.

## 2.4 Shadow Banking Instruments

Among the instruments one has to distinguish between the ones that constitute a funding source for shadow banking, like repos and securities lending, and the instruments which are the end product of the securitization process and sold to investors. The instruments are explained in more detail in the following.

### **Funding instruments**

Repos and securitized lending make up part of the money market segment because they are short-term and use collateral in order to account for counterparty risk (Copeland et al, 2010). In case borrowers default, the collateral can be liquidated. Hence, this activity can be regarded as short-term lending. Just like any other lending activities, these transactions involve maturity and liquidity transformation (FSB, 2013). Due to the risk associated with the underlying collateral, like market, credit, and liquidity risk, overcollateralization and daily resettling are used (ECB, 2002). In overcollateralization the sales price of the instrument is lower than its collateral value. The difference between the two is called the haircut and depends on the risk of the underlying collateral. Securities that are accepted as collateral include safe assets, such as government issued securities, but also medium-term notes, commercial papers, and ABCPs.

Repos have been originally used by Federal Reserve banks to offer credit to member banks and thereby control the liquidity (Baklanova, Copeland and McCaughrin, 2015). Nowadays, repos are also used by banks, broker-dealers, and central banks. Broker-dealers use it for financing purposes (Bianconi, Collot and Knepper, 2010). Dealers work as a middleman and hence profit by the bid-ask spread. Investors, on the other hand, use it to either invest cash at higher interest rates, borrow money at lower rates, or to earn a profit by renting out their securities.

In a repo agreement, a security is sold to another party together with the agreement that the security can be bought back at a later time. The majority of repos pre-specifies the price and buy-back date. The motivation behind the transaction is to either lend or borrow cash. Often the agreements have a maturity of 90 days (Adrian et al, 2012; Dive, 2011). Due to its high liquid character, Moreira and Savov (2014)

label repos as shadow money. However, as will be outlined later, this liquidity is not maintained during periods of illiquidity.

Unlike repos, securities lending is open-ended and does not have a fixed maturity. This also means that the securities can be recalled at any time and represent therefore a higher degree of flexibility than repos. Furthermore, the investment objective is to conduct short-selling or trade settlement with the obtained securities (Dive, 2011).

### **Investment products**

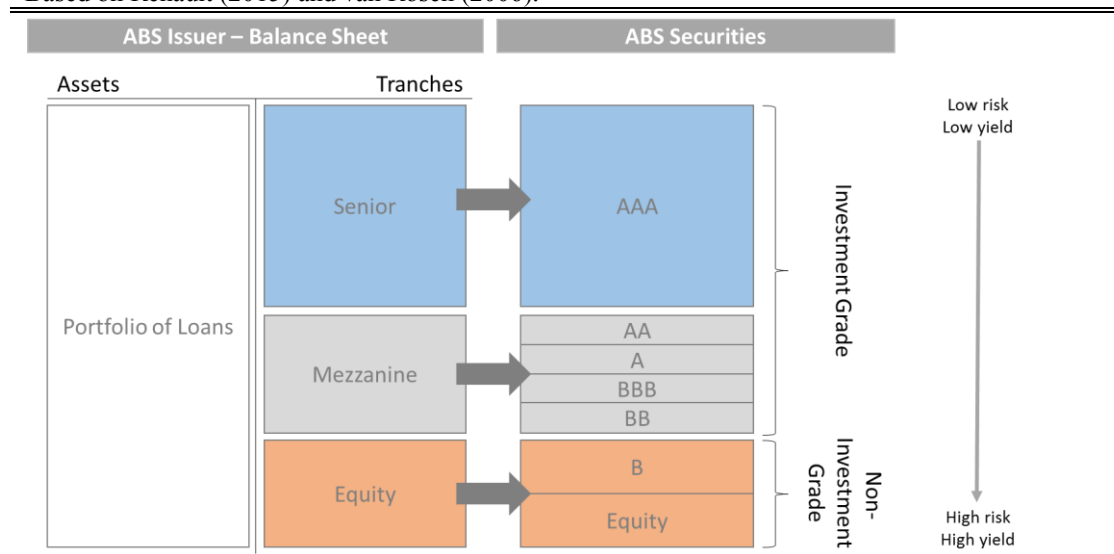
Asset-backed securities (ABSs) are “collateralized claims on pools of loans, mortgages, or receivables” (Adrian and Ashcraft, 2012). To create an ABS, loans are pooled together and tranced in a structure of different seniorities, where claims with lower seniority or subordinate claims absorb initial losses. Figure 3 provides an overview of the just described ABS structure. The figure shows on the left the balance sheet of an ABS issuer. On the asset side, ABS issuers have a portfolio of loans gathered from loan originators. In order to finance those assets, ABS issuers offer securities of different investment grades reflecting the decreasing seniority of claims. If loans on the asset side default, non-investment grade securities, reflecting subordinate claims, are the ones that absorb the initial losses. Due to this structure, senior tranches are not affected by loan defaults until subordinate tranches are exhausted (Kothari, 2006). Therefore, they are the ones that are regarded as riskier and less liquid, but also receive a higher return (Rehault, 2015; van Rosen, 2006). As will be explained later, often, securities with lower seniority stay with the loan originator, ABS issuer, or are repackaged. This pooling and tranching is referred to as securitization. Securitization is a major innovation in the financial industry, and led to the originate-to-distribute business model because it allows credit originators to transfer their credit risk by selling their credits to intermediaries (Adrian and Ashcraft, 2012).

In order to create investment grade ABSs, credits of different types and risk are pooled together. The reasoning here is that individual, illiquid credits become liquid because investors are more willing to acquire a pool of credits rather than one alone. Even though the diversifying effect holds during stable periods, the pooled assets tend to correlate with each other during volatile periods. This means that ABS

**Figure 3: Asset Backed Security Tranching Structure**

ABS issuer's balance sheet and the resulting ABS securities with their return and risk profile are illustrated in the graphic. Tranches on the liability side of the balance sheet reflect different seniorities. Senior tranches have the highest seniority and equity are of lower seniority. These seniorities are also reflected in the issued ABS securities. The AAA rating reflects securities with the highest possible rating and therefore lower default probabilities. Initial losses are absorbed by subordinated securities like equity or also called non-investment grade securities.

Based on Rehault (2015) and van Rosen (2006).



have a higher probability of default during such times.<sup>6</sup> To further securitize ABS products, they are usually over-collateralized; providing collateral in excess of liabilities. Also, credit default swaps (CDS), insurance-like instruments where the portfolio is insured against potential credit losses, help to ensure that claims are fulfilled (Ceorelli & Persitiani, 2012).<sup>7</sup>

CDOs are a type of ABS and transfer credit risk. CDOs are especially used in order to repackage ABSs that cannot be sold. Unsold CDOs in turn are repackaged to CDOs squared (Mizen, 2008). Banks usually stick to senior tranches, which are less risky; whereas the overleveraged equity tranches are sold. Thereby, these instruments are a way for banks to ease up capital and cope with capital regulation (Greenbaum and Kantas, 1982; Poszar, 2008, Duca 1992).

<sup>6</sup> In the run-up to the Financial Crisis, rating agencies omitted the high correlation of assets during unstable times and tail risk when assigning high ratings (Adrian, Ashcraft and Cetorelli, 2013).

<sup>7</sup> The additional securitizing measures, however, did not prevent a broad range of ABSs to default in the Crisis. Investors started to become uncertain which ABS were still reliable since the ratings were meaningless and the ABS structures too complex to understand. Investors who were seeking safe investments rushed out of the market, triggering the start of a liquidity spiral.

The funding of shadow banking entities is conducted through repos and securitised lending; both needing safe collateral for securitised transactions. ABCPs are created during the securitization process in order to raise funding. They are a form of commercial papers and cater short-term investors seeking diversification. Usually, ABCPs mature between 1 and 180 days. ABCPs' underlying assets, however, are mostly long-term and less liquid. This imposes the risk of maturity mismatches (Moreira and Savov, 2014).

## **2.5 Shadow Banking Activities**

According to Classens et al (2012), shadow banking credit intermediation entails two main activities; securitization and collateral intermediation. With both activities shadow banking creates the ostensible safe assets desired by corporations and institutional investors. Securitization is the process of pooling different assets and selling the corresponding rights to the asset's cash flows. Collateral intermediation, also known as re-hypothecation, is the usage of one collateral for multiple financial transactions (Singh, 2011).

### **Securitization**

In general, securitization refers to the originate-to-distribute business model, where banks sell their originated credits to other parties and therefore do not need to hold any capital against their loans anymore. Securitization was introduced in order to transfer credit risk from the financial sector across the economy; thereby, avoiding risk concentration. However, as evidence by Acharya et al (2010), Luck and Schempp (2014) shows, instead, the opposite occurred. Even though securitization was and is used to enhance risk distribution, it has been also used as a tool for regulatory arbitrage, leading to a concentration of credit risk and eventually triggered the Crisis.

The securitization intermediation chain consists of different steps, as outlined by Poszar (2013). It starts with the loan origination and ends with capital market funding. The number of steps varies for securitization and usually increases with long-term loans of low quality (Poszar et al, 2010). Important products of this process are ABSs and ABCPs, which are also used in the collateral intermediation.

In order to create ABSs and ABCPs, finance companies, banks, or mortgage brokers issue income-producing debt obligations like loans or mortgages. In a second step, aggregators such as the initial loan originator or single and multi-seller conduits, warehouse loans by purchasing them from various loan originators. Loans with different credit ratings and maturities are then bought by SPVs, often subsidiaries of banks, and then structured by broker-dealers into ABS, which can be either sold directly or will be warehoused again (Poszar et al, 2013).

In case tranches of ABSs are not sold to the capital market or to individuals through a private placement, the tranches are recycled together with other unsold tranches into CDOs; a subcategory of ABSs. In the Financial Crisis, the middle rated ABS were the ones least requested and then often repackaged and tranced until some eventually became investment grade. Again, if CDOs were not sold they could also be repackaged with other CDOs to a CDO-squared (Mizen, 2008). Unsold ABS, however were also used as a collateral to refinance through ABCPs or repos as will be explained in the next section (Poszar et al, 2010, Cetorelli and Peristiani, 2012).

### **Collateral Intermediation**

The majority of shadow banking funding is accessed through short-term collateralized transactions, such as repos and securities lending. As already explained, these transactions require safe assets in order to enable the exchange for money. However, safe collateral is a scarce resource and therefore shadow banking entities re-use the collateral for multiple transactions (Classens et al, 2012). Thereby, collateral intermediation, also known as re-hypothecation, contributes to more available credit and hence the economy because it enables funding and enforces confidence in short-term funding through the creation of money like claims (ERSB, 2014)<sup>8</sup>. As explained earlier, the money-like feature only maintains during stable periods and disappears once uncertainty enters. In a survey of European banks, ESRB (2014) discovered that 88% of the collateral is reused. 61% of that collateral are government securities, 13% equities and 8% debt securities. On average, collateral is reused once; though pooling of collateral impedes its

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<sup>8</sup> Instead of selling securities, which would incur effort and transaction costs, assets are simply exchanged with the agreement to claim it back at a later point in time. Thereby, money-like features are created.

traceability. In general, the market for collateralized transactions is expected to grow because in a global financial market with high information asymmetry collateral can make up for parts of the counterparty risk (Classens et al, 2012; Singh and Aitken, 2010).

**Figure 4: Collateral Intermediation Chain**

The graph presents a collateral intermediation chain consisting of three parties. Shadow banking (SB) entity A will start the chain by lending its U.S. treasury bond to SB entity B, which in turn gives cash. Entity B will then further lend it to entity C, which can stay with the collateral on its balance sheet. Based on Claessens et al (2012), ESRB (2014)

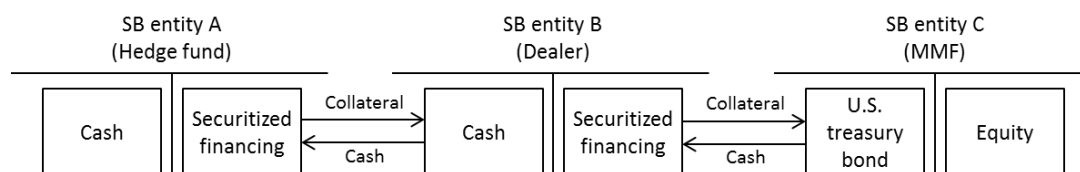


Figure 4 describes a simplified collateral intermediation chain. In practice, this process can start from both sides. Usually, hedge funds and other funds initially have securities at hand which they want to lend out to earn a fee, or they want to borrow cash. Hence, shadow banking entity A pledges, within a repo or securities lending contract, a security in exchange for cash. Dealer banks (shadow banking entity B) source these collaterals and either support other contracts with it, or use it to obtain cash from a third party like shadow banking entity C. Usually, MMFs and similar investors represent shadow banking entity C, provide the cash for the deal and stay with the collateral on their balance sheet. Between shadow banking entity A and C there can be numerous entities, all reusing the collateral to obtain cash. This can lead to long and complex credit ledgers.

The securitizing effect of the collateral might completely vanish when used across multiple transactions because the relationships become complex and opaque (Monnet, 2011). A dealer might have a margin call requiring him to deposit further collateral into his account. This has an effect on the whole collateral intermediation chain; all borrowers must provide additional collateral. If there are significant value decreases or when the initial cash borrower does not roll-over, the securities must be liquidated and thereby drains the whole collateral intermediation chain (Singh, 2013). The complexity and opacity lead to a very instable system. In case prime



brokerages, such as MMFs and hedge funds, reclaim their collateral on a large scale, it can trigger a liquidity spiral leading to severe uncertainties for dealer banks as occurred 2008. At that time, these transactions were secured by ABCPs, which experienced severe value decreases because investors lost trust in the products. This led to withdrawals by investors from MMFs which had to withdraw their money as well. Major institutions like Bear Stearns and Lehman Brothers went bankrupt in this liquidity spiral (Classens et al, 2012).

### **3 Shadow Banking Evolution**

The roots for Shadow banking were laid in the aftermath of the Great Depression. In the subsequent decades the idea of securitization was developed by government related institutions. Later, in the 1970s private banks shifted parts of their business into shadow banking due to margin pressure and regulatory changes. Finally, shadow banking experienced stark growth from the 1990s on and continues to grow after a dip during the Financial Crisis. The factors driving short-term fluctuations are less studied and are more closely investigated in this analysis.

#### **3.1 Emergence of Shadow Banking**

Shadow banking, as defined today, started off after the Great Depression when so called government-sponsored enterprises were founded in 1932 by the Federal Home Loan Bank (FHLB) system. Their goal was to relief distressed banks and homeowners and had the general objective to support the financing of houses. In 1938 Fannie Mae was established and acted as the first secondary market for mortgages approved by the Federal Housing Administration. This led to a more liquid market and enhanced the cash position of banks. In 1968 Fannie Mae was transformed into a shareholder owned company. Two years later, Freddie Mac was created to enlarge the secondary market of mortgages because thrifts were struggling with managing their interest rate risk. The FHLBs were the first providing term warehousing loans to banks; whereas Fannie Mae and Freddie Mac were the first institutions making usage of the originate-to-distribute securitization and credit risk transfer through credit insurance. Those activities were later adopted also by banks and other financial institutions in their credit intermediation and thereby changed the nature of the banking system. Market risk, next to credit risk, was introduced, new

revenue streams through fees rather than interest spreads emerged and wholesale funding as an additional form of funding next to deposits was created (Federal Housing Finance Agency, 2016; Poszar et al, 2010).

### **3.2 Growth of Shadow Banking**

During this time, it was difficult for traditional banks to acquire funding. Regulation Q<sup>9</sup> imposed a maximum interest rate until its phase-out starting in 1986 (Gilbert, 1986) and therefore made it dreadful for traditional banks to attract deposits. Together with high inflation in the 1960s it became increasingly difficult for banks to compete for deposits. Apart from squeezing margins, the subsequent disintermediation led to decreasing depositary funds as investors were looking for higher yield investments (Edwards and Mishkin, 1995 and Duca (1992)).

Regulation was another reason that pushed banks to look for alternatives and innovation in order to maintain profitable. Thereto belong, for example, the higher reserve requirements by the Basel Accord in 1988. Income sources of traditional banks dropped also due to lower information cost as a result of modern information technology (Edwards and Mishkin, 1995; Duca, 1992). These developments led to the creation of financial innovations like CDOs and CDSs. Another way for traditional banks to circumvent regulations was to use OBSVs (Poszar, 2010; Edwards and Mishkin, 1995).

Additionally, investors had a high amount of cash at hand and were seeking “safe, short-term and liquid investments” (Claessens et al, 2012, p.8). Deposits were only insured up to a certain amount and therefore significant amounts were uninsured. By the means of commercial papers, repos, ABCPs and medium-term notes, especially, corporate and institutional investors were incentivized to invest in shadow banking assets (Luttrell et al, 2012). Gennaioli (2013) points out that the high demand for safe assets by those institutions actively led to the creation of new structured products.

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<sup>9</sup> Prohibition of banks to pay interest rates for on demand savings deposits from 1993-2011 and also on several other saving products until 1986.

### 3.3 Drivers of Shadow Banking

The just presented long-term drivers of shadow banking are summarized by IMF (2014, p.74) as “search for yield, regulatory arbitrage, and complementarities with the rest of the financial system”. Next to those causes, leading to the initial emergence of shadow banking, there are factors influencing the size of shadow banking in the short-term.

Studies, with the objective of analysing the short-term drivers of shadow banking, are rare. Duca (2014) conducts a comprehensive time series analysis of drivers in the U.S. shadow banking system based on commercial paper data, ranging from 1963 to 2013. A panel regression analysis, conducted by the IMF (2014), approximating shadow banking size by OFIs’ assets, is more closely related to the analysis in this thesis. The following section presents, first, a general classification of the drivers, then research results and variables used in the panel analysis.

Based on the credit intermediation process, one can detangle the drivers on a broader level, as shown in Figure 5. Shadow banking can be regarded just as any other market and therefore its size depends on the demand for and supply of its products. The products, in this case, are the originated investment products such as ABSs, ABCPs and also the funding instruments like repos and securities lending. Those products are demanded by institutional investors which have a *demand for low risk, high yield investments* (1). The creation of ABSs and ABCPs relies on the amount of credit available to be securitized. The amount of credit available in turn depends on the *demand for credit* (2) and the *supply of credit* (3), which can be provided by either traditional banking or shadow banking. For example, literature shows that demand for credit is linked to economic conditions and hence increases during periods of expansion. However, credit demand only leads to a credit when met by traditional or shadow banking. Hence, shadow banking and traditional banking compete for the same credit (Luck and Schempp, 2011). The credit supply by traditional banks can fail because banks do not have sufficient funding to engage in lending activities. This can be due to too small banking sector compared to the economy driven credit demand or too low credit quality (i.e. high credit rating scores or debt overhang) which, together with regulatory restrictions, limit banks to lend to this specific segment. In both cases, borrowers would seek alternatives to fulfil credit demand and

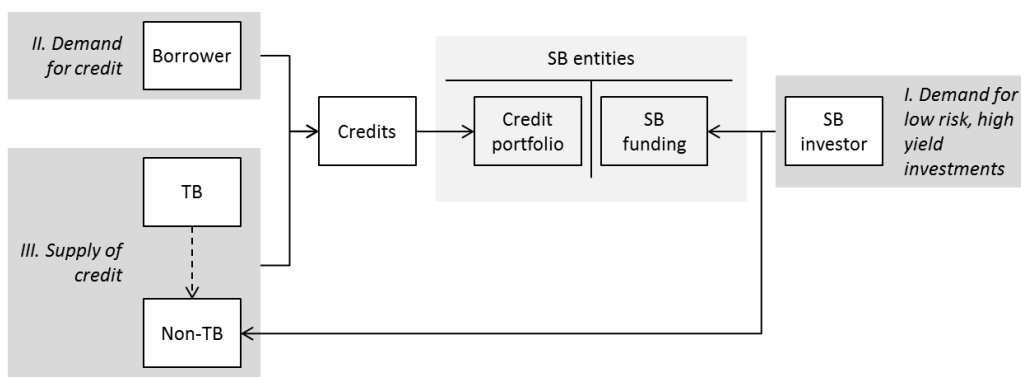
approach non-bank shadow banking institutions.<sup>10</sup> When regulation prevents traditional banks to engage in business they are also more prone to shift their activities into shadow banking, conducting regulatory arbitrage. Shadow banking hence ends up with lower credit quality in a less regulated environment. Luck and Schump (2014), conclude that this type of shadow banking is more likely to tender a financial crisis. However, the shift into shadow banking is only possible if sufficient investors provide money for the investment and funding instruments of shadow banking. In the following those three drivers are explained in more detail.

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**Figure 5: Drivers of Shadow Banking**

The figure shows the general drivers of shadow banking. Shadow banking entities thereby represent the shadow banking market and are shown with their balance sheet consisting of credit portfolio which is funded through shadow banking funding (e.g. repos, securities lending). In order for shadow banking entities to obtain funding shadow banking investors must have a demand for those funding instruments. The products of shadow banking consist of pooled loans (e.g. ABS). Hence, sufficient loans must be available for securitization. A credit will be loaned when there is demand for credit and this demand can be fulfilled by either a traditional bank or a non-traditional banks like shadow banking entities. In case traditional banking is restricted in its lending, it might shift activities into shadow banking sector (dashed arrow).

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**Demand for low risk, high yield investments**

As explained earlier, main investors in shadow banking are MMFs and other investment funds, which seek safe funding. Literature confirms that those investors often invest in the shadow banking sector and that hence the size of shadow banking is related positively to the growth and size of those institutions (IMF, 2014). Sundaram (2014) explicitly points out that the rapid growth in demand for liquid

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<sup>10</sup> Poszar (2013) explains, for example, that in the U.S. the credit used for securitization are often subprime and include commercial mortgages, leveraged loans, credit card and car loans but also corporate loans with low rating. In emerging markets, however, also high quality borrowers shift to shadow banking simply because traditional banking sector is too small to fulfil the demand.

investments is one reason for the growth of shadow banking. Especially, MMFs are funding providers in the repo market. Therefore, Gorton and Metrick (2012) use the size of MMFs as a proxy for available funds to shadow banking entities. The demand in general for investments can be approximated through global liquidity. IMF (2013, 2014) uses therefore total claims in a driver analysis of shadow banking and receives positive but insignificant results.

However, in order to arrive at the net available funding, the specifics of the investment instruments have to be considered. Wholesale funding of shadow banking is conducted through instruments such as repos and securities lending (St. Louis FED, 2011). Those collateral transactions are an exchange of securities for cash (Adrian and Shin, 2009a). As institutional investors seek for riskless investments, the underlying collateral of those transaction must be also sufficiently safe in order to attract capital (Gennaioli, 2013). The haircut determines the amount of cash available based on the quality of the collateral. Therefore, the amount available to the shadow banking system depends largely also on the magnitude of the haircut and hence ultimately on the value of the collateral. Since haircuts are a way to securitize an investment, the buyer increases the haircut when the perceived risk of the underlying collateral increases. With very safe and stable collateral shadow banking's size should not be affected by that. However, this changes when the collateral is riskier and more volatile. In this case, the daily resettling of the haircut can lead to leverage and liquidity reductions in the shadow banking sector.<sup>11</sup> Hence, shadow banking investments can only be considered liquid during stable periods. Therefore, Adrian and Shin (2009a) conclude that leverage and liquidity of shadow banking entities are pro-cyclical as they depend mainly on collateral financing. Moreira and Savov (2014) pinpoint that a subsequent flight to quality can even reinforce illiquidity in the market as safe collateral becomes more scarce and expensive. Consequently, also the shadow banking size should depend upon the perceived risk as well as state of the economy. Gorton, Metrick (2012) and Hui et al (2009) use the spread between the interbank offer rate and the overnight indexed swap rate as a proxy for counterparty risk in the banking system. To account for the

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<sup>11</sup> Moreira and Savov (2014) make this point even more clear by labelling repos and ABCPs as *shadow money*. The spread between shadow money and money becomes larger the more uncertainty is in the economy.

pro-cyclicality of shadow banking's balance sheet Duca (2014) suggests the lagged slope of the yield curve as a proxy for the economic outlook and volatility indices as a measure for uncertainty in the economy.

Finally, MMFs and alike investors are constantly on the search for high yield. Therefore, opportunity cost play an important role in explaining the negative correlation between shadow banking and interest rates. Investments into shadow banking become more attractive when official short-term interest rates, like the money market rate and federal funds targets reduce (Adrian and Shin, 2009a; IMF, 2014). As such, the growth of shadow banking especially spurred during the low interest period in mid-2000s.

### **Demand for credit**

Shadow banking products like ABS and ABCPs are constructed based on a pool of loans. The issuing of credits depends in parts on the demand for credit. Hence, it is expected that shadow banking's size positively varies with the amount of credit demanded. However, measuring credit demand is difficult because the demand itself is not observable; only the credit that is finally awarded can be observed. One possibility to measure credit demand are enterprise surveys. Yet, those survey results are not available across all countries used in this study. Alternatively, Everaert et al (2015) argue that general credit demand is associated with "economic growth, rapid income convergence, rising house prices, and low real interest". IMF (2014) finds significant evidence that GDP positively explains shadow banking size. Finally, the demand for credit is also dependent on the debt overhang of borrowers since it limits borrowers to receive new credit due to too high existing debt load (Everaert et al, 2015).

### **Supply of Credit**

Credit demand can be fulfilled by traditional banks or alternative funding sources. The ability of traditional banks to fulfil credit demand depends on several factors. First, banks need to have sufficient funding, i.e. deposits, to fund their lending activities. Even though banks might have sufficient funding, the ability to lend might be limited by regulation, business outlook and also profitability.

The gross amount of funding available to banks depends on their aptitude to attract funding through interest rates. Furthermore, savers must be willing to deploy their deposits with banks. This depends on the risk associated with such an investment. The more risk savers associate with banks and the less trust they have into the system the less they deposit with banks. IMF (2014), for example, finds significant evidence that banking crises have a negative impact on shadow banking size.

The actual lending to corporates and individuals through traditional banking is also determined by regulation. This has been constantly pointed out by banks in the media and is confirmed academic wise by, for example, Peek and Rosegreen, (1995) Bernauer and Koubi (2004). Therefore, regulatory arbitrage is one main reason for the emergence of shadow banking and continues to play a role in affecting the size of shadow banking in Europe and the U.S. (IMF, 2014). Especially, the Basel Accord in 1988, imposing capital rules, led to higher securitization of low quality loans (Allen, 2004). In Mexico regulatory arbitrage but also the support of government led to the growth of special-purpose non-bank financial institutions, which promoted heavily the mortgage financing of lower and mid-income households (IMF, 2014). In a driver analysis, IMF (2014) identifies a significant and positive relationship for the level of capital stringency, bank regulation and shadow banking.

Another important factor is the banking sector size measured by banks' aggregated assets. It not only tells about the ability of banks to fund credit but, as literature suggests, banking sector size is directly linked to the size of shadow banking. Mandel et al (2012) find that traditional banking cannot be seen isolated from shadow banking since traditional banks contribute a significant amount to securitization and often have their own entities carrying out securitization. This is supported empirically by IMF (2014), who finds that the shadow banking size is associated with the growth of banking sector. The evidence shows also for India that shadow banking is rather a complementation of traditional banking than a replacement. Acharya, Khandwala and Öncü (2013) demonstrate that shadow banking entities support banks in nonurban areas where banks do not have branches.

Finally, banks must be able to profit from the investment in credits. Therefore, the return on credit influences the amount lent. Also, inflation is expected to have an impact, though negative, as it erodes banks' capital and discourages financial transactions (Everaert et al, 2015).

Next to traditional banking, shadow banking institutions, such as dealer and dealer banks, as well as other financial institutions, can fulfil credit demand. The assets of those institutions are, however, already accounted for in the OFI measure and hence cannot be tested separately.

## 4 Data

One reason for the few empirical studies on shadow banking might be the lack of data. Data collection has only started in recent years and stays an ambitious task, owing to heterogeneity across countries and shadow banking's fluctuating character over time. As outlined earlier, the OFI variable, which is in this analysis used as an approximation of shadow banking, is the best available measure for the purpose of this analysis and with a long enough times series. (Poszar, 2010) argues that deductions on shadow banking are admitted since shadow banking is market-based funding's main driver. OFI data are provided by the FSB and range from 2002 to 2014. They are available for 26 jurisdictions<sup>12</sup>, which account for 80% of GDP worldwide as of 2014 and therefore give a very complete picture of the global shadow banking (FSB 2015).

Based on the literature review of the drivers of shadow banking, an initial set of explanatory variables is gathered for all 26 countries (Appendix 5).

Variables describing the *demand for low risk, high yield investments* will be outlined first. The money available for investments in general is represented through global liquidity and uses total claims (ClaimsTotal), considering bank and non-bank claims (BIS, 2011). The funding, available to shadow banking entities, is represented through the aggregate assets of institutional investors (InstInv); using

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<sup>12</sup> The countries reporting Shadow banking data are: Argentina, Australia, Brazil, Chile, Canada, China, France, Germany, Hong Kong, Italy, India, Indonesia, Ireland, Japan, Korea, Mexico, Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Turkey, Switzerland, United Kingdom, and the United States.



FSB data and includes “assets of insurance companies and pension funds” (IMF, 2014). The actual amount invested into shadow banking depends on the perceived risk-return profile. To replicate the risk, first, the counterparty risk is represented by IOROIS, the spread between the interbank offer rate and the overnight indexed swap rate. Furthermore, the lagged slope of the yield curve (YieldCurve) accounts for the pro-cyclicality of shadow banking’s balance sheet and local volatility indices (StockVola) are a measure for uncertainty in the economy, using Bloomberg data. The opportunity cost of investors is represented by the money market rate (MMrate), derived from IFS. Other data describing the shadow banking sector more closely, for example, data on ABS, ABCPs, repos, securities lending, are not available on the required country level.

In order to approximate the *demand for credit*, the state of the economy is reflected by GDP, GDP per capita (GDPCapita) and the unemployment rate. These measures are not flawless since they come with noise, driving credit demand but also its supply. Borrowers demand is further determined by borrower’s current level and quality of funding; namely, non-performing loans (NPL\_Loans). The measure in this analysis is the ratio of bank non-performing loans to total gross loans (World Bank, 2016). Furthermore, the cost of credit plays a role and hence variables like lending interest rate (LendIR), inflation and inflation expectation (InflExpc) are tested. For corporate borrowers also alternative funding sources such as stock market is relevant and therefore local stock index return (StockRet) by Bloomberg included.

Finally, the variables for *supply of credit* are described. Traditional bank’s ability to attract funding through interest rates is reflected through the deposit interest rate (DepIR), the rate of return of alternative investments, such as MMrate and StockRet. For this purpose, also inflation is considered. The risk of banks can be expressed by bank Z-score (BankZScore) and a banking crisis dummy (BankCrisis)<sup>13</sup>. The impact of regulation is considered through variables like capital

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<sup>13</sup> The banking crisis dummy reports 1 for times of crisis and 0 for expanding periods. Conditions for a banking crisis are met when, first, financial distress in the form of bank runs, losses and/ or liquidations are detected among banks. Second, banking policy intervention measures must response to significant losses. The crisis starts in the year where both criteria are fulfilled and ends year before real GDP and real credit grow for two consecutive years. (World Bank, 2016)

stringency (CaString), capital regulatory index (ovr\_cap\_string) and supervisory power index.<sup>14</sup> This analysis further tests ratios like bank regulatory capital to risk-weighted assets (RegCa\_RWA) and bank deposits to GDP (FIDep\_GDP). Since shadow banking seems also to be related to the banking system size the aggregate assets of banks (Banks) and their growth (BanksG) are tested. Banks profitability in lending is dependent on the lending interest rate (LendIR) and inflation diminishes bank's profit. Also, the general return on equity (BankROE) is tested. The degree of competition potentially also presses profit margins and is represented by banks' concentration (BankConc), which is the assets' share of the three major local commercial banks.

An overview of all variables and their sources can be depicted from the Appendix 4. In general, the variables used to identify the three drivers in this analysis, are noisy and, in fact, could arguably be used to identify alternative mechanisms as well. Hence, some care must be taken when interpreting the evidence.

## 5 Methodology

When it comes to the methodology several approaches are at choice. The data, including time series and cross sections, can be either pooled or treated as panel data, also known as longitudinal data. In order to use the appropriate approach, Kennedy (2008) suggests to test, first, whether the intercepts of all variables are equal. If the null hypothesis is accepted, which is not expected, a pooled cross-sectional analysis is conducted. In general, Baltagi (2008) pinpoints that pooled data are inferior towards panel data since they do not account for heterogeneity across units and also do not consider time-invariant omitted variables. Furthermore, autocorrelation and multicollinearity are less of an issue with panel data.

Next, it can be chosen from the fixed effect and random effect model. In the random effect model, the effects are captured by the intercepts and a random component. This approach, however, still does not account for the potential bias through different intercepts and leads to omitted time-invariant characteristics (e.g. risk aversion or culture). In the fixed effect model, also known as least square dummy

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<sup>14</sup> All three measures are survey results based on data from Barth, Caprio and Levine (2013).

variable estimator (LSDV), this bias is corrected through dummy variables, accounting for the different intercepts.

Kennedy (2008) recommends to formally test with the Hausman test whether to use the fixed or random effect model. The Hausman test is based on the reasoning that the random effect model should be used when the composite error does not correlate with the independent variables. The test is, however, not seen as reliable, especially, with smaller data sets (Baum, 2006). Therefore, the test is regarded as redundant and it is decided to proceed with the fixed effect model.

In this analysis a two-way fixed-effect model, using time and cross-sectional estimators, is used. Thereby, the model leaves only the slope responsible for the variation of the dependent variable (Kennedy, 2008). The following regression model with  $j$  representing each country,  $t$  the respective year and  $n$  the cause, is used for the subsequent tests<sup>15</sup>:

$$OFI_{jt} = \sum_{i=0}^n \alpha_{n,jt} \text{ CAUSE}_{n,jt} + \alpha_{n+1,t} \text{ Entity FE}_t + \alpha_{n+2,j} \text{ Time FE}_j + \varepsilon_{jt}$$

Bertrand, Duo and Mullainathan (2004) recommend to use clustered standard errors in fixed-effect regressions since the common standard error does not account sufficiently for serial correlation and hence understates.<sup>16</sup> Furthermore, bootstrapping, a statistical resampling method, is applied. To evaluate the fit of the model the Wald Chi-square test is considered.

In order to test for robustness, the variables are tested over different regressions. For this purpose, first, IMF results are replicated. In the second analysis each of the 30, earlier identified, variables are regressed individually on the shadow banking measure. This exercise is conducted for all countries and for developed and emerging countries separately.<sup>17</sup> This exercise shows that shadow banking in those two country groups is driven by different factors. Hence, subsequent analysis continues with the data grouped by country. In a next step, the explanatory variables

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<sup>15</sup> For the purpose of this analysis the variables are standardized by subtracting the mean and dividing by the standard deviation.

<sup>16</sup> On the other hand, there is also evidence that clustering standard errors with less than 50 groups, which is the case here, overstates the results (Cameron and Miller, 2013).

<sup>17</sup> Developed countries: Canada, Australia, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, Spain, Switzerland, United Kingdom, United States; Emerging countries: Argentina, Brazil, Chile, China, India, Indonesia, Mexico, Russia, Saudi Arabia, Turkey

are assembled in regressions according to the, in section 3.3., identified three main drivers. Finally, the data are split into pre and post Financial Crisis. The models are evaluated based on the R-squared, the coefficient's P-value and the Wald Chi-square.

## 6 Results

The following section describes the results obtained from the just described methodology and approach. It continues with a discussion on these results and finishes with a section on the limitations of this analysis.

### 6.1 Results Presentation

The results summarize regression results from an IMF driver analysis replication, the regression of individual variables on shadow banking, variables grouped by, the in section 3.3. presented, theoretical model and finally shows pre and post Financial Crisis results.

#### IMF (2014) Replication

The earlier mentioned study by IMF (2014) on the growth of shadow banking, is used as a starting point for the analysis. IMF (2014) uses also OFI data by FSB for the period of 2002 to 2012 as the explanatory variable.<sup>18</sup>

The regression in this thesis is once conducted for 15 countries, accounting for 11 developed and 4 developing countries. The variables and their results can be depicted from Table 1. Compared with the IMF (2014) results, the here presented outcomes are rather disappointing since only BankCrisis is significant, though at a 1%-level. The sign is positive in this analysis but negative in IMF's (2014). IMF (2014) also reports Banks, InstInv and YieldCurve as significant, which cannot be confirmed.

The reason for the deviating results might be that this analysis includes two more years (2013 and 2014). As can be seen later, the explanatory power of variables has in general decreased after the Financial Crisis and therefore reduces also the explanatory power of the variables over the complete period. Furthermore, from the IMF report it

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<sup>18</sup> IMF (2014) uses, however, the growth of the OFI measure; whereas, here the absolute size is used. Data for 25 countries were available. The regression analysis did not distinguish between emerging and developed countries and also not between pre and post Financial Crisis.

is not clear which specific methodology they apply. Therefore, also differences in the methodology might affect the results.

R-squared is high for both regressions and increases from 64% for all countries to 67% when focusing on developed countries. Finally, the regressions have sound Wald Chi-square results, which confirms the two-way fixed-effect methodology.

**Table 1: IMF analysis replication**

The analysis conducted in this table is based on IMF (2014) panel regression on the flow of funds measure by FSB. The analysis uses two-way fixed effect panel regression methodology.

The table reports the coefficients of the explanatory variables with bootstrapped standard errors (SE), clustered by country. The significance level is represented by stars; \* presents a significance level of 1%, \*\* a significance level of 5% and \*\*\* a significance level of 10%. Observations are the number of bootstrap replicates used. The R-squared is presented as well as the Wald Chi-square (Wald) and its P-value.

	All Countries		Developed	
	Coef.	SE	Coef.	SE
BankCrisis	0.0813*	0.0286	0.0991***	0.0508
GDP	-0.1800	0.7157	0.2328	1.3529
Banks	0.3856	0.2998	0.3006	0.4556
InstInv	0.4245	0.4708	0.1156	0.6538
YieldCurve	0.0003	0.0342	-0.0018	0.0454
Cap_string	0.0069	0.0581	0.0008	0.0658
Constant	0.0489	0.1569	-0.0209	0.2513
R <sup>2</sup>	0.6402		0.6665	
Observations	26,600		19,800	
Countries	15		11	
Wald	147.42		70.38	
P-value	0.0000		0.0000	

### Individual Variables

To further investigate the driving variables of shadow banking, each variable (in total 30) is regressed on the shadow banking measure with the two-way fixed effect regression model. The results are presented in Table 2. When including all countries, several significant variables are identified. InstInv and BankCrisis have additionally high coefficients of 0.81 and 0.12, respectively and high R-squared of 40% and 60%. Significance, nevertheless, vanishes for most variables when splitting up the data into developed and emerging countries. InstInv seems to be, however, significant for all country groups, at a 1%-level for all countries and emerging countries. For emerging countries InstInv is the only significant variable and has a higher coefficient of 0.99; reporting a R-squared of 82%. For the developed countries significance of InstInv is at a 5%-level, with a coefficient of 0.77. For developed countries, Banks and GDP influence positively the size of shadow banking; with 1% significant coefficients of

0.52 and 0.87, respectively. Also, BankCrisis is significant at a 5%-level with a 0.54 coefficient. All regressions have reasonable Wald Chi-square results, justifying the usage of the methodology. Due to the differences in emerging and developed countries the hereinafter tests split up the data by emerging and developed countries.

**Table 2: Individual Regression Results – Excerpt: most significant variables**

The analysis in this table regresses each individual variable on the shadow banking measure using two-way fixed-effect panel regression methodology. The table reports the coefficients of the explanatory variables with bootstrapped standard errors (SE), clustered by country. The significance level is represented by stars; \* presents a significance level of 1%, \*\* a significance level of 5% and \*\*\* a significance level of 10%. Observations are the number of bootstrap replicates used. The R-squared is presented as well as the Wald Chi-square (Wald) and its P-value.

<b>All Countries</b>	<b>Coef.</b>	<b>SE</b>	<b>R<sup>2</sup></b>	<b>Wald Chi</b>	<b>N</b>	<b>Count.</b>
BankConc	0.1217***	0.0702	34%	65.02*	59,000	26
Sup_Power	-0.0599	0.0374	33%	45.98*	57,400	24
BankNPL_Loans	0.0515***	0.0265	32%	39.59*	61,600	26
StockRet	0.0363	0.0231	30%	39.46*	62,400	26
BankCrisis	0.1224*	0.0434	40%	38.08*	52,000	26
InstInv	0.8081*	0.2914	63%	221.94*	67,600	26
BankRegCap	0.0718*	0.0210	32%	53.96*	61,400	26
<b>Developed</b>	<b>Coef.</b>	<b>SE</b>	<b>R<sup>2</sup> (w)</b>	<b>Wald Chi</b>	<b>N</b>	<b>Count.</b>
Banks	0.5207*	0.1697	63%	271.39*	39,000	15
GDP	0.8701*	0.2967	59%	97.26*	36,000	15
BankCrisis	0.1327**	0.0598	49%	70.6*	30,000	15
InstInv	0.7329**	0.2902	66%	106.17*	39,000	15
<b>Emerging</b>	<b>Coef.</b>	<b>SE</b>	<b>R<sup>2</sup> (w)</b>	<b>Wald Chi</b>	<b>N</b>	<b>Count.</b>
InstInv	0.9923*	0.3792	82%	171.65*	28,600	11

### Driver Classification

The subsequent presents the results from regressions that classify the variables from the literature review into the three main drivers from section 3.3. Table 3 presents those results, distinguishing in emerging and developed countries. It shows that, among the factors driving *credit demand*, inflation plays a role in developed countries with a 0.53 coefficient; significant at a 10%-level. In emerging markets, LendIR and BankNPL\_Loans are significant at 5% and have larger coefficients of 1.31 and of 0.30, respectively. Also GDP plays a role with 1.04 at a 10% significance level. R-squared for those variables are high with 70% and 89% for developed and emerging countries, respectively.

Among the drivers for *low yield, high risk investments*, InstInv is again significant at 5%-level for developed countries and has a coefficient of 0.71, similar to the previous analysis (0.73). In emerging countries, ClaimsTotal, representing global liquidity, is

this time significant at 10%. However, the negative sign of the coefficient (-0.21) is unexpected since this means that shadow banking increases with decreasing liquidity.

For the variables belonging to *credit supply*, developed countries do not have any significant variable and also the R-squared is low with 7% and 3% for developed and emerging countries, respectively. Emerging countries report BanksG and BankCredToDep as significant at 10% and 5%-level. The reason for the unsatisfying results can be endogeneity issues. To account for that already regulatory variables are disregarded; as also IMF (2014) suggests.

**Table 3: Regression analysis by driver classification**

The analysis split up the variables into their main drivers: *credit demand* (panel A), *demand for high yield, low risk investment* (panel B) and *credit supply* (panel C), presented in section 3.3. The table shows the coefficients (Coef.) of the explanatory variables with bootstrapped standard errors (SE), clustered by country. The significance level is represented by stars; \* presents a significance level of 1%, \*\* a significance level of 5% and \*\*\* a significance level of 10%. Observations are the number of bootstrap replicates used. The R-squared is presented as well as the Wald Chi-square (Wald) and its P-value.

A. Credit Demand	Developed		Emerging	
	Coef.	SE	Coef.	SE
BankNPL_Loans	-0.0029	0.2392	0.2987**	0.1374
LendIR	-0.0121	0.1542	-1.3128**	0.6311
StockRet	0.0180	0.0558	0.0112	0.0526
GDP	0.8737	0.5710	1.0242***	0.5730
GFPCapita	0.2187	0.5431	-0.4279	1.6480
Unemployment	0.2175	0.2828	-0.3236	0.7367
Inflation	0.5294***	0.3053	-0.2536	1.6613
InflExpec	-0.2795	0.2192	0.7985	1.5983
Constant	0.0763	0.8485	-0.0597	1.1051
R <sup>2</sup>	0.7024		0.8854	
Observations	22,200		16,800	
Countries	12		7	
Wald	44.17		83.21	
P-value	0.0009		0.0000	

B. Low yield, high risk	Developed		Emerging	
	Coef.	SE	Coef.	SE
ClaimsTotal	0.1965	0.6105	-0.2082***	0.1246
IOROIS3m	0.0577	0.0550		
StockVola	-0.0514	0.0888	-0.0054	0.0186
InstInv	0.7133**	0.2996	0.1884	0.2215
YieldCurve	0.0185	0.0893	-0.0028	0.0326
MMrate	-0.0618	0.1552	-0.0250	0.0716
Constant	-0.0257	0.4395	-0.0789	0.1225
R <sup>2</sup>	0.6658		0.9327	
Observations	19,000		8,600	
Countries	8		4	
Wald	85.89		12229.97	
P-value	0.0000		0.0000	

C. Credit Supply	Developed		Emerging	
	Coef.	SE	Coef.	SE
BankConc	0.0619	0.0435	0.2520	0.5048
BankROE	-0.0067	0.0141	-0.0466	0.1242
DepIR	-0.0284	0.0868	-0.4954	0.5638
BankZscore	-0.0224	0.0272	-0.0739	0.4190
Banks	0.0946	0.5078	0.7740	3.0683
BanksG	0.0031	0.0291	-0.1008***	0.0521
BankNPL_Loans	0.1974	0.1620	0.1110	0.2125
FIDep_GDP	-0.0162	0.1433	-0.2457	0.4529
LendIR	0.0451	0.1093	-0.3702	0.5903
StockRet	0.0279	0.0437	0.0746	0.0702
BankCredToDep	-0.0037	0.0961	1.5461**	0.7117
Inflation	0.0014	0.0284	0.1892	0.2447
BankRegCap_RWA	-0.0129	0.0493	-0.0857	0.1663
Constant	-0.1774	0.3053	-0.2358	1.1997
R <sup>2</sup>	0.0722		0.0348	
Observations	15,400		13,200	
Countries	11		7	
Wald	46.44		63.99	
P-value	0.0026		0.0000	

### Pre versus Post Financial Crisis

Finally, the data are split up into pre and post Financial Crisis<sup>19</sup> due to the expectation that the explanatory power of variables changes after the crisis owing to changes in regulations and the shadow banking system. For the purpose of this analysis all significant variables from the analysis before are included. Before the Crisis, again, BankConc and BankCrisis help explain the size of shadow banking in developed countries. Both variables are significant at a 1%-level. Also the the R-squared is lower (59%) after the Crisis than before (87%). For emerging markets, once more, InstInv is the only explanatory variable with a 10% significance level. Indeed, the post crisis results show that the initial expectation is verified. After the Financial Crisis the explanatory power of the variables is lost completely; even though the R-squared increase from 86% to 93%.

Summarizing, shadow banking in developed countries is likely to be positively driven by BankCrisis. The variable shows significance across all analyses with coefficients between 0.08 and 0.13; hence, robustness is assumed. Furthermore, shadow banking in developed markets can be further driven by the size of institutional investors as well as inflation rate. Both variables are significant but not robust across all

<sup>19</sup> The pre-crisis is defined as 2002-2008 and post crisis includes the years 2009-2014.



regressions. Thereby the majority of the variables fall into the main driver *credit supply*. Significant drivers with low robustness are also GDP, Banks and BankConc. In emerging markets, shadow banking is mainly driven by the size of institutional investors; significant across all analyses. Other significant factors but with low robustness, are BankNPL\_Loans, LendIR, GDP, ClaimsTotal and BankCredit\_Dep. For emerging countries, hence the factors stem mainly from the drivers *credit demand* and *demand for low yield, high risk investments*.

**Table 4: Pre versus Post Financial Crisis for Developed and Emerging Countries**

The analysis uses well performing variables from the previous analysis and splits up the data into pre (2002-2008) and post (2009-2014) financial crisis for developed and emerging countries. The table reports the coefficients of the explanatory variables with bootstrapped standard errors (SE), clustered by country. The significance level is represented by stars; \* presents a significance level of 1%, \*\* a significance level of 5% and \*\*\* a significance level of 10%. Observations are the number of bootstrap replicates used. The R-squared is presented as well as the Wald Chi-square (Wald) and its P-value.

A. Developed	Complete Period		Pre-Crisis		Post-Crisis	
	Coef.	SE	Coef.	SE	Coef.	SE
BankConc	0.1428*	0.0548	0.1148*	0.0408	-0.0412	0.0853
GDP	0.8954	1.0279	0.8215	0.6141	-0.0153	0.7346
Sup_Power	-0.0796	0.0786	-0.0426	0.1660	-0.0142	0.0549
BankNPL_Loans	0.0950	0.0843	0.0502	0.0575	0.0241	0.1050
StockRet	-0.0357	0.0918	-0.0207	0.0513	-0.0326	0.0460
BankCrisis	0.1068**	0.0432	0.0823*	0.0304	-	-
InstInv	-0.1920	0.7680	0.5424	0.5958	0.6189	0.7325
BankRegCap_RWA	-0.0586	0.0491	-0.0448	0.0389	0.0031	0.0399
Inflation	0.1362***	0.0756	0.0900	0.0595	0.0007	0.0474
Constant	-0.0423	0.2072	-0.2864	0.2310	0.1343	0.3020
R <sup>2</sup>	0.6990		0.8685		0.5932	
Observations	20,800		13,600		11,400	
Countries	12		12		12	
Wald	121.57		103.96		13.08	
P-value	0.0000		0.0000		0.3630	

B. Emerging	Complete Period		Pre-Crisis		Post-Crisis	
	Coef.	SE	Coef.	SE	Coef.	SE
LendIR	-0.1890	0.2461	-1.0187	0.9304	-1.1178	1.9796
ClaimsTotal	-0.4579	0.7414	0.9620	1.2702	-0.1329	1.6450
BankConc	0.2647	0.2827	1.3631	1.0550	0.2214	8.0762
GDP_USD	0.1169	0.6988	-0.4654	0.7554	0.8394	3.0955
Sup_Power	-0.0088	0.0797	-0.1137	0.1817	0.1755	8.0656
BankNPL_Loans	0.1782	0.1221	0.2567	0.5905	0.2646	4.0164
StockRet	0.0309	0.0932	0.1727	0.2504	-0.2297	0.6821
BankCrisis	-0.0819	0.0656	-0.0130	0.2061		
InstInv	0.7982***	0.4638	0.8424***	0.4974	0.0105	8.9107
BanksG	-0.0636	0.0421	0.0578	0.1767	-0.1187	0.2548
BankCredTODep	1.1084***	0.5871	-0.7882	1.2211	0.7943	4.5237
Constant	0.6090	0.8631	-0.3206	2.0735	0.4744	2.7659
R <sup>2</sup>	0.8840		0.8618		0.9330	
Observations	14,400		9,600		4,800	
Countries	9		9		8	
Wald	41.4		31.73		40.17	
P-value	0.0021		0.0108		0.0001	

## 6.2 Discussion

The following section will discuss the results and puts them into context of existing literature. First, the results suggest that explanatory power of the drivers is present before the Financial Crisis. After the Financial Crisis, this power reduces; in fact, no significant explanatory power is identified in, both, emerging and developed countries for the post-crisis period. This pattern can be a result of a changing shadow banking system due to the Financial Crisis and subsequent regulation changes. Indeed, the system changed. For example, the usage of SIVs was discontinued after the Financial Crisis and in general the shadow banking market experienced an abundance of capital owing to high insecurity (PWC, 2011). Due to the explanatory power of variables after the Crisis the following interpretation of the results mainly allows deduction on shadow banking's behaviour preceding the Financial Crisis and it is questionable if the same drivers will apply again in the future.

One prominent driver of shadow banking is the size of institutional investors; being more relevant in emerging markets. This means that, especially, in emerging markets shadow banking was driven mainly by institutional investors, which are assumed to have demand for low risk, high yield investments. Indeed, there is evidence that, except for a drop in 2007 and 2008 investments into emerging markets was growing (Ahmed and Zlate, 2014). This corresponds to empirical evidence by IMF (2014), Sunderam (2014), Gorton and Metric (2012), who see institutional investors as one driver of shadow banking. This is only logical as all the, by shadow banking entities produced, products only sell if demand is available.

The results also show that shadow banking in developed countries increases during banking crises. First, this could relate back to the earlier mentioned necessary trust, important to attract deposits. In banking crises this trust can vanish and investors and depositors withdraw money from banks and instead invest into safer, more liquid alternatives, such as MMFs (Barghini, 2015). Indeed, Bengtsson (2013) summarizes evidence that investors perceive MMFs as more safe than ordinary banks during times of turmoil. Second, the result can suggest that shadow banking works as a puffer towards traditional banking. There is evidence that banks' balance sheet is pro-cyclical due to fair value accounting, which limits banks' ability to lend during periods of crisis (Novoa, Scarlata and Solé, 2009). In general, this fits with evidence

from Acharya, Khandwala and Öncü (2013), stating that shadow banking acts rather as a complementation than a substitute. Even though the demand for credit during such periods is also expected to decrease, banks might still not be able to fulfil the demand. The growth of shadow banking, hence, will be driven, especially by low quality credit which cannot be financed by traditional banking. On the other hand, the funding of credits might be risen through off-balance sheet shadow banking entities, sponsored by traditional banks avoiding regulatory pressure. Another reason for these results can be significant changes in regulation, which led to changes in the shadow banking sector. Finally, the results might not be insightful at all as the variable banking crisis reflects in essence counterparty risk, which varies significantly with the business cycle. Hence, the variable might only capture business cycle fluctuations.

At least in developed countries, inflation has a positive effect on the size of shadow banking. This confirms the idea that shadow banking is related to demand for credit as credit demand is expected to grow during times of high inflation (Everaert et al, 2015).

Even though the robustness of the following presented variables is lacking, they will be briefly interpreted as well. Bank concentration, referring to how concentrated the banking sector is, reports in two analyses significance for developed countries; with coefficients of 0.12 and 0.14. This means that shadow banking is likely to be also influenced by the competition in the banking sector. The more concentrated the banking sector in developed countries the more shadow banking is existent.

In emerging markets, the ratio of credit to deposits reports twice significant results with coefficients of 1.55 and 1.11. This indicates that in countries, where less deposits back credits and hence higher liquidity risk is present, the shadow banking sector is bigger. An explanation might be that such a state leads to more securitization of credit by banks in order to transfer their risk. The result can be, however, also due to endogeneity since an already large shadow banking, offering securitization services, can be also the cause for the higher credit to deposit ratio. Nevertheless, the variable is not very robust since the insignificant coefficients have different signs and size.

Relating back to the general drivers presented in section 3.3, the results indicate that shadow banking in developed countries is mainly driven by credit supply factors; meaning that when traditional banks are big and can fulfil credit demand this leads to an increase in shadow banking. In emerging countries, shadow banking is, first, driven by the demand for credit; confirming evidence that shadow banking is here a complementation. Furthermore, it is driven by demand of institutional investors for low yield, high risk investments.

### **6.3 Limitations**

Despite measure to strengthen the results through robustness checks the results are regarded as rather indicative due to several reasons. First, the data are only available on an annual basis over a period of 2002-2014. This time period might be too short and with too few data points to give precise results. Especially, the Financial Crisis from 2007 to 2008 might skew the results. Second, total assets of OFI is only an approximation of shadow banking and hence deductions onto shadow banking might not always be appropriate.

Problematic is also endogeneity, which, first, arises through the closeness of shadow and traditional banking. Both sectors are, in fact, driven by similar factors, making joint estimation necessary. Second, endogeneity might also arise due to closeness of the chosen variables.

Due to the above mentioned arguments, the results cannot be interpreted causally but still provide insights through correlations.

## **7 Conclusion**

The analysis shows that shadow banking in emerging and developed countries is driven by different factors. Developed countries' shadow banking is larger during times of crises, which confirms existing empirical research. The reason for this result, whether shadow banking serves as a puffer or only replicates the business cycle, is however less clear and should be investigated more closely. Nevertheless, the positive relationship towards banking crisis emphasizes the high and complex interconnection of traditional and shadow banking. It can be hence concluded that in developed countries the size of shadow banking depends more on the ability of traditional banks

to fulfil demand. For emerging countries, the size of institutional investors drives the size of shadow banking; meaning that demand for low risk, high yield investments is the major driver. Finally, the analysis demonstrates that explanatory power of the variables vanishes after the Financial Crisis, which can be due to a changed financial system and new regulation.

Shadow banking, making part of market-based funding, will grow further in the next years due to a general shift to market-based funding. Regulators are aiming to secure the shadow banking system and implement forward looking regulation; hence limiting its downside risks. However, due to shadow banking's inherent dynamic nature regulators will always struggle to foresee new and harmful developments. This is one more reason why a thorough understanding of shadow banking's drivers is important. The main identified factors in this analysis, banking crisis and size of institutional investors, should be examined more closely in order to derive a logical explanation. For example, to get a better understanding of the role of institutional investors in emerging markets the set of explanatory variables can be increased to variables describing the openness of the financial sector to foreigners and openness of foreign markets to domestic residents' borrowing. To understand the effect of banking crisis on shadow banking it might be worthwhile to see which part of shadow banking increases in times of crisis.

Furthermore, with better data at hand, it will be of interest to conduct a deeper analysis on the countries that are potentially most negatively affected by shadow banking. For example, countries where shadow banking exceeds the traditional banking sector should be studied more closely since they are, according to Luck and Schump (2014), the countries where the two sectors are more closely interconnected and hence effects are most harmful.

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## 9 Appendix

### 9.1 Appendix 1: OFI's and Bank's Assets Development in each Country



### 9.2 Appendix 2: Country Comparison

**Table 5: Country Selection**

The table shows shadow banking (SB), represented by Economic Function measure, over time and in relation to GDP and bank assets. Source: FSB (2015)

<b>SB growth rate 2014 (exchange rate and inflation adjusted; %)</b>	<b>SB growth 2010-2014 (%)</b>	<b>SB Growth rate exceeding GDP growth rate, 2010- 2014; %-points)</b>
China 37.7	China 48.7	China 37.0
Hong Kong 28.7	Argentina 47.7	Hong Kong 30.9
Ireland 23.7	Hong Kong 37.1	Argentina 22.8
Russia 19.4	Russia 32.0	Russia 20.6
Indonesia 18.9	India 17.4	Canada 7.2
Argentina 17.8	Indonesia 16.7	Korea 6.5
Chile 17.0	Saudi Arabia 15.1	Switzerland 6.3
Switzerland 15.0	Brazil 15.1	India 6.1
Korea 14.8	Chile 12.4	Brazil 5.9
Spain 12.9	Canada 11.6	Ireland 5.5
<b>Jurisdiction contributions to SB growth (%)</b>	<b>Jurisdiction share of SB assets (%)</b>	

Master Thesis: Which Factors drive Shadow Banking?

China	3.0	United States	39.7
Ireland	1.8	United Kingdom	11.4
United States	1.6	China	7.7
Japan	0.9	Ireland	7.6
Germany	0.7	Germany	7.2
Canada	0.4	Japan	6.8
France	0.3	France	4.4
Korea	0.3	Canada	2.8
Brazil	0.3	Brazil	1.9
Switzerland	0.2	Korea	1.8

<b>SB/GDP (%)</b>		<b>SB/Banks assets (%)</b>	
Ireland	1190.1	Ireland	328.1
United Kingdom	146.8	United States	67.1
Switzerland	90.3	Mexico	39.4
United States	82.1	Brazil	35.9
Netherlands	73.8	Germany	30.3
Germany	73.0	Canada	25.5
France	60.7	Switzerland	24.8
Japan	60.0	South Africa	24.7
Canada	58.2	United Kingdom	24.4
Korea	47.6	Korea	23.2

### 9.3 Appendix 3: OFI and Economic Function Measure

**Table 6: OFI and Economic Function measure**

<b>Country</b>	<b>OFIs</b>	<b>EF</b>	<b>OFI/EF</b>
India	50.00	56.48	113%
Saudi Arabia	75.16	75.16	100%
Argentina	31.58	31.11	99%
China	63.81	58.06	91%
Russia	48.69	40.98	84%
Chile	25.00	18.19	73%
Mexico	52.36	36.68	70%
Japan	41.44	28.60	69%
France	45.96	29.23	64%
Germany	50.12	31.26	62%
Ireland	89.35	53.41	60%
Turkey	71.95	39.92	55%
United States	50.24	27.79	55%
Brazil	73.01	39.71	54%
Korea	59.08	28.00	47%
South Africa	31.52	13.84	44%
Italy	46.14	20.16	44%
Australia	31.71	13.40	42%
Canada	55.53	21.88	39%
Spain	63.80	19.14	30%
Hong Kong	41.52	9.59	23%
Switzerland	58.04	13.37	23%
Indonesia	58.58	7.49	13%
Singapore	64.12	7.20	11%
United Kingdom	61.52	5.90	10%
Netherlands	76.49	6.74	9%

## 9.4 Appendix 4: Complete list of variables

**Table 7: Complete list of variables**

The table displays the complete set of variables that were deemed to be relevant based on the literature review. The variables represent the drivers presented in section 3.3. The variables were further classified according to their economic representation. Data were retrieved from World Bank, Bloomberg, FSB, BIS and IMF. Based on the literature a specific sign of the coefficient is expected. Above that correlation between the OFI measure and the respective variables are presented.

Driver	Classification	Variables	Source	E(Sign)	Correlation
Demand for Credit	Alternative funding	Stock market return (% , year-on-year)	Bloomberg	-	-0.134
	Cost of Credit	Lending interest rate (%)	World Bank	-	-0.617
	Cost of Credit	Inflation expectations	World Bank	+	-0.673
	Cost of Credit	Inflation	World Bank	+	-0.676
	Debt Overhang	Bank nonperforming loans to gross loans (%)	World Bank	-	0.368
	Economic Condition	GDP (Current USD)	World Bank	+	0.956
	Economic Condition	GDP per capita (Constant 2005 USD)	World Bank	+	-0.384
	Economic Condition	Unemployment, total (% of total labor force)	World Bank	-	-0.129
Demand for low risk, high yield investments	Alternative Investments	Money market rates	IFS	-	-0.538
	Counterparty Risk	Banking crisis dummy	World Bank	-	-0.123
	Counterparty Risk	LIBOR OIS Spread	Bloomberg	-	0.073
	Counterparty Risk	Stock price volatility	Bloomberg	-	0.293
	Economic Condition	Yield curve (short-long)	World Bank	+	-0.007
	Shadow banking funding	Institutional Investor Size	FSB	+	0.969
	Shadow banking funding	Global liquidity indicators	World Bank	+	0.308
Willingness and ability of traditional banks to fulfil the demand	Alternative Investments	Stock market return (% , year-on-year)	World Bank	-	-0.134
	Competition	Bank concentration (%)	World Bank	-	0.475
	Counterparty Risk	Bank Z-score (low = bankruptcy)	World Bank	-/(+)	0.021
	Debt Overhang	Bank nonperforming loans to gross loans (%)	World Bank	+/(-)	0.368
	Profitability	Bank return on equity (% , before tax)	World Bank	-	-0.364
	Regulation	Capital Stringency	Barth,	+	-0.321
	Regulation	Financial Statement Transparency	Caprio and	+	-0.580
	Regulation	Supervisory Power Index	Levine	+	-0.761
	Return on Credit	Lending interest rate (%)	World Bank	-/(+)	-0.617
	Return on Credit	Inflation expectations	World Bank	-/(+)	-0.673
Return on Savings	Deposit interest rate (%)	World Bank	+	-0.396	

Master Thesis: Which Factors drive Shadow Banking?

Return on Savings	Inflation	World Bank	+ / (-)	-0.676
Traditional Banking capacity	Banking Sector Size	FSB	- / (+)	0.975
Traditional Banking capacity	Banking Sector Growth	FSB	+	-0.290
Funding free for lending	Financial system deposits to GDP (%)	World Bank	-	0.903
Funding free for lending	Bank regulatory capital to RWA (%)	World Bank	-	0.074
Funding free for lending	Bank credit to bank deposits (%)	World Bank	+	-0.888

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## 9.5 Appendix 5: Correlation Matrix

**Table 8: Correlation Matrix on Selected Variables**

The table shows for the best performing variables the correlation matrix. The numbers in bold print are the ones regarded as too high for the panel regression and where therefore dropped in order to account for multicollinearity. Correlation analysis was also conducted for the sub sets of the data but did not reveal any further insights and hence is not presented here.

	<b>OFI</b>	<b>BankSize</b>	<b>BankGrowth</b>	<b>InstInv</b>	<b>ClaimsTotal</b>	<b>Unemploym</b>	<b>BankCrisis</b>	<b>NPL_Loans</b>	<b>IOROIS3m</b>
OFI	1.000								
BankSize	<b>0.975</b>	1.000							
BankGrowth	-0.282	-0.276	1.000						
InstInv	<b>0.967</b>	<b>0.993</b>	-0.289	1.000					
ClaimsTotal	0.303	0.220	-0.251	0.269	1.000				
Unemployment	-0.158	-0.068	0.355	-0.085	-0.403	1.000			
BankCrisis	-0.099	-0.223	-0.302	-0.205	0.373	-0.272	1.000		
NPL_Loans	0.378	0.466	-0.077	0.439	-0.159	0.654	-0.186	1.000	
IOROIS3m	0.039	0.065	-0.035	0.077	0.646	-0.247	-0.014	-0.077	1.000
MMrate	-0.564	-0.521	0.427	-0.482	0.006	0.271	-0.339	-0.261	0.290
LendIR	-0.635	-0.566	0.365	-0.517	-0.019	0.365	-0.187	-0.203	0.240
DepIR	-0.434	-0.367	0.334	-0.301	0.199	0.219	-0.315	-0.219	0.402
GDP	<b>0.953</b>	<b>0.990</b>	-0.293	<b>0.989</b>	0.197	0.009	-0.253	0.521	0.064
GDPCapita	-0.324	-0.438	-0.191	-0.459	0.104	-0.543	0.606	-0.468	-0.127
RegCa_RWA	0.113	-0.032	-0.372	-0.042	0.317	-0.371	0.828	-0.153	-0.163
CaString	-0.370	-0.330	0.256	-0.298	-0.161	0.374	-0.001	-0.125	-0.026
FIDep_GDP	<b>0.9068</b>	<b>0.9044</b>	-0.4685	<b>0.9086</b>	0.2998	-0.3429	0.0256	0.2908	0.0124

	<b>MMrate</b>	<b>LendIR</b>	<b>DepIR</b>	<b>GDP</b>	<b>GDPCapita</b>	<b>RegCa_RWA</b>	<b>CaString</b>	<b>FIDep_GDP</b>
MMrate	1.000							
LendIR	<b>0.942</b>	1.000						
DepIR	<b>0.929</b>	<b>0.924</b>	1.000					
GDP	-0.464	-0.498	-0.303	1.000				
GDPCapita	-0.413	-0.394	-0.474	-0.520	1.000			
RegCa_RWA	-0.598	-0.531	-0.584	-0.090	0.706	1.000		
CaString	0.540	0.667	0.534	-0.277	-0.299	-0.294	1.000	
FIDep_GDP	-0.7312	-0.7419	-0.5355	0.8746	-0.0838	0.2417	-0.4671	1.000

**9.6 Appendix 6: Preliminary thesis report**

BI Norwegian Business School – Preliminary Thesis Report

MSc Financial Economics

**Empirical Study on the Cause and Effect of  
Shadow Banking**

Sophia Alhusen

0989848

Oslo, 15<sup>th</sup> of January, 2016

Professor: Charlotte Østergaard

## Content

1	Introduction .....	61
2	Shadow Banking.....	62
2.1	Emergence of Shadow Banking.....	62
2.2	Shadow Banking versus Traditional Banking.....	63
2.3	Shadow Banking Activities.....	64
2.4	Size measures of Shadow Banking.....	68
2.5	Drivers of Shadow Banking.....	69
2.6	Effects of Shadow Banking .....	70
3	Data .....	71
3.1	Descriptive Statistics.....	71
3.2	Country Selection.....	72
4	Methodology .....	74
5	References .....	75
6	Appendix .....	77
6.1	Cause and Effect tested in regression analysis (draft) .....	77
6.2	Limitations .....	78
6.3	Outlook .....	78

## **Abbreviations**

ABCP	Asset Backed Commercial Papers
ABS	Asset Backed Security
CDO	Credit Default Obligation
CDS	Credit Default Swap
CP	Commercial Paper
FRED	Federal Reserve Economic Data
FSA	Financial Stability Authority
FSB	Financial Stability Board
OFI	Other Financial Intermediary
OIS	Overnight Index Swap
LIB	LIBOR - London Interbank Offered Rate
MMMF	Money Market Mutual Fund
SIV	Structured Investment Vehicle
SPV	Special Purpose Vehicle

# 1. Introduction

Shadow Banking is a relatively recently emerged topic and therefore is far from being a developed research field. However, the role of Shadow Banking in the Financial Crisis 2007/2008 has pushed researchers and regulators to analyse the system closer. In the years following the financial crisis global institutions such as the Financial Stability Board (FSB) emerged, observing the stability of the financial system and therefore created a specific agenda to tackle “weaknesses, spill overs and systemic risk in shadow banking” (Claessens et al 2012, p. 21).

Through Shadow Banking’s activities, mainly securitization and secured, wholesale funding, Shadow Banking enables risk sharing, enhances maturity transformation and market liquidity and therefore Shadow Banking could contribute to more efficient financial market (Claessens and Ratnovski, 2014, Poszar et al, 2013, Poszar, 2012). However, in the financial crisis 2007/2008 it turned out that the Shadow Banking system was not sufficiently prepared for a crisis; together with high uncertainty about Shadow Banks’ assets safety, it triggered, among others, a bank run on the repo market (Gorton and Metrick, 2012). Measures ensuring liquidity, such as collaterals in short-term borrowing and portfolio restrictions on money market funds, failed to compensate for the lack of deposit insurance and FED’s discount window as pointed out by Bernanke (2012). Due to the high interconnectedness of Shadow Banks with Traditional Banks the crisis spilled over to traditional banks and triggered a global economic crisis (Comotto, 2012).

Since, Shadow Banking has the potential to enhance the financial system’s efficiency it is important to preserve these positive characteristics while minimizing its risk exposure and negative impact onto the financial system and the real economy. This thesis aims to provide an understanding of Shadow Banking by first explaining qualitatively its emergence, important activities, its size and drivers of the system. In the second part of the thesis drivers and effects of Shadow Banking’s size are quantitatively tested, through panel regression. Therefore, financial as well as economic indicators are collected for ten countries. The country comparison is regarded as important since most research has focused on the US Shadow Banking sector, so far. Countries included in the study represent developed and emerging

countries, countries with high and low growing Shadow Banking systems and countries where Shadow Banking's asset have a high ratio to GDP and banking assets.

## 2. Shadow Banking

The term Shadow Banking, or sometimes market-based financing, is defined by FSB (2015, p.1) as “credit intermediation involving entities and activities outside of the regular banking system” and will be explained more detailed in the following with a focus on the United States Shadow Banking system.

### Emergence of Shadow Banking

Shadow Banking institutions rapidly grew in the period between 2000 and 2008 in USA and Europe, playing an important role in lending within the international financial system (Alworth and Arachi, 2012). Looking more closely to the causes of Shadow Banking, it can be stated that Traditional Banks became weaker and therefore strived for alternatives and innovations, triggering the emergence of Shadow Banking institutions. Traditional Banks weakened first, due to decreasing profitability, leading banks to seek for alternative business opportunities (Edwards and Mishkin, 1995). Profitability was affected by an increased competition in the financial markets for funds (Edwards and Mishkin, 1995). Furthermore, regulatory changes such as higher reserve requirements by the Basel Accord in 1988 led banks to look for financial innovations like Credit Default Obligations (CDOs) and Credit Default Swaps (CDSs), easing up capital and offering new business opportunities (Greenbaum and Kantas, 1982; Poszar, 2008, Duca 1992). Duca (2015, p.1) emphasizes that the “relative regulatory requirement of bank versus nonbank credit sources” is especially important. Second, also funding became more difficult. Duca (1992), Edwards and Mishkin (1995) explain that the dependency on deposits as a refinancing source became less important due to abolishment of Regulation Q<sup>20</sup>. Finally, also income sources of Traditional Banks dropped due to lower information cost as a results of modern information technology (Edwards and Mishkin, 1995;

---

<sup>20</sup> Regulation Q: Title 12, part 217 of the United States Code of Federal Regulations imposed interest rate ceilings on deposits in USA; established in Banking Act of 1933 (Gilbert, 1986).

Duca, 1992). Hence, Structured Investment Vehicles (SIVs) and conduits emerged (Poszar, 2010).

At the same time investors had a high amount of cash at hand and were seeking “safe, short-term and liquid investments” (Claessens et al, 2012, p.8). Deposits were only insured up to a certain amount and therefore significant amounts were uninsured. Together with the higher yields, produced by Asset Backed Securities (ABSs), especially corporate and institutional investors were incentivized to invest in Shadow Banking assets (Luttrell et al, 2012). Shadow Banks’ assets seemed to have a very attractive risk and return profile. Though it turned out that this was only due to neglected risk in ratings provided by Rating Agencies leading to over stated ratings compared to the inherent risk profile (Adrian, 2014).

### Shadow Banking versus Traditional Banking

It can be stated that Shadow Banking entities perform bank-like activities but are largely-unregulated compared to their Traditional Banking counterparts. Shadow Banks credit intermediation processes as well as the traditional credit intermediation processes, involve maturity- and liquidity transformation and credit risk transfer (FSB, 2011). These activities lead to credit and liquidity risk concentration at the respective institutions.

Though similarities between Shadow Banking and Traditional Banking exist, they deviate as Gandhi (2014) points out by the following (1) less regulation, (2) different funding sources, (3) missing investor protection and (4) in most cases no access to central banks. These differences are elaborated in the following.

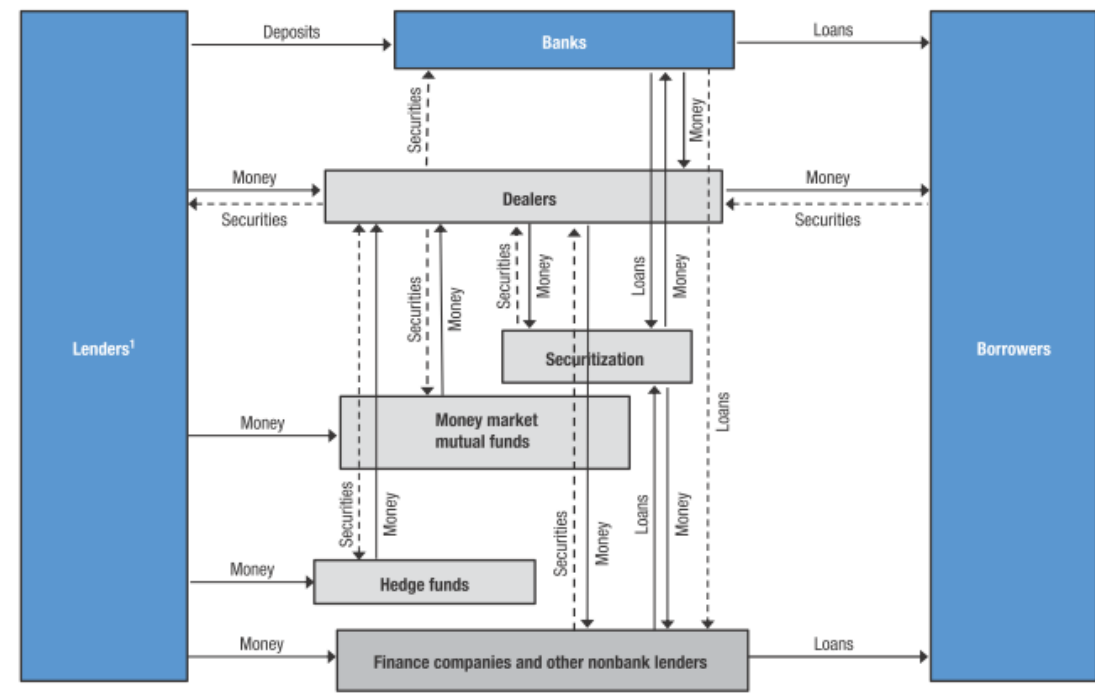
In Traditional Banking issued loans are financed by deposits. In Shadow Banking, however, financing is via money market, mainly with repos. The loans in Shadow Banking are also not held on the balance sheet, as with Traditional Banks, but sold and then pooled together with other loans to be then securitized and promoted to investors. Therefore, the credit intermediation process becomes more complex than in Traditional Banking. Since, Shadow Banks do not use depositary money to finance their activities they do not need to undergo regulation of Traditional Banks. On the other hand, they also do not have access to the discount window of the central banks and deposit insurances (Noeth, 2012).

Finally, it is important to mention that Shadow Banking and Traditional Banking are interconnected by originated loans, transformed to Asset Backed Securities (ABSs), the supply of liquidity by issuing short term paper for Money Market Funds (MMFs) and the marketing of inter alia MMFs to customers (FSA, 2011). The interconnectedness can be further split up into direct and indirect linkages. The former involving the ownership of parts of the credit intermediation chain or funding by Traditional Banks. Indirect linkages are similar investments or the exposure to common counterparties, where commercial banks act on similar markets and are thus indirectly affected by Shadow Banking activities (Gosh, 2012). The interconnectedness of these two markets frees the way for spill over effects from one system to the other, as occurred in the Financial Crisis (Comotto, 2012).

Figure 1 shows the differences between Traditional Banking and Shadow Banking in a simplified version and also depicts direct and indirect linkages.

**Figure 1: Shadow Banking versus Traditional Banking**

The graph presents the flow of funds from lenders to borrowers. Blue boxes are related to Traditional Banking, whereas other colours represent Shadow Banking entities. Source IMF (2014)



## Shadow Banking Activities



The Shadow Banking system itself consists of highly complex processes within the credit intermediation processes. Claessens et al (2012) categorize the Shadow Banking credit intermediation processes broadly into securitising and collateral intermediation. With its securitising activities Shadow Banking creates the safe assets desired by corporations and institutional investors but also, especially European, Banks have used these assets to attract repo funding to increase their leverage. Collateral intermediation embraces many financial transactions including secured funding, securities lending and hedging. Shadow Banks main role, in this process, is to “re-use” collateral since it is scarce. With these two services Shadow Banking provides on its liability side safe assets and on its asset side credit to borrowers. The following describes the two processes in more detail.

### **Securitization Intermediation Process**

Table 1 gives a broad overview of a general securitization process. Participants in this process include issuer, underwriter, trustee and services necessary to transform illiquid loans into tradable securities. In that process, the following Shadow Banking entities are involved, MMFs, Broker Dealers, Finance Companies and Special Purpose Vehicles (SPVs), using instruments such as Assets Backed Securities (ABSs), Credit Default Obligations (CDOs), Commercial Papers (CPs), Repos and Asset Backed Commercial Papers (ABCPs) (Ceorelli and Persitiani, 2012, Poszar, 2012).

**Table 1: Shadow Banking Credit Intermediation Process with function, entity and funding sources**

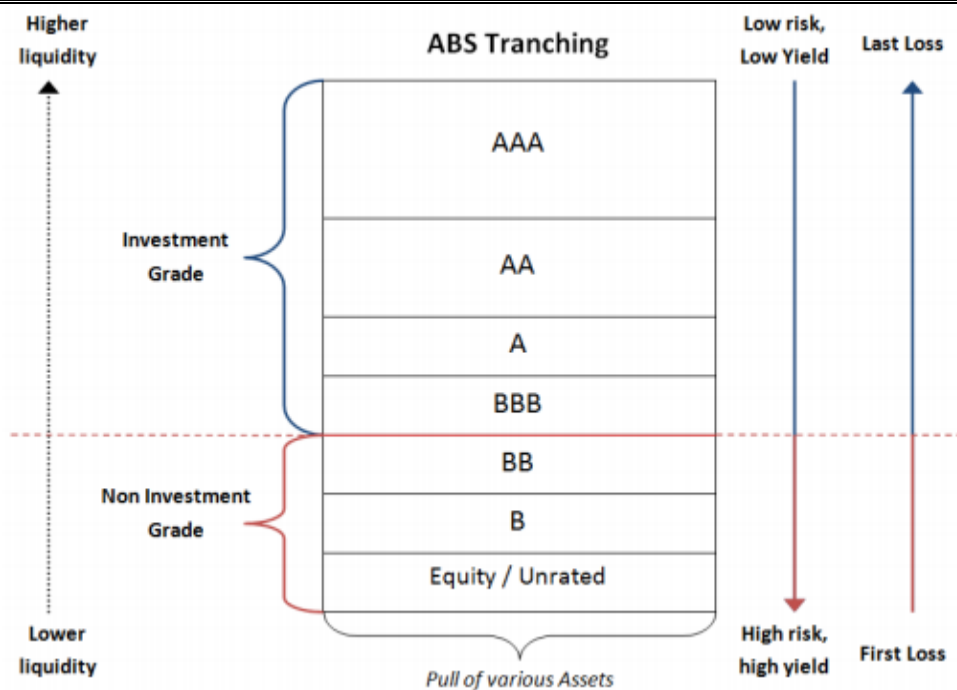
Source: Poszar et al (2012)

<b>Step</b>	<b>Function</b>	<b>Shadow Bank</b>	<b>Shadow Bank's Funding</b>
(1)	Loan Origination	Finance Companies	CP, MTNs, Bonds
(2)	Loan Warehousing	Single and multi-seller conduits	ABCP
(3)	ABS Issuance	SPVs, structured by broker-dealers	ABS
(4)	ABS Warehousing	Hybrid, TRS/repo conduits, broker dealers' trading books	ABCP, Repo
(5)	ABS CDO Issuance	SPVs, structured by broker dealer	ABS CDOs, CDO squared
(6)	ABS Intermediation	LPFCs, SIVs, Securities Arbitrage Conduits, Credit Hedge Funds	ABCP, MTN, Repo
(7)	Wholesale Funding	MMFs, Cash Funds, Securities Lenders etc.	\$1 NAV shares (shadow bank "deposits")

First in the process, finance companies, banks or mortgages brokers issue loans or mortgages. They are funded, depending on their legal status, by medium-term notes (MTNs) and commercial papers. In a second step, single and multi-seller conduits warehouse loans by purchasing them from various originators, being funded by ABCPs. Loans with different credit ratings and maturities are bought by SPVs, often subsidiaries of banks, and then structured by broker dealers. Funding is received from the buyers of ABS issued later by the SPV. The ABS warehousing is enabled by broker dealer's trading books and funded by ABCPs and Repos. In order to create investment grade ABSs, overcollateralization, providing collateral in excess of liabilities, is used. Also, Credit Default Swaps (CDS), an insurance like instrument, cover potential losses (Ceorelli & Persitiani, 2012). Moreover, the pooling itself with loans of different credit worthiness leads to a seniority structure of claims with subordinated loans absorbing initial losses. Due to this structure, senior tranches are not affected by loan defaults only until subordinate tranches are exhausted (Kothari, 2006). Figure 2 provides an overview of the just described ABS structure. An underwriter places then the structured ABS with investors. Else, ABSs are used as collateral for issuing ABCPs or Repos. The main investors of ABSs are, among others, MMFs, institutional investors and security lenders. In case, tranches of ABSs are not sold to the capital market or individuals through a private placement, the tranches are recycled together with other unsold tranches into Credit Default Obligations (CDOs) - a subcategory of ABSs (Poszar et al, 2010, Cetorelli and Peristiani, 2012).

**Figure 2: Asset Backed Security Tranching Structure**

Source: Rehault (2015)



### Collateral Intermediation Process

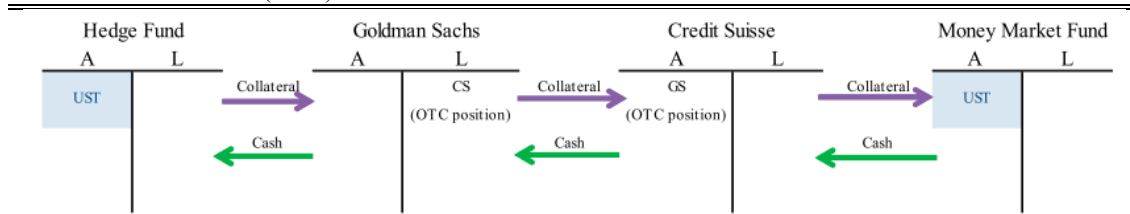
The collateral process involves the extensive reuse of collateral. Thereby, the collateral supports multiple transactions. Since, in this process a number of deal banks and banks, classified as Systemically Important Financial Institutions (SIFI), are involved, the process itself becomes also systemic. It is especially risky when collateral of clients is used for the funding of a bank. In case of asset withdrawal, the bank faces severe liquidity problems due to maturity mismatch. The quality of collateral can vary and hence includes T-bills but also junk bonds (Classens et al, 2012).

The collateral intermediation process starts with dealer banks receiving collateral from parties such as hedge funds and investors in request for funding but also insurers, pension funds, and sovereign wealth funds seeking for the additional return by the convenience fee. The latter ones mostly use repos and security lending as an instrument. In the subsequent the collateral is used again by deal banks to obtain funding for themselves. This process can repeat itself several times and thereby collateral can support many transactions as can be depicted from Figure 3. The amount of collateral available depends, among others, on money market policy or the

perceived risk in the market. In general, the market for this type of deals is expected to grow since in a globalized financial markets collateral makes up for higher information asymmetry (Classens et al. 2012, Singh and Aitken, 2010).

**Figure 3: Example reuse of collateral in Collateral Intermediation Process**

The graph shows the re-usage of collateral by several banks. Off-balance-sheet items are marked with parenthesis and UST stands for U.S. Treasury bond, GS for Goldman Sachs, CS for Credit Suisse. Source: Classens et al (2012)



### Size measures of Shadow Banking

There are various ways on how regulators and academics attempt to measure Shadow Banking system's size. First, it can be distinguished between entity and activity based measures. IMF (2014) presents the Flow of Funds measure and the size of noncore liabilities measure as acceptable measures. The measures vary by definition, data collection and country coverage.

Grounded on the earlier stated definition of Shadow Banking by the FSB, the FSB has also developed two measures to observe the Shadow Banking system. First, there is the rather broad measure, consisting of assets of Other Financial Intermediaries (OFI), defined as assets of financial institutions not classified as banks, insurers, pension funds, financial institutions, central banks or financial auxiliaries and therefore being an entity based measure. (FSB, 2015). Second, FSB (2015) also reports a measure called Economic Function measure, which narrows down the OFI measure to those parts of non-bank credit intermediation where Shadow Banking risk might occur. Thereby, the Economic Function measure is a combination of an entity and activity based measure and the most accurate, so far. However, due to limited data on this measure the regression analysis is conducted with the OFI measure.

	2010	2012	2014
Banks	121.2	136.5	135.1
OFIs	58.2	62.8	68.1
Economic Function	31.3	33.8	35.9

Table 2 shows the assets of OFIs and the Economic Function measure. Despite the difference between the OFI and Economic Function measure, OFI is still an important device as it identifies Shadow Banking risks associated with innovations and changes within in the system (FSB, 2015).

### Drivers of Shadow Banking

Since the emergence of Shadow Banking, its size has fluctuated. In order to better understand which drivers impact the size of Shadow Banking system the following summarizes the causes identified by the literature. As the size of the Shadow Banking market is determined by its ability to provide supply but also by its' customers demand for Shadow Banking products the drivers of Shadow Banking are categorized into demand and supply related causes.

#### **Drivers affecting Shadow Banking Supply**

With regards to financing, Shadow Banking depends largely on wholesale funding such as Repurchase Agreements (St. Louis FED, 2011). Repos are loans in exchange for a collateral. The amount necessary for securitizing the credit is determined by the haircut and hence the size of haircuts influences the amount of funding for Shadow Banks (Adrian and Shin, 2009). Since, haircuts are a way to securitize an investment the issuer increases the haircut when he perceives high risk in the market. Subsequently, the balance sheet of those banks will shrink and hence also their liquidity. Thus, Adrian and Shin (2009) conclude that the leverage and also liquidity of banks depending on repo financing is pro-cyclical. Therefore, good indicators for the development of leverage are volatility indices or risk premia (Duca, 2015). Gorton and Metrick (2012) present the difference between the LIBOR and the OIS rate (LIB-OIS spread) as a proxy for counterparty risk in the banking system.

Duca (2015) also highlights economic outlook as important, measured by the lagged slope of the yield curve, due to Shadow Banks' just described pro-cyclical.

According to Adrian and Shin (2009) alike premiums represent the expected return of Shadow Banks due to the maturity mismatch.

Adrian and Shin (2009) point out that since Shadow Banks rely mainly on short-term funding, short-term interest rates and also the federal funds target rate reflects the cost of borrowing. Since, specifically Money Market Mutual funds (MMMFs), are funding providers in the repo market (\$552 bi repos in December 2008) (Gorton and Metrick, 2012) they represent an ideal measure for the size of funding provision.

According to La Porta et al (1998) the size and effectiveness of financial systems across countries depends on the legal rules and their enforcement. Therefore, it is also expected that Shadow Banking size varies between countries due to the setup of local law and its execution.

### **Drivers affecting Shadow Banking Demand**

The Literature, so far, has not touched the topic of demand too much Classens (2012). However, in order to have a Shadow Banking system there must be demand for its product, namely ABS and Shadow Banking debt like repos. As already mentioned, drivers of demand are the amount available to invest and investors need for safe and short term assets. It will be a task to extend this part of Literature Review further.

### **Effects of Shadow Banking**

As pointed out earlier a good structured Shadow Banking system has the potential to enhance the effectiveness of the Financial System and therefore contribute to the expansion of the economy. Therefore, it is important to identify if Shadow Banking is contributing to efficiency enhancement. Since this might vary for each country it enables the identification of the respective Shadow Banking structure being most suitable. Therefore, in the following important effects of Shadow Banking system are presented.

Duca (1992) mentions that innovations in Shadow Banking affect the growth rate of M1; thereby, indicating a more efficient financial system or the defect of transmission channels (Mazelis, 2015). It is also expected that an increased, more effective Shadow Banking system leads to a higher GDP and indeed, FSB (2015)

finds a positive relationship. Furthermore, Duca (1992) points out that the share of short-term business credit provided by banks decreased steeply since the 1970's. It could be interesting to investigate how the decrease in banks' share is related to the rise of Shadow Banks (Duca, 2015).

### 3. Data

Most, important for the time series analysis is the Other Financial Intermediaries (OFI) measure. The data range from 2002 to 2014 for 26 jurisdictions, accounting thereby for 80% of GDP as of 2014 (FSB 2015).

Since 2015 FSB publishes the Economic Function measure consisting of the broad measure narrowed down to "those parts of non-bank credit intermediation where Shadow Banking risk might occur" (FSB, 2015) and hence being a more accurate measure. However, it is not used in times series analysis since the series only starts in 2010. In order to proportion the OFI results to the EF measure, the OFI measure is compared to the Economic Function measure within descriptive statistics, identifying potential similarities and differences.

Other data will be derived from IMF and Worldbank.

#### Descriptive Statistics

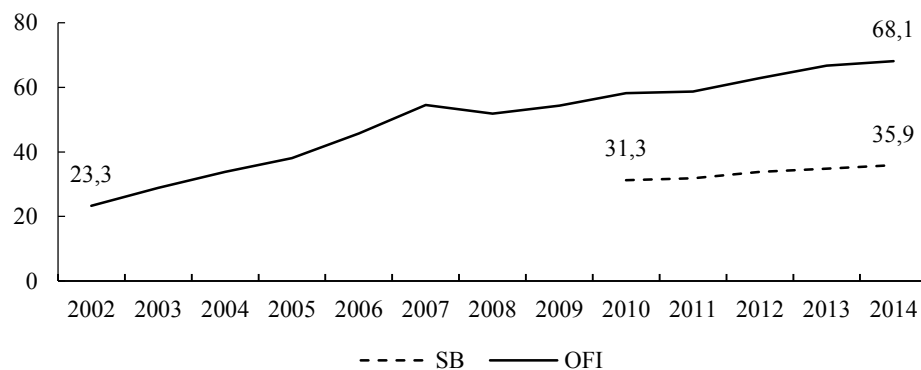
In 2014 the global growth of OFI assets exceeded the growth of banks, insurances, pension funds and public financial intermediaries. OFI's share of total financial system assets amounts in 2014 to 25%; whereas banks assets' share decreased to 45% for the third successive year. OFI assets over the complete period (2002-2014) grew at a growth rate of 192.0%. Thereby, emphasizing Shadow Banking's increased importance for the global financial markets.

In order to relate the results from OFI cause and effect analysis to the more accurate Economic Function measure it is regarded as important to understand the relationship between the two measures.

In Figure 4, one can clearly see that the absolute value for OFI institutions is almost double of the Economic Function measure. However, the relative relationship between OFI and Economic Function measure is much closer with growth rates over

the period of 2010-2014 of 17.0% and 14.6% and a correlation of 0.99 and hence offering a justification for the usage of OFI for the regression analysis.

**Figure 4:** The Graph displays the evolvement of OFI from 2002-2014 and Shadow Banks' assets from 2010-2014. Data are available for 26 jurisdictions.



### Country Selection

For the country selection it has been regarded as important to represent countries with large Shadow Banking system; measured by jurisdiction share of Shadow Banking assets and jurisdiction contributions to Shadow Banking growth. Especially, countries such as United States, Ireland, China are important countries. Furthermore, countries with high Shadow Banking system growth were considered. Thereto belong Russia and Argentina with growth rates for 2010-2014 of 47.7% and 32%, respectively. Since, both countries were also confronted with economic difficulties and Argentina additionally with capital restrictions it might be interesting. With China and Brazil, we have also two other interesting countries in the data set, representing together with Russia, formerly promising emerging markets. Finally, it has been also regarded as important to include the countries that are higher dependent on Shadow Banking sector represented by Shadow Banks to banks asset ratio and Shadow Banks' asset to GDP.



**Table 3: Country Selection**

The table shows Shadow Banking (SB), represented by Economic Function measures, over time and in relation to GDP and bank assets. Source: FSB (2015)

<b>SB growth rate 2014 (exchange rate and inflation adjusted; %)</b>		<b>SB growth 2010-2014 (%)</b>		<b>SB Growth rate exceeding GDP growth rate, 2010- 2014; %-points)</b>	
China	37.7	China	48.7	China	37.0
Hong Kong	28.7	Argentina	47.7	Hong Kong	30.9
Ireland	23.7	Hong Kong	37.1	Argentina	22.8
Russia	19.4	Russia	32.0	Russia	20.6
Indonesia	18.9	India	17.4	Canada	7.2
Argentina	17.8	Indonesia	16.7	Korea	6.5
Chile	17.0	Saudi Arabia	15.1	Switzerland	6.3
Switzerland	15.0	Brazil	15.1	India	6.1
Korea	14.8	Chile	12.4	Brazil	5.9
Spain	12.9	Canada	11.6	Ireland	5.5

<b>Jurisdiction contributions to SB growth (%)</b>		<b>Jurisdiction share of SB assets (%)</b>	
China	3.0	United States	39.7
Ireland	1.8	United Kingdom	11.4
United States	1.6	China	7.7
Japan	0.9	Ireland	7.6
Germany	0.7	Germany	7.2
Canada	0.4	Japan	6.8
France	0.3	France	4.4
Korea	0.3	Canada	2.8
Brazil	0.3	Brazil	1.9
Switzerland	0.2	Korea	1.8

<b>SB/GDP (%)</b>		<b>SB/Banks assets (%)</b>	
Ireland	1190.1	Ireland	328.1
United Kingdom	146.8	United States	67.1
Switzerland	90.3	Mexico	39.4
United States	82.1	Brazil	35.9
Netherlands	73.8	Germany	30.3
Germany	73.0	Canada	25.5
France	60.7	Switzerland	24.8
Japan	60.0	South Africa	24.7
Canada	58.2	United Kingdom	24.4
Korea	47.6	Korea	23.2

Therefore, countries such as Ireland, Switzerland, Germany and United Kingdom have been selected. Table 3 presents the top 10 countries for the just presented measures.

The selected countries with Argentina, China, Brazil, Germany, Ireland, Japan, Russia, Switzerland, United Kingdom and United States, represent therefore a diverse

portfolio with 4 emerging market countries and six developed countries; all of them stemming from different geographic areas.

## 4. Methodology

With OLS regressions the outlined Cause-and-Effect Model will be tested. Therefore, firstly, the causes of Shadow Banking are tested in a panel regression; with the real OFI growth as dependent variable and the causes as independent variables for country  $j$  and time  $t$ . Since, correlation between the unobserved and observed variables cannot be excluded the fixed effects model is used (Allison, 2009). A panel regression can take on the following form:

$$\Delta OFI_{jt} = \alpha_1 CAUSE1_{jt-1} + \alpha_2 CAUSE2_{jt-1} + \alpha_3 CAUSE2_{jt-1} + \alpha_4 OTHER_{jt-1} + \text{Fixed effects} + \varepsilon_{jt}$$

In a second step, regressions are run with the presented effects as dependent variable and OFI real growth as the independent one.

$$\Delta Effect_{jt} = \beta_1 OFI_{jt} + \varepsilon_{jt}$$

Though issues diminishing the statistical robustness of results will be considered it is expected that, due to a short time series, this might not always be possible. Hence, it can already be stated that the potential results are rather indicative and hence present a limitation of this study. Still, the results are helpful in order to understand better the relationship between variables.

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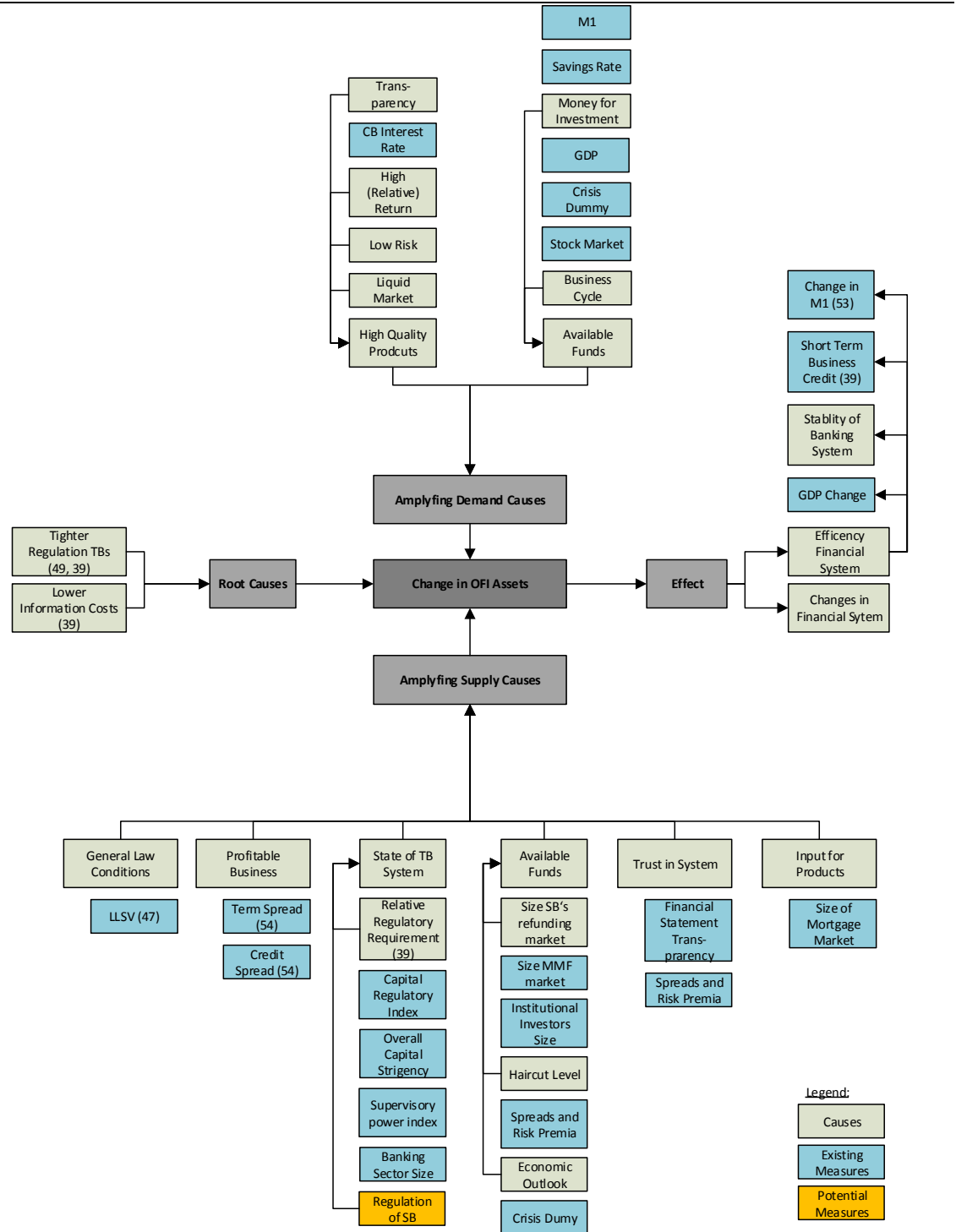
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## 6. Appendix

### Cause and Effect tested in regression analysis (draft)

**Figure 5: Cause and Effect Model**

Cause and Effect Model shows the relationship between different drivers in grey. Measures, potentially for regression analysis shown in blue. Yellow boxes indicate logical relationship but probably no adequate measure available. Numbers refer to the Literature Review; will be shown better in a version to come.



## Limitations

Due to the limited amount of data the panel regression consists only of a few data points. Furthermore, it is expected that SB data are still heterogeneous since the institutions and activities vary from countries.

Due to the innovations going on in the industry and also recent regulatory changes this model is only an attempt to understand relationships in the SB Banking better

## Outlook

The following shall give the reader a brief outlook for the next steps and potential changes to the Master Thesis.

**Literature Review:** Although the preliminary report covers important papers it is regarded as necessary to consider other papers in order to have a complete and comprehensive picture. Furthermore, the Literature Review, now mainly focusing on the US SB system, will also extend to developments in other countries.

**Variable Selection:** Based on the Literature Causes and Effects will be included in the Cause and Effect Model. Therefore, the here presented variables might change in the final version. The changes might be due to lack of data for some countries and an extension of the Literature Review.

**Country Selection:** The country selection could change in the final version due to new analysis insights and lack of data.

**Methodology:** In order to increase the robustness of the results statistical methodology shall be enhanced through further research and identification of relationships and other issues.

**Results:** With differing definitions and measures it is highly heterogeneous and research results are difficult to compare, often indications then statistically robust results.