Has Finance Grown Too Big?

On The Social Efficiency of the Shadow Banking System

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Master in Management of Technology

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On The Social Efficiency of the Shadow Banking System

by

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Executive Summary

Over the previous thirty-five years the financial sector of the high-income (OECD) countries has considerably increased in size, importance and sheer complexity. A social efficient financial system is crucial to a stable, productive and innovative market economy. In such a system, the economic welfare is enhanced as banks and financial institutions provide funding for productive investment, for research, design and development RD&D and for high-tech innovators. They also provide insurance that results in risk reduction, create sufficient amounts of useful liquidity, run an efficient payments mechanism and generate financial innovations to do all these useful things more cheaply and effectively. But decades of financial sector's rapid growth have been taking place mostly in (what is officially called) the "shadow banking system" (SBS) – the unregulated and opaque part of our banking system where most of the (often) speculative financial engineering has taken place and where the financial imbalances were built up which have led to the financial crisis of 2008. More specifically, the SBS is defined as the credit intermediation outside the traditional regulated banking system, involving all sources of funding apart from the, traditionally used, regular deposits. The spectacular rise of the SBS raises the important but so far under-researched question about whether and the extent to which the SBS is serving and furthering the real economy by providing adequate finance to investment and (high-tech) innovation, offering insurance and creating useful liquidity (i.e. the question about the SBS's social efficiency). This is the main research question of this thesis project, which will use novel data sets for the OECD countries in order to empirically evaluate the social efficiency of the SBS. In particular, the contribution of the SBS to the growth of real GDP per capita and hourly labour

productivity (which are two indicators of “social efficiency” often used in economic research) is assessed.

This thesis project is relevant for governments, policy makers, finance regulators, corporate executives and anyone else who are interested in the economic rationale of the modern financial system (including the SBS) and its relationship with the real economy and innovation. The thesis provides useful insights and information that can be used for a more proper understanding and regulation of the (shadow) financial sector.

Reviewing the extant literature and to set the stage, Chapter 2 explains the historical evolution of the SBS by focusing on United States – the country that represents the initial and foremost exponent of the SBS worldwide. Following and extending recent IMF research, we argue that the SBS arose in order to meet the need of global cash pools (i.e. large, centrally managed, short-term cash balances of global non-financial corporations and institutional investors such as asset managers, securities lenders and pension funds) with regard to a safe “parking place” for their cash. In other words, it is the principal need of global cash pools for safety and liquidity, which could not be met through insured deposits (in the commercial banking system) and through safe government bonds, that led to the SBS rise. Other factors that contributed to the rise of the SBS include financial innovations, such as asset securitization, the deregulation of the financial sector and the intensifying competition between commercial and investment banks. Then, we steer our focus on the key functions and constituents of the SBS, aiming to capture its rationale. The key identified functions of the SBS are securitization and collateral intermediation and the most important constituents of the

SBS include asset-backed securities (ABS), asset-backed-commercial paper (ABCP), repurchase agreements (repos), money market mutual funds (MMMF) and re-use of collateral (rehypothecation). The key mechanics of the aforementioned functions and constituents are explained in detail in Chapter 2.

In Chapter 3, initiating from our hypothesis that the SBS has an effect on real GDP per capita growth and/or hourly labour productivity growth even after controlling for other macroeconomic influences, we follow two empirical approaches in order to unveil correlations between the SBS and real GDP per capita growth as well as hourly labour productivity growth.

Our first approach utilizes a recent measurement for the SBS that was undertaken by the IMF statistics department. Their approach consists of two alternative (i.e. broad and narrow) measures of the SBS (2015). By using these two measures, the IMF has come up with results regarding the SBS size of twenty-four countries over the period 2001-2013. We build on their data in order to attain a better understanding of the SBS patterns of evolution in different countries. Then, by using a relevant econometric model, that includes control and dummy variables to control for country-specific influences, we perform statistical tests in order to investigate correlations between the SBS and real GDP per capita growth as well as hourly labour productivity growth for 14 advanced countries over a 12-year span (2001-2012). By using the findings of our first approach, we argue that the SBS has a statistically significant and negative correlation with real GDP per capita growth. Results regarding any negative correlations of SBS with real hourly labour productivity growth are not statistically significant (at 5% or less) and hence must be treated as merely suggestive.

Our second approach builds on our theoretical analysis of Chapter 2 and focuses on (changes over time in) the U.S. economy. The data on the SBS, provided by the Federal Reserve Bank's database, allow us to differentiate between its various parts including ABS, ABCP, repos and MMMF (rehypothecation is not part of our empirical analysis due to data limitations). First, we attain a better understanding of the SBS evolution in the US both in terms of structure and size. Then, by using a relevant econometric model that controls for other factors influencing real GDP per capita growth, we perform statistical tests in order to find any correlations between the SBS and real GDP per capita growth. We use 53 quarterly observations (2001q1-2014q1) for our econometric analysis. Due to data limitations, we cannot perform a similar statistical analysis for real labour productivity growth. By using the findings of our second approach, we argue that the aforementioned SBS constituents are negatively correlated with real GDP per capita growth but the results are not statistically significant and, hence, may be interpreted as merely suggestive.

In Chapter 4, by combining our empirical findings from our empirical approaches with theoretical insights from relevant literature on finance and SBS, we argue that the SBS has a negative impact on real GDP per capita growth, even after controlling for other macroeconomic influences. In general, it is not possible to statistically establish unidirectional causality from the SBS to real GDP per capita growth. However, based on our empirical findings, our hypothesis that there is a statistically significant impact of the SBS on real GDP per capita growth cannot be rejected. Chapter 4 also includes the following two policy implications. First, as our evidence and our literature review bring out, the rapid growth of the SBS has not translated into

higher social welfare in terms of per capita income, while at the same time it has increased the fragility of the overall financial system and heightened the likelihood of a financial (and economic) crisis. Based on this, we argue that that financial regulators (and governments) should deal explicitly with the SBS and impose regulation on global cash pools to facilitate the match between the needs of cash pools for safe financial instruments and the respective supply of these instruments. Second, we argue that governments should not overestimate the influence of monetary policy (i.e. setting interest rates) on economic growth. Sometimes, the negative impact of the real long-term interest rate might be overwhelmed by other drivers of growth.

As far as high-tech innovation is concerned, we argue that shadow banking is unlikely to adequately finance high-tech innovation because its key features are not aligned with high-tech innovation needs. In Chapter 2 we argue that most of the liquidity, managed by the SBS, is used for purely financial transactions and not for funding (high-tech) RD&D. The nature of most transactions taking place within and managed by the SBS is short-term, often extremely short-term. The central role of the SBS in modern finance therefore constitutes a manifestation of the general short-termist culture of the financial sector – the culture of "I'll be gone, you'll be gone". Similar examples of this prevailing culture are found in the financial sector as banks push their clients to do more and more deals – even when an additional deal might not be the wisest choice for the client – and as venture capitalists tend to focus on the exit, which happens usually in less than three years, mainly, via initial public offerings (IPOs). This environment is (in general) not conducive to radical innovations, which are not based on existing technologies and can take 15-20 years to fully develop. High-tech innovation, in other words, requires committed, patient financing. The fact

that shadow banking has become so dominant may well be considered a drag on high-tech innovation. However, in our econometric analysis, the observed negative correlation between the SBS and real labour productivity growth – an indicator that is closely related with high-tech innovation – was not statistically significant. Hence, on statistical grounds, this thesis project can only suggest the aforementioned negative impact of the SBS on innovation.

As far as the scientific contribution of this thesis project is concerned, this project is engaged to innovative ideas from a research point of view. The assessment of the social efficiency of finance and the exploration of the shadow banking's role constitute two new research areas in the field of economics. To the best of our knowledge, this thesis project is the first research attempt to assess the social efficiency of the SBS by measuring its impact on factors that are related to economic growth and innovation (GDP per capita growth and real hourly labour productivity growth). Furthermore, our analysis of the evolution, mechanics, economic functions and key constituents of the SBS is supposed to contribute to a better understanding of the SBS.

Acknowledgments

I am quite pleased with the process as well as the outcome of my master thesis. This pleasant journey would definitely be very different if I did not have the support and aid of the following individuals. This is why I use the following paragraphs to express my sincere gratitude to them.

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helpful to me in order to define some very important concepts in a more concrete way and to provide a final report that is easier for a non-expert reader to draw useful insights from it.

Last but definitely not least, I would like to thank my family and my close friends in both Greece and in the Netherlands. Without their support in many cases, I would not be able to be at this position. I hope that their continuous support will always be the ultimate guide for me in order to pursue all my dreams in both career and personal level.

Vasileios Karagiannis

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CHAPTER 1

Introduction

"WE ARE THE 99%", "REGULATE MARKETS, FREE PEOPLE", "HEY BANKERS! YOU BREAK IT, YOU PAY FOR IT" (Cassidy, 2011)

These are some of the most popular slogans from the Occupy Wall Street protest movement. This popular, anti-inequality protest movement began in September 2011 and was located in New York City's Wall Street financial district. The choice of the location for this movement was not arbitrary. It was only three years earlier, in September 2008, that the collapse of the Lehman Brothers almost brought down the global financial system and had immense impacts on the global economy.

But why did the global financial crisis occur? Was it a Black Swan event or a natural consequence of a socially inefficient financial system? We argue in this thesis that the crisis is a manifestation of a larger social inefficiency of the financial sector. Hence, this thesis project is not another research about the global financial crisis: it is a research about the (measurement of the) social efficiency of finance. Social efficiency of finance refers to the impact of finance on society. A healthy financial system is crucial to a stable, productive and innovative market economy, as banks and financial institutions provide funding for productive investment and for research, design and

development RD&D and high-tech innovators, provides insurance to help reduce risk, creates sufficient amounts of useful liquidity, runs an efficient payments mechanism, and generates financial innovations to do all these useful things more cheaply and effectively (Epstein & Montecino, 2016). In the context of this thesis, a socially efficient financial sector is defined as a sector that enhances the economic welfare of society by fulfilling the various functions outlined above. The issue is relevant for policy-making and financial sector regulation, because there is scope to improve outcomes by means of policy and regulation if finance is not socially efficient. Financial sector regulation has come under close scrutiny following the outbreak of the global financial crisis. The chosen mix of financial system's regulation has been severely questioned. Even Alan Greenspan, the chairman of the Federal Reserve during 1987-2016 and one of the most reputed advocates of the financial sector's status quo during that period admitted that he had put too much faith in the self-correcting power of free markets (Andrews, 2008).

However, there has been no consensus about the required mix of regulation so that a more socially efficient financial system is secured. The different perspectives on the financial system become evident when the economists attempt to diagnose the drivers of the recent global financial crisis. The three most popular perspectives, based on different economic schools of thought, can be broadly described as follows: the first one blames too much regulation of the financial sector as the key driver of the crisis and, subsequently, calls for weaker regulation of the financial sector; the second perspective considers the pre-crisis regulation as too weak and asks for a stronger regulatory approach with regard to the financial sector; the third perspective agrees with the reasoning of the second perspective with regard to the need of stronger

regulation but goes beyond that point. This perspective claims that confining the required changes in regulation to the financial sector without doubting the current economic policy paradigm is too narrow-thinking and bound to fail. (Palley, 2012)

Our starting point is different from the above three perspectives, as we follow the argument made by John Kay (2015) - a distinguished British economist with wide experience of the financial sector - that the financial system's growth in size and complexity has resulted in us having "far too much of a good thing" (p.1). Kay shows that the problem has to do with the fact that it is a system that serves itself and its executives, rather than one that serves its users, directly questioning the system's main purpose. Moreover, most of the perceived profits of the financial industry do not represent value created within it, but instead they result from the appropriation of wealth created elsewhere in the economy - of Other People's Money (Kay, 2015). The finance sector has shifted from being a servant of the society, into a master of the universe. What is required to fix this, according to Kay, is a different regulatory philosophy. We do not need more regulation. We need less, yet more productive regulation, aiming to address issues of structure, incentives, and political influence, as well as to restore the status of the financial services that serve the real economy (2015).

1.1 Background and problem delineation

In this sub-chapter, we provide a brief description of the financialization process and the decoupling between finance and the real economy. Then, we present the recently growing literature on the social efficiency of finance, which provides evidence of the adverse impacts of finance on society. After this, we highlight the role of the Shadow

Banking System (SBS) in modern finance, the rapid growth of which has arguably been the most significant development in finance during the last four decades.

Financialization and the decoupling between finance and the real economy

During the last thirty to forty years (i.e. from the late 1970-80s), the financial sector has grown in size, revenues and sophistication gaining a significant role and influence over economic policy and outcomes (Palley, 2007; Kay, 2015). The process, by which this has happened, is called financialization.

The magnitude of this phenomenon has made Epstein and Crotty claim: "No matter how the size of the financial sector with respect to the rest of the economy is measured, the trend of massive growth is obvious" (2013, p.2). Indeed, the facts regarding the massive growth of finance in comparison with the real economy seem indisputable. For example, focusing on US, according to Greenwood and Scharfstein (2012), the U.S. financial services industry grew from 4.9% of GDP in 1980 to 7.9% of GDP in 2007. That is, according to the authors, the financial services' share of total GDP has increased by about 60%. Similarly, according to Palley (2007), the Finance, Insurance and Real Estate (FIRE) output as percent of GDP grew from 15.2% in 1979 to 20.4%. That is, FIRE/GDP ratio increased by about one third during the era of financialization.

Going beyond the observation of a large and rapidly increasing financial sector, one might wonder about its impacts on real economy. A healthy financial system is supportive of the real – productive – economy and innovation (Kay 2015; Epstein and Montecino 2016), but – as Kay (2015) argues – it is possible to have too much of a

good thing. To put it differently, the question that can be raised is: Has the growth of the financial sector, driven predominantly by the spectacular rise of the SBS, been associated with a proportionate growth of the real economy?

Table *1* shows the growth of per capita income in the major industrialized countries over the period 1960-2004. We can see that the era of financialization (which according to observers such as Palley (2007) started around 1979/1980) coincided with a slowdown in average annual growth in all countries except the U.K. (compared to the earlier period 1960-1979). Furthermore, a slowing trend in terms of growth is noticed, so that growth in the 1980s was higher than in the 1990s, which in turn was higher than in the 2000s (Palley, 2007). This coincidence (or correlation) of faster growth in finance and slower growth in the real economy does not necessarily imply that there is direct causal relationship between the two observed processes, but it does suggest that financial sector growth has become more delinked from growth of real GDP and of employment.

A similar decoupling between growth of finance and real economy is also suggested by evidence in Figure 1.

Table 1. Annual per Capita Income Growth Rates.

Annual Per Capita Income Growth Rates (%)					
Country	1960-79	1979-2004	1979-89	1989-2000	2000-2004
U.S	2.2	1.9	2.1	1.9	1.3
Japan	6.6	2.0	3.1	1.5	0.8
Germany*	3.3	1.7	1.8	2.0	0.6
France	3.4	1.6	1.9	1.7	1.0
Italy	5.0	1.7	2.3	1.5	0.7
UK	1.7	2.1	2.2	2.0	2.1
Canada	3.0	1.6	1.7	1.6	1.4

Note. Adapted from *Financialization: what it is and why it matters* (p.10), by T. Palley, 2007, Washington, DC: The Levy Economics Institute. Copyright 2007 by The Levy Economics Institute.

During the last three decades prior to financialization, total financial assets remain relatively stable as a share of GDP while private investment experienced some growth. During the era of financialization (or period of financial liberalization as named in Figure 1), while the private investment has been slightly reduced, the total financial assets as a share of GDP have more than doubled. Figure 1 is a manifestation of how the financial sector and the real economy may have become decoupled. As shown in Figure 1, the aforementioned decoupling occurred during 1980-1990 and this trend was amplified to a great extent during 1990-2010. Figure 1 is illustrative, and the question is (of course) if there has been decoupling in a statistically significant sense.

Based on this suggestive evidence, we may conclude that the significant growth of the financial sector has not so far been associated with a proportionate growth in the real sector. This makes us wonder about the societal usefulness of the current financial

sector for the real economy and the society. To put it differently, the former facts raise the questions: How much has the growth of finance contributed to higher income and welfare? How "socially efficient" has the financial sector been during the previous decades?

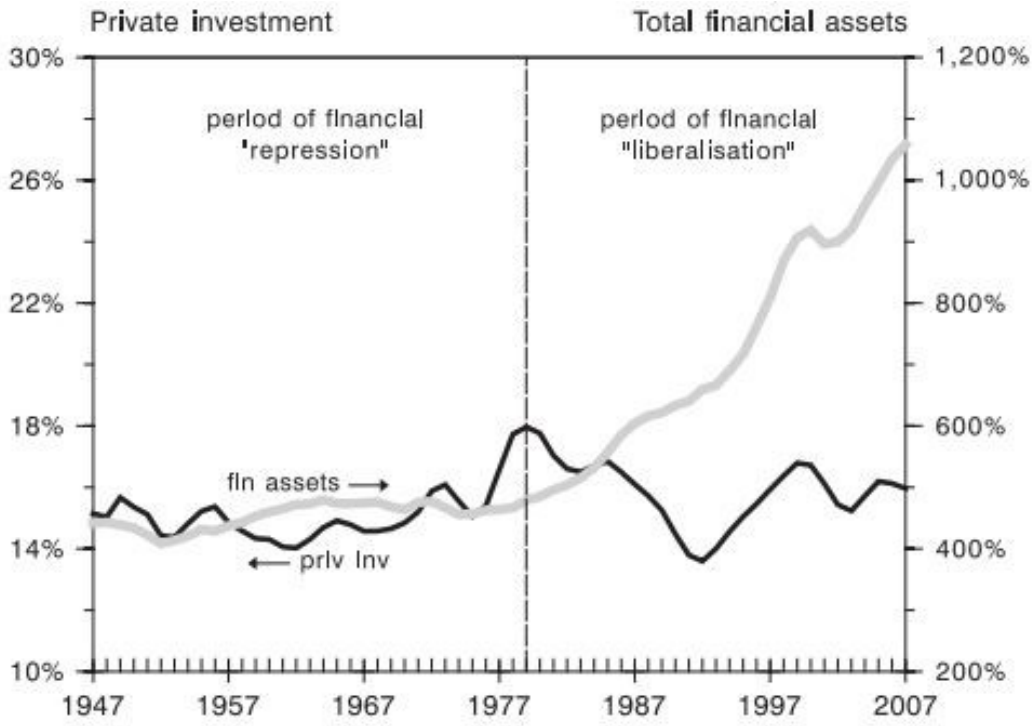

Figure 1. Total financial assets (all sectors) and private investment as percentage of GDP in the USA, 1947–2007. Adapted from "The revenge of the market on the rentiers. Why neo-liberal reports of the end of history turned out to be premature", by J. G. Palma, 2009, *Cambridge Journal of Economics, 33*(4), p. 853. Copyright by the Oxford University Press.

Social efficiency of finance

There is evidence to suggest that the growth in size and complexity of finance has not been socially efficient. First, focusing on the needs of the financial sector's users, Epstein and Crotty (2013) suggest that the financial sector should be reduced at least by 50% in size for efficiency reasons. They compare the ratio: income of the financial sector/services of the financial sector to the real economy of the 2000's with that of

the 1960's. This comparison reveals that the financial sector of 2000's is much less productive than that of the 1960's. This analysis, according to Epstein and Crotty, suggests that the huge increase in the size of the financial sector from the 1960's to 2000's might not have been compatible with the needs of the real sector (2013).

Second, Mazzucato and Perez (2014) provide relevant insights by examining the relationship between finance and innovation. This relationship is relevant to innovation because if finance promotes innovation, then innovation can enhance the overall economic welfare (2014). They claim that, contrary to the current situation, "the revival of real investment does not depend mainly on the amount of finance available or on its low cost, but on the way it is introduced into the economy" (2014, p.9). They call for finance that is committed to innovation for the long-run in order to stimulate growth (2014).

Third, Cecchetti and Kharroubi (2012) focus on some dimensions of the social efficiency. They warn about the unlimited financial development becoming a drag on economic growth after a point and, focusing on advanced economies, they claim that the rapid growth of the financial sector is detrimental to productivity growth (2012).

In another attempt, Greenwood and Scharfstein (2012) undertake a preliminary assessment of whether the growth of the main areas of the financial sector during the period 1980-2007 has been beneficial to the society. They conclude that the society has benefited by some activities of the financial sector but these benefits are accompanied with some risks. According to the authors, the financial system has become more fragile (2012).

This issue, that is, the system's risk exposure, is quite important and is associated with the overall stability of the financial sector. A key idea of financialization advocates regarding the financial innovations of the last forty years was that these innovations would promote a more efficient risk allocation (Kay, 2015). The risk was supposed to be transferred to those investors that had the capacity and willingness to take it (2015). However, according to Greenwood and Scharfstein (2012), the financial stability costs have not been internalized by market participants and households in many cases. The authors claim that, during financialization, the household leverage has soared resulting in larger price volatility (2012). Excessive household (and corporation) leverage is also a source of instability for the entire system (Palley, 2007). Regarding the intermediation chain, it has become too complex and long (Kay, 2015). This situation renders market participants incapable of understanding the risk exposures of their counterparties (Greenwood & Scharfstein, 2012). This enhances the information asymmetry of the intermediation chain leading, in turn, to risk transferring to those who can understand less about it (Kay, 2015). Finally, risks in current intermediation chain are prone to moral hazard. Moral hazard is defined as the tendency of people to undertake more risk when they are insured against it (2015). In our case this translates into potential creditors, knowing that they will be made whole due to government behaving as a last resort, to have little incentive to undertake thorough and careful credit assessment.

To conclude, the research efforts summarized above raise the issue of social efficiency of finance. The studies reviewed here cast doubt on the proposition that

"the more finance we have, the better it is" and they call for more research into how well the financial system is handling "other people's money" (Kay 2015).

Looking inside finance - the role of the SBS

A better understanding of the financial sector is related to financial regulation. As common sense suggests, regulators and policymakers struggle to properly regulate any financial activities that they cannot fully understand. In an article at Financial Times, Robert Lenzner, a former national editor and senior editor at Forbes magazine, wonders: "How can you "oversee", "supervise" or "regulate" something that is "essentially uncharted territory"? The truth is you cannot."(2015, para. 11) Similarly, Epstein and Crotty (2013) admit: "We must do much more work on the "dark matter" functions of the financial sector" (p.13). The problem with looking at the dark heart of finance is that it is a task easier said than done. Despite the immense research efforts, especially after the recent financial crisis, we are still unaware of the structure, the purposes of the financial sector and its social efficiency, mainly due to its complexity.

Seeking for a better understanding of the financial sector, we claim that finance can be distinguished into two parts; the traditional regulated banking system and the so-called 'Shadow Banking System' (SBS) (see Figure 2).

The former system is a relatively simple, regulated system funded by deposits that uses them to make long-term loans. The traditional banking provided intermediation between savers and borrowers in a single institution. That institution was the bank. The way this channel worked is quite simple. The savers entrusted their funds to the

bank in the form of deposits. Then, the banks loaned these funds to the borrowers (Gorton & Metrick, 2012). This system is depicted in Figure 10.

The main purposes of traditional banking and its positive impacts on society are indisputable (Kay, 2015). A non-comprehensive list of these purposes is as follows: The needs of borrowers are matched with those of savers; Payments are facilitated; Savings are channelled into fresh investment; Households manage their finance over lifetime and transfer wealth between generations (Kay, 2015).

Contrary to traditional banking, the SBS is very complex. It can be residually defined as the credit intermediation outside the traditional regulated banking system. In other words, it involves all sources of funding except the, traditionally used, regular deposits) (International Monetary Fund [IMF], 2014). The reason for which we use a residual definition is related to the fact that there is no consensus on a single definition of shadow banking that would suffice for all purposes and would encompass all the SBS functions (IMF, 2014). This, in turn, derives from the current insufficient understanding of the SBS.

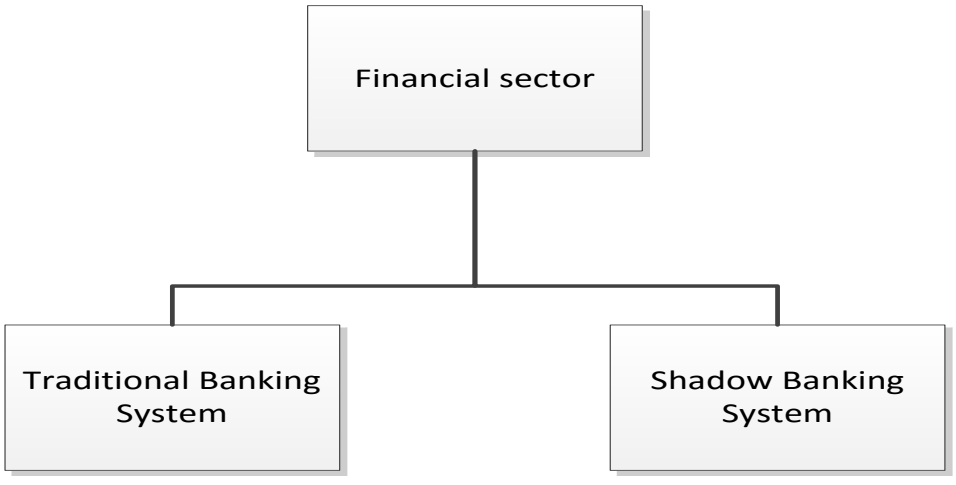

Figure 2: Financial sector breakdown

Indeed, the "essentially uncharted territory" (Lenzner, 2015, para. 11) and the "dark matter functions" (Epstein & Crotty, 2013, p.13) do not refer to the entire financial sector. As Kay suggests, the majority of the people engaged to banking are doing simple, relatively mundane and useful jobs (2015). Many concerns and questions regarding the financial sector do refer to activities of the SBS. Among others, economists from the European Central Bank (ECB) and IMF clearly stress this issue; "There is widespread international agreement on the need to better understand the activities of shadow banking and the related financial stability risks" (Bakk-Simon et al., 2012, p.5), "Although data limitations prevent a comprehensive assessment, the U.S. shadow banking system appears to contribute most to domestic systemic risk" (IMF, 2014, p.65) and "The challenge for policymakers is to maximize the benefits of shadow banking while minimizing systemic risks" (IMF, 2014, p.65)

Hence, it is not unreasonable to conclude that there is insufficient understanding of the SBS activities, let alone their impacts on society.

1.2 Research objective

The context of this thesis refers to the impacts of the financial sector on society. It was made clear that there is insufficient understanding of the SBS, let alone its impacts on society. This thesis project aims to contribute to the filling of these literature gaps. **Hence, the research objective of this thesis project is to empirically evaluate the SBS's social efficiency**. In particular, this thesis project aims to describe the SBS, that is, to describe its evolution and the main function and parts as well as to assess the impact of the SBS on the growth of real GDP per capita and real hourly labour productivity (which we take as our outcome indicators of "economic welfare")

– (see Figure 3). The second indicator, that is, real hourly labour productivity growth, is closely related to high-tech innovation (Hall, 2011). **To the best of our knowledge, this thesis project is the first research attempt to assess the social efficiency of the SBS by measuring its impact on factors that are related to economic growth (real GDP per capita growth and hourly labour productivity growth).**

Furthermore, our analysis with regard to the evolution, mechanics, economic functions and key constituents of the SBS is supposed to contribute on a better understanding of the SBS.

In other words, the main objective can be split up into the **two** following **sub-objectives:**

1. **To provide an empirically founded description of the SBS (covering its evolution, main functions and constituent parts).**
2. **To assess the impacts of the SBS on the growth of real GDP per capita and hourly labour productivity (= GDP/hours worked).**

The underlying reasoning with regard to the choice of assessing the SBS impact on, specifically, GDP and productivity growth is as follows: first, for feasibility and data availability reasons, rather than the entire, some dimensions of the social efficiency should be chosen. GDP is the most preferred indicator for covering the majority of the economic activities. It is also used in the approach of Ceccheti and Kharroubi (2012) for assessing the social efficiency of the financial sector. Productivity is considered a key source of economic growth and competitiveness.

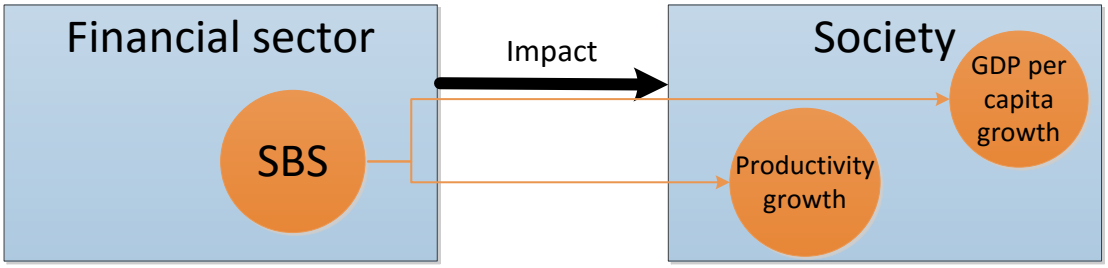

Figure 3: Scope of research. The overall context of this thesis project is the impact of finance on society. The scope of research is depicted by the orange color.

1.3 Research questions

In order to meet the aforementioned objectives, the following central and sub-questions will be addressed.

Central research question:

What is the social efficiency of the Shadow Banking System (SBS)?

Sub-questions:

1. ***Why did shadow banking grow? What are the main drivers of this evolution in terms of size and structure?***
2. ***What are the main functions and purposes and parts of the SBS? How does the SBS work in practice?***
3. ***What is the impact (if any) of the SBS on real GDP per capita growth?***
4. ***What is the impact (if any) of the SBS on real hourly labour productivity growth?***

The answers to the first two sub-questions contribute to the description of the SBS (our first sub-objective) while the answers to the latter two sub-questions will shed light on the SBS impact on real GDP per capita and productivity growth (our second sub-objective).

With regard to the third and the fourth sub-question, the underlying hypothesis is that the SBS has a statistically significant effect on real GDP per capita growth and/or hourly labour productivity growth even after controlling for other macroeconomic influences

1.4 Methodology

We use a combination of an extensive literature review and statistical tests (using various sets of empirical data concerning the SBS) to answer our research questions.

More specifically, the first two questions are dealt with the literature review research method. Relevant papers from economists (with expertise on finance and the SBS in particular) and institutions such as the IMF and the ECB are used. Hence, qualitative analysis and synthesis of the information are crucial for the first two sub-questions.

The **first sub-question** refers to the explanation of the rise of the SBS. Although the SBS is global, it started from the US. Hence, in order to explain the drivers that led to the SBS rise, we have to basically understand the drivers that led to the SBS rise in U.S.. This reason, accompanied by the fact that the literature about the U.S. financial sector is more developed, **led us to focus on the SBS in U.S.** in order to explain the rise of this system.

The **second sub-question** refers to the description of the current main SBS functions and constituents. We **do not focus on a particular country because the SBS has now a global reach.** There is evidence that there is large shadow banking activity in

the Euro Area and also in Asia (IMF, 2014; Harutyunyan, et al., 2015; FSB, 2015). Using the literature, we aim to provide a simplified and understandable version of the SBS that yet captures the key economic purposes and essence of the system.

Indeed, it has to be highlighted that **through our approach we aim to capture the rationale of the SBS (i.e. why it exists, which functions it serves, which are its key parts) rather than attempt to create an exhaustive list of its activities and entities and measure its size in an accurate way**. If we tried to do the latter, the thesis would be of very limited added value due to limitations in terms of access to information. Even global institutions, such as the IMF and the ECB, which possess abundant resources, experience and expertise, struggle to collect all the necessary data for an exhaustive reporting of SBS activities and entities and a completely accurate measurement of the SBS size over time.

With regard to the **third** and **fourth** sub-question, **our method is twofold**: **first, we empirically investigate for statistically significant correlations of the SBS with the GDP per capita and hourly productivity growth; second, we draw causal inferences by combining the empirical findings with theoretical insights from the thesis project as well as relevant literature.**

With regard to the empirical analysis, two different approaches are followed. These approaches are quite different and we consider this as an advantage since their combination gives the reader the opportunity to look at the issue of SBS's social efficiency from two very different perspectives and draw useful insights. The correlation of the SBS/GDP ratio (which is our independent variable) with the two

dependent variables (GDP per capita and hourly labour productivity growth) is examined for "sign" and "statistical significance". The used databases consist of IMF economists' results (Harutyunyan, et al., 2015), Federal Reserve Bank (FRB) and OECD databases.

In our first approach, our analysis is based on a recent measurement for the SBS that was undertaken by the IMF statistic department (Harutyunyan, et al., 2015). Their approach focuses on financial sector's noncore liabilities, which are supposed to represent the SBS (2015). They have created two different measures of the SBS, namely the broad noncore liabilities measure and the narrow noncore liabilities measure. These measures are explained in detail in Chapter 3. By using these two measures, they have come up with results regarding the SBS size of twenty-four countries over the period 2001-2013. We build on their data in order to attain a better understanding about the SBS patterns of evolution in different countries. Then, by using a relevant econometric model, that includes control and dummy variables to control for country-specific influences, we perform statistical tests in order to find any correlations between SBS and GDP per capita growth as well as hourly labour productivity growth. In other words, **our first approach is a, generally, holistic approach that takes into account many countries and builds on a research effort that attempts to capture the vast majority of the SBS activities**.

Our second approach focuses on specific parts and activities of the SBS in US and is based on our theoretical analysis that is undertaken through this thesis project. By using relevant data from the FRB, we attain a better understanding of the SBS evolution in US both in terms of structure and size. Then, we experiment with

some of the main parts of the SBS in order to investigate for any correlations of these SBS parts with GDP per capita growth. Due to data limitations, we cannot perform a similar statistical analysis for productivity growth.

1.5 Relevance of the thesis project with high-tech innovation

A major problem in the management of (new) technology is the financing of unproven, risky new technologies and innovation. Small high-tech start-ups are known to experience a "funding gap", but even large established often report that they have more projects they would like to undertake than funds to spend on them (Hall 2005). There are a number of reasons for the difficulty of financing high-tech innovation: expected returns are low because the risks and uncertainties involved are high and because firms may not be able to capture the profits from an innovation in order to recoup their RD&D costs (2005).

Mazzucato and Wray (2015) claim that "finance and innovation are characterized by feedback: different types of innovations (and firms) require different types of finance, but we need to explore what type of finance is received and how that affects the patterns of innovation" (p. 27). Since the SBS has gained a dominant role in modern finance, as shown in Figure 13, it follows that the relationship between innovation and SBS is important. In this thesis project, through our theoretical analysis, we unveil the economic rationale, purposes and characteristics of the SBS. This gives us the opportunity to assess the extent to which the various elements of the SBS are conducive to the needs of high-tech innovation.

The same focus on innovation and technological progress has led us to econometrically investigate the potential impact of the growing SBS on the growth rate of (real) labour productivity in a panel of 14 countries during 2001-2012, where it is assumed that, following Hall (2011), labour productivity growth is a relevant output indicator of (high-tech) innovation. Hence, by investigating the relationship between the SBS and real labour productivity growth, we can gain some insight of the relationship between SBS and innovation.

Hence, we argue that both our analyses give us some insight into the impact of the SBS on high-tech innovation.

1.6 Overview of the report

The remainder of this paper is structured as follows: Chapter 2 focuses on the description of the SBS; Chapter 3 seeks for empirical correlations between the SBS and the GDP per capita and real hourly labour productivity growth; lastly, Chapter 4 concludes by presenting the main arguments of this thesis project.

In more detail, Chapter 2 explains the evolution of the SBS and describes its main functions and key constituents. In this chapter, some concepts and processes that, first, are crucial for the understanding of the basic mechanisms of banking and, second, are particularly relevant to the subsequent development of the SBS are explained. Then, the focus shifts to the most important changes in the US financial sector for about the last 150 years, including an explanation of the SBS emergence. The SBS mechanics are, then, described, by covering the key functions and parts of the system. The chapter concludes by providing the main points of this chapter.

Chapter 3 aims to provide empirical insights into the SBS and seeks for negative correlations between the SBS and the GDP per capita as well as the hourly labour productivity growth. Two different approaches are followed. Each approach consists of data presentation, descriptive statistics, presentations of the respective econometric models, manifestation of our results and further analysis on them.

Chapter 4 concludes by answering to our research questions and presenting policy implications that derive from the thesis project, arguments that are relevant to high-tech innovation (MoT context), suggestions for further research, thesis limitations and scientific contributions.

CHAPTER 2

Description of Shadow Banking

The aim of this chapter is to shed light on the SBS by explaining its evolution and describing its main functions and key constituents. To explain the SBS evolution, we focus on the country that represents the initial and foremost exponent of the SBS worldwide. That is, we analyze the SBS in U.S. To describe the current main functions and constituents of the SBS, we do not focus on a particular country because the SBS has now a global reach (IMF, 2014). By using the literature, we aim to provide a simplified and understandable version of the SBS that yet captures the key economic purposes and essence of the system.

First, we start by explaining some banking concepts and processes that are relevant to the subsequent development of the SBS. More specifically, we describe how bank runs occur and how money is traditionally created through deposits by commercial banks. We also explain some aspects of the credit intermediation and the traditional banking model.

Then, we exhibit the historical context of the U.S. financial sector. The SBS derived from many private decisions that were made over a long time (Gorton, 2010). But how much back should someone look at the financial sector to be capable of

explaining the evolution, main functions and parts of the SBS? Our approach pays particular attention to the bank runs of the National Banking Era (1863-1914) and the Glass-Steagall Act (1934). These are followed by a description of how the boundaries, which were set by the Glass-Steagall Act, gradually blurred and, finally, an explanation of the SBS emergence.

After the explanation of the SBS evolution, the key functions and constituents of the SBS are described. The interconnectedness between the key roles and the different parts of the SBS is made clear through a detailed description and relevant examples of the key transactions in the SBS.

Finally, the chapter concludes by providing the main points of this chapter.

2.1 Relevant key concepts and theories of finance

The underlying reasoning for choosing to describe bank run theory, traditional money creation through deposits and credit intermediation theory in the context of traditional banking is twofold: first, these concepts are crucial for understanding the basic mechanisms of banking. More specifically, banking is based on trust, since the money created are not kept as a reserve and there is an inherent (maturity) mismatch between savers-depositors that want to have their money accessible on demand and borrowers that do not want to take loans that are repayable on demand. This mismatch renders banking fragile and prone to a liquidity crisis. Through the process of bank run, the liquidity crisis is escalated into a solvency crisis. Besides this, attaining a basic understanding of how commercial banks create money and how credit intermediation works in the context of traditional banking are also important as basic background

knowledge of banking; second, these concepts are indeed relevant to the evolution and main purposes and constituents of the SBS. By having a clear understanding of their analogues in traditional banking, one might be really aided in understanding the core issues of shadow banking as well.

2.1.1 Bank run theory

We claim that bank runs are processes that initiate as liquidity crises and are later transformed into solvency ones. For our purpose, a simplified version of a bank balance sheet is used (see Figure 4). This version is based on examples that can be found in the literature (Furey, 2013).

Assets		Liabilities	
Reserves	10	Deposits	100
Loans	90	Borrowed Funds	20
Bonds	50	Net Worth	30
Total	150	Total	150

Figure 4: Initial bank's balance sheet

The asset side consists of reserves, loans and bonds and the liability side consists of deposits, borrowed funds and net worth. By definition, the asset side is equal to the liability side which is translated in our case as follows:

$$Reserves + Loans + Bonds = Deposits + Borrowed\,Funds + Net\,Worth \quad (1)$$

Looking at the balance sheet of Figure 4, the "liquidity illusion" (Kay, 2015, p.188) becomes evident. Reserves are much less than deposits. Kay describes it vividly: "{for liquidity illusion} ...an illusion that can survive only so long as not many people take advantage of it" (p. 188).

However, banks are under a reserve (or capital) requirement by central banks. In other words, they should keep a ratio of reserves to deposits at a minimum fraction and above. They are generally obliged to have their reserves roughly equal to one tenth of their deposits. Therefore, when deposits decrease, reserves decrease by the same amount in absolute terms and the reserve ratio is violated. This makes banks sell part of their other assets such as loans and bonds so that the ratio requirement is fulfilled again. Even if there were not any capital requirements, the asset selling would be mandatory for a bank in case of a cash shortage (i.e. in case reserves were close to zero).

In case of a bank run, demand for deposit withdrawals is so large that reserves are insufficient to cover the requests. The respective banks are stressed from a liquidity point of view. Consequently, these banks are obliged to sell large amounts of their loans and/or bonds. The other market participants, knowing the desperate need of banks for cash, can behave strategically and take advantage of this situation. By simply postponing any asset purchases from these banks, the participants will essentially force the banks to reduce their requested asset prices. Hence, the asset prices will fall by a significant portion. From the point of view of these banks, this

may constitute a catastrophe. The combination of a decreased asset side and constant liabilities results in a decreased net worth for the bank. The net worth to liabilities ratio decreases. If this happens to a great extent, then the bank becomes insolvent. To put it differently, its net worth is significantly reduced.

For a better understanding of this process, the following example is provided. Suppose that the initial balance sheet of the bank consists of the asset side and the liability side breaking down into: Reserves=$10m, Loans=$90m, Bonds=$50m and Deposits=$100m, Borrowed Funds=$20m, Net Worth=$30m respectively, as depicted in Figure 4. The capital requirement ratio of reserves to deposits is met since the ratio of reserves to deposits is equal to 10/100 or 10%.

In the following paragraphs, we analyze and compare what happens during normal deposit withdrawals with what happens during bank runs.

We suppose that we are in a normal situation in which the bank's depositors request $5m. Thus, the new deposits are equal to 95m, while the rest of the liability side does not change. The new reserves are equal to 5, while the rest of the asset side does not change. This means that the capital requirement is violated since the ratio of reserves to deposits equals to 5/95=5.26%, which is, less than 10% (see Figure 5).

If the bank is to meet the capital requirement, it has to increase its reserves up to $9.5m. To do so, it can sell $4.5m of its other assets, that is, its loans and/or its bonds. We assume that only loans are sold. In this case, the capital requirement is met since

reserves/deposits ratio equals 9.5/95 = 10%. Figure 6 presents the current situation. The fact that the net worth of the bank has not changed should be highlighted.

Assets		Liabilities	
Reserves	5	Deposits	95
Loans	90	Borrowed Funds	20
Bonds	50	Net Worth	30
Total	145	Total	145

Figure 5: Reserve (capital) ratio violation

Assets		Liabilities	
Reserves	9.5	Deposits	95
Loans	85.5	Borrowed Funds	20
Bonds	50	Net Worth	30
Total	145	Total	145

Figure 6: Bank balance sheet. No change in bank's net worth

We, now, assume that we are again in the initial situation of Figure 4 and a bank run occurs. Let us suppose that depositors are afraid of their deposits and massively withdraw them so that deposits decrease by 20%, resulting in a decrease of deposits from \$100m to \$80m.

The reserves may go down up to \$8m if the capital requirement is to not be violated. The bank is in great need for cash. This means that the bank should sell loans and bonds at a total value of \$18m (\$8m for reserves and \$10m for cash). However, either because there is not such demand genuinely or because the market participants are aware of the bank's situation and postpone any asset purchasing, inadequate demand for bank's assets is observed. Having no alternative, the bank basically fire-sells its assets, by offering them at a discount. We assume that in the end the total value of loans and bonds decrease by \$30m instead of \$18m. This results in the following situation of the balance sheet that is depicted at Figure 7.

Assets		**Liabilities**	
Reserves	8	Deposits	80
Loans	60	Borrowed Funds	20
Bonds	50	Net Worth	18
Total	118	Total	118

Figure 7: Bank's balance sheet in a bank run. Net worth reduction.

Through this process, a decrease in bank's net worth is observed. More specifically, the net worth dropped from $30m to $18m. Bad reports and news will be known with regard to the bank's solvency. This may make more depositors worried and they might start massively withdrawing their deposits. In this case, the liquidity crisis is escalated into a solvency crisis and the bank collapses. This process is called bank-run.

2.1.2 Traditional money creation through deposits

Money creation is a crucial function and a source of income for commercial banking. It is associated with liquidity provision for real economy participants. This sub-chapter explains the money-creation process. The underlying reasoning of this explanation is based on literature and, more specifically, Furey's work (2013).

What actually happens can be described as follows. Initially, a person or a small-to-medium corporation comes to a bank and asks for a loan. The bank is supposed to assess the creditworthiness of the other party and come up with a conclusion regarding the acceptance and (if any) the terms of the loan. If there is agreement on the loan terms, the bank increases its loans and deposits by the agreed amount. Regarding deposits, if the other party does not have an account at the bank, then the bank creates a new checking account with the agreed amount. If the other party does have an account, the bank increases this account by the agreed amount. The fact that a commercial bank can make money "out of thin air" is very important. Furey describes it vividly: "There is not one commodity, one piece of gold, one anything to back up this new money. What holds the system together is the confidence people have in accepting checks as payment for goods and services" (2013, p.45). "Confidence" or

"trust" to the financial sector is crucial to the system's stability. Turning again to the transaction, in case the new situation leads to a violation of the reserve requirement, the bank can increase its reserves in two ways. The first is to sell a portion of its bonds or other assets and the second is to borrow from other banks through the fed funds market. If both ways are not feasible at this point of time, the central bank intervenes by providing more reserves. To conclude, while it is true that a central bank creates reserves, money is essentially created by commercial banks.

For a better understanding of the former process, the following example is provided. The transaction parties are the person/corporation and the bank. We take as starting point the balance sheet of Figure 4. We assume that a small corporation comes and asks for a loan of $10m. This request is accepted by the bank, resulting in an increase of $10m for both the loans and the deposits (see Figure 8).

Assets		**Liabilities**	
Reserves	10	Deposits	110
Loans	100	Borrowed Funds	20
Bonds	50	Net Worth	30
Total	160	Total	160

Figure 8: Money creation by bank. Bank gives a loan by increasing its deposits.

The issue now is that the reserve requirement of 10% is not met and there is a deficit of $1m reserves. Therefore, the bank takes a loan of $1m from other banks, leading to total borrowed funds of $21m. The situation is depicted in Figure 9.

Assets		Liabilities	
Reserves	11	Deposits	110
Loans	100	Borrowed Funds	21
Bonds	50	Net Worth	30
Total	161	Total	161

Figure 9: Money creation by bank. Bank borrows from other banks in order to meet the reserve ratio requirement.

This example refers to money creation with existing reserves. If we provided an example with reserves creation, the central bank would also be involved, but the mechanism of money creation would be the same.

2.1.3 Credit intermediation theory and traditional banking

Credit intermediation usually includes credit risk transfer, credit transformation, maturity transformation and liquidity transformation.

Credit risk transfer refers to the transferring the risk of the borrower's default from the entity that originated the loan to another entity (Kodres, 2013). Credit transformation

refers to the "enhancement of the credit quality of debt issued by the intermediary through the use of priority of claims" (Pozsar et al, 2010, p.5). Maturity transformation refers to the use of short-term funds or liabilities like deposits to fund long-term assets such as loans (Kodres, 2013; Pozsar et al, 2010). Liquidity transformation is, in general, a process that is similar to maturity transformation (Kordes, 2013). In the context of shadow banking, it refers to the conversion of short-term tradable money-market instrument into checkable instruments.

In the traditional originate-to-hold banking model the credit intermediation between savers and borrowers was provided in a single institution. That institution was the bank. The way this channel worked is quite simple. The savers entrusted their funds to the bank in the form of deposits. Then, the banks loaned these funds to the borrowers (Gorton & Metrick, 2012). This system is depicted in Figure 10.

With regard to credit intermediation, credit risk transfer, maturity transformation and liquidity transformation, these processes were provided by the bank while credit transformation did not occur. More specifically, the bank's involvement and the government guarantee for deposits let the depositors justifiably feel that their deposits are fully safe. As far as maturity and liquidity are concerned, the bank utilizes short-term funds to fund long-term loans. Banks exploits the differences in the interest rates between the different maturities in order to make profits. However, it is exposed to the relevant risk if loans are not repaid.

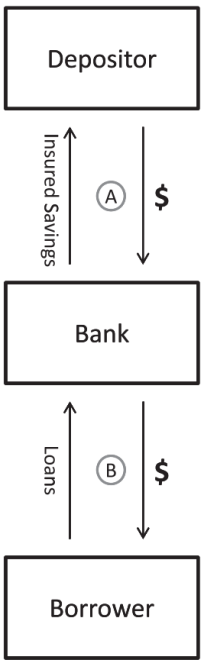

Figure 10: Traditional banking model. Adapted from "Securitized banking and the run on repo", by G. Gorton and A. Metrick, 2012, Journal of Financial Economics, 104(3), p. 426. Copyright 2011 by the Elsevier B.V..

2.2 Evolution of the U.S. financial sector

2.2.1 National Banking Era

The National Banking Era precedes the Quiet period (1934-2007). The distinction between these two periods mainly derives from the difference in terms of the frequency of the banking crises during them. More specifically, a banking crisis is a much more frequent event in the National Banking Era than in the Quiet Period. This is also depicted in Figure 11.

The absence of a central bank is a key feature of this period. This results in no government lender of last resort, something given nowadays. During this period, there was no guarantee or insurance regarding the bank deposits.

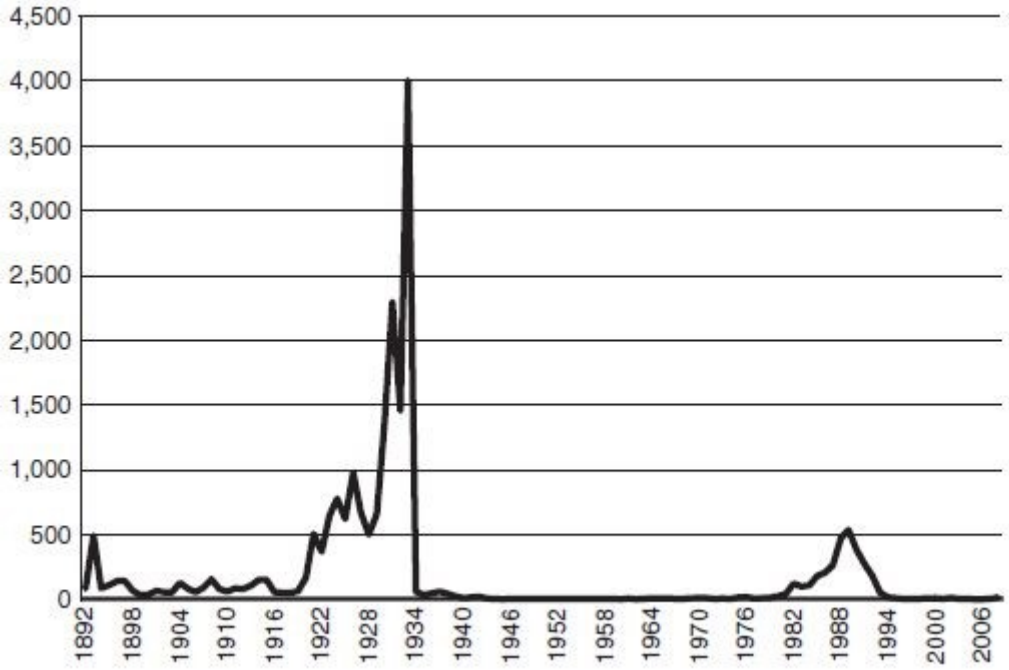

Figure 11: No. of bank failures during National Banking Era and Quiet Period. Adapted from: *Slapped by the invisible hand: the panic of 2007* (p. 14), by G. B. Gorton, 2010, New York, NY: Oxford University Press. Copyright 2010 by Oxford University Press.

The bank runs were generally caused by shocks. These shocks consisted of information about an imminent recession of the real economy that was diffused at the time of business cycle peaks (Gorton, 2010). The depositors were afraid of banks failing during the recession and they were also not aware of which banks were more prone to failure due to prohibitions regarding banks' situation (2010). These prohibitions were supposed to protect weak banks from becoming exposed. However, the outcome was utterly different. The worried depositors were also confused about the solvency of their personal banks. Hence, depositors were running to all banks, seeking to withdraw money from their accounts. Banks could not honor these demands because the money had already been lent out and their loans and other assets were illiquid, that is, they could not be sold (2010).

The National Banking Era ends with the Federal Reserve System coming into being in 1914 (Gorton, 2010). However, as history cynically revealed through the next bank runs and the severity of the Great Depression in 1929, the restoration of public confidence to the banking sector had not been achieved.

2.2.2 Glass-Steagall Act

Given the abundance of banking crises and in response to the Great Depression, regulatory measures were taken to prevent these crises and ensure stability of the financial sector. More specifically, a banking act that is now well-known with the name 'Glass-Steagall Act' was passed in 1933 from the U.S Congress. The act was passed as an emergency measure to cope with the failure of a lot of banks during the Great Depression. During 1930-1933, 9,000 banks in US failed (Ellis, 2013).

The Glass-Steagall Act's primary features were threefold: to create the Federal Deposit Insurance Corporation (F.D.I.C); to introduce Regulation Q; and to separate commercial from investment banking. The separation between commercial and investment banking is the most important element of this act. Indeed, the main purpose of this act was to prevent the exposure of commercial banks to the risks of investment banking. This exposure was considered to undermine any previous efforts aiming to ensure stability of the financial sector (Kregel, 2010).

Regarding the FDIC, we can think of it as an insurance provider that renders the deposits of an average depositor safe even if the bank fails. At this point, we have to remember that this claim does not hold for very large deposits. Due to FDIC, there is no incentive for an average depositor to hasten his deposits withdrawal in case of a

liquidity crisis. Hence, FDIC hinders the escalation of a liquidity crisis into a solvency crisis. To put it differently, the vast majority of depositors have no reason to panic and bank runs are avoided.

The FDIC operations resemble those of an insurance company to a great extent. Banks apply for insurance and the FDIC consents to insure those whose level of risk is considered acceptable (Ellis, 2013). FDIC charges premiums that are proportionate to the respective banks' risks. The whole risk of the deposit insurance system is covered by the banking industry and backstopped by the federal government (2013).

Most concerns about this system are associated with moral hazard issues (Gropp & Vesala, 2004; Ellis, 2013). More specifically, it is claimed that the banks may engage to more risky activities, taking advantage of the safety net that this insurance system offers. In this case, the following paradox is observed; insurance system leads to less stable banks (Kareken & Wallace, 1978). Hence, historically, a lot of effort has been made so that the design of this system provides incentives that minimize this moral hazard issue (Ellis, 2013).

The second feature of Glass-Steagall act - Regulation Q placed limits on the interest rates banks could offer for deposits. More specifically, Regulation Q prohibited the payment of interest for deposits on demand and authorized the Federal Reserve to set interest rate ceilings on savings deposits (Gilbert, 1986).

The key objectives of regulation Q were the following four; first, to encourage country banks to utilize their cash more for lending in local businesses and

organizations rather than holding balances with larger banks in financial centers. The underlying reasoning assumed that the funds ending up to local communities were being used productively, while those ending up at large financial centers were being utilized for speculative purposes. In other words, it was argued that the benefits for the society in the former funds utilization outweighed those of the latter one by far. Hence, restricting interest rates would decrease the attractiveness of large banks deposits for country banks. (Gilbert, 1986)

The second main objective was the reduction of interbank lending. The underlying reasoning was that interbank lending would result in a more illiquid financial sector through the following process. Small banks have deposits in larger banks. Due to small panics or seasonal loans, excessive outflows in their reserves occur. Hence, many small banks withdraw their deposits at larger banks simultaneously. This results in a liquidity crisis for large banks (Gilbert, 1986). The dangers of a liquidity crisis are explained in detail through the sub-chapter 2.1.1.

The third main objective was to alter the risk appetite of banks. The mechanism would be as follows. The competition between banks with regard to offering higher interest rates to depositors would be limited. This would facilitate banks in making higher profits. Thus, banks would not need to be involved in higher-risk activities in order to achieve sufficient profits. (Gilbert, 1986)

Fourth, banks were complaining for paying the aforementioned premiums with regard to deposit insurance. The savings of interest payments through the interest rate ceilings of regulation Q were supposed to alleviate the burden from deposit insurance

premiums. Indeed, some congressmen were even claiming that the savings were exceeding the burden. (Gilbert, 1986)

The last but definitely not least feature of Glass-Steagall act is the separation between commercial and investment banking. Indeed, this separation is the most important element of this act. It created a wall between the commercial banks and the other institutions that are engaged to investment banking. Typical examples of these institutions are savings banks, investment banks or investment houses, building loan associations, land or mortgage banks and trust companies (Kregel, 2010). For simplicity, we use the term "investment banks" in our analysis when referring to all these types that are engaged to investment banking.

The functions of commercial banks were very different compared to the functions of investment banks after the Glass-Steagall Act. More specifically, commercial banks had a monopoly on receiving deposits and issuing commercial loans (Kregel, 2010). Their business model was locked into short-term, self-liquidating business loans (2010). That is, these loans were supposed to be repaid with money generated by the purchased assets. By taking advantage of their monopoly on deposit creation, they could create liquidity and money in the way that is described in sub-chapter 2.1.2. At the same time, these banks were under strict regulation and their deposits were guaranteed. Hence, their depositors were offered safety but in expense of very low returns. On the other hand, investment banks had a monopoly over securities market activities (2010). They were not under external regulation and there was no deposit insurance for them. Thus, investment banks were supposed to be associated with long-

term maturities and to offer – compared to commercial banks – higher returns but at the cost of higher risk and without a safety net.

Reflecting on the Glass-Stegall Act, we come up with the two following observations. First, the objectives of this plan, namely, the promotion of financial sector's stability and the reduction of system's bank runs were achieved by, essentially, the separation of "utility finance" and "casino finance" (Centre for the Study of Financial Innovation (CSFI), 2009). Second, focusing on liquidity creation, after the Glass-Steagall Act, this function was primarily undertaken in practice only by commercial banks through the money-deposit creation process that is described in 2.1.2. However, having the benefit of 80 years hindsight, we can claim that the Glass-Steagall Act did not manage to maintain the separation between commercial and investment banking for a very long time, although this had been achieved, initially, to a great extent. Figure 12 aims to capture the essence of the situation in the U.S. financial sector just after the "Glass-Steagall Act".

2.2.3 The erosion of "Glass-Steagall" wall

The established - through the Glass-Steagall Act - boundaries between the commercial and the investment banking were blurring over time. Initially, investment banks offered products similar to commercial loans but with fewer restrictions and lower costs (Kregel, 2010). More specifically, savings and loan banks were competing for deposits. Due to regulation Q, commercial banks had limits on deposit interest rates. During high-inflation periods, interest rates started to climb with inflation rendering savings and loan banks very competitive (Kregel, 2010). More specifically, in the late 1970s, inflation arose from 3% or 4% to as high as 10% or 11% (Sherman,

2009). Thus, savings and loan banks could offer a much higher interest rate to depositors compared to what commercial banks could offer due to regulatory restrictions. Naturally, investors started seeking for alternatives to traditional deposit accounts (Sherman, 2009).

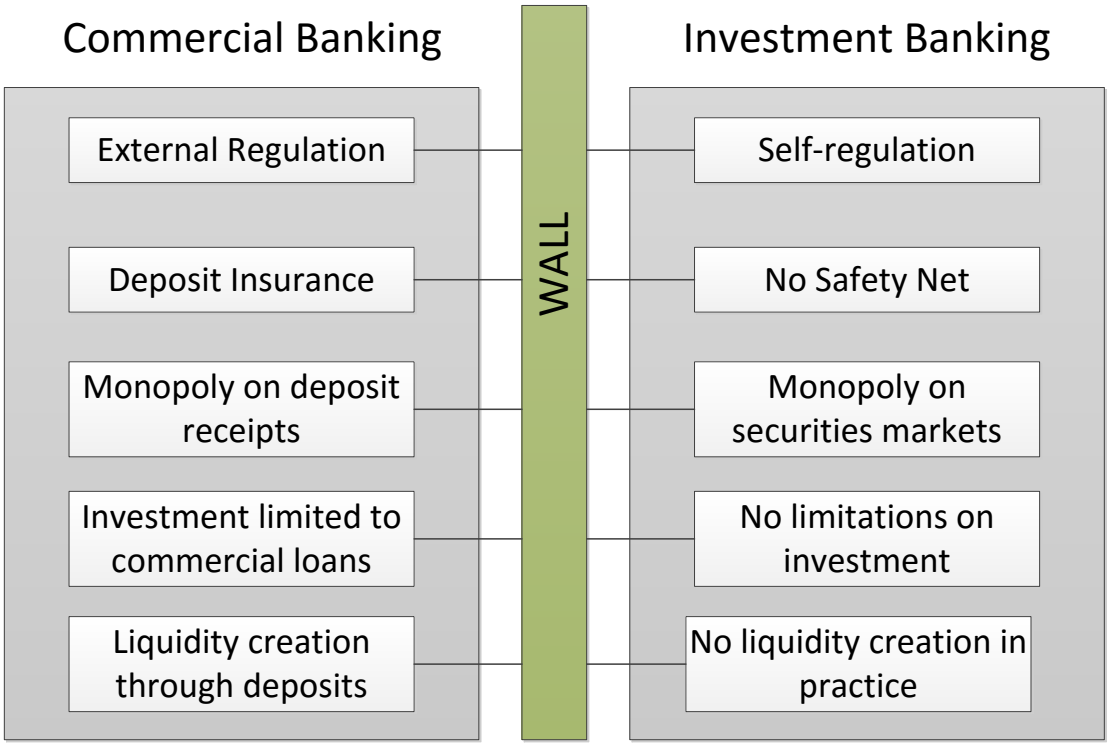

Figure 12: Glass-Steagall Act. Boundaries between commercial and investment banking are shown.

The removal of Regulation Q, which placed ceilings on interest rates on retail deposits, in 1980 (Eighengreen, 2008), deregulation and subsequent decisions during 1980s, driven by the emergence of the neo-liberal political paradigm (Palley, 2007), were gradually making the differences between commercial banks and investment banks more and more subtle (Kregel, 2010). Investment banks were steadily aiming to provide commercial bank-like services and, vice versa, commercial banks sought to compete in the market place by expanding their lending into longer maturities (Kregel, 2010).

2.2.4 The SBS rise

The SBS rise started during the 1980s and the major expansion occurred during the 1990s and 2000s (see Figure 13).

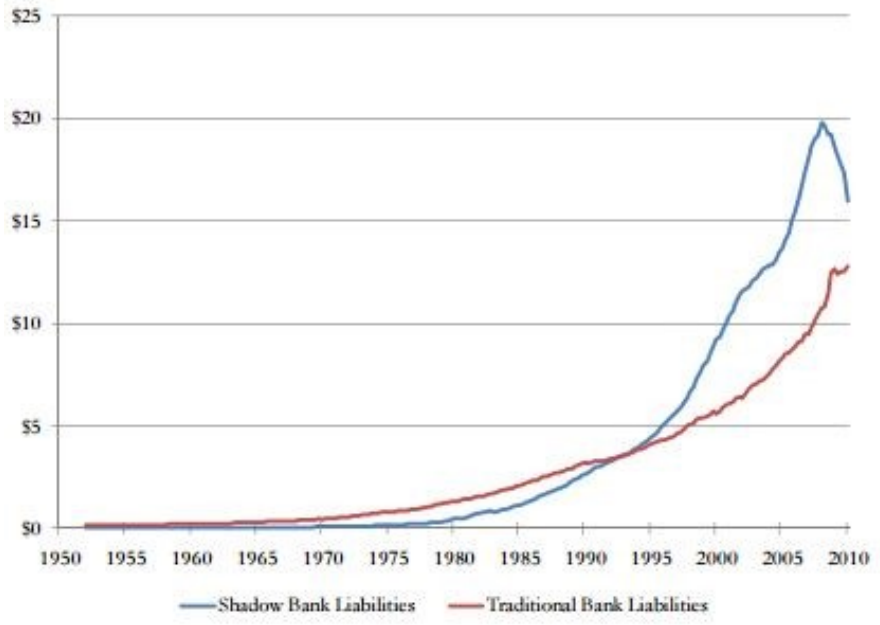

Figure 13: The SBS rise. Adapted from *Shadow Banking* (Staff Reports No. 458) (p. 5), by Z. Pozsar, T. Adrian, A. Ashcradt, & H. Boesky, 2010, New York, NY: Federal Reserve Bank of New York.

First, it has to be highlighted that we should be very cautious about any insights that can be drawn regarding the accurate size of the US SBS from Figure 13. Many of the important aspects of the SBS remain debatable and the need for a better understanding of its activities persists (Bakk-Simon et al., 2012). One such aspect is that there is no single definition of shadow banking that would suffice for all purposes, mainly, due to the large differences in shadow banking activities across countries (IMF, 2014). This renders estimating its size extremely difficult (Bakk-Simon et al., 2012).

Economists from the IMF, the ECB, other organizations and the academic world have proposed different ways of measuring the SBS. These ways are highly dependent on

how the SBS is defined. More specifically, some studies define shadow banking by focusing on the nature of the institution/entity that carries it out (Ricks, 2010; Acharya, Khandwala, & Öncü, 2013; Pozsar et al., 2010). They focus on the distinction between banks and non-bank financial institutions. The latter are considered shadow banks. Some other studies focus on the activities, putting emphasis on the distinction between traditional and non-traditional financial intermediation (Claessens & Ratnovski, 2014; Harutyunyan, Massara, Ugazio, Amidzic, & Walton, 2015). Finally, a third perspective of shadow banking captures both activities and entities (Gorton & Metrick, 2012). Given all the above, neither Figure 13 nor any other figure found in the literature can guarantee that the SBS is measured in an accurate way. To put it differently, the figures estimating the size of the SBS for US and/or the SBS worldwide may be used only as proxies.

However, proxies may be very useful. For instance, Figure 13 clearly illustrates that the SBS has risen sharply from the 1990s both in absolute terms and in relevance to the rest of the financial sector. The subsequent important question is associated with the reasons that explain the emergence of the SBS. In other words, we are led to ask: Why did shadow banking grow? - Which are the main drivers of its evolution?

Since the 1990s, institutional cash pools have become increasingly prominent (Figure 14). By "institutional cash pools" we refer to "large, centrally managed, short-term cash balances of global non-financial corporations and institutional investors" (Pozsar, 2011, p. 4).

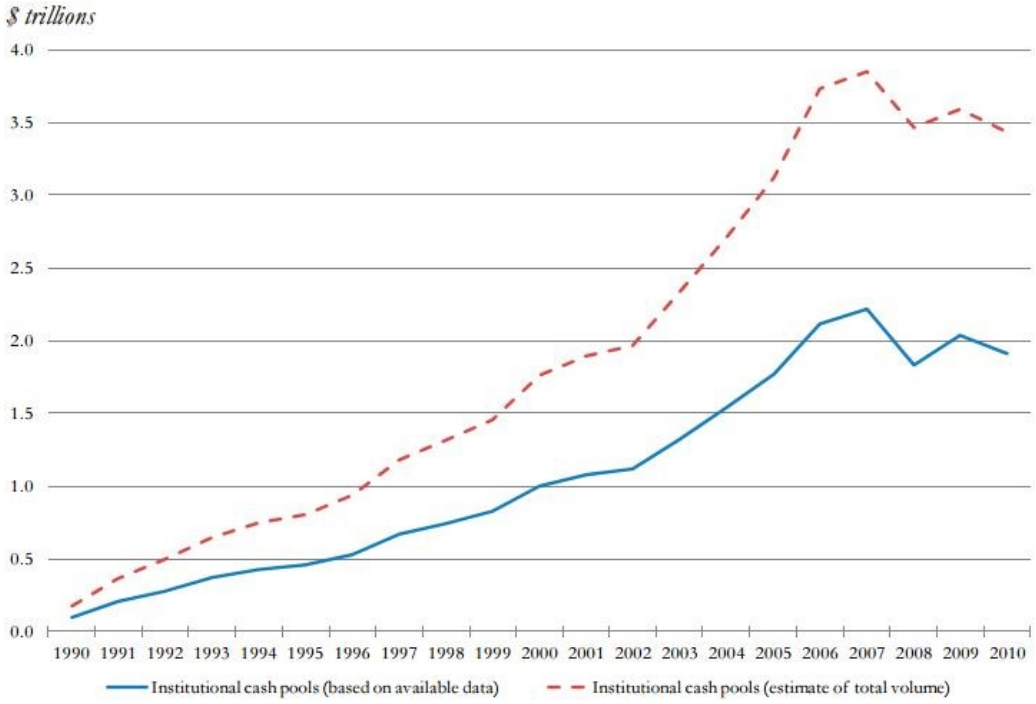

Figure 14: The rise of global institutional pools. Adapted from *Institutional Cash Pools and the Triffin Dilemma of the U.S. Banking System* (IMF Working Paper No. 190) (p. 6), by Z. Pozsar, 2011, Washington, DC: International Monetary Fund.

The explanation of this rise of institutional cash pools may be found, among others, in the globalization of corporations and the subsequent pooling of their cash balances, the increase of earned cash balances, cash and cash equivalents as a share of corporate assets and the increase of inequality (Pozsar, 2011). Inequality is relevant for two reasons. First, higher-income households have a higher propensity to save compared to lower-income households and, second, the deposits of higher-income households generally exceed the amounts up to which the commercial banking deposits have been insured. Manifestations of the previously described increases in cash as a share of total assets and inequality are found in the literature (Pozsar, 2011; Palma, 2009).

Based on surveys, (Pozsar, 2011) we know that cash pools have a strong preference to safety. In other words, they really prioritize options that ensure that their wealth will

not be lost. The traditional options of money market instruments for institutional cash pools were twofold: first, government guaranteed money market instruments. These mostly include very low-risk government bonds such as U.S. Treasury bills and insured deposits; second, unguaranteed instruments such as uninsured deposits. Among these choices, only the first one, that is, the government guaranteed deposits are aligned with the principal need-preference of institutional cash pools for safety. However, the rise of global cash pools, reinforced by the limitations on deposit insurance and the consolidation of the banking sector (between 1990 and 2010 the number of FDIC-insured banks decreased from 15,000 to 8,000 banks), resulted in a mismatch between the demand for safe money market instruments and the relevant supply.

We claim that the SBS has grown so much in order to fill the vacuum between the demand and the supply of safe money market instruments. In particular, this vacuum derived from limited supply of government-guaranteed money market instruments, on the one hand, and an aversion of global cash pools to uninsured deposits of the traditional banking system on the other hand.

However, it has to be highlighted that this vacuum would not be filled without relevant financial innovations such as asset securitization, money market mutual funds and repurchase agreements. All these key innovations are described in sub-chapter 2.3, in which the main functions, constituents and processes of SBS are explained.

2.3 Main purposes and constituents of Shadow Banking

This sub-chapter is devoted to the description of the purposes, constituents and processes of the SBS. This is achieved through the analysis of the two key SBS functions, namely **securitization** and **collateral intermediation**. The role of the key constituents (**ABS, ABCP, Repo, MMMF, Rehypothecation**) of the SBS is described through the analysis of the key SBS functions and their chains-processes.

After an examination of the SBS literature, we claim that the two most important functions of the SBS from an economic point of view are securitization and collateral intermediation. Among other studies, the key role of securitization with regard to the SBS has been highlighted by the works of Pozsar, Adrian, Ashcraft and Boesky (2010) and Gorton and Metrick (2012). Similarly, the key role of collateralization with regard to the SBS is evident through, among other efforts, the works of Singh and Aitken (2010), Singh (2011) and Singh and Stella (2012).

These two functions have large, distinct roles and are similar to traditional banking in the sense that they are aimed to provide credit intermediation between savers and borrowers as well as to manage counterparty risks (Claessens, Pozsar, Ratnovski, & Singh, 2012). However, their respective chains are much more complex and involve much more entities compared to the chain of traditional banking model. The chain of traditional banking model was pretty simple and included only one single entity - the bank.

Securitization

As far as securitization is concerned, this function caters to institutional cash pools that seek safe, short-term, deposit-like investments to "park" their cash balances and to banks that use securitized safe and long-term assets to attract repo funding (Claessens et al., 2012). There are **two key securitization chains**. Based on the differences in the relevant transactions and, in particular, the different short-term funding instruments, we call them **"ABCP securitization chain"** and **"Repo securitization chain"**.

ABCP securitization chain

The "ABCP securitization chain" is depicted in Figure 15.

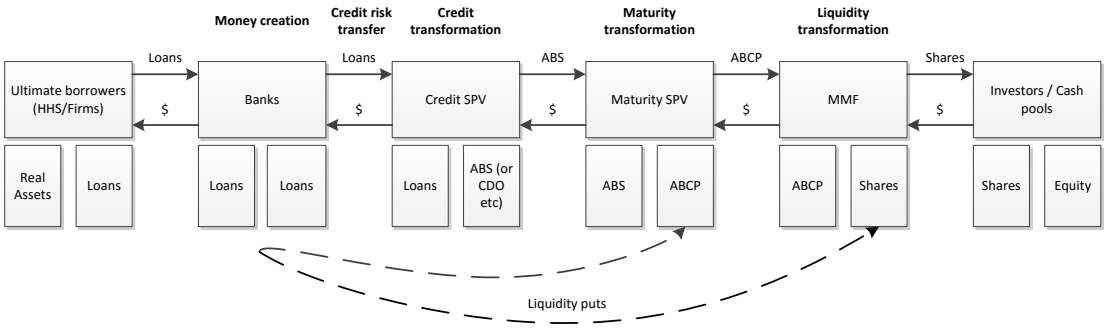

Figure 15: ABCP securitization chain

The first step is the loan origination from the bank out of thin air. This action constitutes money creation through deposits. This is thoroughly described in sub-chapter 2.1.2.

The second step is the credit risk transfer from the bank to another entity - the credit special purpose vehicle (SPV) or special purpose entity (SPE). SPVs, in general, undertake some transactions - or even a single transaction – and do not have any other

purpose. They are governed by rules that are set in advance of their creation and limit the SPVs' actions. SPVs seem like robotic entities in the sense that they do not have physical location and no one works at them. They have two important features with regard to bankruptcy. First, they are bankruptcy remote. Indeed, the insolvency of their sponsor banks or other entities that originate the loans does not affect the respective SPV. Even if the sponsor bank goes bankrupt, the bank's creditors cannot recover their funds from the SPV. Second, the design of the SPV renders the entity's bankruptcy impossible from a legal point of view. (Gorton & Metrick, 2012)

The third step is undertaken by the credit SPV and refers to the credit transformation of the loans. The essence of this activity is the pooling of loans and the subsequent issuance of prioritized capital structure of claims, known as tranches, against these loan pools (Coval, Jurek, & Stafford, 2009). This issuance is also known as structuring. The outcome of this process is the repackaging of risks and the creation of some assets that are far safer than the loans of the underlying pool (Coval et al., 2009). It follows, of course, that some other assets carry more risk than the loans of the underlying pool. Credit transformation is at the heart of the whole securitization process. Sometimes, this process is also called securitization or structured finance activity. The mechanisms of this process are indeed of paramount importance. So is the role of credit rating agencies. The final product of this process is a safe long-term asset, such as the Asset-Backed-Security (ABS). If the process is repeated by securitizing the ABSs, then Collateralized-Debt-Obligations (CDOs) will be created. Likewise, financial securities such as CDO^2, CDO^3 are created. A simplified example of the credit transformation is provided. Particular focus has been given in the main assumptions of this process and the relevant role of credit rating agencies.

We assume that we have two loans (L1, L2) in our portfolio. Each of these loans has a credit risk of default equal to 10%. In case of a default, the respective loan becomes useless. A crucial assumption is that the credit risks of the loans are not correlated. That is, if one of the loans defaults, the other loan is not affected.

We move on the credit transformation of these loans by pooling and then structuring them. The two loans are now transformed into two ABSs (ABS1, ABS2). The two ABSs have different credit risk (and naturally different returns). More specifically, the safe ABS (ABS1) defaults only if both the two loans default. The riskier ABS defaults if either the first or the second loan defaults. It, obviously, defaults also in the case that both the two loans default. The credit risks of the ABSs can be calculated by the decision tree of Figure 16.

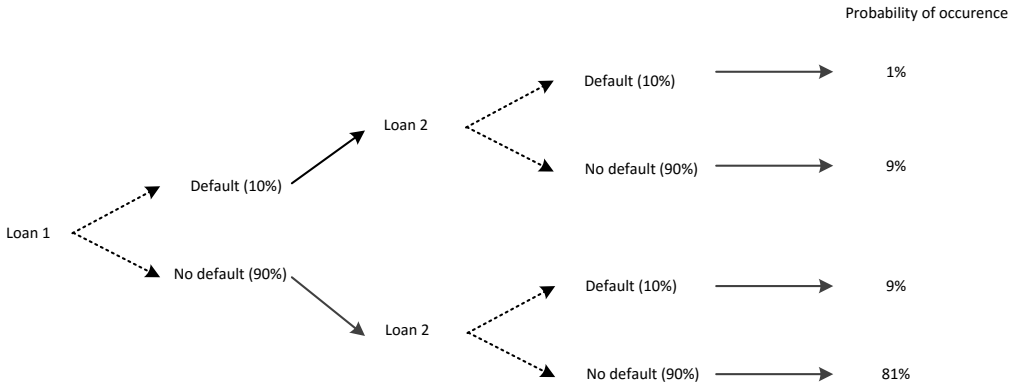

Figure 16: Securitization - decision tree.

Based on the decision tree of Figure 16, we know that the credit risk of the senior tranche (ABS1) is only 1% while the risk of the junior tranche (ABS 2) is 19% (=1%+9%+9%). This means that the senior-safe ABS is ten times less risky than the loans while the junior-risky ABS is almost twice as risky as the two loans. The overall risk has remained 20%.

If we now again pool the two ABSs and structure them, then we will create two CDOs. The safe-senior CDO will have less credit risk than the safe-senior ABS. The junior-risky CDO will entail more risk than the junior-risky ABS. Again, the sum of the risks will remain the same. The process can be repeated again with CDOs resulting in CDO^2 and so on.

Aiming to reflect on this process, the first remark one may make is that the credit transformation has resulted into some very safe securities. This would be true if the assumption that zero correlation between the different securities held. This assumption does not hold in practice. Indeed, a key factor determining the ability of the whole process in creating securities much safer than the underlying collateral (loans in our case) is the extent to which loans' defaults are correlated (Coval et al., 2009). The higher the default correlation, the less safe the senior tranches are. Hence, the effectiveness of securitization/structuring heavily depends on the extent to which the default correlations are calculated accurately.

But how had this happened so far? Credit rating agencies had the role of assessing the credit risks of the different structured products and informing the investors about the credit quality of these products. As the global financial crisis of 2007 has showed, the quality of credit ratings was rather poor. The drivers of this outcome are twofold; first, credit rating agencies have not been particularly competent in valuing structured securities. They have built their expertise and brand in valuing single-name securities. The fundamental difference between single-name securities and structured securities is associated with the exposure to systematic risk – i.e. risk of loans defaulting due to

the situation of the overall economy (Coval et al., 2009). Unlike single-name securities that are primarily driven by firm-specific considerations, the performance of structured securities is strongly affected by the performance of the economy as a whole (Coval et al., 2009). The exposure to systemic risk of structured securities has been undervalued. In other words, the correlation between the default risks of the various ABSs has been undervalued and this, in turn, led to misconceptions regarding the credit quality of the safe ABSs. Some of the safe ABSs were not as safe as they were perceived to be; second, credit rating agencies were given perverse incentives. More specifically, they were (and still are) paid by the banks whose securities are to be rated (Baker, 2008). At the same time, the credit rating agencies were competing with each other in order to attract these banks as customers. Hence, the credit rating agencies had a strong incentive to issue high ratings to the banks' securities (Baker, 2008), even when this was not justified. Again, some of the safe ABSs were not as safe as investors thought.

The fourth step is associated with maturity transformation and is undertaken through a maturity SPV. It refers to a long-term asset, such as ABS, that is sold to a vehicle that is funded in short-term markets. The most usual transformation of the ABS is the so-called Asset-Backed-Commercial-Paper (ABCP).

The fifth step of this process is the liquidity transformation. It refers to ABCPs becoming liquid through the Money Market Mutual Funds (MMMFs) and the liquidity puts of banks, that is, the obligation of banks to provide liquidity support to the maturity SPV and/or the MMMF. Some background knowledge about the MMMFs is provided in the next paragraph.

Investors, in general, seek for a balanced portfolio, that is, a portfolio that includes cash and different types of securities such as stocks and bonds. Small investors cannot do that by themselves, since they do not possess the required funds to buy many different securities. MMMFs can solve this issue by collecting funds from many investors for the purpose of investing in different securities. MMMFs constitute a specific open-ended type of these funds. To put it differently, they do not have any restrictions regarding the amount of shares that they can issue. If there is demand, they will continue issuing shares regardless the amount of investors in the fund. They will also buy back shares when investors want to sell. MMMFs invest in short-term securities such as government bonds, repos, ABCPs and other types of commercial paper (Adrian & Ashcraft, 2012). More specifically, they are restricted by regulation to invest only in assets which satisfy very strict safety criteria. This regulation is very important because the risk-taking opportunities of MMMFs are supposed to be quite restricted. Moreover, this regulation has probably led to similar returns of MMMFs from their beginning in 1970s until the crisis of 2008 (Kacperczyk & Schnabl, 2011). In terms of their organizational form, most MMMFs are owed by financial conglomerates and stand-alone investment companies. The latter institutions manage the funds of their clients without providing other financial services. On the contrary, the conglomerates do both. Examples of the financial services that they provide include commercial banking and insurance. Another exclusive characteristic of conglomerate-owned MMMFs is that they are capable of offering implicit guarantees to investors. If the fund ends up being in distress, the conglomerate can cover investor's severe losses by having access to retail deposits and short-term funding

markets. This not an option when the owner of the MMMF is a stand-alone investment company. (Kacperczyk & Schnabl, 2011)

Repo securitization chain

The "Repo securitization chain" is depicted in Figure 17.

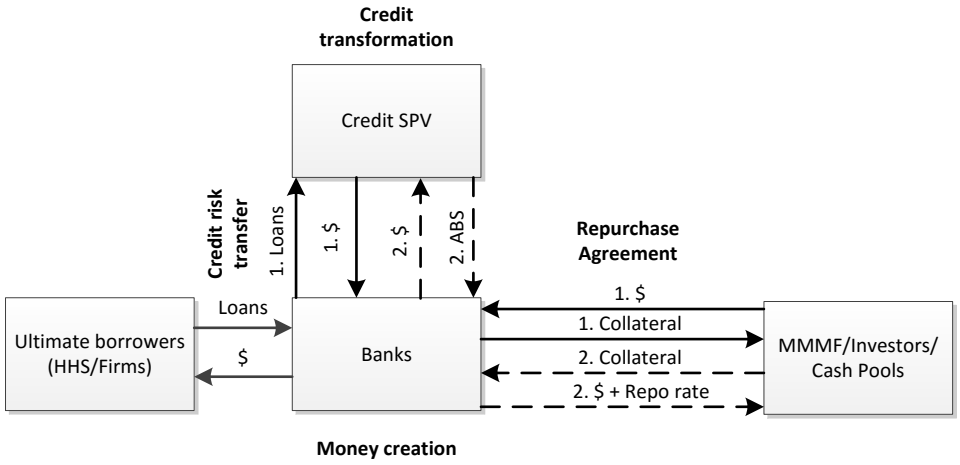

Figure 17: Repo securitization chain

The first two steps, namely money creation and credit risk transfer are identical to the first two steps of the "ABCP securitization chain". The first difference lies on the third step, the credit transformation. Although the securitization processes are identical, in this case, the ABS is sold again back to the bank in exchange for cash. The bank now possesses long-term very safe ABSs. These can be used as collateral for repurchase agreements (Repos).

A Repo transaction is a two-step process. First, the investor or MMMF gives some cash to the bank in exchange for some tradable collateral. Second, when the repo expires, the collateral is returned to the bank in exchange for the borrowed cash plus an additional amount, called repo rate. It has to be highlighted that lending against

collateral is neither unique nor new. The distinctive feature of repurchase agreements is the fact that the collateral is tradable. In other words, the investor thinks that if the borrower (in our case the bank) goes bankrupt, then he is able to convert the tradable collateral into cash. This convertibility is crucial for the whole transaction.

The features of repos become more comprehensible if they are compared with their analogues in traditional banking. First, in traditional banking, minimum reserves are set by regulators and any deficits can be borrowed from central bank. The analogue in repos is the repo haircut. That is, repos are over-collateralized. The value of the collateral exceeds that of the sale price. The difference is the haircut. The minimum levels of haircuts are set by counterparties. It should be highlighted that central bank does not intervene in case of any shortfalls. Second, the role of deposit insurance, which is guaranteed by the government in traditional banking, is played by collateral in repos. The collateral may take various forms including cash, loans and securitized securities such as the ABS. Third, interest rates are the source of yield in traditional banking. They give incentives to lenders to put their money in the bank. Hence, if the bank aims to attract more deposits, it can raise the interest rates. In repos, this role is played by repo rates. The repurchase price in a repo exceeds the sale price and this difference is called repo rate. Repo rates are increased when funds are low. These three analogues are depicted in Table 2.

Table 2. Analogues between Traditional Banking and Repos.

Traditional Banking	**Repos**
Minimum reserves	Repo haircut
Deposit insurance	Collateral
Interest rates	Repo rates

Repo haircuts, rates and collateral may be made more understandable through the following example. If we assume that a bank has an ABS with market value of $200 and sells it to a MMMF for $160 with an agreement to repurchase it for $176, then the haircut is 20% (=(200-160)/200) and the repo rate is 10% (=(176-160)/160). If the bank defaults on the promise to repurchase the ABS, then the MMMF has the right to terminate the agreement and keep or sell the collateral.

Collateral intermediation

The second key function of the SBS is collateral intermediation. It involves the intensive re-use of collateral (rehypothecation) so that the same collateral underpins as many as possible financial transactions. Unlike securitization that is associated only with safe assets, this function includes assets of varying quality, from very safe to very risky. The wide range of underpinned financial transactions involves, among others, securities lending, Over-The-Counter (OTC) derivatives and repos.

Regarding the collateral intermediation chain, it is simpler but less standardized compared to securitization chain. By less standardized, we basically mean that the same entity might play different roles in different transactions that involve collateral intermediation. The most typical example of a collateral intermediation chain is depicted in Figure 18. The most common source of collateral is hedge funds that need to borrow cash or securities. The most common source of cash is MMMFs that seek for a place to put their money. Between them, dealer banks are involved. They receive the collateral from hedge funds and use it in transactions with other banks in order to obtain funding or support other contracts, such as OTC derivatives. This evolves into

a system in which a single unit of collateral is repeatedly used in order to support multiple financial transactions.

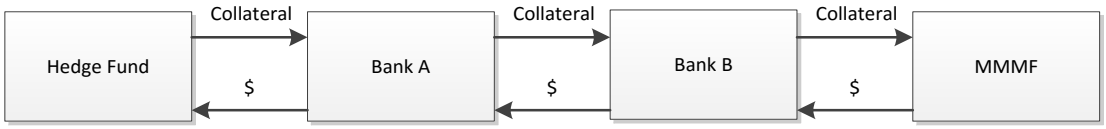

Figure 18: Collateral intermediation chain

2.4 Conclusions

As far as the SBS evolution is concerned, we claim that the SBS arose in order to meet the need of global cash pools with regard to a safe "parking place" for their cash. In other words, it is the principal need of global cash pools for safety and liquidity, which was not met through insured deposits and safe government bonds adequately, that led to the SBS rise.

Other factors that contributed to this rise are associated with financial innovations, deregulation of the financial sector and competition between commercial and investment banks. The most important financial innovation with regard to the SBS evolution is asset securitization and the most relevant outcome of deregulation and competition between the different types of financial institutions has been the practical (and later the official) repeal of the Glass-Steagall-Act.

Regarding how the SBS works in practice, its key functions are securitization and collateral intermediation and the most important constituents of the SBS include ABSs, ABCPs, Repos, MMMFs, Rehypothecation. The key operations of the SBS are presented through Figure 15, Figure 17 and Figure 18.

CHAPTER 3

Empirical insights on Shadow Banking

This chapter aims to provide empirical insights into the SBS that contribute to our attempt to shed light on the impact of the SBS on GDP per capita growth as well as real hourly labour productivity growth. This is quite an explorative task given the fact that, as discussed in the introductory chapter, literature is on an initial stage with regard to any measurements of the shadow banking's social efficiency. Besides this, data limitations with regard to an accurate measurement of the SBS render any empirical conclusions to be taken with caution.

Given this context, we follow two approaches in order to search for any statistically significant correlations between (parts of) the SBS and GDP per capita growth and productivity growth. Each approach consists of data presentation, descriptive statistics, presentations of the respective econometric models, manifestation of our results and further analysis on them. Our first approach is a, generally, holistic approach that takes into account many advanced countries and builds on a research effort that attempts to capture the vast majority of the SBS activities. Our second approach focuses on specific parts and activities of the SBS in US and is based on our theoretical analysis that is undertaken through this thesis project. We use this

approach in order to attain a better understanding regarding the impact of these specific SBS parts on GDP per capita growth and productivity growth. Real GDP per capita growth and labour productivity growth are output-indicators which should capture the ultimate (net) impact of the growth of the SBS after controlling for relevant other determinants such as the interest rate. Both variables are generally interpreted as measures of social welfare or social efficiency. Hence, our approaches are quite different. We think of this as an advantage since their combination gives the reader the opportunity to look at the issue of SBS's social efficiency from two very different perspectives and draw useful insights.

In the end of this chapter, we conclude by reporting our key empirical findings.

3.1 First Approach

3.1.1 Data presentation

We use annual data from a study of IMF economists (Harutyunyan, et al., 2015) and the OECD database for our first approach. The data regarding the SBS are derived from the aforementioned study while the data regarding the GDP per capita growth, real productivity growth, inflation rate, nominal long-term interest rate and output gap as a percentage of potential GDP (potential GDP is a theoretical term and refers to a full-capacity GDP, output gap is defined as actual GDP minus potential GDP) are derived from the OECD database.

As far as the measurement approach for the SBS that was undertaken by IMF economists (Harutyunyan, et al., 2015) is concerned, this approach focuses on financial sector's noncore liabilities, which are supposed to represent the SBS (2015).

Two different measures of the SBS have been created, namely the broad noncore liabilities measure and the narrow noncore liabilities measure. The broad measure "reflects all exposures of the SBS, including its level of interconnectedness within the SBS. The narrow measure of noncore liabilities reflects the net exposure of the SBS to macroeconomic sectors outside the SBS. The broad and narrow measures complement each other and can be interpreted as the upper and lower bounds, respectively, of the estimated size and interconnectedness of the SBS in a given country or country grouping" (Harutyunyan, et al., 2015, p.11).

Our panel has data for 12 years (2001-2012) and the following 14 countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Portugal, Spain, United Kingdom and United States (the Euro Area is also used but only in the descriptive statistics part. It is not used in the statistical analysis because this would result in double counting of a significant part of the Euro Area SBS). This results in our panel consisting of 12*14 = 168 observations.

3.1.2 Descriptive statistics

First, we break down the SBS activities into those that take place in US, UK and Euro Area. Figure 19 and Figure 20 illustrate the broad and narrow SBS in absolute terms and country's/region's GDP scaled respectively.

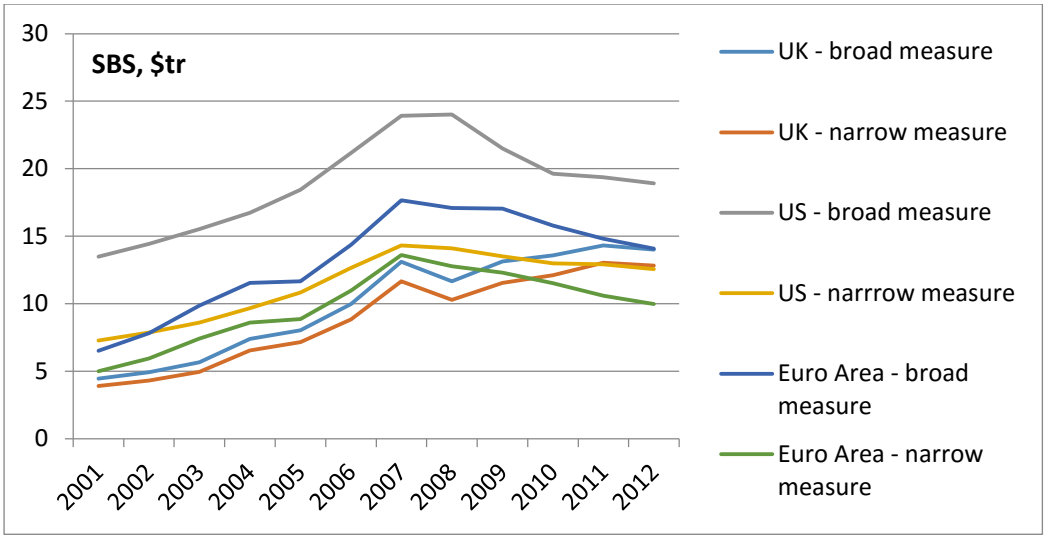

Figure 19: Broad and narrow measure of the SBS, UK, US, Euro Area, $ trillion

Based on Figure 19, the following four conclusions are drawn:

1) The absolute size of the SBS is higher in US than in Euro Area, in which, in turn, is higher than in UK.
2) During the pre-crisis period, from 2001 to early 2008, both broad and narrow SBS increase in all three regions.
3) While the SBS decreases after the crisis (2009-2012) in US and Euro Area, it increases in UK.
4) SBS broad and narrow measure follow the same trend for any given time period and region. This suggests that the trend of the SBS in terms of direction (increase or decrease) is set mainly by the SBS exposure to macroeconomic sectors outside the SBS and not by the intra-SBS positions.

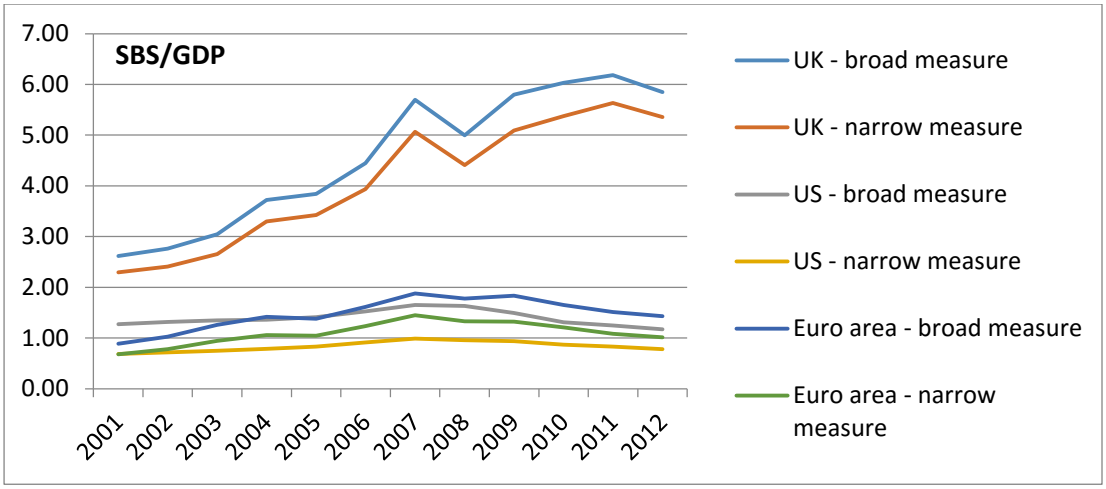

Figure 20: Broad and narrow SBS/GDP ratios.UK, US, Euro Area

Based on Figure 20, the following four conclusions are drawn:

1) SBS/GDP ratio is three to four times higher in UK than in US and Euro Area. This suggests that if there is, in general, an impact of the SBS in a country's GDP, UK might be much more exposed to this impact than Euro Area and US.
2) During the pre-crisis period, from 2001 to early 2008, both broad and narrow SBS/GDP ratio increase in all three regions.
3) After the crisis of 2008, while both broad and narrow SBS/GDP ratios decrease in US and Euro Area, they increase in UK.
4) SBS broad and narrow measure follow the same trend for any given time period and region. This suggests that the trend of the SBS in terms of direction (increase or decrease) is set mainly by the SBS exposure to macroeconomic sectors outside the SBS and not by the intra-SBS positions.

By combining Figure 19 and Figure 20, we can also conclude that despite the fact that the largest amount of SBS activities is located in US, UK seems to be much more exposed to any SBS impacts on its GDP.

We also focus on the exposure of all the fourteen countries on the SBS, by depicting all the respective SBS/GDP ratios for three different years. The years chosen are 2001, 2007 and 2012, referring to the start of our dataset, the peak of SBS before the crisis and the end of our dataset after the crisis respectively (see Figure 21, Figure 22 and Figure 23).

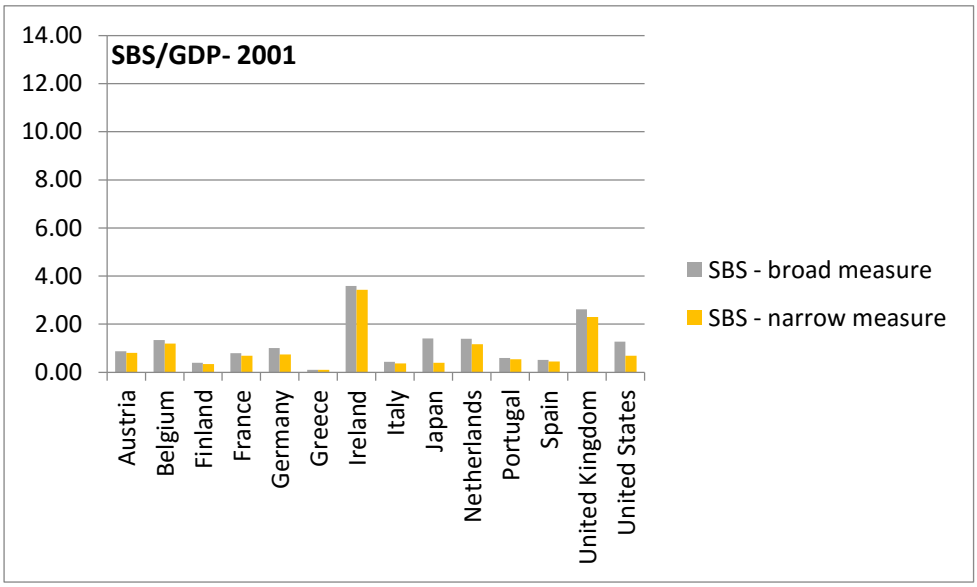

Figure 21: Broad and narrow SBS/GDP ratios, 2001.

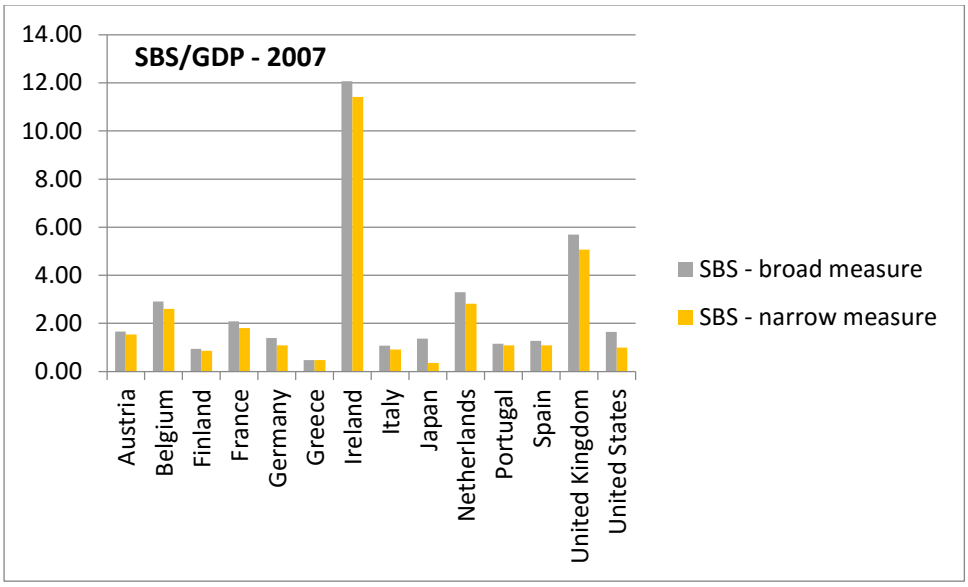

Figure 22: Broad and narrow SBS/GDP ratios, 2007.

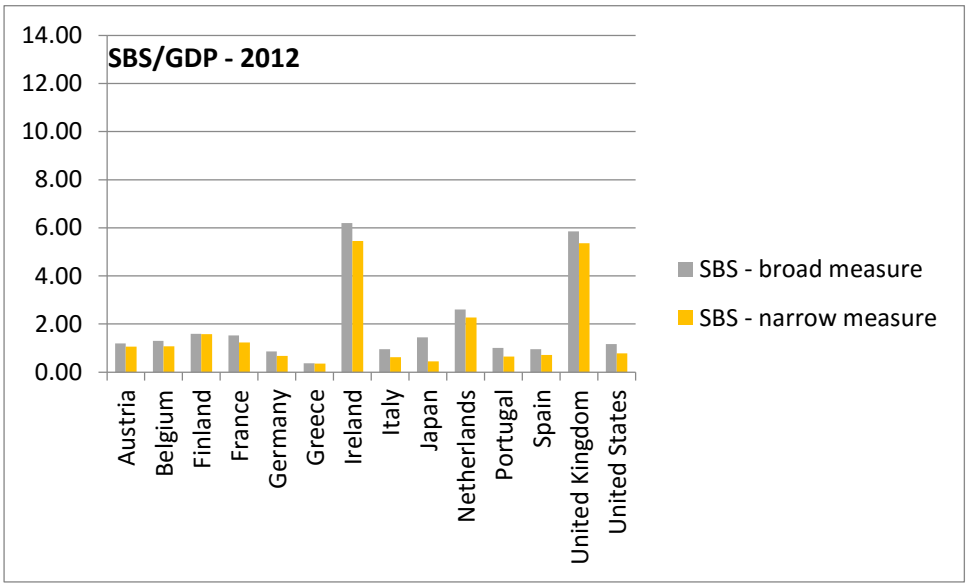

Figure 23: Broad and narrow SBS/GDP ratios, 2012

Based on Figure 21, Figure 22 and Figure 23, the following two conclusions are drawn:

1) Ireland and UK have the largest SBS/GDP ratios. More specifically, Ireland was much more exposed than UK but after the crisis, their SBS/GDP ratios have become comparable.
2) In the majority of the countries, the SBS/GDP ratios are larger in 2007 than in 2001. In 2012, the SBS/GDP ratios are smaller than in 2007, but larger than in 2001. This means that although after the crisis the SBS as a portion of GDP has, naturally, been reduced, it is not that it has reached the levels of 2001.
3) Quite counterintuitively, there are three countries from our sample of fourteen advanced countries whose SBS/GDP ratio has increased after the crisis. These countries are UK, Japan and Finland.

Moreover, Figure 24 and Figure 25 depict the relationship between SBS/GDP (broad and narrow respectively) and real GDP per capita growth. A slightly negative relationship is observed in both cases.

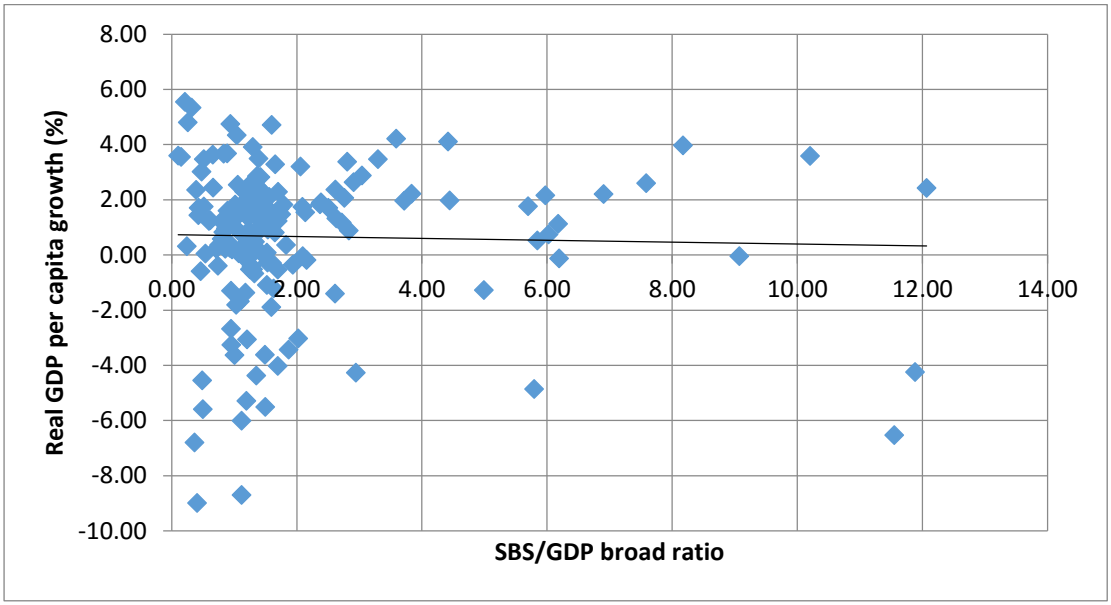

Figure 24: Relationship between the broad SBS/GDP ratio and the real GDP per capita growth

Figure 25: Relationship between the narrow SBS/GDP ratio and real GDP per capita growth

Finally, Table 3 presents some common descriptive statistics that are aimed to provide a further insight on the database's features. The most important insight from Table 3 is that these variables are quite volatile. Indeed, the standard deviation is larger than the mean and the median value for all variables. This high volatility of such important macroeconomic variables is not desirable, because it is not aligned with the need of investors for a stable economic environment.

Table 3. Common Descriptive Statistics of Database

	Country	Year	GDP per capita growth	Productivity growth	SBS/GDP broad ratio	SBS/GDP narrow ratio	Real long-term interest rate	Output gap as a percentage of potential GDP
Valid N	168	168	168	168	168	168	168	168
Missing N	0	0	0	0	0	0	0	0
Mean			0.66	1.14	2.01	1.69	2.13	0.14
Median			1.29	1.12	1.35	0.97	1.85	0.08
Std. Deviation			2.61	1.60	2.15	2.04	2.29	3.40
Variance			6.79	2.56	4.61	4.17	5.25	11.59
Range			14.54	10.01	11.96	11.30	22.36	22.03
Minimum			-9.00	-4.66	0.11	0.11	-1.36	-12.61
Maximum			5.54	5.35	12.07	11.41	21.00	9.42

3.1.3 Econometric model

We use a fixed effects model in order to search for any negative correlations between the SBS and the real GDP and productivity growth. The fixed effects model is chosen since it renders our approach consistent. The fixed effects model is not the most efficient, but this is not a problem for our case because the data that is used for the SBS is not completely accurate. As already discussed, a completely accurate measurement of the SBS does not exist in the literature. At best, any measures of the

SBS created by organizations with relevant expertise, such as the IMF, the ECB and the FRB can be taken as proxies of the SBS. In order to have meaningful results, some of our econometric variables are GDP scaled. We use four different econometric models of the same logic. Our dependent variables are GDP per capita growth and productivity growth. Our main independent variables are broad and narrow SBS/GDP ratios and our control variables are real long-term interest rate and output gap as a percentage of potential GDP. These control variables are commonly used in the literature with regard to macroeconomics issues and are closely related to monetary policy decisions. The real long-term interest rate values are obtained by subtracting inflation from nominal long-term interest rate values. Our model also includes dummy variables to control for country-specific influences.

Given our panel dataset, we come up with the following **versions of our econometric model** for our first approach:

$$\{GDPPCG\}_{i,t} = a_i + b*\{SBSBGDP\}_{i,t} + c*\{R\}_{i,t} + d*\{O\}_{i,t} \quad (1)$$

$$\{PG\}_{i,t} = a_i + b*\{SBSBGDP\}_{i,t} + c*\{R\}_{i,t} + d*\{O\}_{i,t} \quad (2)$$

$$\{GDPPCG\}_{i,t} = a_i + b*\{SBSNGDP\}_{i,t} + c*\{R\}_{i,t} + d*\{O\}_{i,t} \quad (3)$$

$$\{PG\}_{i,t} = a_i + b*\{SBSNGDP\}_{i,t} + c*\{R\}_{i,t} + d*\{O\}_{i,t} \quad (4)$$

Where:

GDPPCG = GDP per capita growth

PG = productivity growth

SBSBGDP = broad SBS/GDP ratio

SBSNGDP = narrow SBS/GDP ratio

R = real long-term interest rate

O = output gap as a percentage of potential GDP

a_i = country dummy variable (time-invariant)

The former four versions are used in four different cases, in which the dependent and the main independent variables differ (see Table 4).

Table 4. Examined Versions of the First Econometric Model (First Approach)

Dependent variables	**Main independent variables**	
	SBS broad noncore liabilities	SBS narrow noncore liabilities
Real GDP per capita growth	Version 1	Version 3
Productivity growth	Version 2	Version 4

3.1.4 Results and analysis

For each version, five different scenarios are analyzed. The scenarios differ in terms of the combination of the independent and control variables. The results of each version are summarized in respective tables. All scenarios are interpreted and a few key conclusions are drawn for each version. Finally, we come up with some key overall conclusions, by combing the findings of all the four versions of the econometric model.

Version 1

First, version 1 is aimed to assess the association between the broad SBS/GDP ratio and the real GDP per capita growth. Table 5 presents the results of our statistical analysis for version 1.

Table 5. Results of Version 1. Correlation between the Broad SBS/GDP Ratio and the Real GDP per Capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Broad SBS/GDP ratio	-0.51**	-	-0.58**	-0.59**	-0.39*
Control Variables	Real long-term interest rate	-0.29**	-0.24**	-	0.39**	-
	Output gap/potential GDP	0.14*	0.20**	-	-	0.33**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*.

Scenario 1

The first scenario consists of the real GDP per capita growth as dependent variable, the broad SBS/GDP ratio as the independent variable and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. If the broad SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.51%. The real long-term interest rate is negatively correlated with the real GDP per capita growth and the output gap as a percentage of potential GDP is positively correlated with the real GDP per capita growth. The results are statistically significant. The broad SBS/GDP ratio and the real long-term interest rate are significant at 1% significance level.

Scenario 2

The second scenario consists of the real GDP per capita growth as dependent variable, no independent variables and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. By comparing results of Scenario 1 and 2, we can observe that the coefficients of the control variables are

relatively similar. This suggests that the correlations between the control variables and the real GDP per capita growth are quite steady.

Scenario 3

The third scenario consists of the real GDP per capita growth as dependent variable, the broad SBS/GDP ratio as the independent variable and no control variables. If the broad SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.58%. The results are statistically significant at 1% significant level. By comparing the results of Scenario 1 and Scenario 3, we can observe that the coefficients of the broad SBS/GDP ratio are very close. This suggests again that the broad SBS/GDP ratio is negatively correlated with the real GDP per capita growth irrespective of the control variables.

Scenario 4

The fourth scenario consists of the real GDP per capita growth as dependent variable, the broad SBS/GDP ratio as the independent variable and the real long-term interest rate as the control variable. If the broad SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.59%. The results are statistically significant at 1% significant level. By comparing the results of Scenario 3 and Scenario 4, we can observe that the coefficients of the broad SBS/GDP ratios are extremely close. This suggests again that the broad SBS/GDP ratio is negatively correlated with the real GDP per capita growth irrespective of the real long-term interest rate.

Scenario 5

The fifth scenario consists of the real GDP per capita growth as dependent variable, the broad SBS/GDP ratio as the independent variable and the output gap as a percentage of potential GDP as the control variable. If the broad SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.39%. By comparing the results of Scenario 3 and Scenario 5, although there seems to be some interdependence between the broad SBS/GDP ratio and the output gap as a percentage of potential GDP, the negative correlation between the broad SBS/GDP ratio and the real GDP per capita growth still holds. This is also the case for the positive correlation between the output gap as a percentage of potential GDP and the real GDP per capita growth. The results are statistically significant.

The **main conclusion of version 1** is that the broad SBS/GDP ratio has a quite clear and important negative correlation with the real GDP per capita growth. The magnitude of this correlation is between -0.51 and -0.39. This means that countries, in which the broad SBS/GDP ratio is higher by one percentage point than the panel average, experience a rate of per capita real GDP growth that is by 0.39 to 0.51 percentage points lower than the panel average. This association holds irrespective of the control variables (real long-term interest rate and output gap as a percentage of potential GDP). Regarding the control variables, the real long-term interest rate is negatively correlated with the real GDP per capita growth and the output gap as a percentage of potential GDP is positively correlated with the real GDP per capita growth. Results are statistically significant (most of the times even at 1% significant level) for all the 5 scenarios. This strengthens the former arguments.

Version 2

Second, version 2 is aimed to assess the association between the broad SBS/GDP ratio and the real productivity growth. Table 6 presents the results of our statistical analysis for version 2.

Scenario 1

The first scenario consists of the real productivity growth as dependent variable, the broad SBS/GDP ratio as the independent variable and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. A negative correlation between the broad SBS/GDP ratio and the real productivity growth is observed but the results are not statistically significant.

Table 6. Results of Version 2. Correlation between the Broad SBS/GDP Ratio and the Real Productivity Growth

Dependent Variable	Real productivity growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Broad SBS/GDP ratio	-0.19 (n.s.s.)	-	-0.17 (n.s.s)	-0.17 (n.s.s)	-0.18 (n.s.s)
Control Variables	Real long-term interest rate	-0.01 (n.s.s)	0.01 (n.s.s)	-	0.01 (n.s.s)	-
	Output gap/potential GDP	-0.28 (n.s.s.)	-0.01 (n.s.s)	-	-	-0.02 (n.s.s)

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*, n.s.s = not statistically significant at 5% level.

Scenario 2

The second scenario consists of the real productivity growth as dependent variable, no independent variables and the real long-term interest rate and output gap as a

percentage of potential GDP as the control variables. The results are not statistically significant.

Scenario 3

The third scenario consists of the real productivity growth as dependent variable, the broad SBS/GDP ratio as the independent variable and no control variables. The association between the broad SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

Scenario 4

The fourth scenario consists of the productivity growth as dependent variable, the broad SBS/GDP ratio as the independent variable and the real long-term interest rate as the control variable. The correlation between the broad SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

Scenario 5

The fifth scenario consists of the real productivity growth as the dependent variable, the broad SBS/GDP ratio as the independent variable and the output gap as a percentage of potential GDP as the control variable. The correlation between the broad SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

The main conclusion of Version 2 is that, given our data, we cannot conclude regarding the correlation between the broad SBS/GDP ratio and the real productivity growth. Although the coefficients of the broad SBS/GDP ratio are negative

throughout all the examined scenarios, all the results are not statistically significant. This makes us consider these results as merely suggestive at most.

Version 3

Third, version 3 is aimed to assess the association between the narrow SBS/GDP ratio and the real GDP per capita growth.

Table 7 presents the results of our statistical analysis for version 3.

Table 7. Results of Version 3. Correlation between the Narrow SBS/GDP Ratio and the Real GDP per Capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Narrow SBS/GDP ratio	-0.56**	-	-0.59**	-0.64**	-0.43**
Control Variables	Real long-term interest rate	-0.29**	-0.24**	-	-0.40**	-
	Output gap/potential GDP	0.14*	0.20**	-	-	0.33**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*.

Scenario 1

The first scenario consists of the real GDP per capita growth as dependent variable, the SBS/GDP narrow ratio as the independent variable and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. If the narrow SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.56%. The real long-term interest rate is negatively correlated with the real GDP per capita growth and the output gap as a percentage of potential GDP is positively correlated with the real GDP per capita growth. The results are statistically

significant. The narrow SBS/GDP ratio and the real long-term interest rate are significant at 1% significance level.

Scenario 2

The second scenario consists of the real GDP per capita growth as dependent variable, no independent variables and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. By comparing results of Scenario 1 and 2, we can observe that the coefficients of the control variables are relatively similar. This suggests that the correlations between the control variables and the real GDP per capita growth are quite steady.

Scenario 3

The third scenario consists of the real GDP per capita growth as dependent variable, the narrow SBS/GDP ratio as the independent variable and no control variables. If the narrow SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.59%. The results are statistically significant at 1% significant level. By comparing the results of Scenario 1 and Scenario 3, we can observe that the coefficients of the narrow SBS/GDP ratio are very close. This suggests that the narrow SBS/GDP ratio is negatively correlated with the real GDP per capita growth irrespective of the control variables.

Scenario 4

The fourth scenario consists of the real GDP per capita growth as dependent variable, the narrow SBS/GDP ratio as the independent variable and the real long-term interest rate as the control variable. If the narrow SBS/GDP ratio increases by 1%, then the

real GDP per capita growth decreases by 0.64%. The results are statistically significant at 1% significant level. By comparing the results of Scenario 3 and Scenario 4, we can observe that the coefficients of the narrow SBS/GDP ratios are very close. This suggests again that the narrow SBS/GDP ratio is negatively correlated with the real GDP per capita growth irrespective of the real long-term interest rate.

Scenario 5

The fifth scenario consists of the real GDP per capita growth as dependent variable, the narrow SBS/GDP ratio as the independent variable and the output gap as a percentage of potential GDP as the control variable. If the narrow SBS/GDP ratio increases by 1%, then the real GDP per capita growth decreases by 0.43%. By comparing the results of Scenario 3 and Scenario 5, although there seems to be some interdependence between the narrow SBS/GDP ratio and the output gap as a percentage of potential GDP, the negative correlation between the narrow SBS/GDP ratio and the real GDP per capita growth still hold. This is also the case for the positive correlation between the output gap as a percentage of potential GDP and the real GDP per capita growth. The results are statistically significant.

The main conclusion of version 3 is that the narrow SBS/GDP ratio has a quite clear and important negative correlation with the real GDP per capita growth. The magnitude of this correlation is between -0.63 and -0.44. This means that countries, in which the narrow SBS/GDP ratio is higher by one percentage point than the panel average, experience a rate of per capita real GDP growth that is by 0.39 to 0.59 percentage points lower than the panel average. This association holds irrespective of

the control variables (real long-term interest rate and output gap as a percentage of potential GDP). Regarding the control variables, the real long-term interest rate is negatively correlated with the real GDP per capita growth and the output gap as a percentage of potential GDP is positively correlated with the real GDP per capita growth. Results are statistically significant (most of the times even at 1% significant level) for all the 5 scenarios. This strengthens the former arguments.

Version 4

Fourth, version 4 is aimed to assess the association between the narrow SBS/GDP ratio and the real productivity growth.

Table *8* presents the results of our statistical analysis for version 4.

Scenario 1

The first scenario consists of the real productivity growth as the dependent variable, the narrow SBS/GDP ratio as the independent variable and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. The correlation between the narrow SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

Table 8. Results of Version 4. Correlation between the Narrow SBS/GDP Ratio and the Productivity Growth

Dependent Variable	Productivity growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Narrow SBS/GDP ratio	-0.22 (n.s.s.)	-	-0.21 (n.s.s)	-0.17 (n.s.s)	-0.18 (n.s.s)
Control Variables	Real long-term interest rate	-0.01 (n.s.s)	0.01 (n.s.s)	-	0.01 (n.s.s)	-
	Output gap/GDP	-0.28 (n.s.s.)	-0.01 (n.s.s)	-	-	-0.02 (n.s.s)

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*, n.s.s = not statistically significant at 5% level.

Scenario 2

The second scenario consists of the real productivity growth as the dependent variable, no independent variables and the real long-term interest rate and output gap as a percentage of potential GDP as the control variables. The results are not statistically significant.

Scenario 3

The third scenario consists of the real productivity growth as the dependent variable, the narrow SBS/GDP ratio as the independent variable and no control variables. The correlation between the narrow SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

Scenario 4

The fourth scenario consists of the productivity growth as the dependent variable, the narrow SBS/GDP ratio as the independent variable and the real long-term interest rate as the control variable. The correlation between the narrow SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

Scenario 5

The fifth scenario consists of the real productivity growth as dependent variable, the narrow SBS/GDP ratio as the independent variable and the output gap as a percentage of potential GDP as the control variable. The correlation between the narrow

SBS/GDP ratio and the real productivity growth is negative but the results are not statistically significant.

The main conclusion of version 4 is that, given our data, we cannot conclude regarding the correlation between the narrow SBS/GDP ratio and the real productivity growth. Although the coefficients of the narrow SBS/GDP ratio are negative throughout all the examined scenarios, all the results are not statistically significant. This makes us consider these results as merely suggestive at most.

Main conclusions derived from versions 1-4:

1) The (both broad and narrow) SBS/GDP ratio has a quite clear and important negative correlation with the real GDP per capita growth. This correlation holds irrespective of the control variables (real long-term interest rate and output gap as a percentage of potential GDP). In terms of magnitude, the coefficient of the SBS/GDP ratios vary between -0.59 and -0.39. This means that, ceteris paribus, countries, in which the SBS/GDP ratio is higher by one percentage point than the panel average, experience a rate of per capita real GDP growth that is by 0.39 to 0.59 percentage points lower than the panel average. This association holds irrespective of the control variables (real long-term interest rate and output gap as a percentage of potential GDP). Results are statistically significant (most of the times even at 1% significant level) for all the examined scenarios. This strengthens the former arguments.
2) We cannot make a similar claim about the correlation between the (either broad or narrow) SBS/GDP ratio and the real productivity growth. Although the coefficients of the (both broad and narrow) SBS/GDP ratio are negative

throughout all the examined scenarios, all the results are not statistically significant. This makes us consider these results as merely suggestive at most.

3) Regarding the correlations between the control variables and the real GDP per capita growth, the real long-term interest rate is negatively correlated with the real GDP per capita growth and the output gap as a percentage of potential GDP is positively correlated with the real GDP per capita growth.
4) The outcomes regarding the effects of the SBS/GDP ratio on the real GDP per capita growth and real productivity growth are very similar no matter which of the two different measures – broad or narrow – is used as the indicator of the SBS. This strengthens the first two conclusions.

By combining the first two empirical findings and attempting to interpret the differences between the outcomes for GDP per capita and hourly labour productivity growth, we claim that potential significant differences in the growth rates of average number of hours worked per worker per annum or in the growth rates of labour force participation rate between countries could explain the fact that the negative association between GDP per capita growth and SBS/GDP ratio does not hold for productivity growth. Our reasoning is as follows:

By definition, it is true that:

$Y/POP = (Y/H)*(H/LF)*(LF/POP)$

Where:

Y = real GDP

POP = population

H = hours worked by the labour force

LF = Labour force in persons

GDP per capita = Y/POP

Y/H = labour productivity per hour worked

H/LF = average number of hours worked per worker per annum

LF/POP = labour force participation rate

In growth rates (g) we get:

g(Y/POP) = g(Y/H) + g(H/LF) + g(LF/POP)

This means that GDP per capita growth is not equal to hourly labour productivity growth in case the growth in the average number of hours worked per worker per annum or the growth in labour force participation rate are large in absolute terms. In other words, a group of countries may have similar growth rates for hourly labour productivity but different growth rates for GDP per capita growth.

Regarding our case, it could be that potential significant differences in the growth rates of average number of hours worked per worker per annum or in the growth rates of labour force participation rate between countries could explain the fact that the negative association between the GDP per capita growth and the SBS/GDP ratio does not hold for productivity growth.

Sensitivity Analysis

The former statistical analysis revealed very interesting results about the correlation between the (both broad and narrow) SBS/GDP ratio and the real GDP per capita

growth. This led us perform four sensitivity analyses. The first two refer to the broad SBS/GDP ratio correlation with the real GDP per capita growth, while the latter two refer to the narrow SBS/GDP ratio correlation with the real GDP per capita growth. For the first and the third sensitivity analysis, all the countries, one at a time, are excluded. We run a statistical test with the absence of one country each time and check for two issues. First, we examine the extent to which the coefficient of the SBS/GDP ratio varies. Second, we check for statistical significance of the SBS/GDP ratio's and control variables' coefficients. The same process is repeated for the second and fourth sensitivity analysis, but instead of excluding a country, we exclude a year each time.

Herewith we present the main conclusions of our sensitivity analyses (for further detail, see Tables A1, A2, A3 and A4 in Appendix):

1) The coefficients of the SBS/GDP ratio are quite steady. The SBS/GDP ratio's correlation with the real GDP per capita growth is as follows: per 1% increase in the SBS/GDP ratio, the real GDP per capita growth decreases by an amount between 0.44 to 0.66 %.
2) When Ireland or Greece is excluded, there are issues regarding statistical significance for the SBS/GDP ratio and real the long-term interest rate respectively. More specifically, when Ireland is excluded, the coefficient of the (both broad and narrow) SBS/GDP ratio is not statistically significant. When Greece is excluded, the coefficient of the real long-term interest rate is not statistically significant.
3) The coefficient of the output of gap as a percentage of the potential GDP is generally on the verge of significance at 5% level.

4) The main results regarding the broad SBS/GDP and the narrow SBS/GDP ratios are identical.

Finally, we compare the correlation of the (both broad and narrow) SBS/GDP ratio with the real GDP per capita growth before and after the crisis. In our case, the pre-crisis period is 2001-2007, consisting of 7*14=98 observations and the post-crisis period is 2008-2012, consisting of 5*14=70 observations. The outcomes are presented in Table 9, Table 10, Table 11 and Table 12.

Table 9. Correlation between the Broad SBS/GDP Ratio and the Real GDP per Capita Growth Before the Crisis (2001-2007).

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Broad SBS/GDP ratio	-0.30*	-	-0.35*	-0.35*	-0.31*
Control Variables	Real long-term interest rate	0.05 (n.s.s)	0.10 (n.s.s)	-	-0.04 (n.s.s)	-
	Output gap/potential GDP	0.11 (n.s.s)	0.17 (n.s.s)	-	-	0.11 (n.s.s)

Table 10. Correlation between the Broad SBS/GDP Ratio and the Real GDP per Capita Growth After the Crisis (2008-2012).

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Broad SBS/GDP ratio	-1.15**	-	-0.78*	-0.82*	-1.04**
Control Variables	Real long-term interest rate	0.33**	0.24 (n.s.s)	-	-0.27**	-
	Output gap/potential GDP	0.76**	0.63**	-	-	0.47**

Table 11. Correlation between the Narrow SBS/GDP Ratio and the Real GDP per Capita Growth Before the Crisis (2001-2007).

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Narrow SBS/GDP ratio	-0.33*	-	-0.38*	-0.38*	-0.33*
Control Variables	Real long-term interest rate	0.05 (n.s.s)	0.10 (n.s.s)	-	-0.04 (n.s.s)	-
	Output gap/potential GDP	0.11 (n.s.s)	0.17 (n.s.s)	-	-	0.10 (n.s.s)

Table 12. Correlation between the Narrow SBS/GDP Ratio and the Real GDP per Capita Growth After the Crisis (2008-2012).

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Narrow SBS/GDP ratio	-1.09**	-	-0.70 (n.s.s) (0.052)	-0.76*	-0.99**
Control Variables	Real long-term interest rate	0.32*	0.24 (n.s.s)	-	-0.28**	-
	Output gap/potential GDP	0.75**	0.63**	-	-	0.47**

By comparing the negative correlations between SBS/GDP ratios with the real GDP per capita growth before and after the global financial crisis, the following conclusions are drawn:

1) The negative correlations are of higher magnitude after the crisis than before.
2) The coefficients of the SBS/GDP ratios are statistically significant at 5% level (except one case that the achieved significance is at 10% level).
3) The results for the broad SBS/GDP ratio are similar to those of the SBS/GDP ratio.

3.2 Second Approach

3.2.1 Data presentation

Regarding our second approach, we focus only on the SBS in US. We use quarterly data from the FRB of St. Louis and the OECD databases. The data regarding the SBS and the potential GDP are derived from the FRB of St. Louis while the data regarding the GDP per capita growth, inflation rate and nominal long-term interest rate are derived from the OECD database.

Our empirical analysis is based on the theoretical analysis and the SBS description that is undertaken in Chapter 2. More specifically, our empirical analysis is based on the main purposes and constituents of the SBS that are highlighted in sub-chapter 2.3. These parts are: ABS, ABCP, Repo and MMMF (Rehypothecation is not part of our empirical analysis due to data limitations). At this point, it has to be reminded that our analysis in Chapter 2 is aimed to capture the main economic rationale of the SBS and does not constitute an attempt to describe the SBS in an exhaustive way.

The data availability is different across the aforementioned SBS part. More specifically, we have 128 observations (1983q1-2014q4) for ABS, 61 observations (2001q1-2016q1) for ABCP, 97 observations (1990q1-2014q1) for Repo and 169 observations (1973q4-2015q4) for MMMF. With regard to our econometric statistics, we mainly use observations that refer to common periods only, that is, 53 observations (2001q1-2014q1).

3.2.2 Descriptive statistics

First, we plot the evolution of ABS/GDP, ABCP/GDP, Repo/GDP and MMMF/GDP both separately and together in order to attain a better understanding about the way that the SBS in US has evolved in terms of size and structure (see Figure 26, Figure 27, Figure 28, Figure 29, Figure 30 and Figure 31).

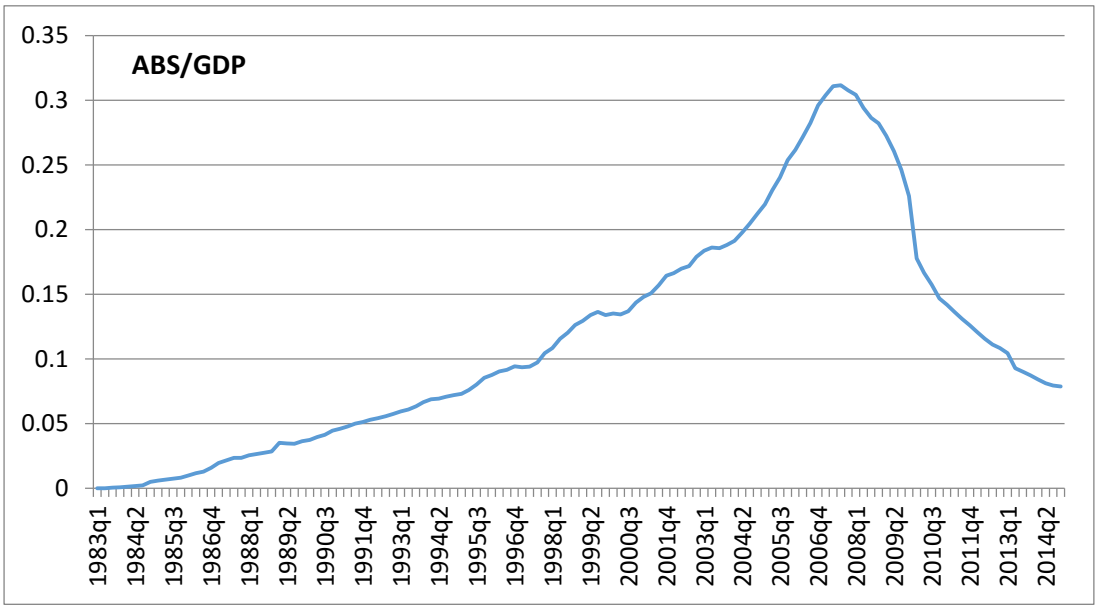

Figure 26: US ABS GDP-scaled evolution. 1983q1-2014q4.

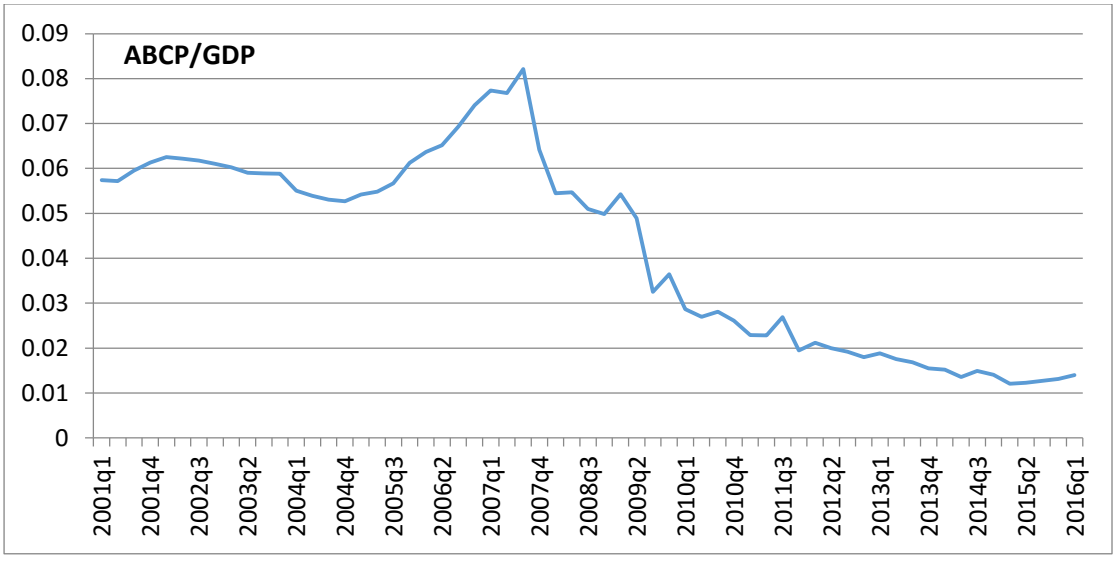

Figure 27: US ABCP GDP-scaled evolution. 2001q1-2016q1

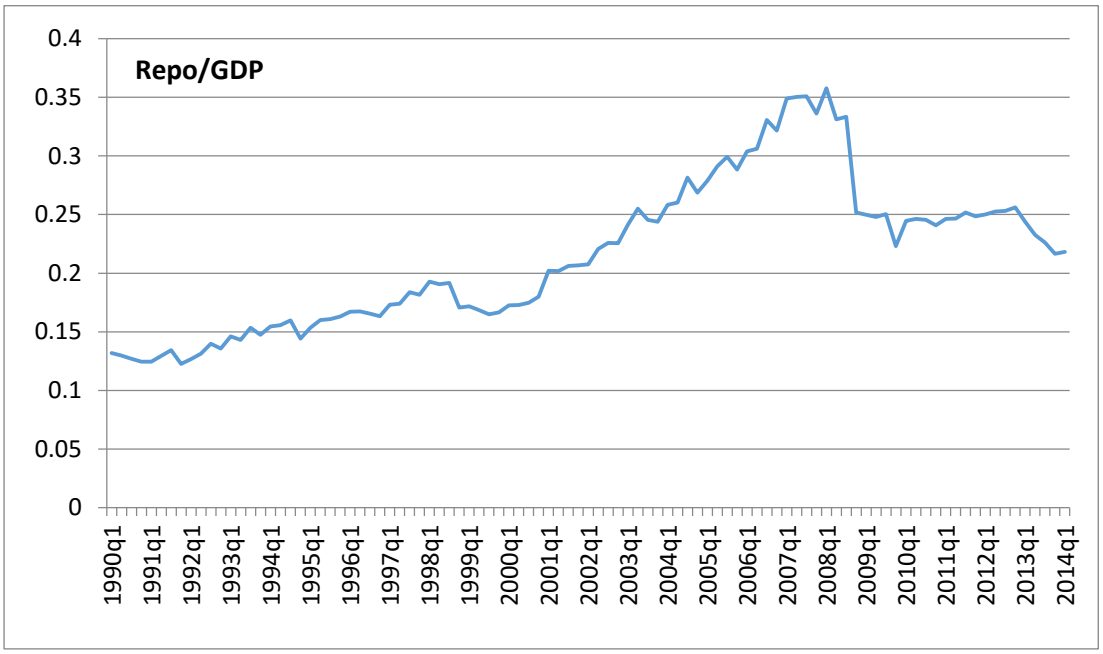

Figure 28: US Repo GDP-scaled evolution. 1990q1-2014q1

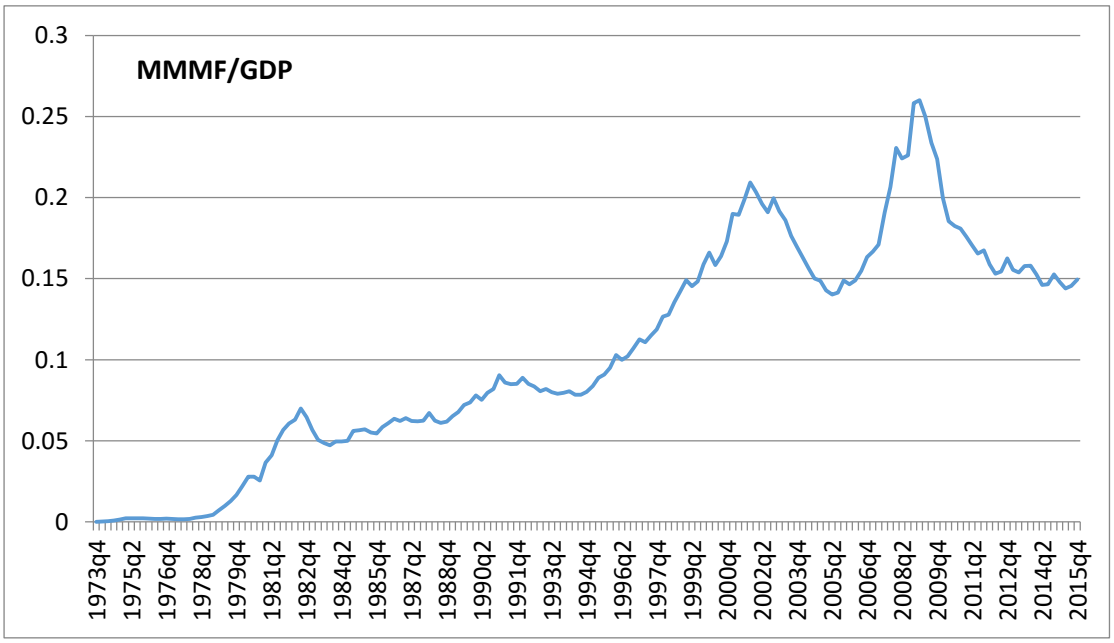

Figure 29: US MMMF GDP-scaled evolution. 1973q4-2015q4

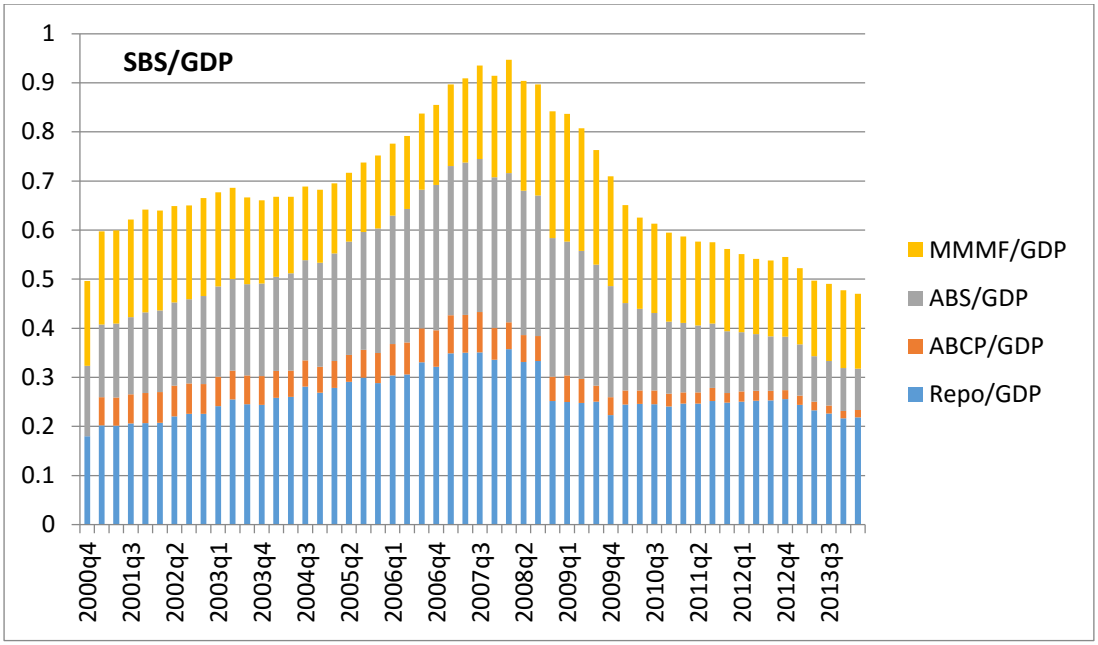

*Figure 30:*US Repo/GDP, ABCP/GDP, ABS/GDP and MMMF/GDP composition. 2001q1-2014q1

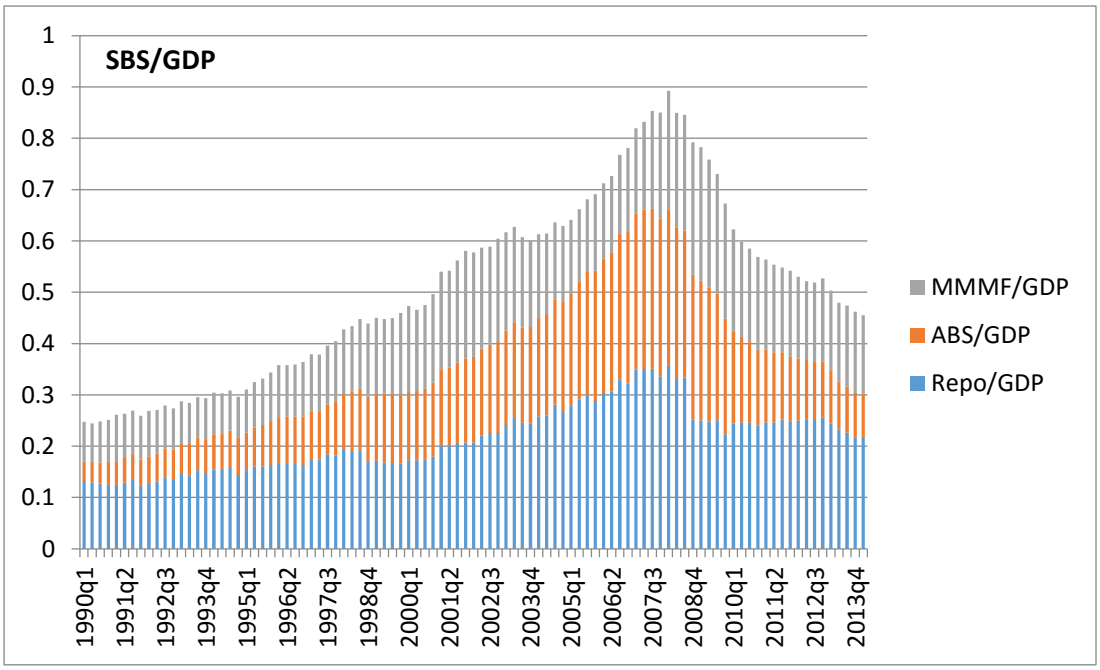

Figure 31: US Repo/GDP, ABS/GDP and MMMF/GDP composition. 1990q1-2014q1

Based on Figure 26, Figure 27, Figure 28, Figure 29, Figure 30 and Figure 31, we come up with the following conclusions:

1) The peak of the sum of these SBS parts and each part's separately occurs about one year before the global financial crisis. The outbreak of the global financial crisis coincides with the gradual decline of these SBS constituents. These two facts, if combined, suggest that shadow banking had indeed a central role at the global financial crisis.
2) Similar evolution patterns of the different SBS parts can be observed. This is aligned with our theoretical analysis of Chapter 2 in which we group all these as parts of the securitization function.
3) A tremendous increase of MMMF, Repo and ABS from 1990s and later on is observed. This is also related to the rise of global cash pools at 1990s, as explained in the theoretical analysis of Chapter 2.
4) ABCP seems to have a smaller role of in terms of magnitude compared to Repo, MMMF and ABS in US.
5) Although, in general, an upward trend of the SBS parts is observed up to the global financial crisis, ABCP and MMMF faced a downturn during 2001-2005. A key driver for this downturn might be the Enron Scandal in 2001. Enron's failure was followed by a run on unsecured commercial paper programs and hit mutual funds. (Covitz, Liang, Liang, & Suarez, 2009; Howlett & Alphonso, 2002).

We also plot the relationship between the US GDP and the different parts of the SBS (see Figure 32, Figure 33, Figure 34, Figure 35 and Figure 36). A negative relationship between the US SBS and the GDP is depicted.

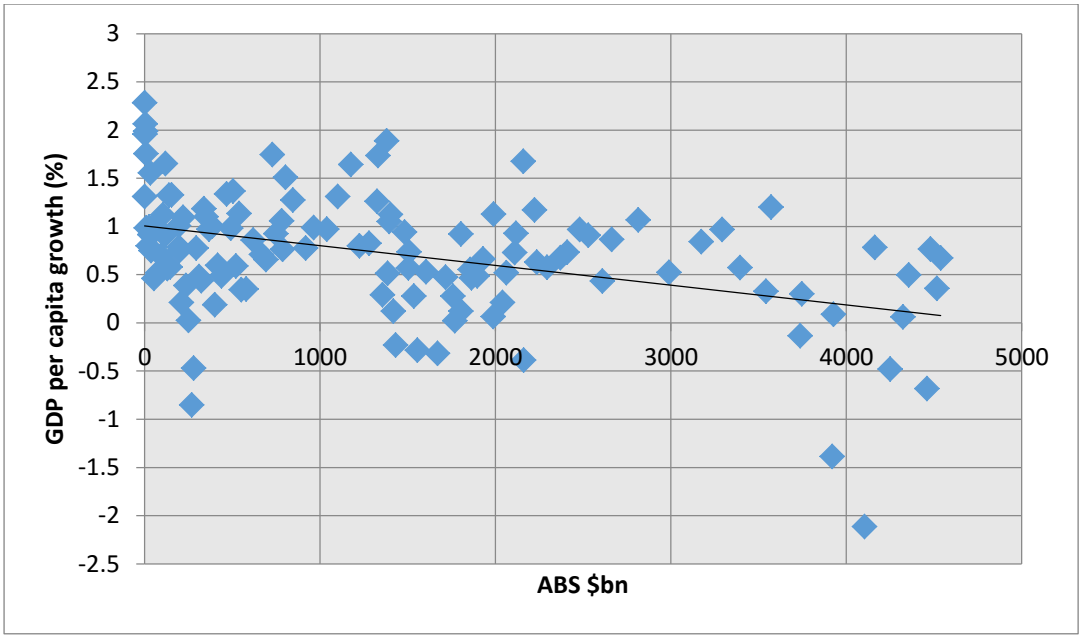

Figure 32: Relationship between GDP per capita growth and ABS. Data measurements during 1983q1-2014q4

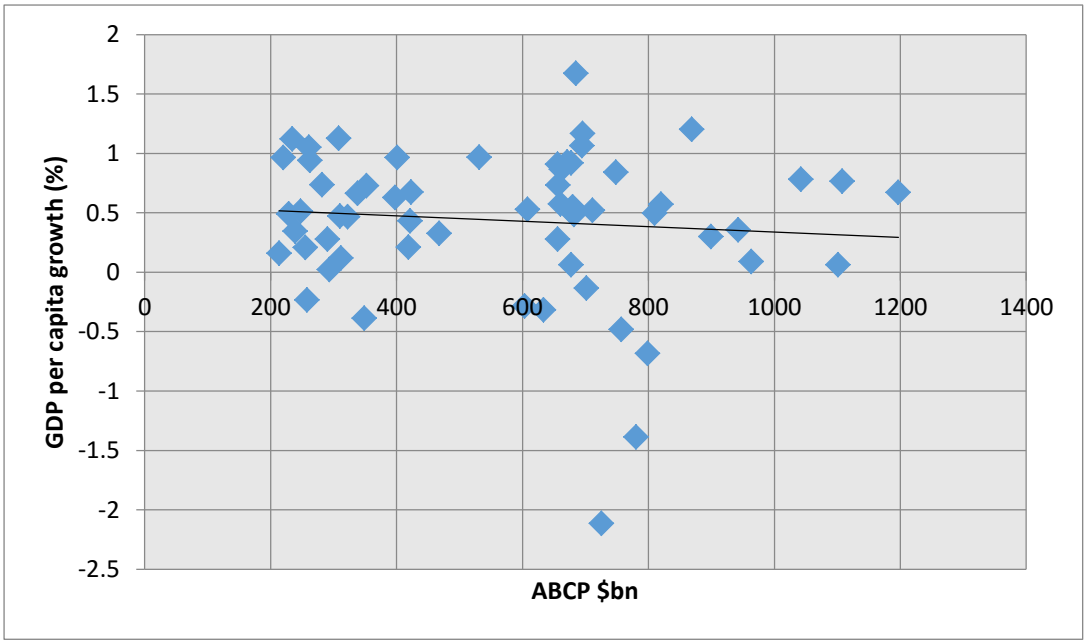

Figure 33: Relationship between GDP per capita growth and ABCP. Data measurements during 2001q1-2016q1

Figure 34: Relationship between GDP per capita growth and Repo. Data measurements during 1990q1-2014q1

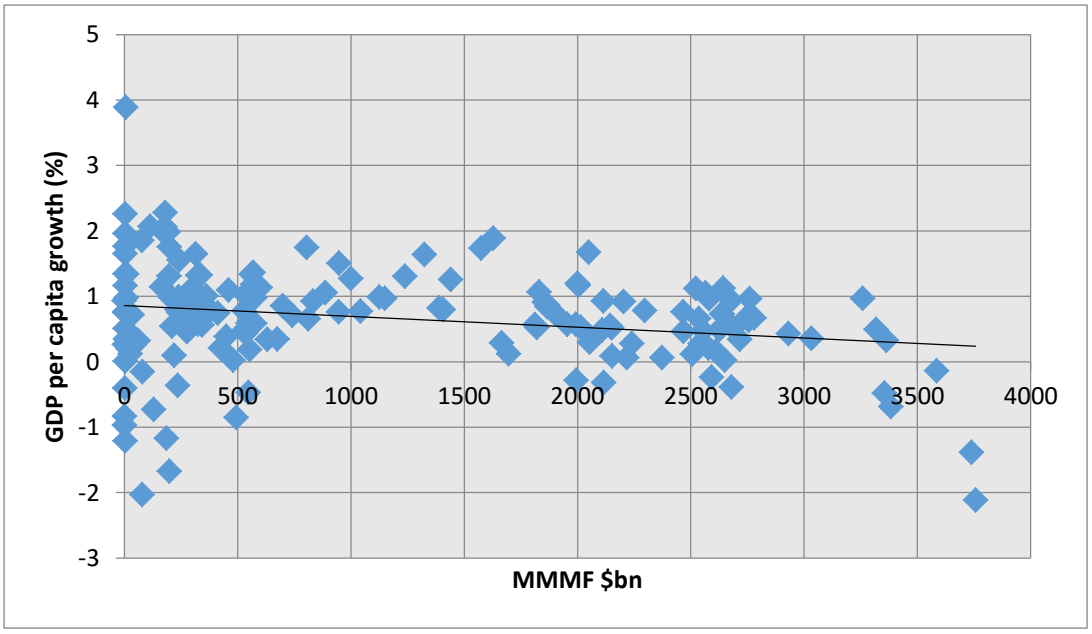

Figure 35: Relationship between GDP per capita growth and MMMF. Data measurements during 1983q1-2014q1

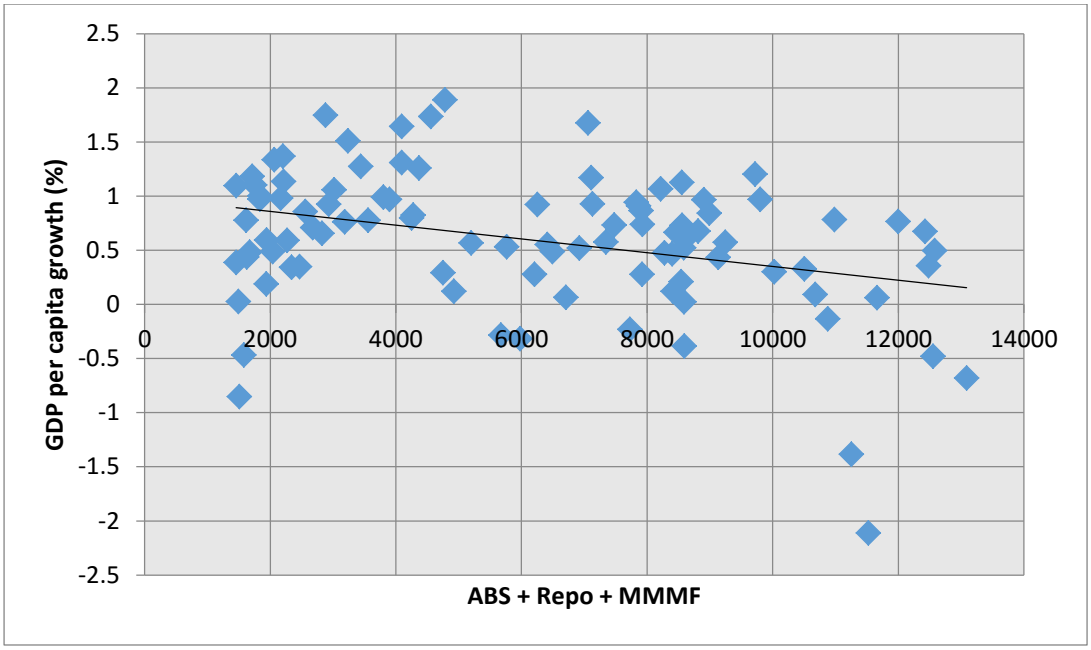

Figure 36: Relationship between GDP per capita growth and sum of ABS, Repo and MMMF. Data measurements during 1990q1-2014q1

3.2.3 Econometric model

In this approach we use a linear regression model for time series data. We aim to calculate the relevant coefficients with the OLS estimators, but we also check for autocorrelation. More specifically, we use the Durbin-Watson test in order to detect the presence of autocorrelation in the residuals. In order to take care of autocorrelation and be able to check for any statistically significant impacts on our dependent variables, we use the Prais-Winsten estimation procedure.

The reasoning behind the choice of the dependent, independent and control variables is the same with the reasoning for the respective choices in our first approach. However, we could not find quarterly data for productivity growth and, hence, we use only real GDP per capita growth as our dependent variable. As in our first approach, the main independent variables are GDP scaled and our control variables are the real long-term interest rate and the output gap as a percentage of the potential GDP.

Our econometric model is as follows:

$$\{GDPPCG\}_t = a + b*\{SBSGDP\}_t + c*\{R\}_t + d*\{O\}_t \quad (1)$$

GDPPCG: GDP per capita growth

SBSGDP: SBS/GDP ratio

R: real long-term interest rate

O: output gap as a percentage of potential GDP

The key issue is what to choose as an indicator of the SBS. There are many ways by which someone may experiment in terms of choosing some of the main parts of the SBS (both separately and combined) as independent variables in order to assess the correlations of these SBS parts with the GDP per capita growth.

We have investigated all the different combinations but we wanted to present through our main text only those that make sense both in terms of economic theory and dataset features. Otherwise, all this information would be very difficult and perhaps dull for the reader to digest. However, all the different combinations that have not been chosen to be included in this text are presented in Appendix B.

Table 13 depicts the different correlations between the key SBS parts. In particular, there is very high positive correlation between Repo, ABCP and ABS but not so much correlation between MMMF and the other aforementioned key SBS parts.

Table 13. Correlation Matrix. Repo, ABCP, ABS, MMMF. 2001q1-2014q1.

	Repo	ABCP	ABS	MMMF
Repo	1.000	0.469**	0.787**	-0.072 (n.s,s)
ABCP	0.469**	1.000	0.757**	0.164 (n.s.s)
ABS	0.787**	0.757**	1.000	0.359**
MMMF	-0.072 (n.s.s)	0.164 (n.s.s)	0.359**	1.000

Note. Significance at 1/5% level is indicated by **/*, n.s.s = not statistically significant at 5% level.

Empirical findings depict very high positive correlations between ABS, ABCP and repo. This confirms our theoretical analysis of Chapter 2, according to which, the aforementioned SBS parts serve similar purposes. However, the fact that similar correlations are not observed between MMMF and the other SBS parts seems a little bit surprising at first glance, since MMMF is also supposed to serve similar purposes. We think that this outcome derives from the Enron Scandal of 2001. The Enron's collapse hit US mutual funds, whose value remained low until 2005 (see Figure 29). This argument is strengthened by the fact that the observed positive correlations between US MMMF and ABS and repo are very high before the Enron's Scandal (see Table 14).

Table 14. Correlation Matrix. Repo, ABS, MMMF. 1990q1-2000q4.

	Repo	ABS	MMMF
Repo	1.000	0.847**	0.705**
ABS	0.847**	1.000	0.947**
MMMF	0.705**	0.947**	1.000

Note. Significance at 1% level is indicated by **.

Given the correlations of the SBS parts, it would not make economic sense to test the correlation of the SBS parts separately. Our results would be biased to multicollinearity, especially between ABS, ABCP and Repo. This result is also confirmed by the factor analysis of Table 15.

Table 15. Factor Analysis. Repo, ABCP, ABS, MMMF. 2001q1-2014q1.

	Component 1	Component 2
Repo	0.901	-0.291
ABCP	0.808	0.129
ABS	0.934	0.212
MMMF	0.039	0.978

Therefore, we use **the two following versions of the second econometric model** (see Table 16); **first, we use as SBS the sum of ABS, ABCP, Repo and MMMF**; **second, we use two factors that derive from factor analysis of the aforementioned SBS parts. The first factor includes Repo, ABCP and ABS while the second factor includes MMMF**.

Table 16: Examined Versions of the Second Econometric Model (Second Approach)

Version No.	Number of main independent variables	Main independent Variables (all of them are GDP scaled)	Time period
1	1	SBS (= ABS + ABCP + Repo + MMMF)	2001q1-2014q1
2	2	Factor 1 (including ABS, ABCP and Repo) Factor 2 (including MMMF)	2001q1-2014q1

3.2.4 Results and analysis

For each version, as in the first approach, five scenarios are tested. In the first scenario, both the independent variables and the control variables take part. In the second scenario, only the control variables are examined. In the third scenario, only the independent variables take part. In the fourth scenario, the independent variables and the long-term interest rate are taken into account. In the fifth scenario, the independent variables and the output gap as a percentage of the potential GDP are taken into account. For each case, a table with the outcomes of all the five scenarios is presented and conclusions are briefly stated. The logic behind any conclusions from the different scenarios is the same with the logic of the first approach.

Table 17. (ABS+ABCP+Repo+MMMF)/GDP Correlation with the real GDP per capita Growth.

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	(ABS+ABCP+Repo+MMMF)/GDP	-1.880 n.s.s	-	-1.085 n.s.s	-1.110 n.s.s	-1.801 n.s.s
Control Variables	Real long-term interest rate	0.041 n.s.s	0.024 n.s.s	-	0.017 n.s.s	-
	Output gap/potential GDP	14.073*	12.703*	-	-	13.753*

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*, n.s.s = not statistically significant at 5% level.

Version 1

The main conclusion of version 1 is that the GDP scaled sum of ABS, ABCP, Repo and MMMF is negatively correlated with the GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive. The real long-term interest rate has a very low correlation (close to zero) with the real GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive. The output gap as a percentage of the potential GDP

is positively correlated with the real GDP per capita growth. The results are statistically significant.

The main conclusion of version 2 is that factor 1 and factor 2 are negatively correlated with the GDP per capita growth. The results are not statistically significant for factor 1, while they are statistically significant for factor 2. The real long-term interest rate has a very low correlation (close to zero) with the real GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive. The output gap as a percentage of the potential GDP is positively correlated with the real GDP per capita growth but the results are mostly not statistically significant.

Table 18. SBS Factors Correlation with the Real GDP per Capita Growth.

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Factor 1 (including Repo, ABCP, ABS)/GDP	-0.064 (n.s.s)	-	0.007 (n.s.s)	-0.005 (n.s.s)	-0.077 (n.s.s)
	Factor 2 (including MMMF)/GDP	-0.367**	-	-0.341**	-0.415**	-0.280*
Control Variables	Real long-term interest rate	0.121 (n.s.s)	0.024 (n.s.s)	-	0.128 (n.s.s)	-
	Output gap/potential GDP	4.728 (n.s.s)	12.703*	-	-	6.736 (n.s.s)

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*, n.s.s = not statistically significant at 5% level.

Main conclusions from versions 1-2

1) The different parts of the SBS are negatively correlated with the GDP per capita growth but the results are, in general, not statistically significant and, hence, can be only interpreted as merely suggestive.

2) The real long-term interest rate has a very low correlation (close to zero) with the real GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive.
3) The output gap as a percentage of the potential GDP is positively correlated with the real GDP per capita growth. Sometimes, the results are statistically significant.

3.3 Conclusions

The key empirical findings from our econometric analysis, including both the first and the second approach, are as follows:

1) The SBS/GDP (both broad and narrow) ratio has a quite clear and important negative correlation with the real GDP per capita growth. This correlation holds irrespective of the control variables (real long-term interest rate and output gap as a percentage of potential GDP). In terms of magnitude, the coefficient of the SBS/GDP ratios vary between -0.59 and -0.39. This means that, ceteris paribus, countries, in which the SBS/GDP ratio is higher by one percentage point than the panel average, experience a rate of per capita real GDP growth that is by 0.39 to 0.59 percentage points lower than the panel average. Results are statistically significant (most of the times even at 1% significant level) for all the examined scenarios. This strengthens the former arguments.
2) We cannot make a similar claim about the correlation between the (either broad or narrow) SBS/GDP ratio and the real productivity growth. Although the coefficients of both the SBS/GDP ratios are negative throughout all the examined scenarios, all the results are not statistically significant. This makes

us consider these results as merely suggestive at most. This is also relevant for high-tech innovation since high tech-innovation is closely related to real labour productivity (Hall, 2011).

3) The real long-term interest rate is negatively correlated with the real GDP per capita growth.
4) The output gap as a percentage of potential GDP is positively correlated with the real GDP per capita growth.
5) The outcomes regarding the effects of the SBS/GDP ratio on the real GDP per capita growth and real productivity growth are very similar no matter which of the two different measures – broad or narrow – is used as the indicator of the SBS. This strengthens the first two conclusions.
6) The different parts of the SBS (ABS, ABCP, Repo and MMMF) in US are negatively correlated with the country's GDP per capita growth but the results are, in general, not statistically significant and, hence, can be only interpreted as suggestive.
7) The US real long-term interest rate has a very low correlation (close to zero) with the county's real GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive.
8) The US output gap as a percentage of the potential GDP is positively correlated with the county's real GDP per capita growth. Sometimes, the results are statistically significant.

Besides these key empirical findings, many useful insights were drawn with regard to SBS evolution from descriptive statistics. In general, similar patterns were observed for the majority of the examined countries and for the examined key SBS constituents

(ABS, ABCP, Repo and MMMF (besides the period affected by Enron's Scandal)). The most striking results refer to the UK SBS. We claim that UK SBS/GDP ratio is much higher than the respective ratios for US and the Euro Area. Furthermore, quite counterintuitively, given the relevance of shadow banking in the global financial crisis, UK, Finland and Japan SBS/GDP ratios have increased after the crisis.

CHAPTER 4

Conclusions

This final chapter consists of answers to our research questions, policy implications deriving from this thesis project, claims relevant to MoT context, suggestions for further research and elaboration on the limitations and scientific contribution of the thesis.

4.1 Answers to our research questions

The research objective of this thesis project is to shed light on major dimensions of the SBS's social efficiency. This led us to answer the following central research question:

What is the social efficiency of the Shadow Banking System (SBS)?

To answer this central question, the following four sub-questions are addressed.

1. **Why did shadow banking grow? What are the main drivers of this evolution in terms of size and structure?**

We claim that the SBS arose in order to meet the need of global cash pools with regard to a safe "parking place" for their cash. In other words, it is the principal need

of global cash pools for safety and liquidity, which was not met through insured deposits and safe government bonds adequately, that led to the SBS rise.

Other factors that contributed to this rise are associated with financial innovations, deregulation of the financial sector and competition between commercial and investment banks. The most important financial innovation with regard to the SBS evolution is asset securitization and the most relevant outcome of deregulation and competition between the different types of financial institutions has been the practical (and later the official) repeal of the Glass-Steagall-Act.

For empirical information with regard to evolution in terms of size and structure, the reader is referred to Figure 13, Figure 26, Figure 27, Figure 28, Figure 29, Figure 30 and Figure 31.

2. **What are the main functions and purposes and parts of the SBS? How does the SBS work in practice?**

The key functions of the SBS are securitization and collateral intermediation and the most important constituents of the SBS include ABSs, ABCPs, Repos, MMFs, Rehypothecation. The key operations of the SBS are presented in Figure 15, Figure 17 and Figure 18.

3. **What is the impact (if any) of the SBS on real GDP growth?**

We claim that the SBS has a negative impact on GDP per capita growth. Based on our empirical analysis, a negative correlation between the aforementioned variables is shown. The fact that this holds true no matter if the narrow or broad measure of SBS

is used, strengthens our argument regarding negative correlation. We draw the conclusion that the SBS has a negative impact on GDP per capita growth because, first, the SBS is central to modern finance and, second, modern finance is increasingly being disputed with regard to its impacts on society and growth. More specifically, as Kay (2015) suggests, the financial sector serves itself and its executives, rather than society and its users and "much of the growth of the finance sector represents not the creation of new wealth but the sector's appropriation of wealth created elsewhere in the economy" (p.7). This translates into finance becoming bigger by absorbing growth of the overall economy. Moreover, Cecchetti and Kharroubi (2012) illustrate empirically how finance has become a drag on growth.

4. **What is the impact (if any) of the SBS on hourly labour productivity growth?**

We cannot make any strong claims about the impact of the SBS on the real productivity growth. Although the coefficients of the GDP scaled SBS are negative throughout all the examined scenarios, the results are not statistically significant. This makes us consider these results as merely suggestive at most. Hence, no correlation is established and, this, in turn, results into no causal inferences.

4.2 Policy implications

The first policy implication is related to the way governments deal with shadow banking. We claim that governments should deal explicitly with global cash pools and attempt to facilitate the match between the needs of cash pools for safe instruments with the respective supply of these instruments. Our reasoning is as follows:

The main driver for the rise and current existence of the SBS is the principal need of global cash pools for safety and liquidity, which has not been, adequately, met through insured deposits and safe government bonds. At the same time, the SBS has a negative impact on economic growth, which is a pretty undesirable outcome. Hence, to support economic growth, governments should deal explicitly with cash pools. The potential regulatory responses are many and they go beyond the scope of this thesis. However, we strongly claim that the chosen regulatory actions should not ignore the aforementioned economic rationale of the SBS.

The second policy implication is that governments should not overestimate the influence of monetary policy (i.e. setting interest rates) on economic growth. Sometimes, the negative impact of the real long-term interest rate might be overwhelmed by other drivers of growth.

Our empirical findings indicate a negative correlation between the real long-term interest rate and the GDP per capita growth. This is in-line with the general economic theory. However, we also found a very low (close to zero) correlation between the aforementioned variables in US. A potential explanation could be, as Palley (2012) suggests, that asset price inflation and debt accumulation probably were the two key forces with of the US growth model. For this example, according to our empirical findings, the real GDP per capita growth was not much influenced by the real long-term interest rate.

The third policy implication is that policy makers should rethink about the potential GDP's role. We claim, based on our empirical findings, that it could be the case that

the importance and usefulness of potential GDP are overestimated. In order to make our argument clear, we first, give some relevant macroeconomics background.

Potential GDP is a theoretical construction that determines (with the actual GDP of course) the output gap. More specifically, as it is used in this thesis project, output gap as a percentage of potential GDP refers to the deviation of actual GDP from the potential GDP, divided by the potential GDP. According to conventional economic thinking, output gap (either positive or negative) is not desirable, since it means that economy is running at an inefficient rate (Jahan & Mahmud, 2013). When the output gap is positive, the economy is supposed to overwork its resources; when the output gap is negative, the economy is supposed to underwork its resources (Jahan & Mahmud, 2013). This perspective has made economists argue that "the output gap has guided and will continue to guide policymakers" (p. 39). This reasoning has proceeded even further when Taylor (1993) suggested that policymakers may just use a formula to compute the real interest rate target. The critical input of this formula is the potential GDP. This renders the existence and correct measurement of the potential GDP particularly important, since, when this is not true, the interest rate is wrongly set. This, in turn, results in lower economic growth and more unemployment. This loss of economic growth derives completely from wrong policy decision-making.

Given this line of reasoning, if the output gap had an adverse effect on the GDP per capita growth, a positive correlation between the output gap and the GDP per capita growth would not be observed unless the negative output gap observations were dominant and the positive output gap observations were really scarce.

In our empirical findings, both positive and negative output gaps are observed. The averages of output gaps are positive and close to zero in our two econometric approaches respectively. However, no matter which approach is used, when the coefficients of output gap are statistically significant, they are always positive. This confirms theories that claim that public policy decisions cannot be based on the strict acceptance that a higher actual GDP compared to the theoretical potential GDP is not desirable (Storm & Naastepad, 2012).

4.3 Relevance to high-tech innovation (MoT context)

This thesis project consists of the theoretical analysis (literature review) and the econometric analysis. Both of them are relevant to high-tech innovation.

With regard to our theoretical analysis, we argue that shadow banking cannot finance high-tech innovation because its key features are not aligned with high-tech innovation needs. Moreover, shadow banking represents a general short-termist culture of the financial sector that is not favorable for high-tech innovation. The fact that shadow banking has become so dominant (see Figure 13) may well be considered a drag on high-tech innovation.

Through this thesis project, we examine the structure and unveil the features of the most important SBS parts. These key SBS parts have two common features. They were thought to be super-safe, up to the outbreak of the global financial crisis, and they only take part in short-term transactions. This type of finance is not aligned with the type of finance that high-tech innovations need. High-tech innovations seek for committed and long-term financing (Mazzucato & Perez, 2015).

Besides this, the central role of the SBS in modern finance constitutes a manifestation of the general short-termist culture of the financial sector – the culture of "I'll be gone, you'll be gone" (Kay, 2015, p.204). A similar manifestation of this culture is the banks' preference for short-term profits rather than long-term commercial relationships. Banks push their clients to do more and more deals – even when an additional deal might not be the wisest choice for the client - since their remuneration mainly derives from fees and commissions on transactions (Kay, 2015). This results in short-term profits for banks but is accompanied with less trust and less long-term commercial relationships between banks and corporations (Kay, 2015). Another example is to be found on venture capitalists' increasingly risk-averse behavior (Mazzucato & Perez, 2015). They tend to focus on the exit, which happens usually in less than three years, mainly, via initial public offerings (IPOs) (Mazzucato & Perez, 2015). This environment is very hostile for radical innovations, which are not based on existing technologies and can take 15-20 years to fully develop (Mazzucato & Perez, 2015).

As far as our econometric analysis is concerned, we examine the correlation between the SBS and two indicators of economic welfare. One of these indicators is real hourly labour productivity growth. This indicator is closely related to high-tech innovation (Hall, 2011). A negative but not statistically significant correlation between the SBS and that indicator is observed. This means that the empirical evidence of this thesis project with regard to a potential negative impact from the SBS on innovation can be interpreted as merely suggestive at most.

4.4 Suggestions for further research

Further research efforts could be done to shed more light on the interplay between the SBS and the society.

First, this thesis has sketched the flourishment of the SBS in US. Our focus was given to the SBS in US, because the global SBS's origins are, indeed, to be found in US. However, the SBSs of UK, EU or Euro Area and emerging markets have gradually become of paramount importance. It would be interesting to examine how these systems have evolved and which reasons and forces lay behind their evolution. Moreover, a comparison between the evolution of these systems and the evolution of the SBS in US might give quite a few useful insights regarding the global SBS evolution. Finally, an analysis of the interplay between the different systems over time would also be quite interesting. Hence, a thorough study of the evolution of the SBS systems worldwide is proposed as an interesting next step.

A second interesting step would be to experiment more with our econometric models and try to find even better combinations of control variables. Although the real long-term interest rate and the output gap as a percentage of the potential GDP were very helpful, other combinations of control variables might come up with new insights and find results that are more often statistically significant.

A third interesting step would be to use our second empirical approach in other countries. If access to data was secured, it would be very interesting to attain a better understanding of the evolution of the different key constituents of the SBS worldwide

and to assess their impact on real GDP per capita growth. It would also be quite informative to compare the outcomes between countries.

A fourth interesting step would be to examine the impact of the SBS on alternative indicators of technological progress and innovation that capture high-tech innovation more directly (e.g. patent counts) or from the input side (e.g. RD&D spending). To the best of our knowledge, this has not been researched so far. Besides this, it would be very interesting to observe if there is any statistically significant impact of the SBS on high-tech innovation (operationalised using alternative indicators). This would contribute to the justification of the observed impact of the SBS on real GDP per capita growth.

4.5 Thesis limitations and scientific contribution

Limitations with regard to access to data constitute a problem of almost any research study on the SBS. This holds true even when the research is undertaken by global organizations with tremendous expertise and resources, such as the ECB, FRB and IMF. Naturally, access to data has been an issue for this thesis project. Besides limitations regarding the SBS data, we were not able to find quarterly data on productivity growth. Hence, it was not feasible to use our second empirical approach in order to investigate for any correlations between the SBS and the real productivity growth.

Regarding scientific contribution, this thesis project is engaged to innovative ideas from a research point of view. The assessment of the social efficiency of finance and

the exploration of the shadow banking's role constitute two new research areas in the field of economics.

This thesis project has gone even further than this point. To the best of our knowledge, this thesis project is the first research attempt to assess the social efficiency of the SBS by measuring its impact on factors that are related to economic growth (GDP per capita growth and real hourly labour productivity growth).

Furthermore, our analysis with regard to the evolution, mechanics, economic functions and key constituents of the SBS is supposed to contribute on a better understanding of the SBS. In other words, we think that this thesis project sheds some light on this "black-box" and that further exploration of the SBS may build on our analysis.

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Appendix

APPENDIX A – SENSITIVITY ANALYSIS

Table A1. Sensitivity analysis of the broad SBS/GDP ratio correlation with the real GDP per capita growth by excluding one country each time.

Excluded Country	SBS/GDP coefficient	Sig. of SBS/GDP coefficient	Sig. of interest rate coefficient	Sig. of output gap/potential GDP coefficient
Austria	-0.50	Yes	Yes	No
Belgium	-0.51	Yes	Yes	No
Finland	-0.51	Yes	Yes	No
France	-0.51	Yes	Yes	No
Germany	-0.47	Yes	Yes	No
Greece	-0.48	Yes	No	Yes
Ireland	-0.49	No	Yes	Yes
Italy	-0.52	Yes	Yes	No
Japan	-0.55	Yes	Yes	No
Netherlands	-0.52	Yes	Yes	No
Portugal	-0.48	Yes	Yes	No
Spain	-0.53	Yes	Yes	No
United Kingdom	-0.51	Yes	Yes	Yes
US	-0.51	Yes	Yes	No

Table A2. Sensitivity analysis of the broad SBS/GDP ratio impact on the real GDP per capita growth by excluding one year each time.

Excluded Year	SBS/GDP coefficient	Sig. of SBS/GDP coefficient	Sig. of interest rate coefficient	Sig. of output gap/potential GDP coefficient
2001	-0.56	Yes	Yes	Yes
2002	-0.52	Yes	Yes	Yes
2003	-0.51	Yes	Yes	Yes
2004	-0.51	yes	Yes	No
2005	-0.52	yes	Yes	No
2006	-0.52	yes	Yes	No
2007	-0.51	yes	Yes	No
2008	-0.38	yes	Yes	No
2009	-0.61	yes	Yes	No
2010	-0.50	yes	Yes	Yes
2011	-0.46	yes	Yes	Yes
2012	-0.49	yes	Yes	No

Table A3. Sensitivity analysis of the narrow SBS/GDP ratio impact on the real GDP per capita growth by excluding one country each time.

Excluded Country	SBS/GDP coefficient	Sig. of SBS/GDP coefficient	Sig. of interest rate coefficient	Sig. of output gap/potential GDP coefficient
Austria	-0.55	Yes	Yes	yes
Belgium	-0.56	Yes	Yes	yes
Finland	-0.55	Yes	Yes	No
France	-0.55	Yes	Yes	yes
Germany	-0.53	Yes	Yes	No
Greece	-0.50	Yes	No	yes
Ireland	-0.56	No	Yes	yes
Italy	-0.57	Yes	Yes	No
Japan	-0.60	Yes	Yes	No
Netherlands	-0.56	Yes	Yes	No
Portugal	-0.53	Yes	Yes	No
Spain	-0.58	Yes	Yes	No
United Kingdom	-0.55	Yes	Yes	No
US	-0.56	Yes	Yes	No

Table A4 – Sensitivity analysis of the narrow SBS/GDP ratio impact on the real GDP per capita growth by excluding one year each time.

Excluded Year	SBS/GDP coefficient	Sig. of SBS/GDP coefficient	Sig. of interest rate coefficient	Sig. of output gap/potential GDP coefficient
2001	-0.62	Yes	Yes	Yes
2002	-0.56	Yes	Yes	Yes
2003	-0.55	Yes	Yes	Yes
2004	-0.56	Yes	Yes	Yes
2005	-0.57	Yes	Yes	No
2006	-0.57	Yes	Yes	No
2007	-0.57	Yes	Yes	No
2008	-0.44	Yes	Yes	No
2009	-0.66	Yes	Yes	No
2010	-0.54	Yes	Yes	Yes
2011	-0.50	Yes	Yes	Yes
2012	-0.56	Yes	Yes	No

APPENDIX B

Table B1. Additional examined versions for second approach.

Version No.	Number of main independent variables	Main independent Variables (all of them are GDP scaled)	Time period
1	1	ABS	1983q1 – 2014q4
2	1	ABCP	2001q1-2016q1
3	1	Repo	1990q1-2014q1
4	1	MMMF	1973q4-2015q4
5	4	ABS, ABCP, Repo, MMMF	2001q1-2014q1
6	1	SBS (= ABS + Repo + MMMF)	1990q1-2014q1
7	3	ABS, Repo, MMMF	1990q1-2014q1
8	1	SBS (= ABS + MMMF)	1983q1 – 2014q4
9	2	ABS, MMMF	1983q1 – 2014q4
10	1	SBS (= ABS + Repo)	1990q1-2014q1
11	1	SBS (= Repo + MMMF)	1990q1-2014q1
12	2	Repo, MMMF	1990q1-2014q1

Table B2. Version 1. ABS/GDP correlation with real GDP per capita growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	ABS/GDP	-1.448 n.s.s	-	-2.943**	-1.462 n.s.s	-2.740**
Control Variables	Real long-term interest rate	0.082*	0.114**	-	0.092*	-
	Output gap/potential GDP	8.470*	8.841*	-	-	9.986**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 1 is that ABS/GDP is negatively correlated with GDP per capita growth. When the real long-term interest rate is excluded, this

correlation is statistically significant even at 1% level. When the real long-term interest rate is included, the negative correlation is just suggestive.

Table B3. Version 2. ABCP/GDP correlation with real GDP per capita growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	ABCP/GDP	-11.214 n.s.s	-	-0.941 n.s.s	-0.876 n.s.s	
Control Variables	Real long-term interest rate	0.055 n.s.s	0.007 n.s.s	-	-0.003 n.s.s	-
	Output gap/potential GDP	17.819*	12.099*	-	-	

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 2 is that ABCP/GDP is negatively correlated with GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive.

Table B4. Version 3. Repo/GDP correlation with real GDP per capita growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Repo/GDP	-0.654 n.s.s	-	-2.093 n.s.s	-1.304 n.s.s	-2.014 n.s.s
Control Variables	Real long-term interest rate	0.071 n.s.s	0.085 n.s.s	-	0.095 n.s.s	14.928**
	Output gap/potential GDP	14.424**	14.546**	-	-	

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 3 is that Repo/GDP is negatively correlated with GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive.

Table B5. Version 4. MMMF/GDP correlation with real GDP per capita growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	MMMF/GDP	-1.643 n.s.s	-	-2.638*	-2.484*	-1.680 n.s.s
Control Variables	Real long-term interest rate	0.096**	0.098**	-	0.093**	-
	Output gap/potential GDP	13.551**	15.146**	-	-	15.392

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 4 is that MMMF/GDP is negatively correlated with real GDP per capita growth. When the output gap as a percentage of the potential GDP is excluded, this correlation is statistically significant. When the output gap as a percentage of the potential GDP is included, the negative correlation of MMMF/GDP with real GDP per capita growth is just suggestive.

Table B6. Case 5. ABS/GDP, ABCP/GDP, Repo/GDP, MMMF/GDP correlation with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	ABS/GDP	0.373 n.s.s	-	1.840 n.s.s	0.549 n.s.s	1.180 n.s.s
	ABCP/GDP	4.119 n.s.s	-	3.763 n.s.s	2.666 n.s.s	7.972 n.s.s
	Repo/GDP	-1.425 n.s.s	-	-3.915 n.s.s	-1.535 n.s.s	-3.302 n.s.s
	MMMF/GDP	-14.054*	-	-14.167**	-13,766**	-15.056**
Control Variables	Real long-term interest rate	0.068 n.s.s	0.024 n.s.s	-	0.071 n.s.s	-
	Output gap/potential GDP	-1.259 n.s.s	12.703*	-	-	-3.851 n.s.s

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 5 is that the negative correlation of MMMF/GDP ratio with real GDP per capita growth is statistically significant in all tested scenarios. The coefficients of the other GDP scaled SBS parts are not statistically significant.

Table B7. Version 6. (ABS+Repo+MMMF)/GDP correlation with the real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	(ABS+Repo+MMMF)/GDP	-0.680 n.s.s	-	-1.156*	-0.778 n.s.s	-0.922 n.s.s
Control Variables	Real long-term interest rate	0.051 n.s.s	0.085 n.s.s	-	0.077 n.s.s	-
	Output gap/potential GDP	13.603**	14.546**	-	-	14.093**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 6 that the GDP scaled sum of ABS, Repo and MMMF is negatively correlated with GDP per capita growth. When the control variables are excluded, this correlation is statistically significant. When the control variables are included, this correlation is just suggestive.

Table B8. Version 7. ABS/GDP, Repo/GDP, MMMF/GDP correlated with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	ABS/GDP	-4.729 n.s.s	-	2.014 n.s.s	-0.490 n.s.s	-1.425 n.s.s
	Repo/GDP	6.380 n.s.s	-	-0.793 n.s.s	2.955 n.s.s	1.455 n.s.s
	MMMF/GDP	-1.707 n.s.s	-	-7.485*	-6.037*	-3.493 n.s.s
Control Variables	Real long-term interest rate	0.131 n.s.s	0.085 n.s.s	-	0.104 n.s.s	-
	Output gap/potential GDP	12.286**	14.546**	-	-	12.587**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 7 is that MMMF/GDP is negatively correlated with real GDP per capita growth. When output gap as a percentage of potential GDP is excluded, this correlation is statistically significant. When output gap as a percentage of potential GDP is included, this correlation is not statistically significant.

Table B9. Version 8. (ABS+MMMF)/GDP correlation with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	(ABS+ MMMF)/GDP	-1.175 n.s.s	-	-2.153**	-1.344 n.s.s	-1.937**
Control Variables	Real long-term interest rate	0.070 n.s.s	0.114**	-	0.073 n.s.s	-
	Output gap/potential GDP	7.737*	8.841*	-	-	8.457*

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 8 is that the GDP scaled sum of ABS and MMMF is negatively correlated with GDP per capita growth. When the real long-term interest rate is excluded, this correlation is statistically significant. When the real long-term interest rate is included, this correlation is just suggestive.

Table B10. Version 9. ABS/GDP, MMMF/GDP correlation with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	ABS/GDP	0.415 n.s.s	-	1.045 n.s.s	1.229 n.s.s	0.199 n.s.s
	MMMF/GDP	-4.085 n.s.s	-	-7.334**	-5.908*	-5.534 n.s.s
Control Variables	Real long-term interest rate	0.062 n.s.s	0.114**	-	0.059 n.s.s	-
	Output gap/potential GDP	6.154 n.s.s	8.841*	-	-	6.339 n.s.s

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 9 is that MMMF/GDP is negatively correlated with real GDP per capita growth. When output gap as a percentage of potential GDP is excluded, this correlation is statistically significant. When output gap as a percentage of potential GDP is included, this correlation is not statistically significant.

Table B11: Version 10. (ABS+Repo)/GDP correlation with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	(ABS+Repo)/GDP	-0.678 n.s.s	-	-1.198 n.s.s	-0.621 n.s.s	-1.034 n.s.s
Control Variables	Real long-term R	0.059 n.s.s	0.085 n.s.s	-	0.092 n.s.s	-
	Output gap/potential GDP	14.173**	14.546**	-	-	14.929**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 10 is that the GDP scaled sum of ABS and Repo is negatively correlated with real GDP per capita growth but the results are not statistically significant and, thus, can only be interpreted as suggestive.

Table B12. Version 11. (Repo+MMMF)/GDP correlation with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	(Repo+MMMF)/GDP	-1.132 n.s.s	-	-2.208*	-1.613 n.s.s	-1.589 n.s.s
Control Variables	Real long-term interest rate	0.048	0.085 n.s.s	-	0.061 n.s.s	-
	Output gap/potential GDP	13.357**	14.546**	-	-	13.576**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 11 is that the GDP scaled sum of Repo and MMMF is negatively correlated with real GDP per capita growth. When the control variables are excluded, this correlation is statistically significant. When the control variables are included, this correlation is just suggestive.

Table B13: Version 12. Repo/GDP, MMMF/GDP correlation with real GDP per capita Growth

Dependent Variable	Real GDP per capita growth	(1)	(2)	(3)	(4)	(5)
Independent variables	Repo/GDP	1.561 n.s.s	-	0.856 n.s.s	2.447 n.s.s	0.319 n.s.s
	MMMF/GDP	-4.470 n.s.s	-	-6.412**	-6.313**	-4.377 n.s.s
Control Variables	Real long-term R	0.074 n.s.s	0.085 n.s.s	-	0.098 n.s.s	-
	Output gap/potential GDP	11.045**	14.546**	-	-	11.935**

Note. (1) – (5) refer to scenarios 1-5 respectively. Significance at 1/5% level is indicated by **/*. n.s.s = not statistically significant at 5% level.

The main conclusion of version 12 is that MMMF/GDP is negatively correlated with real GDP per capita growth. When output gap as a percentage of potential GDP is excluded, this correlation is statistically significant. When output gap as a percentage of potential GDP is included, this correlation is not statistically significant.

Main conclusions from versions 1-12

We claim that all the examined SBS parts (ABS, ABCP, Repo, MMMF) have at least a suggestive negative correlation GDP per capita growth. The presence or omission of one of two control variables or both of them influences the outcome regarding the statistical significance of the respective SBS coefficient. More specifically, MMMF's negative correlation is usually statistically significant when output gap as a percentage of potential output is omitted. When this control variable is included, the MMMF's

negative impact may be only considered as suggestive. The same applies for the case of the ABS with the role of the "critical control variable" to be played by the long-term interest rate this time. Same issues also apply when the impact of the different sums of some or all of the SBS parts is examined. Given our database, the negative impacts of ABCP and Repo on real GDP per capita growth may only be considered as suggestive.

Table B14 presents a grouping of the main conclusions that derive from each version.

Table B14: Key conclusions of examined cases

Version No.	Main independent Variables (all of them are GDP scaled)	Type of Impact	Critical control variable
1	ABS	Mixed	Long-term interest rate
2	ABCP	Suggestive	-
3	Repo	Suggestive	-
4	MMMF	Mixed	Output gap as a percentage of the potential GDP
5	ABS, ABCP, Repo, MMMF	Mixed	-
6	SBS (= ABS + Repo + MMMF)	Mixed	Both control variables
7	ABS, Repo, MMMF	Mixed	Output gap as a percentage of the potential GDP
8	SBS (= ABS + MMMF)	Mixed	Long-term interest rate
9	ABS, MMMF	Mixed	Output gap as a percentage of the potential GDP
10	SBS (= ABS + Repo)	Suggestive	-
11	SBS (= Repo + MMMF)	Mixed	Both control variables
12	Repo, MMMF	mixed	Output gap as a percentage of the potential GDP

Note. Mixed type of impact refers to statistical results in one version in which the main independent variable's coefficient is statistically significant for some scenarios and not statistically significant for some others. Critical control variable refers to the control variable, whose presence converts the coefficient of the main independent variable from statistically significant to not statistically significant.