SECURITIZATION, ASSET-BACKED COMMERCIAL PAPER, INFORMATION OPACITY, SYSTEMIC RISK AND BANKS' INCENTIVES TO BECOME LARGE

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Abstract

This thesis consists of five chapters. In the first chapter I provide the introduction to the three essays examined in this thesis. In the second chapter I examine the impact of securitization on U.S. bank holding companies' (hereafter BHCs) credit risk, credit risk taking, profitability, and capital level between 2001 and 2013. I also study the effect of the credit enhancements and liquidity provision on BHCs' performance between 2001 and 2013. Since securitization is an endogenous decision, I use the treatment-effects model to control for the selection bias and observe a positive relationship between securitization and credit risk. I also find that securitization decreases BHCs' profitability, but that securitization increases BHCs' capital levels. Although it is possible that relatively risk-averse BHCs may consciously increase their capital buffer by retaining earnings, for example, I do not exclude the possibility that BHCs engaged in regulatory capital arbitrage to increase their capital level. Nevertheless, I find that use of securitization for capital regulatory purposes is mitigated by the risk-retention mechanism, *i.e.* credit enhancements and liquidity provision—banks had to keep the required capital for their extended guarantees. However, as was uncovered during the financial crisis, these credit and liquidity risk-reducing tools were not sufficient to prevent the recent turmoil in the securitization markets.

The third chapter analyzes information opacity and systemic risk for the U.S. BHCs in the context of the asset-backed commercial paper (hereafter ABCP) between 2001:Q2 and 2012:Q4. Banks which set up costly ABCP conduits might have benefited from the regulatory capital relief and from providing financing alternatives to their clients. However, they faced costs in terms of the increase in information opacity through the provision of ABCP guarantees to BHCs' own and third-party sponsored ABCP conduits. Furthermore, I observe that higher information asymmetry about BHCs' value is associated with higher volatility of returns and also with higher systemic risk.

In the fourth chapter I examine the proposal to limit bank size, which is known as tackling the banks' incentive to become "too big to fail", and also how this regulation to curb bank size may affect banks' operating costs. I examine the relationship between the size of BHCs and BHCs' operating costs from 2001:Q2 to 2014:Q1 to evaluate the costs that the newly suggested regulations on bank size might bring. I find that rules to limit the size of banks could significantly reduce economies of scale. In particular, if large and cost-efficient banks

become split into smaller parts, data processing, legal fees, audit and consulting expenses, in addition to expenses on premises and automated teller machines (hereafter ATMs) are likely to increase.

I also pay particular interest to legal fees and litigation settlement; I find evidence that larger banks, but not necessarily systemically more risky banks, face litigation charges more frequently. I do not find evidence that larger banks face a lower probability of being fined. This suggests that another phenomenon known as "too big to jail" may not be true, if the assumption is that the misconduct detection is perfect. I do, however, observe that penalties had little effect on BHCs' profitability, and that some of the largest banks continuously face litigation charges. In turn, this could possibly imply that benefits from wrongdoing outweighed the costs.

The fifth chapter summarizes major findings and concludes.

Table of Contents

Table of Figures

Table of Tables

Abbreviations

ABCP - asset-backed commercial paper

ABS - asset-backed securities

AME - advertising and marketing expenses

ATM - automated teller machine

BH - buy and hold

BHC - bank holding company

BSA - Bank Secrecy Act

CDS - credit default swaps

CEI - credit-enhancing interest-only strip

CEO - chief executive officer

CFO - chief financial officer

CH - Clearing House

CML - conditional maximum likelihood

CP - commercial paper

CPP - Capital Purchase Program

CRSP - Center for Research in Security Prices

CUSIP - Committee on Uniform Securities Identification Procedures

DoJ - Department of Justice

E.U. - European Union

ECB - European Central Bank

ERISA - Employee Retirement Income Security Act

ES - Expected shortfall

FDIC - Federal Deposit Insurance Corporation

FHFA - Federal Housing Finance Agency

FIRREA - Financial Institutions Reform, Recovery and Enforcement Ac

FRB - Federal Reserve Bank

FRBNY - Federal Reserve Bank of New York

GAAP - Generally Accepted Accounting Principles

GLBA - Gramm–Leach–Bliley Act

IFRS - International Financial Reporting Standards

IIROC - Investment Industry Regulatory Organization

IMF - International Monetary Fund

LIBOR - London InterBank Offered Rate

LRMES - long-run marginal expected shortfall

M&A - Mergers and Acquisitions

MBS - mortgage-backed securities

MES - marginal expected shortfall

NPATA - non-performing assets to total assets

NPL - non-performing loans

NYDFS - New York's Department of Financial Services

OCC - Office of the Comptroller of the Currency

OLS - Ordinary Least Squares

OTD - originate-to-distribute

PERMCO - CRSP identifiers

RELROE - relative profitability

ROA - returns on assets

ROE - returns on equity

RWATA - Risk-weighted assets to total assets

SEC - Securities and Exchange Commission

SIFI - systemically important financial institutions

SIV - structured investment vehicle

SLC - standby letter of credit

SPE - special purpose entity

SPV - special purpose vehicle

SRISK - systemic risk measure

SRMES - short-run marginal expected shortfall

SUB - subordinated security

TALF - the Term Asset-Backed Securities Loan Facility

ARP - Troubled Asset Relief Program

U.K. - United Kingdom

U.S. - United States

UBPR - Uniform Bank Performance Reports

VAR - value at risk

VLab - Volatility Laboratory

WRDS - Wharton Research Data Services

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Author’s declaration

“I declare that, except where explicit reference is made to the contribution of others, that this thesis is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.”

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Chapter 1

Introduction

1.1 Introduction

The 2007–2009 global financial crisis is viewed as the most severe since the Great Depression. Many large financial institutions were on the brink of collapse as a result of excessive exposure to securitized assets.

To stabilize the financial system, the U.S. Treasury Department launched a bailout program called the Troubled Asset Relief Program (hereafter TARP). Its purpose was to bail out the troubled financial institutions. The U.S. Treasury had to purchase assets and equity from financial firms to strengthen the financial sector and prevent avoidable foreclosures.[1] TARP programs included several programs of which the largest was the Capital Purchase Program (hereafter CPP) targeted at banking organizations. As part of the CPP, the Treasury invested approximately $245 billion in over 700 banking institutions. Of these banking organizations, 32 were among the biggest banks in the U.S. in the fourth quarter of 2011. This gave rise to a widespread public dissatisfaction with the fact that taxpayers' money had to be used to save the "too big to fail"[2] banks.

Another TARP program, called the Term Asset-Backed Securities Loan Facility (hereafter TALF), created jointly by the Fed and the Treasury in 2009, provided eligible borrowers with three-year and five-year non-recourse loans, collateralized by asset-backed securities (hereafter ABS). Under TALF facilities, around $71 billion in loans were provided to troubled financial firms. The Treasury committed to provide the Federal Reserve up to $20 billion under TARP in credit protection for the TALF. In July 2010, this amount was reduced to $4.3 billion, and in June 2012 was subsequently reduced again to $1.4 billion. The outstanding amount of TALF loans fell from $24.7 billion at the start of 2011 to $5.3 billion as of June 20, 2012. As of the end of March 2012, all loans were performing as scheduled (FSOC, 2012). Just like CPP, TALF has also generated widespread public debate,

[1] American International Group (AIG), General Motors, Chrysler, Fannie Mae and Freddie Mac also received capital injections in the form of preferred and common stocks (Barth, Prabha, and Swagel , 2012).

[2] This term is used to denote financial firms that would substantially damage the financial system and the rest of the economy should they go bankrupt.

with regards to the regulation of banking activities and the moral hazard problem of "too big to fail" banks.[3]

The "laissez-faire" approach toward regulation of investment banks has widely been believed to be a contributor to the depth of the recent economic downturn. Following the events of August 2007, supervisors have suggested various regulations to limit the scope of banking activities. For example, capital regulations have been revised and increased in the Basel III Accords. The U.S. has also passed the Dodd–Frank Wall Street Reform Act and Consumer Protection Act that included the "Volcker Rule"[4] which was designed to limit U.S. banks' exposure to hedge funds and private equity vehicles. In addition, following the unpopularity of TARP and to address the issues and prevent the possible activation of programs like TARP in the future, policy regulators have produced the new orderly liquidation authority in Title II of the Dodd–Frank Act. This involves making bondholders and other creditors more prone to incur losses if a financial institution fails, as opposed to making taxpayers incur the losses if government steps in to save the failing banks. Title II does not eliminate the possibility for the deployment of government funds to save some firms. However it gives extra protection to taxpayers in the event of a possible failure of a large financial institution because bondholders will be first to incur losses. This has been welcomed by the public; however, the Dodd–Frank Act sparked much discussion, especially from the regulated financial institutions. Many banks argued that it would have significant adverse consequences for corporations, investors, financial markets and the U.S. economy (Lester and Bovenzi, 2010).

The major financial innovations that contributed to the recent crisis and the changes in the regulations of bank activities after 2007 have motivated the compilation of this thesis. In particular, this thesis focuses on the securitization activities of the big banks, which were made possible with the passing of the Gramm–Leach–Bliley Act (hereafter GLBA). In 1999, GLBA removed business operation restrictions on all types of banking and financial institutions. Banks could loan and securitize, innovate, make swaps and reinsure, hedge and guarantee and become closely interconnected. Financial innovation such as securitization

[3] The CPP is now closed. The Treasury has reported that as of June 2012 all the repayments along with interest, dividends and other income exceeded the original disbursement. Moreover, Treasury estimates that the total gain to taxpayers from the $245 billion disbursed under all bank support programs under TARP will ultimately exceed $20 billion (FSOC, 2012).

[4] The Volcker rule prohibits insured depository institutions and any company affiliated with an insured depository institution from engaging in proprietary trading and from acquiring or retaining ownership interests in a hedge fund or private equity fund. These prohibitions are subject to a number of statutory exemptions and restrictions.

increased the interconnection between the financial firms and made it more challenging to determine where credit risk ultimately lies. August 2007 began with the seizure in the banking system precipitated by BNP Paribas announcing that it was ceasing activity in three hedge funds that specialised in US mortgage debt. This was the moment when banks realized that the derivatives on their balance sheets were worth significantly less than banks had previously imagined.

In the second chapter of this thesis, I explore whether current U.S. BHCs' exposure to securitized assets had an adverse impact on their risk, profitability and returns.

In addition, sophisticated and complex securitization programs are also thought to have increasingly compromised the financial transparency of banks, resulting in a highly opaque banking sector and an erosion of trust in the financial sector as a whole. To put differently, apart from discussing motivations and consequences of asset securitization, I focus on the benefits and costs benefits of securitization structures. In particular, I examine the opacity[5] in the banking industry and analyze how information opacity was affected by the banks' exposure, via various guarantees, to asset-backed commercial paper (hereafter ABCP).

ABCP, which is at the epicenter of discussion in my third chapter, is different from ABS.[6] ABCP programs provide corporations with alternatives to direct debit issuance and term ABS. The main difference is that ABCP is generally issued with maturities of under three months unlike ABS, which are longer term. ABCP conduits issued high levels of debt with practically no equity and yet they managed to obtain the highest ratings from the ratings agencies due to the credit and liquidity back-up lines provided by the agents extending the guarantees (BlackRock, 2013).

Then, in the third chapter I describe the basic structure of ABCP conduits and their connection with sponsoring financial institutions through guarantees. Standard & Poor's (2003) defined structured finance as "*a type of financing in which the credit quality of the*

[5] I define bank opacity as the extent to which financial accounting information creates uncertainty about intrinsic value (Bushman and Williams 2013). The proxy for information opacity is the bid–ask spread. Based on the microstructure theory, it is rational to expect that if investors find it difficult to assess the value or riskiness of firms, this will be reflected in the bid–ask spread (Kyle, 1985). My results will bear direct policy implications, *i.e.* given that increased financial disclosure lessens information opacity, this will lead to less ambiguity about the true value of the financial institution.

[6] Typically, ABCP conduits benefit from two-tiered enhancement (liquidity and credit enhancements) whereas an ABS has typically one level of credit enhancement. This gives some protection for the repayment of principal and interest if the maturing ABCP cannot be rolled over in the market. In addition, an ABS usually has exposure to a single sector (e.g. mortgages, student loans, automobile or industrial loans), while most ABCP conduits have diversified portfolios of assets (BlackRock, 2013). Over the past years, the cost of providing liquidity support has risen due to the increased capital requirements and regulatory scrutiny.

debt is assumed to be based on a direct guarantee from a creditworthy entity or on the credit quality of the debtor's assets, with or without credit enhancement, rather than on the financial strength of the debtor itself." The definition summarizes well why guarantees are important and their role during the recent economic downturn.

As for the existing empirical evidence on ABCP conduits, Acharya et al. (2013) show that banks that set up ABCP conduits suffered significant losses because conduits could not be rolled over to maturing ABCP. This raises the need for evaluation of benefits and losses to banks from setting up these conduits.

Acharya et al. (2013) assess the benefits to banks by quantifying how much profit conduits yielded to banks. Assuming a risk weight of 100 percent for underlying assets, banks could avoid capital requirements of around 8 percent by setting up conduits relative to on-balance sheet financing. Assuming that banks could finance short-term debt at close to the riskless rate, which is consistent with the rates paid on ABCP before the start of the financial crisis, and taking an equity beta of one and a market risk premium of 5 percent, banks could reduce the cost of capital by 40 basis points by setting up conduits relative to on-balance sheet financing. Assuming that conduits have no costs, and that revenues are equal to profits, banks were earning (prior to a run on the ABCP market) a carry of about ten basis points on conduit assets. Comparing the costs and benefits of conduits, it seems clear that conduits would not have been profitable if banks had been required to hold equity against assets in their conduits, to the same extent as for assets on their balance sheets. In fact, banks would have made a loss (negative carry) of 30 basis points on each dollar invested, had they kept these assets on their balance sheets. However, given that banks were not required to hold equity to the same extent as for assets on their balance sheets, they could earn a profit of ten basis points. Conduits were thus a relatively low-return activity but offered a way for some banks to attract money market savings and effectively increase bank size without increasing regulatory capital.[7]

[7] In 2003 the Financial Accounting Standard Board required banks to consolidate all SPV in which they were the main beneficiary. However, in 2004, the Office of the Comptroller of the Currency (OCC), the Federal Reserve (Fed) and The Federal Deposit Insurance Corporation (FDIC), The Office of Thrift Supervision (OTS) announced that ABCP conduits were exempt from this directive. In practice, however, the credit and liquidity guarantees provided the same protection because the definition of the asset default was such that ABCP always matures before assets are declared in default and thus liquidity protection was enough for ABCP buyers to feel safe and invest in ABCP. This resulted in the rapid growth of ABCP after 2004. Gilliam (2005) notes that regulatory charges for conduit assets were 90 percent lower than regulatory charges for on-balance sheet financing.

The shadow-banking environment facilitated the structure and evolution of the ABCP market. The profits shown above explain well why ABCP has grown in popularity over time. For example, ABCP was only about 6 percent of the total commercial paper market in 1990, but by mid-2007 it accounted for about 60 percent of the total market, or approximately $1.2 trillion (Figure 1.1).

Figure 1-1 - Asset-backed Commercial Paper Outstanding

Source: Board of Governors of the Federal Reserve System (US) retrieved from Federal Reserve Bank of St. Louis; September 30, 2016.

Note: The above graph shows the asset-backed commercial paper outstanding. The asset-backed commercial paper **(**ABCP) market collapse occurred on August 9, 2007

It is important to note that shadow banking was perceived as stable and non-risky because of the guarantees provided from the private sector. Operations of many shadow banking vehicles and activities are interlinked with traditional banking via credit enhancements, liquidity back-up lines, implicit support to SPVs, and so forth. However, once the solvency of the put providers (*e.g.* banks and insurance companies) was questioned, shadow banking underwent a major collapse, partly because credit ratings, risk managers and investors themselves underestimated the tail risks in the private sector guarantees. The run on the shadow banking system began on 9th August 2007, when BNP Paribas suspended the calculation of the net asset value of its three mortgage-backed securities funds (Kasperczyk and Schnabl, 2013).

This led to the freezing of the market. Many large ABCPs which had recourse to their sponsors had to be taken back onto banks' balance sheets. The high opacity of these structures meant that banks themselves were not sure who and when would be affected by these events.

Events reached momentum after the collapse of the Lehman Brothers on 17th September, 2008. The Federal Reserve had to step in and directly repurchase ABCP from the market to prevent catastrophic consequences. There has been no single conduit declaring bankruptcy throughout this recent economic downturn (Acharya et al., 2010).

Once the crisis had begun, many economists stated that it had been unavoidable, that many warning signals had been received, and that many people in the industry saw this collapse coming (Rajan, 2005). In contrast to Rajan (2005), IMF (2015) stated that crisis came as total a surprise. In turn, The Financial Crisis Inquiry Commission (2011) concluded that the recent financial crisis was avoidable. Thus, it is of great interest to explore whether investors took into account that the banks that provided guarantees to these conduits might run into difficulties and whether they anticipated that given the adverse state of the economy, the government would step in and help BHCs to fulfill their commitments.

Existing literature on bank opacity and market microstructure is not conclusive on whether or not off-balance sheet activities increase bank opacity.

Acharya et al. (2010) show that in the period preceding the 2007-2009 financial crisis, there was no relationship between exposure to ABCP and stock returns. This may suggest that investors were ignorant about the exposure of their bank to ABCP. Thus, it is reasonable to assume that the same may be true for the guarantees. Acharya et al. (2010) mention that the credit guarantees directly affect the ability of the conduits to issue ABCP after the financial crisis, *i.e.* conduits that have weaker guarantees could see diminished ability to issue ABCP. Regarding the investors, Acharya et al. (2013) examine the risk transfer from the perspective of the investor buying ABCP. The focus in Chapter 3 is purely on the investors of the BHCs who extended the guarantees but did not necessarily themselves sponsor ABCP to address the issue of information opacity.

Acharya et al. (2013) show however that commercial banks with higher exposure to ABCP conduits, in terms of the ratio of total ABCP outstanding to bank equity, had a larger decline in stock returns around the beginning of the financial crisis, *i.e.* 9th August 2007. Acharya et al. (2010) focus on the total amount of ABCP; but I am interested in ABCP guarantees. In contrast to their study, I examine how credit and liquidity guarantees impacted

the stock price of the banks that extended this protection before and after the crisis. In addition, I differentiate between the guarantees to own versus third-party conduits, based on the supposition that third-party assets might be more opaque. It is possible that credit guarantees were ignored, not only by investors, but also by bank managers who did not keep pace with financial engineering (Acharya et al., 2013; Allen, et al. 2009) or were simply due to moral hazard arising from the presence of government guarantees.

To be more precise, I examine whether investors in the banks had taken into account that some banks extended protection to their ABCP conduits and to the third-party ABCP conduits. The fact that BHCs extended protection and thus in fact held all the risk on-balance might show a negative effect of credit guarantees on BHCs' stock returns and higher returns volatility, if investors were aware of the risk BHCs were exposed to and took that into account when buying the shares of these BHCs. However, if investors were not aware of the risk posed or they believed that banks were in a good enough condition to extend protection if called upon or if they believed that no matter what happened, banks would receive help from the government, I should not observe any effect.[8]

In addition, I also study guarantees and systemic risk.[9] I examine whether guarantees to ABCP increased systemic risk, as, recently, many critiques have stated that it was primarily guarantees that banks provided, which made the banking industry more interconnected and more fragile. Thus while, it is intuitive that guarantees increased systemic risk, to the best of the author's knowledge no study has previously looked at the effect of guarantees to ABCP conduits on systemic risk.

Subsequently, in the third essay, I explore the reasons for banks to grow in size.[10] It is rational to expect that economies of scale may be the reason why banks may want to become large to save on operating costs. Alternatively, it might be the case that banks may want to grow in size because they anticipate that regulatory authorities is more likely to treat large

[8] Regarding the expectation of the government intervention, the U.S. government's long-standing policy of "constructive ambiguity" (Freixas 1999; Mishkin 1999) is designed to encourage this type of uncertainty, *i.e.* that investors do not expect the government to actually implement "too big to fail" policies, as there is no formal obligation to do so.

[9] I measure systemic risk as marginal expected shortfall (MES) and systemic risk (SRISK). The metrics I use for systemic risk have the advantage that they are used by regulators for monitoring financial stability and that their properties have been extensively discussed in the recent literature (*e.g.* Adrian and Brunnermeier , 2012).

10 As for the size of the banks, it is worth noting that the assets of the 50 biggest banks (7 of them were U.S. banks) were nearly equal to world GPD in the fourth quarter of 2011. The 30 biggest world banks' assets exceed three-fourths of world GDP (Barth et al., 2012).

banks more favourably and save them if necessary, since their collapse can have disproportionately large effect on the economy. It is also possible, that banks want to become large so that they are "too big to jail"[11], that is regulators may want to go light on some of the biggest banks.

The following findings emerge from the three essays:

- Securitization increased bank credit risk and reduced bank profitability after the financial crisis. However, it increased bank capital adequacy. In particular, securitization increased capital level only before and during the crisis and decreased capital level after the financial crisis. These results are consistent with the fact that the regulatory loopholes were eliminated, and that banks stopped retaining their earnings to increase capital buffers.

- Banks that provided credit and liquidity enhancement to their own ABCP conduits and conduits sponsored by other banks had higher information opacity than BHCs which had no exposure to ABCP programmes. Exposure to ABCP conduits increased information opacity only after the crisis but exerted no effect before the crisis.

- Analysis also revealed that exposure to conduits had significant effect on the volatility of returns, while bank opacity significantly increased systemic risk.

- Significant economies of scale were observed as BHC grew in size between 2001:Q2 and 2014:Q4.

- Size in turn was positively correlated with the probability of facing litigation charges, *i.e.* larger banks were more often involved in litigation settlements.

[11] The political power of large banks and risks of economic impact from major prosecutions has led to use of the term "too big to jail", usually when referring to the leaders of "too big to fail" financial institutions. "Too big to jail" can be used, for instance, in the context of the Department of Justice (DoJ) who applied unequal justice to the very large banks and did not prosecute the bank managers.

Chapter 2

The Effects of Securitization On U.S. Bank Holding Companies' Performance

"Securitization is one of the major financial innovations to have occurred over recent decades".

Alan Greenspan (1998)

2.1 Introduction

The lethal cocktail of fundamental and structural weaknesses in the U.S. economy and a new generation of regulators and their policies, including innovative liquidity injection tools, sophisticated derivatives markets and different hazardous incentive structures of financial firms contributed to the current economic downturn.[12] Asset-backed finance, commonly referred to as securitization, is regarded as one of the main culprits of the recent financial crisis (Brunnermeier, 2009). Although it is the U.S. that is perceived to be the largest market for the securitization activities, securitization programs have also become widespread in Europe. They have also been important in Asia and Latin America (Gyntelberg and Remolona, 2005; Scatigna and Tovar, 2007) [13].

Existing literature provides mixed evidence on how securitization affects bank performance. Although it has been documented that securitization affects banks' insolvency risk, leverage, credit risk, profitability and capital level, researchers provide different conclusions regarding the direction of the effect and the channels through which securitization activities affect bank performance measures. While some academics find that securitization has a positive effect on banks' financial health (*e.g.* Cebonoyan and Strahan, 2004; Jiangli and Pritsker 2008; Shin, 2009; Panetta and Pozzolo, 2010), others (Dionne and Harchaoui, 2003; DeMarzo, 2005; Di Cesare, 2009; Casu et al., 2011) provide evidence that securitization actually has a negative or no impact on banks' performance. The difference in the effect of securitization on banks' performance usually stems from how much risk is

[12] For the genesis of the current crisis, Allen et al. (2009) and Diamond and Rajan (2009) provide a synopsis of the current economic downturn and conjectures about causes and remedies.

[13] Global securitization programmes differ significantly in terms of the legal, tax, and accounting requirements of the seller's country.

transferred from the banks to outside investors, as well as how a securitizing banks in the data samples reinvest their proceeds from the securitized assets.

This thesis attempts to fill the gap in the asset-backed finance literature, and analyze the effect of securitization on BHCs' performance measures before and after the crisis. In particular, it examines empirically the effects of securitization on BHCs' credit risk, their credit risk taking, profitability and capital levels over from 2001:Q2 to 2012:Q4. I also examine the credit and liquidity enhancements to BHCs' own and to third-party securitizations, and what role they played in BHCs' securitizations. This is important as it may have a direct implication on the ongoing discussion on how to redesign the risk retention mechanism, *i.e.* how to better align banks' incentives in lending and securitization.

I analyze the relationship between securitization and BHCs' credit risk, profitability and capital level using the treatment effect model. I choose this model in order to address the endogeneity problem that is persistent in many similar studies on the effects of securitization on banks' performance. In addition, I focus on banks' exposure to securitization via their extended credit enhancements and liquidity lines. To the best of my knowledge, the only study that examines the relationship between securitization, credit risk taking and credit enhancements is Casu et al. (2013). They find that credit enhancements reduce credit risk. I, however, depart from their study and analyze in greater detail how credit enhancements and liquidity provision, extended to the BHCs' own and third parties' sponsored conduits affected BHCs' profitability and capital level. I explore the effect of securitization on BHCs' credit risk, credit risk taking, profitability and capital level, as well as how the credit and liquidity enhancements affected the BHCs' performance over time, *i.e.* before, during and after the crisis.

This analysis is of paramount importance, with wider policy implications. For instance, as reflected in the recently introduced banking regulations, the Dodd–Frank Act requires sponsors to disclose to investors all the representations and warranties given to rating agencies, as well as fulfilled and unfulfilled repurchase requests, aggregated by the originator, in order to allow investors to identify originators with underwriting deficiencies.

Finally, I also examine the relationship between banks' performance measures and securitizing of different asset classes to get a deeper insight into which asset classes exerted the most effect on BHC's credit risk, credit risk taking, profitability and capital level.

The remainder of the chapter is organized as follows. First, I provide the background on securitization. Then I review the relevant literature on securitization and the risk retention

mechanism. Subsequently, I describe the data selection and sample specification. Then I proceed to the empirical specification and results of the empirical analysis. Next, I proceed to the robustness tests. Finally, I discuss the findings and conclude.

2.2 Background

Securitization is a financial operation by which a bank[14] transforms illiquid assets or rights to flow of income payments into a fixed-income instrument that is homogeneous, standardized, liquid and suitable for sale to the third parties. The special feature of the securitization is that it reduces irregular flows in payments of the underlying cash flow and transforms the underlying cash flows into stable payments. This transformation of illiquid claims into marketable securities is made through a remote bankruptcy SPV[15] that has ownership rights to the instrument, but is by law separate from the originating firm. Essentially, assets are sold to the SPV. The SPV pays for these assets by issuing bonds, notes or short-term commercial paper. The originating bank usually continues to act as a servicing agent in the securitization program. It will continue to collect receivables on behalf of the SPV in exchange for a fee. These fees have been one of the major reasons why banks engaged in securitization on such a scale prior to the recent financial crisis, along with other often mentioned motives such as the need to obtain new sources of funding, to transfer credit risk, to find new profit opportunities and to comply with the regulatory capital rules.

The vast majority of existing studies on European banks (e.g. Martin-Oliver and Saurina, 2007; Agostino and Mazzucca, 2008), for example, conclude that the main driver of securitizing banks in Europe was the need to obtain liquidity. In the U.S., however, securitization was primarily a means for financial institutions to comply with regulatory capital requirements (Calomiris and Mason, 2004; Acharya et al., 2010). As for the range of assets that can be securitized, these typically include: mortgage loans, credit card receivables, auto loans, commercial and industrial loans, home equity loans, and other innovative developments including the securitization of commodity risk and catastrophe risk (de Vries, 2008).

The advent of securitization also gave rise to new theories about a banking model, known as the "originate-to-distribute" (hereafter OTD) model, where banks were originating their

[14] Although the are significant differences between a BHC and a bank (e.g. banks take deposits and make loans to consumers and corporations; BHCs own or control these banks, and also own other businesses), I use these two terms interchangeably.

[15] A special-purpose vehicle, or SPV is a subsidiary of a company formed by a company for a particular project or task which is bankruptcy remote from the main organization.

loans with the intention to sell them off. The OTD model gradually replaced (but did not eliminate) the traditional "buy and hold" (hereafter BH) model. In a traditional BH model, a bank would extend a loan to a borrower and hold the loan on their balance sheet until maturity, while monitoring the borrower's performance along the way. However, with the liberalization and deregulation of the financial sector in the U.S. in the early 1980s, the traditional banking model became less profitable (Edwards and Mishkin, 1995). Securitization appeared at the same time, suggesting that banks switched from on-balance sheet financing to off-balance sheet financing due to the decline in profitability (Cardone-Riportella et al., 2010; Panetta and Pozzolo, 2010; Gorton and Metrick, 2011).

OTD has contributed to the following: two main roles of banks, *i.e.* liquidity transformation (Diamond and Dybvig, 1983) and delegated monitoring (Diamond, 1984), have lost their significance. This is not surprising: since securitizing banks are no longer the primary holders of illiquid assets, they have fewer incentives to monitor their borrowers (see *e.g.* Pennacchi, 1988; Loutskina and Strahan, 2007). To overcome this problem of informational asymmetry, several risk retention mechanisms have been designed for and adopted by banks.

Theoretical studies on the credit risk transfer mechanisms, optimal retention mechanism and informational asymmetries have found the following. DeMarzo (2005) notes that by pooling assets, then tranching them into different risk categories and retaining interest in the equity tranche, banks can signal the quality of the sold loan portfolio and optimality of the debt contract. Hence, such risk retention is a result of the signaling equilibrium where securitizing banks, in an attempt to signal the value of assets, retain poorer quality assets on their balance sheets (Greenbaum and Thakor, 1987; Instefjord, 2005). In the same vein, Kiff and Kisser (2010) argue that equity tranche retention is the best instrument to incentivize loan screening.

In contrast, Fender and Mitchell (2009) suggest that it is the mezzanine tranche retention that is the optimal tool to align bank incentives. They model a principal–agent problem, where a loan's originating institution extends loans to borrowers and has the option to screen its borrowers at a cost, in order to increase its expected return. They show that mezzanine tranche retention may ensure more diligent screening than both equity and vertical slice retention (*i.e.* retaining equal amounts of each tranche in the securitization structure). They note that mezzanine tranche retention may be better than equity tranche retention because if banks are forced to retain equity tranche and know that there will not be any residual left, there is no incentive for them to screen loans at all in the first place. This is especially true

in a recessionary economy, because it is more likely that in a bad state of the economy equity tranches would be completely wiped out. Thus, in bad times, the benefits of screening are virtually non-existent, and so banks have little incentive, if any, to extend good loans.

As for risk retention, if the level of risk retention is designed to signal the commitment of the bank to its own securitization activities, then I would expect to observe that the retained interests should decrease credit risk. If, on the contrary, it is designed to reflect the risk of the underlying assets, and the level of retained risk closely mimics the expected loss, this may result in an increase in banks' credit risk. That is, the effect of retained interest on credit risk is ambiguous ex ante. Moreover, there is no unilateral consensus in the literature on how to overcome asymmetric information problems pertinent to the securitization markets.

2.3 Literature Review

There are three main strands in the securitization literature related to this thesis. The first strand contains theoretical studies on the economic benefits of securitization. The second strand examines empirically the effects of securitization on banks' performance. The third strand analyzes the optimal design of the risk retention mechanism.

2.3.1 Economic benefits of securitization

One of the main reasons why banks securitize is because securitization allows them to manage their risk exposure; it provides them with the option to transfer credit risk and diversify their funds. For example, banks that have a relatively high proportion of risky loans on their balance sheets may decide to securitize more in order to reduce their credit risk (Cumming, 1987; Dell'Ariccia et al., 2009) and to reduce expected losses (Wagner and Marsh, 2006). Certainly, the degree by which a bank can reduce its credit risk can vary. For example, a bank may decide to retain some portion of the securitized assets instead of selling all their assets, and may choose only to remove the first losses or the so-called equity tranche from the SPV. This way it secures a sufficient degree of credit improvement for subsequent tranches and limits the credit risk transfer to the final investors.

Other benefits from asset securitization discussed in prior studies include diversification of funding alternatives, immediate access to capital for expansion purposes, ability to focus on competitive advantages and the ability to manage earnings. For instance, securitization allows banks to recognize accounting gains when the market value of their loans exceeds their book values (James, 1988; DeMarzo, 2005; Karaoglu, 2005). They can also redeploy funds obtained from their sold loans toward more profitable investments (Greenspan, 2004; Schuermann, 2004). In addition, banks may securitize their loans to benefit from the

intermediation profit (Duffie, 2008). Lockwood et al. (1996) also report that the cash inflows from the issued asset-backed securities (hereafter ABS) could be used to retire existing debt which in turn reduces banks' interest expenses, increases their reported earnings, and increases stockholders' equity. As for the reported earnings, Karaoglu (2005) finds that banks choose which loans to securitize and thus they bias the estimated fair values of retained interest. Karaoglu (2005) and Pavel and Phillis (1987) find that banks that securitize or sell loans have higher loan concentrations and, therefore, greater needs for asset diversification than non-securitizing banks. In addition, these studies find that banks are more likely to securitize loans if they have a competitive advantage in originating loans.

Dechow and Shakespear (2009) show that managers tend to time their securitizations to maximize the window dressing benefits offered by securitization accounting rules. They find that securitizations are more often reported in the last few days of each month and the last few days of the quarter. In turn, Loutskina and Strahan (2009) note that another feature of the securitized assets is that these are more liquid than other assets, which renders banks more immune to liquidity shocks. Consequently, it enhances banks' financial stability.

With respect to the motivation to obtain immediate access to capital, Karaoglu (2005) finds that banks that sell or securitize loans have higher growth expectations and greater liquidity needs, compared to banks that do not engage in securitization. Wagner (2007) however reports that increased liquidity of a bank increases banking instability. This is in contrast to the commonly accepted view that higher asset liquidity directly benefits stability, by encouraging banks to reduce the risks on their balance sheets and by facilitating the liquidation of assets in an adverse state of events. Thus, it also makes financial crises less costly for banks. Banks may have an incentive to take on more new risks and thereby offset the positive direct effect on stability. This evidence is in line with the results of Instefjord (2005) who notes that when a bank has access to a wider selection of instruments to manage risks, it is likely to engage in excessive risk taking. Cardone-Riportella et al. (2010) analyze the sample of Spanish securitizing banks over the time period 2000–2007 and also find that securitization may make banks actually less risk averse to the prospect of an own crisis situation. The rationale is that they can more easily liquidate parts of their balance sheet through securitization operations.

2.3.2 Securitization and bank performance

Prior to the recent global financial crisis, securitization was seen as a tool that enabled more sophisticated banks to disperse risk or to pass credit risk to institutions with far less leverage. This led to an overall improvement of bank financial stability (Duffie, 2008). In

addition, Altunbas et al. (2009) and Loutskina and Strahan (2009) find that securitization increases banks' lending ability. However, they also found that by making illiquid loans more liquid, securitization could enhance, *ceteris paribus*, banks' risk taking (Ambrose et al., 2005) and increase their credit risk.

Securitization does not necessarily lead to credit risk diversification, but it could actually promote the retention of risky loans on banks' balance sheets (Instefjord, 2005; Chiesa, 2008). For example, Purnanandam (2009) compares performance of loans that had originated with U.S. banks and were to be retained with loans that had originated but were to be sold between 2006 and 2008. He shows that banks that were extensively securitizing during the pre-crisis period had originated loans of inferior quality. After the crisis erupted, banks that were "stuck" with these loans on their balance sheets had significantly higher charge-offs and higher borrower default rates. These findings are consistent with evidence in Mian and Sufi (2009), Keys et al. (2007) and Dell'Ariccia et al. (2012) who find that in the last decade, U.S. banks securitized their worst mortgage loans. Similarly, Cerrato et al. (2012), who studied U.K. banks from 2000 to 2008, report that banks that issued more ABS before the crisis, suffered more defaults after the financial crisis. These results are also consistent with Di Cesare (2009), who shows that Italian banks that securitized before the crisis, experienced a higher increase in their default probability during the crisis, however, they contradict evidence in Ambrose et al. (2004), Dionne and Harchaoui (2003), Aggarwal et al. (2001) and Nadauld and Sherlund (2013) who suggest that banks retained more risky assets on their balance sheets, while securitizing their less risky assets.

Regarding bank's insolvency risk, Casu et al. (2013) who examine the relationship between banks' retained interests in securitizations and insolvency risk for 197 U.S. BHCs from 2001 to 2007 find that the provision of credit enhancements significantly increases bank insolvency risk. In particular, retained interests increase the insolvency risk for "large" securitizations while having a risk-reducing effect for "small" and/or first-time securitizations. In addition, they find that the most subordinated (first-loss) position has the largest impact on banks' Z-score[16]. This finding aligns well with evidence from Franke and

[16]The Z-score is an indicator of a bank's probability of insolvency in the sense that it estimates the number of standard deviations that the bank's profits have to fall below its expected value before its equity becomes negative. It combines banks' buffers (capital and profits) with the risks they face (measured by the standard deviation of returns). That is, a Z-score is calculated as $Z = (ROA + E/A)/\sigma(ROA)$, where ROA is return on assets, E/A denotes the equity to asset ratio, and $\sigma(ROA)$ is the standard deviation of return on assets. I used a 3-quarter rolling time window to calculate the volatility of returns in the denominator of the Z-score (Stiroh and Rumble, 2006; Hesse and Čihák, 2007). A higher Z-score indicates that a bank is more stable, where the

Krahnen (2005), who show that systematic risk by the banks in their sample, measured by the banks' equity beta, increases because securitizing banks retain the equity tranche, *i.e.* the largest part of the risk remains within the banks. Franke and Krahnen (2005) analyze 73 securitization announcements of 27 banks in Europe between 1999 and 2002. Their results suggest that banks' systematic risk increases due to securitization transactions because banks invested their newly obtained funds to invest in riskier projects. They attribute such a finding to the possibility of tranching the securities. That is, a post-event increasing beta should result from the fact that the first-loss piece exhibits a higher probability of failure than less risky senior tranches being transferred to external investors. Hänsel and Krahnen (2007) confirm previous findings, showing that the credit risk transfer activity enhances the systematic risk (equity beta) of the issuing bank and that overall credit securitization increases banks' risk appetite.

As far as the relationship between securitization and banks' profitability is concerned, the impact of securitization on banks' profitability is not clear either. Securitization provides a larger investment set and allows banks to improve their profitability (Jiangli and Pritsker, 2008). Jiangli and Pritsker (2008) in their analysis of U.S. BHCs find that securitizing banks that are active tend to have lower insolvency risk and higher profitability than banks not active in the securitization market. It is also possible that increased competition in the underlying credit market may have led to lower spreads, and thus reduce banks' profitability (Instejford, 2005).

Earnings management is another motivation for securitizing financial assets has often been presented in the literature; however, the evidence how securitization affects earnings or profitability is mixed. Consistent with the view that securitizations are used to manipulate earnings, Dechow and Shakespear (2009) find that some financial firms tend to report significant securitization gains when income is low. Dechow and Shakespear (2009) find that the reporting of gains or losses from securitization transactions appears to be influenced by financial reporting incentives, such as exceeding analyst forecasts. Karaoglu (2005) finds that securitization gains are negatively related to the change in earnings before securitization effects. In turn, Udhe and Michalak (2010) who study securitization and systematic risk in the European banking sector over the period 1997–2007 find that securitization has a positive impact on leverage and return volatility, and a negative effect on profitability.

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value of the Z-score depends positively on the bank's profitability and capital ratio and negatively on the variability of the bank's profits (Laeven and Levine, 2009).

As for the effect of securitization on capital levels, it is intuitive to expect that securitization should increase banks' regulatory capital levels, because banks are not required to hold extra capital for securitized assets. They have to hold extra capital only for the part of securitization for which they provide liquidity or credit enhancements. In other words, in order to meet both of the economic capital requirements banks could alter the numerator, for instance by retaining earnings and issuing equity, or they could change the denominator, by cutting back assets and reducing lending, or shifting toward less risky assets. Securitization offered a third option: to decrease regulatory and market capital requirements. However, it is challenging to prove that banks engaged in securitization mainly to comply with the regulatory Basel II rules, because banks may have consciously chosen to hold an extra capital buffer. In fact, prior literature recognizes the ability to obtain off-balance sheet treatment through sale accounting as one of the motivations for financial asset securitizations (Ambrose et al., 2004; Minton et al., 2004). However, many studies report (e.g Shin, 2009) that securitization allows banks to avoid regulatory capital requirements and lower their credit standards, which adds negatively to their financial stability.

Overall, studies find mixed evidence on the hypothesis that financial institutions' decision to securitize is motivated by the desire to minimize regulatory capital. This has been among the primary motivations for the analysis in this chapter.

2.3.3 Securitization and risk retention

The cost of credit enhancements is the largest expense in structuring the ABS following the coupon rate paid to investors. The Basel Committee on Banking Supervision (2002) defines credit enhancement as "*a contractual arrangement in which the bank retains or assumes a securitization exposure and, in substance, provides some degree of added protection to other parties to the transaction*". While accounting rules[17] require securitized

[17] Under SFAS 140, securitization can be accounted for either as sales or secured borrowings. For a transfer of financial assets to a special purpose entity (SPE) to qualify for sale accounting treatment, it must meet the following criteria: (1) the assets must be isolated from the transferor and its creditors even in bankruptcy; (2) the SPE has the right to pledge or exchange the assets; (3) the transferor does not maintain effective control over the assets through certain forms of continuing involvement. If the securitization receives sale accounting treatment, then the transferor: (1) removes the assets from its balance sheet; (2) records cash proceeds in the amount received and recognizes any non-cash proceeds in the securitized assets at fair value; (3) recognizes retained asset- backed securities at the book value of the securitized assets times the fair value of the retained securities divided by the fair value of the securitized assets; (4) recognizes retained contractual interests other than asset-backed securities (e.g., servicing assets and recourse liabilities) at fair value; (5) records a gain or loss on sale to balance the journal entry. If the securitization is accounted for as a sale and additional conditions are satisfied the issuer does not have to consolidate the assets and liabilities held by its SPEs. If

loans to be sold without recourse,[18] originators retain credit risk exposure through internal (structural or cash flow driven) or external (*e.g.* third-party guarantee) risk retention mechanisms. That is, banks may retain risk through extending warranties, liquidity facilities, early amortization provisions, tranches cover or excess spreads.

It is worth emphasizing that ABS issued by banks are *not a legal obligation of the originating bank*, however, banks often provide credit or liquidity enhancement to ABS for reputational reasons. Guarantees also improve the credit rating of the security, and consequently, its marketability (Chen et al., 2008).[19] Hence, additional credit enhancements may be provided to ensure that securities issues by the SPV are AAA rated. Rating agencies typically required the seller's interest component to be around 4 to 12 percent of the receivables for the ABS to receive AAA ratings, as noted in the "Report to the Congress on Risk Retention" (BGFR, 2010).[20]

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the transfer is accounted for as secured borrowing, the financial assets remain on the balance sheet and the issuer recognizes a liability for the proceeds from this transfer (see Gorton and Souleles, 2005).

[18] In other words, the sale of the assets by the originating bank to the SPV may be re-characterized as a secured loan. In this case, the assets would not be removed from the originator's balance sheet r and the transfer would be enforceable for failure (Walker, 2014). In fact, the economic substance of many securitizations is a secured borrowing because originators retain most if not all the risks associated with transferred assets (Ryan, 2002). Niu and Richardson (2006) find evidence that a debt-to-equity ratio of 5.9 reported in their study using sale accounting would increase to 10.2, had the transferors accounted for the transfers as secured borrowing. In the same vein, Landsman et al. (2011) find that the market views asset securitizations with low retained interest as sales, whereas with high retained interest as secured borrowing. In general, the off-balance sheet treatment was easier to achieve under U.S. Generally Accepted Accounting Principles (GAAP) than under International Financial Reporting Standards (IFRS) rules, which are used in Europe. In 2010, however, changes to U.S. accounting rules related to SPE reduced the ability of transactions to obtain off-balance sheet status.

[19] Chen et al. (2008) state that the two most important types of such ABS are credit enhancing interest-only strips (CEI) and subordinated ABS (SUB). CEI have considerably more concentrated risk than SUB, all else being equal. CEI are a type of ABS that receive the difference, if positive, between the interest rate paid on the securitized loans and the weighted-average interest rate paid on the other ABS, referred to as the excess spread. Though referred to only as credit enhancing, these strips typically concentrate all of the risks of the securitized loans, particularly prepayment risk, since if the loans prepay the excess spread disappears. Because CEI have no right to the principal payments on the securitized financial loans, they usually have very small value compared to their risks. Contractual interests that bear first risk of loss are similar to derivatives in having relatively small value and concentrated risk compared to the securitized assets. In addition, Chen et al. (2008) find that risk retention by banks varies by type of securitization and is relatively low in the case of mortgages, while relatively high for revolving loans such as credit loans.

[20] Also in March 2001, the Fed allowed BHCs to include credit ratings in calculating regulatory capital for holding the securities. Before 2001, capital charges were generally determined by asset type rather than credit quality. For instance, mortgage-backed securities (MBS) guaranteed by a government agency (e.g. Fannie Mae) carried a 20 percent risk-weighting in which case the capital charge was 20 percent of 8 percent, *i.e.* 1,6 percent, in contrast to 8 percent for corporate loans, whereas non-agency MBS which were perceived to have similar risk, had a higher capital charge. Thus, after 2001:Q2, a regulatory capital charge was determined based on the securities' credit ratings. AAA and AA securities carried 20 percent risk-weighting, A-rated securities have 50 percent risk-weighting, BBB-rated and BB-rated securities have 100 percent risk weighting, respectively. In other words, poor credit quality securitized assets became more expensive as they required more capital charges. It is also worth mentioning that some BHCs could still use their own Value-at-

Gorton and Souleles (2005) also find that market prices of ABS securities reflect the originator's ability to provide recourse. In practice, however, banks have little choice over the amount and type of contractual retained interests that they provide because those are usually determined by credit rating agencies and underwriters (Casu et al., 2013). In summary, the purpose of risk retention is to create information-insensitive and liquid securities (Dang et al., 2012), which are defined as securities that are immune to adverse selection in the trading process (*i.e.*, the value of which does not depend on insider information).

2.4 Data and Descriptive Statistics

2.4.1 The data and sample

The key source of financial data on U.S. BHCs is the FR 9YC *Consolidated Report of Condition and Income,* completed quarterly by BHCs[21]. The data has since 1986 been provided by the Federal Reserve Bank of Chicago. It is by far the most comprehensive database for the analysis of BHCs. Following previous research, I have used this data for BHCs rather than the Call Reports submitted by commercial banks, because risk and capital management are typically exercised at the highest level of the financial group (Casu et al., 2013). However, the results could be generalized and extended to commercial banks for the following reason. As noted by Mandel et al. (2012), while BHCs control a large number of non-bank subsidiaries, most assets are generally held in a small number (between one and five) of domestic commercial banks. For example, the largest BHC by total assets, JPMorgan Chase, controls 3,391 subsidiaries, of which 2,940 are domestically domiciled, and only four are domestic commercial banks. However, these banks and their subsidiaries do hold 86 percent of the firm's total assets. The share of total assets held within the BHC's banking subsidiaries varies significantly across firms. For smaller BHCs, this fraction is close to 100 percent. For MetLife, Goldman Sachs and Morgan Stanley, which engage in relatively little traditional lending and deposit taking, banking subsidiaries contain a strikingly small

Risk (VaR) models to calculate capital requirements on their trading book. BHCs which were subject to the market risk capital guidelines could use their VaR model to calculate their capital requirements, as long as their consolidated trading activity (defined as trading assets and liabilities for the previous quarter) equals 10 percent or more of BHCs assets for the previous quarter or is $1 billion or more (Erel et al., 2012).

[21] BHCs are companies that own or control one or more commercial banks. A majority (around 84 percent) of commercial banks are part of the BHC structure. This includes the bank and any non-bank subsidiaries such as broker-dealers, investment companies or insurance companies. As of the end of 2011, there were 4,743 top tier BHCs in the United States (excluding Puerto Rico), with aggregate assets of about $17.4 trillion. Aggregate pretax income in 2011 totalled $148 billion, an increase of 26 percent from 2010 (FSOC Annual Report, 2012).

fraction of the firm's assets (3.2 percent, 11.2 percent and 10.5 percent, respectively). For the other largest BHCs, which have considerable retail banking operations but also engage in securities dealing and underwriting, insurance, etc., the fraction of bank assets falls between these two extremes, varying between 69 percent and 93 percent of firm assets among the four largest firms. Authors also note that these estimates of commercial banking assets are calculated by summing total assets, as reported in the Call Reports of each commercial banking subsidiary. From a consolidated BHC perspective, this calculation will overstate commercial bank assets in cases where there are related party exposures among commercial banks within the same BHC (since these should in principle be "netted out" from a consolidated perspective).

However, Mandel et al. (2012) report that such an overstatement should be small in practice. In addition, securitization may involve a couple of subsidiaries of BHCs which may affect the capital and liquidity planning of the whole group (Aggarwal and Jacques, 2001; Thomas and Wang, 2004). The FR Y-9C data provides consolidated BHCs financial data that encompasses balance sheet data, income sheets, a schedule of off-balance sheet items, with the detailed information on banks securitization activities. My main variables, *i.e.* securitized loans and retained interests by type of interest and type of loan, are collected from schedule HC-S, *Servicing, Securitization and Asset Sale Activities* of these FR Y-9C reports. Schedule HC-S was first provided in FR Y-9C reports in the second quarter of 2001, which determined the starting point in my sample. From June 2001, U.S. banks have been required to provide detailed information on their securitization activities in the regulatory forms. Specifically, banks are required to report the following items on the securitization schedule: (i) securitized assets, as an outstanding principal balance of assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements; (ii) maximum credit exposure arising from recourse or other seller-provided credit enhancements[22], provided to the reported securitization structures in the form of (a) credit-enhancing interest-only strips; (b) subordinated securities and other residual interests; (c) standby letters of credit and other enhancements; (iii) unused commitments to provide liquidity to securitization structures; (iv) past due amounts, charge-offs, and recoveries on the securitized assets; (v) seller's interests in the form of securities and loans; (vi) past due amounts, charge-offs, and recoveries in seller's interest. Schedule HC-S instructions define these strips as an on-balance-sheet asset that, in form or in substance represents the

[22] Ashcraft and Schuermann (2008) provide a more general discussion of enhancements.

contractual right to receive some or all of the interest due on the transferred assets and exposes the bank to credit risk that exceeds its pro-rata share claim on the underlying assets whether through subordination provisions or other credit-enhancing techniques. Elsewhere, the HC-S instructions note that the field for credit-enhancing, interest-only strips can include excess spread accounts. Excess spread is the monthly revenue remaining on a securitization after all payments to investors, servicing fees, and charge-offs. As such, excess spread—a measure of how profitable the securitization is—provides assurance to investors in the deal that they will be paid as promised. Excess spread accounts are the first line of defense against losses to investors, as the accounts must be exhausted before even the most subordinated investors incur losses.

The second class of enhancements, subordinated securities and other residual interest, is a standard-form credit enhancement. By holding a subordinated or junior claim, the bank that securitized the assets is in the position of being a first-loss bearer, thereby providing protection to more senior claimants. In that sense, subordination basically serves as a buffer or collateral. However, in the asymmetric information context, holding a subordinate claim gives the bank the stake that can motivate it to screen the loans carefully before it securitizes them and to continue monitoring the loans after it securitizes them. The bank's willingness to keep some risk may serve as a signal that it has screened loans adequately and plans to monitor diligently.

The third class of enhancements, *i.e.* standby letters of credit, obligates the bank to provide funding to a securitization structure to ensure that investors receive timely payment on the issued securities (for example, by smoothing timing differences in the receipt of interest and principal payments) or to ensure that investors receive payment in the event of market disruptions. The facility counts as an enhancement, if and only if advances through the facility are subordinate to other claims on the cash flow from the securitized assets. Although not technically classified as an enhancement, a fourth item on Schedule HC-S that I consider, comprises of unused commitments to provide liquidity. Unused commitments represent the undrawn balance on previous commitments.

The schedule also provides information on: (i) maximum amount of credit exposure arising from credit enhancements provided by the reporting institution to other institutions' securitization structures (an aggregate measure of credit enhancements including standby letters of credit, purchased subordinated securities, and other enhancements); (ii) reporting institution's unused commitments to provide liquidity to other institutions' securitization structures.

Credit-enhancing interest-only strips receive no principal and typically are subservient to subordinated ABS, and so they are riskier than subordinated ABS, all else being equal (Chen et al., 2008). For example, any amount unpaid to the subordinated ABS holders must be compensated in subsequent years before any amount can accrue to the benefit of the credit-enhancing interest-only strip. To put it another way, credit-enhancing interest-only strips are a type of ABS that receives the difference, if positive, between the interest rate paid on the securitized loans and the weighted-average interest rate paid on the other ABS, referred to as the excess spread. Thus, credit-enhancing interest-only strips have some of the character of residual interest. Credit-enhancing interest-only strips have no right to the principal payments on the securitized financial loans; as a result, they usually have very small value compared to their risks. Although referred to only as credit-enhancing, these strips typically concentrate all of the risks of the securitized loans, particularly prepayment risk, since if the loans prepay then the excess spread disappears (Chen et al., 2008). Credit-enhancing interest-only strips are reported from the second quarter of 2001; subordinated securities and standby letters of credit are reported from the first quarter of 2003. Sellers' interest is reported only for home equity line, credit card, and commercial and industrial loan securitizations.

For reporting, the data on securitization activities are broken down into seven categories according to the underlying assets: (i) 1–4 family residential loans; (ii) home equity lines; (iii) credit card receivables; (iv) auto loans; (v) other consumer loans; (vi) commercial and industrial loans; (vii) all other loans, all leases, and all other assets.

My quarterly panel data is significantly larger compared to previous studies. In addition, the time horizon allows me to focus on the relationship between securitization and banks' exposures before, during and after the 2007–2009 crisis. I draw upon Baele et al. (2011) and Casu et al. (2013) to choose the control variables for my regressions (definitions of the variables are provided in Appendix 1).

When constructing the dataset, I follow Casu et al. (2013). I exclude BHCs with negative, missing or zero values for total assets, deposits, loans and securitization activities in any quarter (330 observations are dropped). I also delete observations where loans to assets ratios exceed 100 percent (17 observations are dropped) and where capital is missing or negative (1013 observations are dropped). Subsequently, I define BHC as a securitizer if it securitizes in any of the quarters within the sample period. This selection procedure leaves me with 342 securitizing BHCs and 2,682 non-securitizing BHCs from 2001:Q2–2013:Q2.

In March 2006, the minimum reporting size for BHCs was raised from $150 million to $500 million. This significantly skews the sample. To overcome this problem, I delete all observations that do not reach the minimum reporting threshold over the sample period. This ensures that banks that began reporting prior to 2006 continued reporting after the threshold was raised from $150 million to $500 million in 2006. I adjust the threshold of $500 million for price level per quarter with base March, 2006. This method of deleting the observations ensures that these are not deleted randomly, but helps to preserve all the observations of the BHCs that once having started reporting continue to do so even after a temporary drop in their total assets. This procedure drops around 50 observations per quarter from 2001 to 2006. Final data sample consists of 1,718 BHCs, of which 299 securitize their loans.

Finally, to prevent outliers from driving the results, I winsorize all variables at 1 percent, a standard procedure used in similar studies. Detailed information on the FR 9-YC item codes used in this study and information how I calculated all the variables is included in Appendix 1.

2.5 Summary statistics

My final sample consists of observations for 48 quarters. The summary statistics are provided in Table 2.1 and the comparison table of the securitizing versus non-securitizing BHCs is provided in Table 2.2, along with lowest, mean and highest values, and differences in mean values along with their statistical significance.

The most striking difference between securitizers and non- securitizers is the size measured by BHC's total assets (Table 2.2). Securitizing BHCs are about 21 times larger than non-securitizing BHCs. This is consistent with the previous research which finds that larger banks tend to securitize more often (Hänsel and Bannier, 2007; Martin-Oliver and Saurina, 2007; Uzun and Webb, 2007; Jiangli and Pritsker, 2008; Minton et al., 2005). Further, non-securitizing BHCs tend to hold about 5.3 percentage points more of liquid assets than securitizing BHCs, which is consistent with findings in Karaoglu (2005). This is also well aligned with the evidence in Loutskina (2011), that securitizing BHCs usually have better access to external sources of liquidity than non-securitizing BHCs. Loans to total assets ratio is 3.3 percentage points lower for securitizing BHCs than for non-securitizing BHCs.

Univariate comparisons also reveal that the leverage ratio is 3.3 percentage points higher for securitizing BHCs than for non-securitizing BHCs. This is consistent with prior research (*e.g.* Pavel and Phillis, 1987). As for capital levels, bank capital is 3.7 percentage points

higher for non-securitizing BHCs than for securitizing BHCs, and the difference is statistically significant. This is consistent with the findings in Cebenonyan and Strahan (2004) who note that securitizing banks tend to have lower capital levels. Nonetheless, in my sample, both groups have capital levels well above the regulatory capital requirements. This is interesting especially in the view of the argument that banks securitized primarily to benefit from the regulatory capital arbitrage.

As for the profitability, securitizing banks tend to be approximately 20 percentage points more profitable than non-securitizing banks. Charge-off ratios are higher for securitizing banks (15 percentage points), while credit risk measured as non-performing loans (NPL) the total assets ratio is higher for non-securitizing banks (5 percentage points). The former aligns well with evidence provided in Jiangli and Pritsker (2008) and Keys et al. (2007), who report that securitizing banks have less of an incentive to monitor their loans.

As far as the risk-weighted assets to total assets (hereafter RWATA) ratio is concerned, securitizing banks have a higher RWATA than non-securitizing banks. It may seem intuitive to expect such a finding because banks that have a higher RWATA will want to securitize more to offload their risk; however, the difference is not statistically significant.

As for the loan composition, real estate loans constitute the largest share of the loan portfolio for both securitizing and non-securitizing BHCs (68 percentage points and 73 percentage points of the loan portfolio, respectively), and the difference is statistically significant. This is followed by commercial loans (15 percentage points and 16 percentage points for non-securitizing BHCs and for securitizing BHCs, respectively). This may be intuitive when one considers the fact that real estate loans are usually safer than commercial loans; thus securitizing banks hold more commercial loans and fewer real estate loans as compared to the non-securitizing BHCs. Univariate analysis also indicate that securitizing BHCs have 38 percentage points higher consumer loans, 6 percentage points more commercial loans and 49 percentage points more other loans than non-securitizing BHCs, although commercial loans are considered to be riskier than real estate loans; again, this may seem intuitive. As for other loans, however, the statistics are not very intuitive, because "other" loans include both loans to financial institutions, agricultural loans, and other different types of loans with different risk levels. Thus, for such types of loans, the riskiness is difficult to evaluate because these loans are presented in FR-9YC forms in aggregate form.

As for the income composition, interest income is the major source of revenue for both securitizing BHCs (around 70 percentage points) and non-securitizing BHCs (around 79 percentage points). In addition, securitizers have 11 percentage points lower deposit ratios

than non-securitizers. Loan to deposit ratio is 16 times higher for securitizers than for non-securitizers, which may be intuitive, given that securitizers tend to lend more on average, especially when they plan to securitize their loans afterwards. The difference is significant both statistically and in terms of its economics magnitude. As far as the trading assets ratio is concerned, securitizing BHCs have a 13 times higher trading ratio than non-securitizing BHCs.

As for the securitization activities, the summary statistics show the following. The securitization-to-total-assets ratio is around 6 percent. This ratio varies significantly between BHCs, from 0 up to 842 percent. This variation is mainly driven by mortgage securitization. Mortgage securitization accounts for the greatest share of securitized assets (around 4 percent of total assets), followed by credit card securitization (0.5 percent), and automobiles (0.1 percent). Credit enhancements to total assets is about 1.6 percent, of which subordinated securities account for around 0.5 percent of credit exposure; standby letters of credit constitute 0.7 percent; credit enhancement interest-only strips ratio is around 0.4 percent, and the liquidity provision ratio is around 0.16 percent. As for the exposure arising from providing credit liquidity and liquidity enhancements to third-party securitizations, this constitutes around 0.02 percent and 0.01 percent of total assets, respectively. Securitizers provide more both credit enhancements and liquidity provision to third-party securitizations than non-securitizing banks.

Finally, the descriptive statistics for the 299 BHCs that have non-zero securitization values for all types of securitization activities show the following. 216 BHCs engage in mortgage securitizations, 39 BHCs engage in home equity securitizations, 45 BHCs handle credit card securitizations, 50 BHCs participate in automobile securitizations, 47 BHCs engage in commercial and 105 BHCs perform other loans securitizations. I find that credit enhancements are most often provided to mortgage securitizations, followed by other loans securitizations, home equity, commercial, auto and credit card securitizations.

As for the distribution of credit exposure across the three forms of retained interest (credit-enhancing interest-only strip (hereafter CEI) ratio, subordinated security (hereafter SUB) ratio and standby letter of credit (hereafter SLC) ratio, it differs significantly across different securitizations. I find that SUBs are the most widely used form of credit enhancements. As for the liquidity provision, it varies between 0.2 percent for credit card securitization to 2.9 percent for other loans. The seller's interest is largest in non-zero credit card loans securitization activities at around 13 percent, followed by home equity loans securitizations (9.3 percent) and declines to 1.4 percent for mortgage loans securitizations,

consistent with Chen et al. (2008) who find that SUB ABS are provided on average four times more often than CEI for different classes of loan securitizations. To provide the magnitude of the credit enhancements in dollar terms, I observe that they trended upwards from about $25 million in 2001:Q2 to around $70 million in 2009:Q1 (in percentage terms around 2–3 percent per securitized asset). Then, in the following quarter, total enhancements increased almost twice as much, mainly because of the rise in the enhancements on credit cards (to around $164 million or around 6 percent per securitized asset).

Finally, univariate comparisons in show that charge-offs to securitization ratios are 0.4 percent for non-zero mortgage securitizations, 0.7 percent for non-zero values in other loans, 0.8 percent for non-zero commercial loans securitizations, 1 percent for auto securitizations, 1.1 percent for home equity loans securitizations, and around 2 percent for credit card securitizations.

To conclude, securitizing banks are significantly larger and hold fewer liquid assets but they have more diversified loan portfolios. They are also more risky and more profitable, earning a higher share of revenue from non-interest income compared to non-securitizers.

2.6 Methodology and Empirical Strategy

2.6.1 Treatment effect model

In contrast to previous studies, which estimated a linear model in a pooled sample, I employ a treatment effects model to account for the selection bias, because existing evidence suggests that banks do not securitize randomly. For example, if a BHC that has more non-performing loans is more inclined to securitize, the OLS estimates could overestimate the effect of a securitization decision on the non-performing loans. The treatment effect model that I use is similar to Heckman's sample selection model, which I discuss here.

Heckman's sample selection model was a pioneering approach for correcting selection biases (Guo and Fraser, 2010) in the last three decades. The logic behind Heckman's sample selection model is to estimate the probability of a participant to be in the sample, and subsequently use that information for estimating the outcome of interest. In the sample of this chapter, Guo and Fraser (2010) note that a treatment effect model is better suited

compared to the standard Heckman selection model.[23] The estimation procedure may be summarized as follows.

I specify two equations: a selection equation and an outcome equation. Participation in the sample is determined by some observed variables that determine the selection plus an error term that includes all unobserved selection factors. In predicting the selection condition, the binary dummy variable that indicates whether participants have self-selected themselves into the sample is treated as an endogenous latent variable, and its expected value is estimated based on both observed and unobserved factors (Morgan and Winship, 2007). Then, the error term from the selection equation, which is treated as a true omitted variable, referred to as the unobserved heterogeneity, which determines the selection bias (Guo and Fraser, 2010), is used to estimate the outcome equation in the second stage.

This procedure is Heckman's lambda method for correcting selection bias, where the inverse Mill's ratio is estimated in the selection equation, based on the probability of choosing the treatment, including all unobserved characteristics. Including the inverse Mill's ratio in estimating the outcome equation of interest, an omitted variable is taken into account, which essentially removes variance in the error term that is because of the selection. This ensures that errors of the selection equation and the outcome equation no longer correlate (Wooldridge, 2002).

The selection (2.1) and outcome (2.2) equations are the following:

$$w_i^{*} = yZ_i + u_i \qquad (2.1)$$

$$w_i = 1 \text{ if } w_i^{*} > 0 \text{ or } w_i = 0 \text{ if } w_i^{*} \leq 0$$

$$Y_i = \beta X_i + \delta w_i + \varepsilon_i \qquad (2.2)$$

where w_i^{*} and Y_i are the dependent variables, and Z_i and X_i are vectors of independent variables, w_i represents the treatment indicator and u and ε are error terms. Substituting the selection into the outcome equation leads to two regressions for two separate regimes (treated banks (2.3) and non-treated banks (2.4)).

$$Y_{i,t} = \beta X_{i,t-1} + \delta(yZ_{i,t-1} + u_{i,t}) + \varepsilon_{i,t} \qquad (2.3)$$

$$Y_{i,t} = \beta X_{i,t-1} + \varepsilon_{i,t} \qquad (2.4)$$

[23] The treatment effect model differs from the sample selection model in two aspects: (1) a dummy variable indicating the treatment condition w_i (i.e., $w_i = 1$ if participant i is in the treatment condition, and wi = 0 otherwise) is directly entered into the regression equation and (2) the outcome variable y_i of the regression equation is observed for both $w_i = 1$ and $w_i = 0$.

That is, w_i is the endogenous variable that indicates whether a bank securitizes or not (the treatment indicator). The difference from the standard Heckman model is that the first stage outcome variable Y_i is observed for all banks in the sample. Therefore, it is not in the "non-observability" of this continuous variable where the selection takes place. Furthermore, in the treatment effect model, the treatment dummy is directly included into the outcome equation.

Following Casu et al. (2013), I lag all control variables by one-quarter (except for the securitization dummy) to additionally address the problem of reverse causality in my estimations. Next, I address serial correlation in securitization at the bank level by clustering standard errors at the bank level (Michalak and Uhde, 2013), since some of the banks in my sample continuously securitize over the entire sample period, while others do not. I also use time dummies to account for business-cycle effects in my sample.

Subsequently, I have to use at least one additional control variable to identify the selection equation. Thus, following Demirgüç-Kunt and Detragiache (2002), I include an additional variable "fad", which stands for the popularity or enthusiasm for banks to securitize their loans, into the selection equation. I borrow fad variable from the study on deposit insurance and banking crises by Detragiache and Demirgüç-Kunt (2002). They use a multivariate logit model, where they try to purge the endogenous component of the deposit insurance variable in the first stage. For the two-stage logit model to be properly identified there has to be at least one variable that is correlated with the probability of adopting an explicit deposit insurance scheme, but is uncorrelated with the country's probability of experiencing a crisis. Detragiache and Demirgüç-Kunt (2002) hypothesize that, when deciding whether to implement deposit insurance, policymakers are influenced by choices made by policymakers in other countries. As explicit depositor protection becomes more widespread, it becomes a sort of "universal practice" or a "fad", and countries become more prone to adopting it. To capture this "fad" element in the deposit insurance adoption decision, they use the proportion of countries in the sample, which have already adopted explicit deposit insurance. In a similar fashion, I use "fad" as a percentage of banks within the same size (in terms of assets) decile that engage in securitization activities. "Fad" captures the popularity of securitization and is similar to the contagion effect. That is, it takes into the account the fact that banks may feel under pressure to securitize, when other banks of similar size engage in

securitization. Such herding behavior is common in practices of financial institutions[24]. It is a well-documented fact in banking literature that banks compete on the variety of services provided and may mimic each other's behavior. I observe, *inter alia*, that the percentage of securitizing banks increases with size. That is, while only 3 percent of the banks in the first size decile securitize, the percentage of securitizing banks increases to more than 50 percent for the largest banks.

I improve upon the existing studies on securitization activities by using a treatment effect model. Thereby, I address the problem of the selection bias that plagues a number of existing studies and therefore raises doubts about the validity of their results. Although some more sophisticated models (e.g. Kyriazidou (2001) or Semykina and Wooldridge (2005; 2010) proposed conditional maximum likelihood (CML) estimation procedure)

may handle sample selection bias better that the treatment effect model, this does not mean that it was applied incorrectly for the estimation purposes of this chapter (e.g. Affinito and Tagliaferri (2010) use similar methodology in their robustness checks).

2.6.2 Dependent variables

My dependent variables are the following: credit risk, credit risk taking, profitability and capital level. Following previous studies, I proxy credit risk by RWATA[25] and the non-performing loans (hereafter NPL) ratio, calculated as the ratio of loans that are past due 90 days or more or that are non-accrual. I choose to include NPL as a measure of asset quality[26] instead of a charge-off ratio, which is also often employed in similar studies. I also choose NPL, because the NPL measure is less likely to be subject to managerial discretion and thus

[24] The instrument chosen is similar to most "peer effects", however, it seems to suffer from Manski's reflection problem. One of the most suitable econometric methodology to cater to all features in this data is the Wooldridge suitable conditional maximum likelihood (CML) estimator, which can cater to state dependence, unobserved heterogeneity in the form of fixed effects and serves as a correction for sample selection bias. However, the methodology of CLM is beyond the scope of this thesis. Consequently, this method will not be employed, but it provides an interesting avenue for future research.

[25] Under Basel Accords, banks assets and off-balance sheet activities are divided into four risk categories: assets with zero default risk (e.g. Treasury bills); low risk assets 20 percent (e.g. interbank deposits or claims conditionally guaranteed by OECD central governments); medium risk 50 percent (e.g. residential mortgages) and assets with high default risk (e.g. commercial loans). To calculate risk-weighted assets, the bank applies a risk weight w_j to each asset of a risk group j on its balance sheet. There are four major risk weights: 0 percent, 20 percent, 50 percent and 100 percent. Some assets, such as securitized assets get weights between 20 percent and 200 percent depending on credit ratings (Kisin and Manela, 2014). A risk-weighted asset (RWA) measure is then calculated using relative risk weights per category between 0 and 1: RWA=0 x category I+0.2 x category II + 0.5 x category III + 1.0 x category IV.

[26] As noted by Casu et al. (2012), RWATA might be less inefficient in capturing the true credit risk position of a bank compared to NPL, which is regarded as an ex-post measure of the credit risk.

it is likely to be a better indicator of asset quality (Moyer, 1990; Shrieves and Dahl, 1992). Also, charge-offs do not happen immediately, while NPL reflect in 90 days, if problems with the payments arise. In turn, credit risk taking is the change in RWATA between the current and following quarter.[27] As for profitability, it is measured as returns on assets (hereafter ROA). I choose ROA rather than return on equity (hereafter ROE) because it is less influenced by a bank's leverage than ROE (Cardone-Riportella et al., 2010). Moreover, since charge-offs and ROA are cash flow variables, differences are taken over the year to obtain the true quarterly ratio. Thus, these variables are missing for the first two quarters of 2001.

As for the capital level, the literature has not unilaterally agreed which definition of capital ratio should be used.[28] I use the Tier 1 risk-based capital ratio, since this is the measure that is used most frequently in similar studies (Casu et al., 2011; Baele et al., 2011).

2.6.3 Independent variables

Control variables are chosen based on the variables used in previous studies. In particular, I use control variables from Cebenoyan and Strahan (2004), Stiroh (2004a; 2004b; 2006), Jiangli et al. (2007), Jiangli and Pristker (2008), Loutskina and Strahan (2009); Baele et al. (2011), and Casu et al. (2013). In addition to the securitization dummy, which indicates if a bank securitizes in a certain period or not, I include bank's size (log of total assets). I include "size"to capture a possible impact on bank risk taking through a number of channels. For instance, Loutskina (2005) notes that only the largest banks in the U.S. have a sufficient number of loans to enable access to securitization markets. Also, since setting up SPV is costly, only large banks usually undertake securitizations. I expect a positive relation between bank size and credit risk, because larger banks are more likely to engage in credit risk taking due to implicit government guarantees (Kacperczyk and Schnabl, 2011; banks are "too big to fail" (*i.e.* banks expect to be bailed out in adverse states of events). As for the profitability and capital level, I expect *a priori* that more profitable and better capitalized banks should have fewer incentives to engage in securitization. I also expect that these variables will be negatively associated with a bank's risk. Additionally, I include nontraditional income (non-interest income normalized by net operating revenue) to capture

[27] I use a change in RWATA as a credit risk-taking measure because of the accompanying difficulties involved in differencing NPL quarterly.

[28] Stiroh (2006) and Casu et al. (2011) use the equity to assets ratio, Cebenoyan and Strahan (2004) use capital to risky assets ratio, and Baele et al. (2011) use the Tier 1 risk based capital ratio without explanations for their choice. A fourth candidate would be to include the Tier 1 leverage capital ratio. Berger et al. (1995) study the literature on capital ratio, and conclude that *all* measures are imperfect.

risk associated with different types of revenue-generating activities such as trading or investment banking (Stiroh, 2006). I also include liquidity ratio, loan ratio, and leverage capital ratio (leverage/tier 1 capital). In addition, I use dependent variables as control variables, except when they enter their own regressions, *e*.g. capital is used as a control variable in the regression where NPL is the dependent variable, but capital is not used in the regression where capital is the dependent variable. I also include credit enhancements and liquidity provision by the banks for their own and for third party securitizations scaled by BHCs' total assets. I also alternate by scaling credit enhancements and liquidity provision by the securitized assets and by bank capital, since the capital cushion is meant to provide rescue in the adverse state of the world, *i.e.* scaling by BHC's capital can possibly better reflect BHCs' ability to provide recourse to their securitized loans. I do not venture any expectation about the effect it will exert on the dependent variables in any of my regressions.

Subsequently, to analyze the risk retention mechanism more profoundly, I decompose the retained interest ratio into: Credit Enhancement Ratio (I also split it later into CEI, SUB and SLC Ratios; Liquidity Provision Ratio; Seller's Interest Ratio; Third-party Credit Enhancement Ratio; Third-party Liquidity Provision Ratio.

2.7 Empirical Results

This section presents empirical results. First, I discuss the validity of the model. Then, I discuss results per dependent variable, *i.e.* BHCs' credit risk, credit risk taking, profitability and capital levels. The main results are from the treatment effect model regressions, which are reported in Tables 2.4- 2.14. Finally, I discuss the regression estimates for credit and liquidity enhancements and how the effect has changed after the 2007-2009 financial crisis.

The correlation between the error terms of the selection regression and the outcome regression (i.e rho=0) can be rejected in all the specifications of the treatment regressions. This shows that the securitization decision is indeed endogenous and that the treatment effect model is a more appropriate model to examine the effect of securitization on BHCs' performance measures compared to the OLS panel regressions. In addition, I find that the variable *"*fad*"* is positive and statistically significant at 1 percent across all first-stage regressions. This suggests that the pressure to securitize stemming from other securitizing BHCs does affect a BHC's decision to securitize its assets.

In addition, I find that securitization increases credit risk (coefficient on securitization dummy (secdummy) in RWATA and NPL regressions is positive and statistically significant (Table 2.4, Column 3 and 7). As for the credit risk taking, I observe that securitization

reduces bank credit risk taking[29] (secdummy is negative and statistically significant in ΔRWATA regression in Table 2.4 Column 5). As for profitability, in contrast to the majority of existing studies, I find that securitization reduces profitability (secdummy exhibits a negative and statistically significant coefficient on Profitability in Table 2.4 Column 9). It is highly likely that my findings may differ from previous research because my sample period covers the financial crisis. As for capital, I observe that securitization increases capital levels (the coefficient on secdummy in the Capitalization regression is positive and statistically significant Table 2.4 Column 11).

Turning to other control variables, I find that larger banks are more profitable but have lower capital levels (size exhibits a positive and statistically significant coefficient on Profitability in Table 2.4 Column 9, while it shows a negative effect on capital levels in Column 11). Further, I observe that banks with a higher share of NPL engage in credit risk taking on a higher scale, which may be because banks try to generate higher revenue to cover possible forthcoming losses (Table 2.4 Column 5).

Regarding credit enhancements are concerned, I find that credit enhancements increase credit risk, which may seem intuitive since by retaining interest in securitization, banks expose themselves to additional risk (Table 2.4 Column 7). I also observe that banks that provide credit enhancements also engage in more credit risk taking (Table 2.4 Column 5). However, I also find that credit enhancements increase profitability (Table 2.4 Column 9). As for capital level, I find that credit enhancements and liquidity provision reduce capital level (*i.e.* the coefficient on Credit Enhancements and Liquidity Provision is negative and statistically significant in Table 2.4 Column 11). This may seem intuitive because when a bank provides explicit support, it must hold a certain amount of the risk-based capital. That is, an increase in the number of risk-weighted assets implies a decrease in the risk-weighted capital ratio.[30]

[29] Casu et al. (2011) find a negative effect of securitized assets on the credit taking, which is primarily attributed to the securitization of mortgages, HEC, and other consumer loans. This implies that banks take less risk to compensate for holding certain securitized assets such as commercial loans. However, they stress that the impact of securitization on the credit risk taking of the BHCs is ambiguous and it depends on the transaction.

[30] When a bank increases total capital to adjust exactly for the rise in risk-weighted assets, the capital ratio will remain unchanged after securitization. Instead, if the bank increases capital more than required by the risk-weighted assets, the capital ratio will increase. This means that the bank is taking additional protection against credit risk, to account for risks which are not explicitly specified in the regulations.

As for liquidity provision to third-party securitization, I find that liquidity provision decreases bank credit risk taking (*i.e.* the coefficient on the Third Part. Liquidity Provision in the ΔRWATA regression is negative and statistically significant in Table 2.4 Column 5). This may suggest that banks exposed to other banks cannot perfectly monitor those banks, they cannot "monitor the monitor" (*i.e.* to monitor whether other banks are monitoring their own borrowers (Freixas and Rochet, 2008) and thus they adjust their own risk-taking behavior accordingly so that they meet their obligation to extend credit lines if required. As for the liquidity provision to the third parties, I find that it decreases bank capital levels, as expected (Table 2.4 Column 11) .[31]

Furthermore, I would expect that providing credit guarantees to third parties should have a positive effect on BHCs' profitability because banks may choose whether to sell or not to sell the "guarantees" and to which banks to sell this protection against an adverse state of events. *Ex ante* I would expect that guarantees should increase banks profitability because banks can usually choose whether to extend the guarantee or not (any uncertainty about the quality of the loans provided by other banks will be reflected in the price of the guarantee). However, it is possible that my findings are influenced by the recent financial crisis. It has been noted that during the economic downturn, risk was not assessed correctly; it was underestimated, and consequently the guarantees were too cheap compared to the risk that they covered. Also, other studies report that banks that engage in securitization transactions have higher information opacity than banks with no asset securitizations (Cheng et al., 2008). They also find that information opacity increases with the magnitude of the securitized assets. However, I do not observe that providing credit enhancements to other securitizations increases bank profitability. That is, the finding referred to by Casu et al. (2013) as a possible positive diversification effect, *i.e.* investing in other institutions' structures might have a positive effect on bank performance, is not confirmed in my results.

I also decompose securitization assets into different types of securitization and rerun the regressions. The results reported are presented in Table 2.5- 2.9. In particular, I show that credit card, automobile loans and securitization of other loans increased credit risk (Table 2.5 Column 5 and Column 11 and Table 2.7 Column 7 and Column 11, respectively). I also find that residential and credit card securitizations increased profitability (Table 2.8 Column

[31] It is important to point out, however, that the hypothesis that there is a correlation between the error terms of the selection regression and the outcome regression (rho=0) cannot be rejected in RWATA treatment regressions, which indicates that some other estimation technique may be superior to the treatment effect model. For that reason, I present results from RWATA regression, however, I refrain from drawing causal interpretations.

5 and 11). In addition, I observe that securitization of commercial loans reduced capital levels while other loans increased capital levels. Results also show that residential and credit card increased capital levels, however, results are not consistent across various specifications.

In contrast to the majority of existing studies that suggest a positive effect of securitization on banks' profitability, I find a negative relationship between securitization and BHCs' profitability. This result could be driven by banks that redeploy their proceeds from securitized loans to increase their capital buffer instead of increasing profitability. Such findings are also consistent with Cohen (2013), who documents that during the recent financial crisis, banks actually reduced their profitability to improve their capital ratios. However, they note that in normal economic conditions, it is unlikely that banks would sacrifice their profits to increase capital requirements, especially when capital levels were well above the regulatory levels. My results also accord well with Pagano and Volpin (2010) who report that in uncertain financial times, opaque securitized products may reduce banks' profitability.

As for the capital level, I observe that securitization increases capital level, which is intuitive, since after loans have been sold, *ceteris paribus,* the level of regulatory capital increases.

Generally speaking, when a BHC transfers its assets to the SPV, it has to decide how it is going to use the amount of liquidity from the asset sale. For example, it can keep cash on its balance sheet; it can also invest the funds into less risky assets; or it can use liquidity to repay its debt. In all these cases, the risk-weighted assets will decrease and the capital ratio will increase. However, banks can also invest in more risky assets, in which case its capital level will decrease.

My findings align well with empirical literature that analyzes U.S. banks and finds that banks often used securitization to benefit from the capital arbitrage because regulatory capital requirements were less stringent for the securitized assets (Acharya et al., 2012). However, I stress that my findings may also result from the fact that some securitizing banks realized the risk associated with securitization activities, and therefore they consciously chose to increase their capital buffer above regulatory capital requirements on top of the immediate increase in the capital level that would result as soon as the loans had been sold off. In other words, since I find that securitizing increases BHCs' credit risk and since banks are aware of this increased credit risk and other possible effects stemming from systemic risk, securitizing banks may want to hold an additional capital buffer. This is well accorded

with the evidence in Berger et al. (2008) that BHCs were more than adequately capitalized before the crisis (*i.e.* in my data sample mean Tier 1 risk-based capital ratio of BHCs was around 12 percent compared to the regulatory requirements under which banks had to hold a Tier 1 risk-based ratio of 6 percent to be considered financially healthy. My findings, which show that securitization decreases bank credit risk-taking and profitability, but increases capital levels, may be consistent with the fact that banks may be relatively risk averse, *i.e.* banks realized that risks they were exposed to through retaining risks in these securitized assets were far greater and that the regulatory capital will not suffice to cover for the possible losses, thus they chose to hold capital buffer in excess of the regulatory minima.

My interpretation is supported by some evidence in Casu et al. (2013), who note that the sample time period in my study is less biased by regulatory capital arbitrage because it involves the development and implementation period of Basel II, which should better align regulatory capital charges on banks' assets and reduce the possibility of undertaking securitization to increase capitalization ratios. Nevertheless, I cannot exclude the pure capital arbitrage and state that my result stems from risk aversion of some of the biggest banks, because Basel II was adopted much later in the U.S. than in Europe, and even during the crisis, many U.S. banks were still operating under Basel I (Acharya et al., 2012).

As far as credit enhancements are concerned, I find that credit enhancements increase credit risk (NPL), which may seem intuitive since by retaining their interest in securitization banks may expose themselves to additional risk. This finding is consistent with the evidence in Shin (2009) who notes that the risk inherent in securitized assets was not passed on to investors, but remained on banks' balance sheets, in the form of retained interest and guarantees, which is considered one of the key reasons for the severity of the financial crisis. I also observe that banks which provide credit enhancements also engage in more credit risk taking, contrary to the evidence in Casu et al. (2012), who note that before the crisis, credit enhancements did reduce bank credit risk taking.

I also find that credit enhancements increase profitability. It is possible that banks increase their risk taking by extending risky loans and then by providing credit enhancements to those securitized assets; they ensure these securitized loans obtain AAA ratings, all of which subsequently brings banks higher profits. However, it is possible that credit enhancements increase bank profitability because banks exert more effort to continue monitoring their borrowers after they have sold off these loans. This is because they have retained some interest in these securitizations or because they act as a servicing agent and thus collect fees of the well-performing SPV for much longer. Therefore, the argument I provided earlier that

securitizing banks are relatively risk averse may be partly influenced by the provision of the credit enhancements to SPVs.

As for liquidity provision to third-party securitization, I find that it decreases bank credit risk taking. It may also be because banks that provide guarantees to third parties are aware of the opaqueness of the assets held by other banks and even if other banks exert significant effort in monitoring their borrowers, the complexity of the securitization activities may add an extra layer of difficulty. That is, I find that extending protection to other banks makes banks more risk averse and makes them adjust their credit risk taking.

Then, turning back to the result of the significance of the coefficient on BHC size, I observe that the coefficient on size is statistically significant across different specifications. That is, it was primarily the largest banks that engaged in securitization. This lends support to recent suggestions by policymakers that controlling for the largest systemically important financial institutions (SIFIs) may be more efficient than producing more complex regulations regarding risk retention. More discussion on the size of the BHC and its effect on various aspects of banks' decision making will be provided in Chapter 3.

As a next step, and motivated by recent studies which confirm that results may be driven primarily by the financial crisis period (Berger and Bouwman, 2013), I reran regressions by decomposing the treatment regressions into four sub-periods: (2001:Q2–2004:Q2, 2004:Q3–2007:Q2, 2007:Q3–2010:Q2, 2010:Q3–2013:Q1) to gain a deeper insight into a relationship between securitization, risk retention and bank performance measures and how they varied within the entire time span.

There needs to be caution because splitting the sample into shorter sample periods gives us less variation in the variables and some variables lose their statistical significance. For example, I find that securitization no longer has any effect on credit risk taking in any of the sub-periods (Table 2.11).

However, I find that a positive economically and statistically significant effect of securitization on credit risk in all the sub-periods of the sample (Table 2.12) reinforces my findings in Table 2.7. That is, I show that results were not driven by the pre-crisis or post-crisis period. I also find that securitization increased credit risk as measured by RWATA but only in the period before the crisis (Table 2.10). Results in Table 2.12 also show that credit enhancements and liquidity provision reduced credit risk in all sub-periods. This shows that credit enhancement along with liquidity lines were a relatively successful risk retention mechanism. Coefficients of the credit enhancements to third parties however exhibit a mixed

impact on BHCs' credit risk. For instance, liquidity provision for third-party securitizations decreased credit risk before the financial crisis (Table 2.12 Column 3). In turn, credit enhancements to third-party conduits increased banks' credit risk after the crisis (Table 2.10 Column 9). However, results show that credit enhancements to third parties decreased credit risk before and during the crisis (Table 2.10 Column 3 and Column 5). I cannot provide any economic interpretation for this result, other than that third parties' assets are usually more opaque, and it is rational to expect that banks would seek third-party guarantees for their worst quality assets, which increase the credit risk of the guarantees' providers. Interestingly, liquidity provision to third parties decreased credit risk—however, only before the crisis (Table 2.12 Column 3).

Overall, results support the evidence that guarantees were relatively successful in what they were structured to achieve. This also implies that making the risk retention mechanism more rigorous is not necessarily the best tool to prevent future crises. The design of the risk retention mechanism may have correlated with the likelihood of the financial crisis but it is unlikely that it was a main contributor to the crisis.

In addition, I find that the decrease in profitability from securitization has primarily been driven by the post-crisis period (Table 2.13 Column 9), which may seem intuitive as the quality of assets sold became more apparent; markets have become more aware of the inferior quality of loans sold and buyers were willing to pay significantly less for securitized products. Securitization lost its pre-crisis attraction.

As for capital levels, results confirm that securitization increased capital levels only before and during the crisis (Table 2.14 Columns 3, 5 and 7) and decreased capital levels after the financial crisis (Column 7). This may result from the fact that the elimination of all regulatory loopholes has taken place, or that banks stopped retaining their earnings to increase capital levels. Results however might have reversed because of market interventions that took place during the crisis. Similarly puzzling results are observed after the financial crisis, when credit enhancements and liquidity provision show a positive effect on capital levels; it is challenging to come up with an economic rationale for this finding. Results in Table 2.14 (Columns 3, 5, 7 and 9) also reveal that credit enhancements and liquidity provision to the third parties reduced capital levels. Although the economic magnitude of the effect differs, because of the difference in the regulatory capital requirements for the different types of guarantees, these differences are relatively small, because the credit and liquidity enhancements typically constituted no more than 5% of the securitization portfolio ABS.

2.8 Robustness Tests

This section discusses robustness checks. I arranged my tests as follows. First, to check whether the relationship between securitization and its determinants changes after a certain threshold I progressively winsorized tail observations, *i.e.* I winsorized control variables at 2.5 percent and 5 percent[32]. This procedure, however, did not produce significant changes in the results, which indicates that my findings were not driven by the outliers. The results are reported in Table 2.15 and Table 2.16.

Subsequently, I conducted the Instrumental Variable (IV) analysis. I employed a two-stage least squares (2SLS) estimator with fixed effects and a robust-clustering at the bank level. The results of the estimation are reported in Table 2.17.

The Columns 2, 4, 6, 8, and 10 report the first stage regression, where my instrument "Fad" enters positively and statistically significant, while all control variables exhibit the signs as in the treatment effect regressions. The second stage of my IV regressions are reported in the Columns 3, 5, 7, 9, 11 of Table 2.17 The results confirm our main findings as per treatment effect model estimations. All else constant, the results show that securitizing banks securitization increases credit risk (coefficient on securitization dummy (secdummy) in NPL regression (Column 7) is positive and statistically significant. In relation to the credit risk taking, I observe that securitization reduces bank credit risk taking (secdummy is negative and statistically significant in ΔRWATA regression (Column 5). In regard to profitability, I find that securitization reduces profitability (secdummy exhibits negative and statistically significant coefficient on Profitability in Column 9). As for the capital adequacy, I observe that securitization increases capital adequacy (coefficient on secdummy in the Capitalization regression is positive and statistically significant in Column 11).

Further verifying the validity of our instrument, Table 2.17 reports the underidentification and weak identification tests. For the former, we use Kleibergen-Paap rank LM statistic which is robust under heteroskedasticity and clustering on identifier in the case of a single endogenous variable and a single instrument (Michalak and Uhde 2012). The value of the test is between 6.3 and 8.9 in all the columns in Table 2.17, rejecting the null hypothesis that the equation is underidentified at the 0.5% level. For the weak identification, the Kleibergen-Paap rank Wald F statistic is between 13.86 and 14.50 in all the columns in Table 2.17,

[32] Winsorisation consists of replacing the data below the N^{th} percentile with the N^{th}, *e.g.,* a 1% winsorisation implies replacing the data below the 1^{st} percentile with the 1^{st} percentile data.

which is close to the Stock and Yogo (2005) 10% critical value of 16.38, rejecting the null hypothesis of a weak correlation between the endogenous variable and the instrument, that is, between securitization dummy and peer pressure "fad".

2.9 Conclusion

Securitization has brought a fundamental change to the banking industry (Affinito and Tagliaferri, 2010). It is a process based on the following functions: the transfer of assets; SPV funding; servicing and profit extraction; collateral provision; and credit enhancement.

Banks securitized their assets to obtain additional funding, to transfer risk to third-party investors, to generate fee income, to manage profits, and to minimize regulatory capital requirements (Rajan, 2005; Allen and Carletti, 2006). While securitization and credit-risk transfer techniques allow banks to move risks outside their balance sheet as well as to achieve portfolio diversification more easily, they can also encourage banks to engage in excessive risk taking by using the funding obtained from securitization to issue new, more risky credits. Consequently, banks may end up being more at risk if they decide to keep the junior tranche in a securitization, or because of the guarantees that banks extend to securitization vehicles. Credit-risk transfer techniques may not only increase banks' systematic risk, but they are also likely to affect financial stability as a whole, *i.e.* they may increase systemic risk.

The literature has not reached consensus on the effect of securitization on bank performance measures. As documented in the existing studies the net impact of securitization on the riskiness of issuing banks is ambiguous and will depend on the structure of transactions, in particular on the magnitude of the credit support (both implicit and explicit) provided by banks to their own and third-party securitizations. That is, while there is considerable literature on the relationship between securitization and risk, the literature on credit enhancements, liquidity provision and the interconnection of banks via guarantees is more scarse.

Differences in regulations may explain the divergence in previous studies on securitization between different geographical regions. In general, securitization allowed financial firms, especially in the U.S., to circumvent regulatory capital requirements. In general, there was less "skin in the game" in the U.S.[33], compared to Europe. In Europe,

[33] This issue has been identified as one of high importance and been addressed in response to the occurrences in the market during 2007–2009 in the Dodd-Frank Act Section 939A which mandates that issuers must

regulation and underwriting standards were significantly more robust. The resilience of the structured European finance market can be evidenced in the post-crisis default data provided for example by the OECD Report (2011) which uses Standard & Poor's estimations to calculate that from mid-2007 to the end of 2010 only 0.95% of all European structured finance issues defaulted, compared to 7.7% of U.S. structured finance issues and 6.3% among universal global corporate bonds.

In this chapter, I contribute to the broader understanding of the securitization process, as well as risks arising from banks' engagement in securitization activities by providing liquidity and credit enhancements. My analysis of the credit and liquidity enhancements to BHCs own and to third-party securitization activities is relevant to the ongoing discussions on how to redesign the risk retention mechanism, and better align banks incentive to lend and securitize. In particular, I use the treatment effect model to examine the relationship between securitization and credit risk, profitability and capital levels. I use this model to alleviate the sample selection bias that plagues many existing studies in this field. In particular, the results in this chapter show that securitization increases credit risk. However, it reduces bank credit risk taking. Subsequently I find that securitization has a negative impact on banks' profitability and capital levels in the post-crisis period.

As for the regulatory capital arbitrage hypothesis, although I cannot totally eliminate it, I show some evidence that some banks consciously chose to increase their capital buffer. Another caveat in interpreting the effect on credit enhancements and liquidity provision might be the implicit support that has played a significant role in banks' decisions to securitize assets. That is, because of the interference by implicit guarantees to explicit guarantees it may be challenging to reach a definite conclusion on the effect of credit enhancements and liquidity provisions on banks' performance. In addition, I explore how the effect of securitization on the BHCs' performance measures changes over time. I observe that the relationship between securitization and banks' performance is affected significantly throughout the crisis period.

Overall, as noted in Greenspan (2000), securitization enabled a more efficient allocation of risk to a wider range of agents; it also allowed more effective risk management and

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retain some exposure in their own deals. However, to the best of my knowledge, regulations are relatively silent on how much credit enhancement and liquidity support banks can provide. That is, risks stemming from banks' own actions versus those from foreign financial institutions have not been explicitly addressed. The nature of the risk stemming from banks investing directly and providing guarantees is certainly different, and thus this motivates me to address these issues in my study.

enhanced market liquidity. However, at the same time it lowered lending standards by relaxing constraints on credit availability and distorting the incentives of U.S. banks to screen and monitor their borrowers. Securitization also increased the risk of crisis and reduced economic welfare (Rajan, 2005; Ashcraft and Schuermann, 2008).

Chapter 3

The Effect of BHCs' Exposure to Asset-Backed Commercial Paper Conduits on BHCs' Information Opacity and Systemic Risk

3.1 Introduction

In the late fall and winter of 2008–2009, the worldwide economy and financial markets collapsed. The stock market fell by 42 percent in the U.S. and, on a dollar-adjusted basis, the market dropped 46 percent in the U.K., 49 percent in Europe at large, 35 percent in Japan, and around 50 percent in the largest Latin American countries. Likewise, global GDP fell by 0.8 percent with the decline in advanced economies by a sharp 3.2 percent. Furthermore, international trade fell by almost 12 percent (Acharya et al., 2013).

The recent financial crisis brought to the surface fundamental flaws in the design of the shadow banking system (Adrian and Ashcraft, 2012).[34] Shadow banking was perceived as stable and non-risky because of the guarantees provided by the private sector.[35] However, since the solvency of the put providers was questioned shadow banking has undergone a major collapse, partly because credit rating agencies, risk managers and investors underestimated the tail risks in guarantees from the private sector.

What became apparent after the crisis erupted is that there was high uncertainty about banks' holdings and inter-bank connections that contributed to the financial turmoil. Governments that did not account for the fact that some banks were too interconnected, often ended up with banks "too big to fail", "too big to jail" and "too many to fail" (too many financial institutions to bail out).

Large amounts of short-term lending via ABCP and repurchase agreements (repos) collapsed during the financial crisis. Credit losses on subprime mortgages affected the ABCP market via the runs on programs that were exposed to these assets. As investors lost

[34] Adrian and Ashcraft (2012) define shadow banking as banking intermediation without public liquidity and credit guarantees. In reality, however, the operations of many shadow banking vehicles and activities interlink with traditional banking via credit enhancements, liquidity backup lines, implicit support to SPVs, and so forth.

[35] Credit guarantees are structured to align the risk and control excessive risk taking of banks, a view consistent with the optimal allocation of control rights under asymmetric information (Acharya et al., 2010). This ensures that sponsors have incentives to screen the conduit's asset purchases (Ramakrishan and Thakor (1984); Calomiris and Mason (2004)). Guarantees also ensure that ABCP qualifies for the highest ratings from credit rating agencies. In turn, the highest ratings ensure that some financial institutions, for example, money market funds are legally allowed to invest in ABCP (Kaperczyk and Schnabl, 2009). That is, guarantees were a crucial factor that facilitated the rapid expansion of the market by injecting the large doze of confidence into assets for investors (e.g. Levitin and Wachter, 2012).

confidence and ABCP could not roll over, support provided by the banks was called on which increased the pressure on bank balance sheets even more. Thus, as banks were more uncertain about their ability to fulfill their commitments they had to reduce their lending to each other and so the effects on the initial ABCP runs magnified even further. Krishnamurthy, Nagel and Orlov (2012) and Schroth, Suarez and Taylor (2014) examine the debt runs during the 2007 ABCP crisis and report that ABCP played a much more significant role than the repo market in supporting both the expansion and contraction of the shadow banking sector.

ABCP rose from $650 billion at the beginning of 2004 to $1.2 trillion before the beginning of the crisis[36]. However, in 2007 the ABCP market shrunk rapidly. When the crisis erupted, a significant number of banks had to be bailed out or merged with other banks due to huge losses from exposure to conduits. When the value of subprime mortgages became highly uncertain in the summer of 2007, purchasers of ABCP became worried that the assets backing their commercial paper would drop in value. The ABCP market rapidly diminished, with ABCP falling by $190 billion in August 2007 and then by another $160 billion within the same year. The crisis in the ABCP market had a profoundly negative effect on banks—directly because they invested in ABCP, and indirectly because they insured the ABCP by providing credit and liquidity enhancements to ABCP conduits[37] sponsored by other banks.

The majority of the guarantees were structured as liquidity enhancements[38] that reduced their regulatory capital requirements to at most a tenth of the capital required to hold for on-balance sheet assets. Thus banks were benefiting from regulatory capital arbitrage (Acharya et al., 2010).[39] Also, the majority of conduits had guarantees strong enough to cover for all

[36] Total amount of outstanding commercial ABCP is available from Board of Governors of the Federal Reserve System, at http://www.federalreserve.gov/releases/cp/about.htm.

[37] ABCP conduits are SPVs set up by banks that issue short-term paper to finance medium- and long-term asset claims.

[38] In the United States, bank regulators historically made a distinction between credit and liquidity guarantees. Credit guarantees were estimated to cover credit risk and, thus, were considered equivalent to on-balance sheet financing. Assets covered by credit guarantees, therefore, had the same capital requirements as assets held on the balance sheet. Liquidity guarantees were considered to cover liquidity risk but no credit risk. Regulators required no capital for liquidity risk. Similarly, extendible notes guarantees and SIV guarantees were judged to be weaker forms of liquidity guarantees and did not require banks to hold any capital. This regulation generated a sharp discontinuity between the capital requirements for credit guarantees and other types of guarantees. Over time, banks developed guarantees that were classified as liquidity guarantees but effectively covered credit risk. Banks created these guarantees by defining asset default in such a way that ABCP almost always matured before assets were declared in default (Acharya et al., 2013).

[39] In contrast to credit enhancements that required full capital charges, essentially until September, 2004 liquidity guarantees did not require any additional capital charges; then from 2004 until January 2010 they

of the possible losses, which made the entire setting up of ABCP conduits almost equivalent to on-balance sheet financing.

I contribute to the growing empirical literature on the relationship between off-balance sheet activities, asymmetric information and systemic crisis. I examine whether exposure to ABCP conduits increased the information opacity of BHCs and whether exposure to ABCP and information opacity exerted any impact on the accumulation of systemic risk. It is natural to expect that a higher degree of uncertainty was costly for the banks, as it may have deterred investors from investing into these more opaque banks. I also stress that I examine opacity from the perspective of the investors who invested in BHCs, not the investors who invested directly into ABCP conduits (*e.g.* mutual funds).

I stress that there are important differences between ABCP and term ABS. There is a common misconception that they are similar investments. In what follows I present some major differences between ABCP and ABS.

In contrast to ABS, which are usually over one year, ABCP is generally issued with a maturity of under three months. Also, as noted in the BlackRock publication "Understanding ABCP"[40] (2013: 4), with ABCP there is

> *"no such concept as expected and legal final maturity as in the term ABS market. For example, if the loans in ABS structure are prepaying at a much slower rate than originally projected or default rates are higher than original expectation, then an investor may not get paid back on the expected maturity date but on the legal final maturity date which will be later than the expected maturity date. With ABCP there is only one maturity".*

In addition, ABS usually has exposure to a single sector, *e.g.* mortgages, student loans, credit cards, while the majority of ABCP conduits have diversified portfolios of assets. In addition, ABCP conduits benefit from more levels of credit enhancement than ABS and, thus, they are considered to be a safer investment.

This study is timely, given the scale of the ABCP market and the government bailouts that followed the eruption in this relatively "safe market". I also contribute to the discussion

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had a 10 percent conversion factor, and only after 2010 was this loophole eliminated. The banks providing the liquidity guarantees were effectively taking the risk on their balance sheets like the providers of the credit enhancements because investors in the short-term ABCP would stop rolling over the debt if the assets were not performing satisfactorily (Acharya et al., 2013).

[40] https://www.blackrock.com/cash/literature/whitepaper/understanding-abcp-a-primer.pdf.

of the increased disclosure of the banks' balance sheets. Transparency is important because it allows equity and debt holders to monitor the banks and share this function with regulators. Different market participants may have different expectations about the probability of a change in ABCP market conditions and/or a different assessment of issuers' dependence on securitization funds, which may be reflected in the bid–ask spread, commonly used in the literature as a measure of information asymmetry (*e.g.*, Mohd, 2005; Leuz and Verrecchia, 2000).

Existing studies have focused mainly on the benefits that may arise as banks engage in the ABCP market. For example, Elyasiani and Wang (2008) note that banks may benefit from the diversification by engaging in off-balance sheet activities, such as securitization and buying and selling of credit protection, or they might take advantage of the regulatory capital arbitrage as in Acharya et al. (2010). In contrast, I focus mainly on the costs to the banks stemming from such activities.

To my knowledge, this is one of the first studies to examine the costs of exposure to ABCP from the perspective of the investors in BHCs, which provided guarantees to ABCP conduits. Also, to the best of my knowledge, no previous study has looked at the effect of guarantees to ABCP on systemic risk. Thus, I also examine whether guarantees to ABCP increased systemic risk.

A recent format change in quarterly *Reports of Income* filed with regulators by banks, enables me to study this issue in more detail. The dataset that I use is a significant departure from the previous studies in that I can directly evaluate the effect of the credit and liquidity enhancements to own and third-party ABCP conduits on banks' opacity, as a result of novel data available at the FED regulatory database.

The structure of this chapter is as follows. First, I present the institutional background to the ABCP market. Second, I analyze the data, discuss the methodology and my chosen specification and empirical strategy. In the third section, I present the results of the regressions and discuss their implications. The fourth section caters to robustness exercises. The fifth section summarizes and concludes.

3.2 Overview

3.2.1 Institutional background of ABCP

ABCP is a form of senior secured, short-term borrowing, in contrast to corporate commercial paper (CP), which is a senior unsecured short-term debt.

The first ABCP conduits appeared in the mid-1980s. The ABCP conduit is an SPV typically structured as a limited purpose company, which funds a portfolio of assets using a standard securitization framework where the financing of assets is accomplished through the issuance of ABCP as their primary liability. ABCP is a security with a term to maturity usually no longer than 270 days in the U.S. However, often ABCP is issued for under 30 days. In contrast to term securitizations, which have a fixed life span, ABCP programs are intended to be essentially perpetual. Most maturing ABCP is repaid with the proceeds of a newly issued ABCP and, thus, the entire process is "rolling". ABCP provides corporations with alternatives to direct debt issuance and term ABS. Although the majority of ABCP conduits are "plain vanilla", some ABCP conduits have expanded to include extendible CP (usually single-seller programs that finance credit card receivables or mortgages), medium-term notes, and in some cases, subordinated debt to provide credit enhancement (Moody's, 2003).

Many of the assets included in an ABCP program do not have rating agencies' explicit ratings. For instance, Moody's Prime 1 rating on the ABCP program refers only to the CP notes issued by the ABCP program. Hence, Prime 1 rating applies only to the conduit as a whole, and not to any particular asset. Generally, ABCP programs are subject to two major risks: credit risk, *i.e.* the likelihood that the receivable will incur losses and thus they will not be fully collectible, and liquidity risk, *i.e.* that collections on receivables will not be obtained in time). The rating of a partially[41] supported ABCP program depends on the performance of the program's assets, on the amount of credit support and the credit strength of the counterparties that provide different support facilities. In contrast to the partially supported programs, the rating of the fully supported ABCP program is directly linked to the credit strength of the guarantor. That is, the program is fully supported when ABCP investors are immune to asset deterioration because they fully rely on the third-party guarantees to ensure that repayment of ABCP occurs on time. Full support for the transaction can be provided, for example, by a surety bond from a monoline insurance company, an irrevocable letter of credit from the sponsoring bank or a "wrap" (*i.e.* full guarantee

[41] The risk-based capital standard that came into force around 1988 imposed a significant cost on the support providers (typically banks). Banks were required to hold regulatory capital for the amount of support that they extended. In fully supported ABCP programs, for example, banks had to hold regulatory capital for the entire face amount of ABCP outstanding because the credit support was perceived as a "direct credit substitute" and not just a loan commitment. Thus, banks decided to provide partial support rather than full support to avoid excessive regulatory charges. Thereby, banks could benefit from more favorable risk-based capital requirements and keep offering funding at attractive rates for sellers. This is primarily why partially supported ABCP programs became more popular than fully supported ones.

repayment by a highly rated party). These programs will also have a program wide credit enhancement of around 5 to 10 percent of the purchase commitment. Most transactions will also have liquidity support, provided by syndicates, *i.e.* several banks equal to maximum purchase commitment plus some amount to cover for the interest rate on ABCP. A liquidity facility can also be provided by one institution, but be guaranteed by another. For example, in variable rate demand obligations there may be a standby bond purchase agreement, which is a liquidity facility that is provided by the commercial bank and which is also wrapped by the monoline insurance company (Moody's, 2003).

As for the types of ABCP conduits, there are five principal types of ABCP programmes: general purpose multi-seller; single-seller; securities arbitrage; structured investment vehicle (hereafter SIV) and some hybrid programs which combine features of several ABCP programs (Covitz et al., 2009). The main difference between ABCP conduits lies in the type of assets held, sponsors and services provided by the sponsor.

The most traditional ABCP program is a multi-seller program, in which a bankruptcy-remote conduit purchases receivables and loans from multiple firms. The sponsor is typically a financial institution that provides the conduit with a committed liquidity line, administers its daily operations, and sometimes also provides the conduit with credit enhancement through a letter of credit that absorbs credit losses. At the end of July 2007, there were 98 active multi-seller conduits in the US (Covitz et al., 2009).

Single-seller conduits are typically used by companies or banks to securitize their own balance sheet, e.g., a portfolio of credit cards or auto loans, whereas large banks employ multi-seller programs to securitize the assets of various of their customers, as in the case of trade receivables (Durrer, 1997). The majority of single-seller conduits mainly fund auto loans, credit-card receivables, mortgages, mortgage-backed securities. Many of these single-seller conduits issued extendible paper, which allow the issuer the option to extend the maturity of its paper and pay a pre-specified penalty rate to the investor. One of the reasons why a bank might decide to establish its own ABCP program instead of participating in a multi-seller programme is because it may find various cost advantages or more advantageous accounting or tax treatment from setting up single-seller conduits (Moody's, 2003). Before the crisis erupted in August 2007, there were 51 active single-seller programs.

Securities arbitrage programmes, involve banks sponsoring conduits to finance long-term assets through a special purpose entity that has a lower regulatory capital charge than if the assets were held on balance sheet. Securities arbitrage programmes have explicit agreements with their sponsoring banks for committed back-stop liquidity lines covering all their short-

term liabilities. Securities arbitrage programmes allowed banks to exploit regulatory capital arbitrage opportunities. In July 2007, there were 35 active securities arbitrage programmes (Covitz et al., 2009).

Similarly to securities arbitrage programmes, SIVs fund highly-rated securities. But unlike the securities arbitrage programs, which had full liquidity lines, SIVs relied on dynamic liquidity management strategies, which involved liquidating assets to pay investors in the event of distress. In July, 2007 there were 35 SIVs in operation, which ceased to exist after the crisis erupted in August, 2007 (Covitz et al., 2009).

Hybrid programmes combine features of securities arbitrage and multi-seller programs. In July 2007, there were 18 active hybrid programmes. All the remaining programmes were not classified (Covitz et al., 2009).

The largest ABCP programs are usually partially supported bank sponsored multi-seller programs. Each transaction in the multi-seller conduit is typically structured similar to a term securitization or a secure loan and is collateralized by a pool of assets. In addition, unlike longer-term structured credit, ABCP pools are usually not tranched, thus the debt is repaid proportionally to all investors.[42]

Specific regulations also apply to entities who can invest in ABCP. "Qualified buyers"[43] are usually money market funds, who are the largest single class of investors in ABCP, investment funds, corporations and sophisticated and wealthy individuals. Typically, the highest ratings from credit ratings agencies ensure that some financial institutions, for example, money market funds, are legally allowed to invest in ABCP (Kasperczyk and Schnabl, 2009).

Registration and disclosure rules mean that the ABCP market is now very competitive in relation to other money market instruments, providing a high-quality credit profile and exemption from registration with the Securities and Exchange Commission (hereafter SEC). Thus, because of the structure of ABCP programmes, the conduits are not required to be registered under the Company Act, nor are the CP notes obliged to be registered under the Securities Act of 1933. This allows for avoiding costly and time-consuming registration. As for the disclosure rules, ABCP programs are structured to satisfy the disclosure of Rule 2a-7, which states that conduits must disclose any asset that comprises 10 percent or more of

[42] "Report to the Congress on Risk Retention", Board of Governors of the Federal Reserve System, 2010.

[43] "Qualified purchasers" as defined in Section 3(c)7 of the Investment Company Act and " Qualified Institutional Buyers" as in Rule 144a under the Securities Act.

the value of total investments made by the conduit. Since ABCP typically prefers not to disclose the names of the sellers of the assets funded by the program, they diversify their assets to satisfy that 10 percent assets ratio and to meet Rule 2a-7. Hence, the administrator of the conduit discloses all the information (*e.g.* asset type, funding amount, amount of the credit enhancement, performance of each deal, etc.) but not the name of the seller. This is done partly because, in contrast to the corporate CP, ABCP investors are not directly exposed to the seller's credit risk, therefore there is no need for them to know the seller.

ABCP program sponsors, while relatively few in number, make up a significant part of the banking sector. They are usually larger than ABCP non-sponsoring banks, which adds to their importance in the financial sector and also makes them SIFIs.[44]

As of 30th September 2001, there were approximately 280 active ABCP conduits, with more than $691 billion in outstanding commercial paper. Before the crisis, more expensive conduits usually issued paper at 5–10 basis points below LIBOR, the cheaper programs at 5–10 basis points over LIBOR. By July 2007, ABCP was the largest money market instrument in the United States with $1.3 trillion outstanding. However, following concerns regarding asset value beginning in August 2007, money market funds withdrew from the market and the value of outstanding paper collapsed to $833 billion in December 2007 (Irani, 2011). After the initial shock, off-balance sheet conduit assets and liabilities became de facto on-balance sheet. Moreover, the market liquidity of asset- and mortgage-backed securities dried up, as banks were no longer able to securitize these loans and investors were unwilling to purchase them directly (Cornett et al., 2011; Krishnamurthy, Nagel and Orlov., 2014). When the crisis began, the interest rate spread of overnight ABCP over the Fed rate rose from 10 basis points to 150 basis points within one day.

Investors in ABCP conduits could not evaluate the risk correctly; even more so the investors in BHCs, who were even less likely to take into account the fact that their BHCs were exposed to these risks by providing guarantees to the third-party ABCP conduits. Explicit guarantees, coupled with implicit support that many banks usually extended to ABCP conduits for the reasons such as "moral" standing or protection of their reputation, made it difficult to evaluate the riskiness of their BHCs.

[44] To provide an example of a particular conduit, as of January 1, 2007, Grampian Funding was the largest conduit rated by Moody's. The conduit had $37.9 billion of ABCP outstanding. It was set up by the British bank HBOS, rated AAA, and fully invested in U.S. assets with a 36 percent allocation to residential mortgages. HBOS provided a full liquidity guarantee for maturing paper, which was put to use on August 22, 2007 (Irani, 2011).

The general run on all conduits brought down conduits (*e.g*. SIV conduits) that could have continued if investors had had a clear understanding of each conduit's asset composition and quality. However, this was not possible due to the sophistication of this market and the general lack of transparency of the ABCP structures. For example, the Investment Industry Regulatory Organization of Canada (IIROC) report notes that neither the brokers nor the chief compliance officers interviewed were familiar with the nature of the liquidity guarantees built into the non-bank ABCP. Furthermore, they did not know the difference between the global-style liquidity arrangements and so-called Canadian liquidity arrangements, for example. Instead, they just relied on credit ratings to assure them that the products were safe to sell. However, asset holdings of ABCP conduits, like those of the banks, are not transparent. While the vast majority of ABCP programs have credit ratings from the major rating agencies, credit support mechanisms vary and the specific assets held in the programs are not widely known. For example, some ABCP programs viewed their holdings to be "proprietary" investment strategies and deliberately did not disclose. Thus, random events or concerns about an economic downturn can create uncertainty about asset values. This uncertainty is greater when less information is available about the assets. Overall, it is rational to assume that it was impossible for investors in banks to understand the risk to which banks were exposing themselves through extending guarantees to ABCP conduits. However, if they had realized these risks, investors would rather have invested in banks with little exposure to ABCP.

As for the guarantees, they were a crucial factor that facilitated the rapid expansion of the market by injecting confidence into the assets for investors (*e.g.* Levitin and Wachter, 2011). Guarantees are structured to align the risk and control the excessive risk taking of the banks, a view consistent with the optimal allocation of control rights under asymmetric information (Acharya et al., 2010). This ensures that sponsors have incentives to screen the conduit's asset purchases (Ramakrishan and Thakor, 1984; Calomiris and Mason, 2004).

A wide body of empirical research supports the finding that markets function better under increased transparency (*e.g.* Goldstein et al., 2007). Thus, it is important to identify those activities, which significantly contribute to opacity in the banking sector, before a myriad of excessive disclosure regulations is produced. That is because increased disclosure may not always be beneficial and, in the presence of market failures, may bring instability or reduce market quality (Morris and Shin, 2007; Pagano and Volpin, 2010).

Examining the motives for certain bank behaviors, and analyzing the consequences of exposure to the ABCP market, for example, is also of paramount importance to policymakers

in structuring new capital regulations. As noted in Acharya et al. (2010), conduits were a low-return strategy for banks and the benefits of setting up these conduits were not pronounced. For example, Deutsche Bank reports in its annual report in December 2007 that conduits generated fees of 6 million euros relative to a total commitment of 6.3 billion euros. Similarly, the Bank of New York Mellon reports in December 2006 revenues of $3 million relative to a commitment of $3.2 billion (Arteta et al., 2008), which seems surprising after one sees how keenly banks engaged in these activities. Assuming that conduits have no costs and revenues are equal to profits, banks earned about 10 basis points on conduit assets. Also, for some smaller banks the conduit activities were in fact large enough to wipe out the entire bank capital. For larger banks, conduit activities were small enough to withstand the losses on conduit assets, but these banks weakened as the financial crisis continued (Acharya et al., 2013). Such small profits with high risks pose questions about the costs and benefits of exposure to ABCP. This is an important issue to examine because the issuance of ABCP is again on the rise. US ABCP outstanding stood at $226 billion through early December 2015, 81% below the $1.2 trillion peak seen in July 2007 (Fitch Ratings, 2016). However, Fitch Ratings (2016) predict a robust demand for ABCP and notes that sponsors of the major ABCP programmes, *i.e.* multi-seller and single-seller ABCP conduits, remain active.

3.2.2 Opacity

Opacity can be defined as an ex ante ambiguity about the profit-and-loss probability density function so that ex post actual losses are likely to become subject to considerable conflict (Ansari, 2012). The opposite of opacity is "transparency". A transparent investment is when the provider of the capital is well informed ex ante about the payoff distribution, and fully consents to bear the risks to which their capital is employed. This definition characterizes opacity largely in terms of ambiguity about the risk ex ante.

In its report on "Enhancing Bank Transparency", the Basel Committee on Banking Supervision (1998: 4) defines transparency as "public disclosure of reliable and timely information that enables users of that information to make an accurate assessment of a bank's financial condition and performance, business activities, risk profile and risk management practices". Thus, in the finance industry, opacity is more commonly understood as a lack of available credible information about the credit score of borrowers or about the assets traded in over-the-counter markets. This makes banks' risk taking hard to monitor (Myers and Rajan, 1998; Morgan, 2002). In turn, Pagano and Volpin (2010) argue that regulation on transparency is necessary to make financial systems more efficient. They find that opacity is privately optimal. However, it is not socially optimal. They argue that more information

may enhance lending in the financial sector. Generally, information asymmetry is of particular interest to academics who study the banking sector, because this industry is unique in terms of opaqueness and is usually perceived as a black box (Morgan, 2002).

There exists substantial evidence that suggests that banks' opacity contributes to financial crises by impairing the market's ability to discipline banks. Investors cannot price banks' default risk if they are unable to assess the quality of banks' assets. Banks will take excessive risks anticipating that they will not have to pay. Excessive risk taking *ex ante* magnifies the costs of bank opacity *ex post*.

As for the link between opacity and guarantees to ABCP conduits, it is possible that credit guarantees were ignored not only by investors but also by bank managers who did not keep pace with financial engineering (Carletti and Allen, 2009; Acharya et al., 2013). In addition, it is worth noting that banks often provided non-contractual implicit recourse to ABCP conduits for reputational reasons. This made it difficult for investors to monitor their banks as they could not assess whether implicit recourse[45] existed for some banks' set up conduits. In other words, information users may find it difficult to determine the probability that a bank will for example offer implicit recourse.

In this chapter information asymmetry is approximated by the BHC's stock bid–ask spread, a standard proxy for asymmetric information used in Welker (1995), Leuz and Verrecchia (2000), and Mohd (2005), and a variant of which is also used as a measure of illiquidity by Amihud and Mendelson (1989).

The term "bid" refers to the highest price a buyer is willing to pay for a specified number of shares in a stock at any given time. The term "ask" refers to the lowest price at which a seller will sell the stock. The bid price will almost always be lower than the ask or "offer" price. The difference between the bid price and the ask price is called the "spread." In particular, I hypothesize that if outside investors find it difficult to assess the benefits and costs of their banks' exposure to ABCP via guarantees, the bid–ask spread should increase.[46]

Based on the above discussion, the following hypothesis is specified and examined in the following sections:

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[45] Implicit recourse involves issuers transferring additional higher quality assets to the initial pool of the transferred assets to strengthen the quality of the collateral behind the asset-backed securities. The issuer may also agree to add cash or other credit enhancements to a deal to protect securitization investors from losses due to underperforming assets.

[46] My choice of proxy and prediction that higher opacity will be reflected in a higher bid–ask spread aligns well with Bagehot (1971).

H1: BHCs with higher exposure to ABCP conduits, have higher information opacity.

If exposure to ABCP increases information opacity, it would imply that greater transparency and more stringent disclosure requirements could simultaneously reduce costs and perhaps help restore confidence in the banking industry. Certainly, the goal of achieving transparency has become more challenging in recent years as banks' activities have become more complex and dynamic.

Cheng et al. (2008) note that asset securitization is more complex compared to other financing techniques. Usually, firms rely on multiple SPVs and on specialists from several disparate areas such as accounting, bankruptcy law, commercial law, securities law, finance and tax to structure securitization transactions. Therefore, it is natural to predict that investors may find it difficult to completely understand the implications of securitizations or may find the costs of analyzing such transactions prohibitively high. Thus, it is likely that many investors cannot accurately assess the implication of asset securitizations.

Furthermore, it is likely that the effect on opacity will vary depending on whether banks extended guarantees to their own sponsored conduits or to the third party conduits. Hence, I examine whether there would be differences in bid–ask spread if BHCs extended protection to their own set up ABCP conduits versus guarantees provided to the third-party ABCP conduits.

Concludingly, studies on the relationship between stock market return expectations, investors' risk aversion and investment decisions were conducted; however, to the best of my knowledge no studies examine these issues in relation to the ABCP market.

3.2.3 ABCP exposure and volatility of returns

The next part of my study is motivated by Acharya et al. (2013) who find that banks' stock price deterioration at the start of the financial crisis was linked to their exposure to ABCP conduits.

I conjecture that the provision of guarantees to ABCP conduits could be reflected in the volatility of the BHCs' stock returns. I derive the following testable hypothesis:

H2*: Exposure to ABCP increases the volatility of BHCs' returns.*

Apart from the previously mentioned increase in the spread, increase in the volatility of returns could have an additional cost for banks being exposed to ABCP. Increase in the volatility of returns might result from banks' commitment to extend the support to ABCP conduits, which in turn could have caused fluctuations in the BHCs' returns. Generally, it is

natural to expect that, if investors viewed the entire setting up of ABCP conduits and extending guarantees to them as a risky activity, they might be less willing to invest in those banks that are exposed to the ABCP market. Thus, the fact that BHCs extended protection, and thus in fact held all the risk on their balance sheets might have had a negative effect of credit or liquidity enhancements on BHCs' stock returns and higher returns volatility had investors been aware of the risks to which their BHCs were exposed, and took those into account when buying shares in these BHCs. However, I should not observe any effect in the instances such as: if investors were not aware of the risk posed; they believed that banks were in good enough condition to extend protection if called upon; or investors anticipated that their banks would receive financial help from the government if their financial position was not sound enough to extend the protection.[47]

In general, from a macroeconomic point of view, volatility is important because of the growth benefits conferred by stability (Ramey and Ramey, 1995; Aghion et al., 2005). From the viewpoint of the firms, volatility is important, because stable firms, e.g. firms firms with smooth cash flows, face lower expected costs from financial distress (Smith and Stulz, 1985). Also, financial policies are more effective for solving agency problems in stable firms (Stulz, 1990), and investors value firms with smooth cash flows at a premium (Rountree et al., 2008).

My third hypothesis concerns the banks' exposure to ABCP and their systemic risk. I elaborate more on financial stability analyzing how ABCP guarantees added to the systemic risk.

3.2.4 Exposure to ABCP conduits, opacity and systemic risk

Since the financial crisis there has been much discussion regarding guarantees to ABCP conduits making banks systemically more risky. Financial firms are systemically important, if the failure of the firm to meet its obligations to creditors and customers may have significant adverse consequences for the financial system and the broader economy.

[47] It may be the case however that ABCP did not add to any volatility because even if investors had not been ignorant but could have perfectly well observed whether and how much their banks provided those ABCP guarantees, they could have anticipated unconditional support from the government. This is aligns well with recent evidence. For example Acharya, Anginer and Warburton (2015) find that bondholders of major financial institutions have an expectation that the government will shield them from large financial losses and, as a result, they do not accurately price risk. An implicit government guarantee dulls market discipline by reducing investors' incentives to monitor and price the risk taking of potential too-big-to-fail candidates. In summary, it is rational to expect that if guarantees did not affect returns volatility, it may be because investors were not aware of their BHCs' activities or perhaps they were anticipating government intervention in case the ABCP market failed, inferred from the magnitude of the ABCP market.

A current challenge in this field of research is that there is no consensus on the definition of systemic risk, and thus the measures of systemic risk show a substantial heterogeneity. Prominent systemic risk measures are the marginal expected shortfall (MES) of Acharya et al. (2010), the systemic risk measure (hereafter SRISK) of Brownlees and Engle (2011). The aforementioned systemic risk measures have an exact economic interpretation. For example, MES corresponds to a firm's expected equity loss when the market falls below a certain threshold over a given horizon, namely a 2 percent market drop over 1 day for the short-run MES, and a 40 percent market drop over six months for the long-run MES. The main idea is that the banks with the highest MES contribute to the market's decline the most. Thus, these banks are the greatest drivers of systemic risk. In turn, the SRISK is a function of the level of leverage of the firm and MES, the tail expectation of the firm equity returns conditionally on a substantial loss in the market. While the leverage of a firm can be measured using balance sheet data, MES requires appropriate time-series methodology. Brownlees and Engle (2011) note that MES provides useful tools for monitoring systemic risk and, in retrospect, it captures several of the early signs of financial crisis. For instance, eight companies out of the SRISK top ten a year and a half before the Lehman Brothers bankruptcy turned out to be troubled institutions.

On an *ex post* basis, if I observe a clear linkage, this may make the monitoring of the BHCs easier for investors in the future and reduce risk aversion of investors to ABCP paper (*e.g.* since MES and SRISK are freely available on a daily basis on the VLAB website[48]). It may also reduce the rationale for the government to bail out many of such programs on the grounds that information was freely available. Thus the argument that investors could not assess the risk would be less plausible. In addition, investigating the relationship between asymmetric information and systemic risk is crucially important *per se*, because as Goodhart (2010) notes, asymmetric information can contribute to the market freezing up. Leaving aside the discussion of systemic risk measures[49], I examine whether exposure to ABCP conduits, and higher information opacity, increases systemic risk. The following hypothesis is specified based on the above discussion.

[48] VLAB (vlab.stern.nyu.edu or systemicriskranking.stern.nyu.edu) provides estimates of systemic risk for the largest U.S. financial firms for the most recent period. It is a leading website for systemic risk, updated weekly to allow regulators, practitioners and academics to see early warnings of system risks. However, it does not provide historical data. I am grateful to Rob Cappellini at the Volatility Institute, NYU, who provided me with the data.

[49] Appendix 2 presents the derivation of these measures and the graph that shows how banks' MES varied from 2001 to 2013.

H3: *Exposure to ABCP conduits and information opacity increases BHCs' systemic risk.*

Bank businesses are complex by nature and are subject to relatively high information opaqueness and asymmetries between insiders and outside stakeholders (Morgan, 2002). This information problem about complex business operations and high agency costs (*e.g.*, the relatively high cost of monitoring banks by outside stakeholders) tends to precipitate the contagion of bank distress risk and crash risk among banks or their transmission to other banks in the banking sector (Jacklin and Bhattacharya, 1988; Caballero and Simsek, 2009). Hence I expect a positive relation between ABCP and systemic risk. I also expect to observe that opacity increases systemic risk.

3.3 Related Literature

Literature on asymmetric information is abundant, but research on the opacity of BHCs and their exposure to ABCP conduits is limited. My analysis of the information on opacity is most closely related to Cheng et al. (2008). As for the relationship between stock returns volatility and ABCP guarantees, my study is in accordance with Acharya et al. (2010, 2013, 2014). Section 3.5 where I analyze systemic risk is linked to Acharya and Richardson (2009), Acharya and Schnabl (2009), Shin (2009) and Acharya et al. (2013).

3.3.1 Opacity

Evidence as to whether securitization and exposure to conduits increase or decrease information opacity is not conclusive.

Cheng et al. (2008) find that banks that engage in securitization transactions have higher information opacity compared to the banks that do not securitize. Cheng et al. (2008) report that there exist two main reasons why complex securitization transactions may lead to information opacity. The first reason is related to the difficulty of assessing whether the risks of the securitized assets have been transferred to outside investors. For example, investors may find it difficult to assess to what extent retained interests leave the issuer more or less exposed to risk. In addition, on-balance sheet retained interests do not fully capture issuers' risk retention. For example, they do not capture risk retention through servicing rights or recourse obligations. It is difficult to assess to what extent securitizations expose a firm to changes in market conditions. All this uncertainty may lead to the increase in information asymmetry that would have further consequences for banks. For instance, information opacity may affect a firm's cost of capital (Barry and Brown, 1985; Coles and Loewenstein, 1988; Lambert, Leuz and Verrecchia, 2006) and the efficiency of capital markets (Zhang, 2006).

However, the opposite can also be true. By transforming illiquid assets into open market traded securities, securitization may increase the average transparency of what would otherwise be opaque assets (Foley et al., 1999; Schwarz, 2004). By issuing ABS based on pools of financial assets, firms are obliged to disclose more information about these assets (through registering ABS with the SEC) compared to what they would disclose if they kept the assets on the balance sheet (Cheng et al., 2008). Following securitization, periodic reports on the performance of the securitized asset pool are filed with the SEC. In addition, the statistical properties of the securitized financial assets are periodically published by credit rating agencies that assess the performance of ABS throughout their lives, and provide third-party monitoring of the securitized assets.

My analysis is also related to the literature that examines whether banks are more opaque than other firms (Morgan, 2002; Flannery et al., 2004; Haggard and Howe, 2007). Although the evidence is generally mixed, the literature suggests that banks' assets are more difficult for outside investors to value compared to the assets of non-bank firms. This can be seen as supportive of my hypothesis that investors may face significant challenges in evaluating banks' exposure to the ABCP market. The literature (e.g. Berlin and Loeys, 1988; Diamond, 1989, 1991; Morgan, 2002; Haggard and Howe, 2007) shows that although underlying financial assets used in securitization are subject to information opacity irrespective of whether they are securitized or kept on the balance sheet, bank assets are more difficult to value for outside investors than are the assets typically found on a non-financial firm's balance sheet. My study also relates to studies on the source of the opacity. For example, Flannery et al. (2012) examine whether a bank's portfolio composition affects its opacity. They document that various portfolios had divergent effects on bank opacity during the financial crisis; however, the portfolio source of opacity is difficult to pin down.

The choice of the bid–ask spread as an empirical proxy for information asymmetry is motivated by prior literature (Welker, 1995; Leuz and Verrecchia, 2000; Mohd, 2005). The bid–ask spread is a measure of information uncertainty and relates to the inability of market participants to agree upon a price for the bank's equity offerings. When information asymmetry among market participants is high, informed traders can exploit their informational advantage at the expense of uninformed traders. The market makers realize that they are faced with an adverse selection problem and increase the bid–ask spread to protect themselves against expected losses from trading with more informed investors. This argument suggests a positive association between the degree of information asymmetry and bid–ask spreads and justifies the use of spreads as a proxy for information asymmetry. The

relative bid–ask spread that measures information asymmetry between informed and uninformed traders was first discussed by Bagehot (1971). Bagehot's intuition was subsequently modeled by Copeland and Galai (1983), Glosten and Milgrom (1985) and Kyle (1985). Typically, bid–ask spread is defined as the quarterly average of the monthly differences between the closing ask and closing bid quotes, scaled by the average of the ask and the bid, and is expressed in percentage terms. However, several variants of the spread may be encountered in the literature, but the conceptual differences are minor (Flannery et al., 2013).

I also contribute to literature that examines the optimal levels of banks' opacity. For instance, Thakor (2015) documents that although the opacity of bank balance sheets was considered as a contributor to the liquidity shortages during the 2007–2009 crisis, it has been suggested theoretically that banks are optimally opaque because this makes the claims of risk-averse depositors information-insensitive, thereby facilitating risk sharing. In turn, Dang et al. (2014) note that bank opacity is an optimal response to demand depositors' need for secrecy. The bank uses early depositors' money to invest in the borrower's project, but in exchange promises not to divulge information about the borrower so as to facilitate ex ante efficient risk sharing and information-insensitive trade between early and late depositors. Thus, bank opacity is designed to provide efficient risk sharing to risk-averse depositors. My study is also related partly to Bushman et al. (2004) who note that reduced reporting transparency can hinder the efforts of investors to understand firm operations and value.

My study is also related to prior literature, which shows that information opacity affects a firm's cost of capital (Barry and Brown, 1985; Coles and Loewenstein, 1988; Lambert et al., 2006) and the efficiency of capital markets (Zhang, 2006).

Furthermore, my study also relates to Acharya et al. (2010) who note that banks with more exposure to ABCP were more likely to have a higher probability of default. They also perform an event study to look at how the cumulative returns were affected by the banks' exposure to conduits between the 7th and 10th August, 2007. They find that returns of the banks with higher conduit exposure were negatively more affected by the crisis as compared to banks with lower exposure to the conduits. In particular, Acharya et al. (2010) show that in the pre-crisis period there is no relationship between exposure to ABCP and stock returns. However, around the beginning of the financial crisis, *i.e.* August 9, 2007, commercial banks with higher exposure to ABCP conduits had a larger decline in stock returns. They also note that credit guarantees directly affect the ability of conduits to issue ABCP after the financial

crisis, *i.e.* conduits which had weaker guarantees, *i.e.* where the measure of the strength of the guarantee is the riskiness of the sponsor as measured by the sponsor credit default swaps (hereafter CDS) spreads saw diminished ability to issue ABCP. As far as investors are concerned, Acharya et.al (2010) examine whether investors in ABCP could actually rely on these guarantees once the crisis erupted. They find that all investors in conduits with strong guarantees suffered almost no losses and were repaid in full. That is, they document that ABCP conduits provided little risk transfer during the run and that losses from conduits remained with banks instead of outside investors, *i.e.* banks with more exposure to ABCP conduits had lower stock returns.

In another study Acharya et al. (2013) analyze the incentives that prompted banks to engage in ABCP market. They find that U.S. commercial banks structured their support to ABCP conduits to reduce regulatory capital.

My analysis also relates to Covitz et al. (2009) who analyze the runs in the U.S. ABCP market. Covitz et al. (2009) note that around one- third of all ABCP programs were in a run at the beginning of the crisis.[50] They also show that runs on ABCP conduits were negatively related to the strength of their credit guarantees.

My study also relates to Irani (2011) who studies how the funding shock associated with the collapse of the ABCP market was transmitted by commercial banks to the market for corporate liquidity. He uses the variation in the financial condition resulting from the differential exposure of banks to the mid-2007 collapse of the ABCP market to assess the impact on liquidity provision to U.S. non-financial corporations via syndicated lines of credit. Irani (2011) finds that high-quality borrowers were more likely to exit relationships with the banks exposed to ABCP during the ABCP crisis.

This study also relates partly to the literature that examines business diversification and discount in value (Laeven and Levine, 2007). It has been documented that diversification is accompanied by an increase in information asymmetry, which in turn may result in "information discount". In the context of ABCP, setting up ABCP conduits allowed banks greater diversification. However, some empirical studies note that stockholders do not seem to appreciate BHCs' pursuit of non-interest income activities. In particular, if an information

[50] Covitz et al. (2009) document that runs in the ABCP market were mostly fundamental, however, they also provide some evidence for the fact that runs were caused by the investor's panic (non-fundamentals-driven). This panic driven ABCP run is similar to the bank run where investors withdraw their funds from a potentially insolvent bank. Maturity of assets in ABCP conduits takes longer than the liabilities, which positively impacts the possibility of the runs in the ABCP market.

asymmetry problem worsens along with the firm's business diversification resulting in a highly opaque banking sector and an erosion of trust in the financial sector as a whole, investors may simply value the firm at a discount because of the information disadvantage compared to investing in focused firms.

My study also relates to Kisin and Manela (2014) who estimate the shadow cost of bank capital requirements by exploiting the loophole in the regulatory requirements when banks could face lower regulatory charges by providing liquidity guarantees to ABCP conduits as opposed to providing credit enhancements. They estimate that a ten percentage point increase in capital requirements (Tier 1 capital ratio) would cost $2.2 billion a year for all banks that exploited the loophole combined, and $3.7 billion for all U.S. banks. The average cost per individual bank is $143 million, or 4 percent of annual profits. They estimate that lending interest rates would increase by 3 basis points and quantities would decrease by 1.5 percent.

Section 3.5 of my study, in which I examine systemic risk relates to Yorulmazer (2013), who analyzes the use of CDS for regulatory capital relief and their effects on systemic risk. Yorulmazer (2013) shows that when a bank acquires a CDS contract, it is able to hold less capital against risky investments. This allows the freeing up of regulatory capital and allows a bank to expand its balance sheet. The author notes that when the failure of the risky project and the insurer are correlated the probability of double default increases, *i.e.* the likelihood of the credit risk and the counterparty risk materializing at the same time is higher, so that the CDS provides only partial insurance. In the same fashion, motivated by the link between CDS and systemic risk, I study guarantees to ABCP conduits and systemic risk because commitment to provide guarantees to ABCP are likely to affect the MES of the BHC.

3.3.2 Systemic risk

There is no widespread agreement on the definition of systemic risk. The measures of systemic risk have a relatively high degree of heterogeneity.[51]

Two standard measures of risk used in pre-crisis financial literature is the value at risk (hereafter VaR) and the expected shortfall (hereafter ES) which focus on the risk of an individual financial firm in isolation. Both VaR and ES measure the potential loss incurred by the firm as a whole in an extreme event. Specifically, the VaR is the maximum amount

[51] Bisias et al. (2012) provides a comprehensive a survey of 31 measures of systemic risk in the economic and finance literature.

that the bank loses with confidence $1 - \alpha$, that is, $\Pr(R < -VaR\alpha) = \alpha$, where R stands for returns and the parameter α is typically taken to be 1 percent or 5 percent. Recent literature has noted many limitations of the VaR measure (Brunnermeier et al., 2009), especially during the recent financial turmoil because it failed to identify possible "tail" losses in the senior tranches (rated AAA). VaR models assume that the asset returns follow a normal distribution and disregard the fat-tailed properties of actual returns, underestimating the likelihood of extreme price movements. In other words, VaR only measures the distribution quantile and disregards extreme loss beyond the VaR level. This means it fails to take into account the risk referred to as "tail risk". To alleviate the problems inherent in VaR, Artzner et al. (1999) propose the use of ES. ES is the expected loss conditional on the loss being greater than the VaR. The ES is a more robust measure of a bank's individual risk than VaR.

Three prominent examples of systemic risk measures, developed post-crisis, are the MES of Acharya et al. (2010), the SRISK of Brownlees and Engle (2011) and Acharya et al. (2012), and the Delta Conditional Value-at-Risk (CoVaR) of Adrian and Brunnermeier (2011).[52] Different risk measures led to identifying different SIFIs. [53]

In my study, I use SRISK and MES, which capture in a single measure many of the characteristics considered important for systemic risk such as size, leverage and interconnectedness (Acharya et al., 2010). The derivation of these measures is as follows.

The MES can be viewed as a natural extension of the concept of marginal VaR proposed by Jorion (2007). It measures the increase in the risk of the system (measured by the ES) induced by a marginal increase in the weight of firm i in the system. The higher the firm's

[52] These three systemic risk measures have been favoured in the latest empirical studies because have more explanatory power than sophisticated ones and also because they are easier to grasp and explain (Benoit et al., 2012). First, the MES corresponds to a firm's expected equity loss when market falls below a certain threshold over a given horizon, namely a 2 percent market drop over 1 day for the short-run MES (hereafter SRMES), and a 40 percent market drop over six months for the long-run MES (hereafter LRMES). The basic idea is that the banks with the highest MES contribute the most to market declines; thus, these banks are the greatest drivers of systemic risk. Second, the SRISK measures the expected capital shortfall of an institution conditional on a crisis occurring. The intuition is that the firm's with the largest capital shortfall will contribute the most to a crisis and therefore should be considered as the most systemically risky. Third, the CoVaR corresponds to the VaR of the financial system conditionally on a specific event affecting a given firm. The contribution of a firm's to systemic risk (CoVaR) is the difference between its CoVaR when the firm's is, or is not, in financial distress.

[53] Systemic risk measures calculation is the initiative undertake by the NYU Stern V-Lab. A model of this form is implemented based on publicly available data in order to determine which institutions are systemically risky, what the cost of a bailout would be, and how this leads naturally to a regulatory strategy. The results of this analysis are updated weekly and posted at http://vlab.stern.nyu.edu/welcome/risk) for approximately 100 U.S. financial firms and for 1200 global financial firms.

MES (in absolute value) the higher the individual contribution of the firm to the risk of the financial system.

MES depends upon the volatility of a firm's equity price, its correlation with the market return and the co-movement of the tails of the distributions. These in turn are estimated by asymmetric versions of GARCH models such as Dynamic Conditional Correlation (DCC) and nonparametric tail estimators. The MES is then extrapolated to reflect a financial crisis that takes several months and involves significant market declines. Finally, these reductions in equity value will give rise to capital shortages for highly levered firms. The capital shortfall is computed assuming a standard prudential capital buffer.

In turn, the SRISK measure proposed by Brownlees and Engle (2011) and Acharya et al. (2012) extends the MES. The SRISK corresponds to the expected capital shortfall of a given financial institution, conditional on a crisis affecting the whole financial system. In this perspective, the firms with the largest capital shortfall are assumed to be the greatest contributors to the crisis and are the institutions considered to be most systemically risky. Appendix 2 presents a formal definition of these systemic risk measures.

3.4 Data

Data come from several sources. The core sample is a panel of all publicly traded U.S. BHCs that report on form FR-9YC, which is filed quarterly on a consolidated basis by all U.S. BHCs with over $150 million in assets ($500 million after 2006) and is retrieved from the Federal Reserve Bank of Chicago[54] via the Wharton Research Data Service (WRDS). It covers the period from 2001:Q2–2013:Q1. In March 2006, the minimum reporting size for the BHCs was raised from $150 million to $500 million. This significantly skews the sample. To overcome this problem, I delete all the observations that do not reach the minimum reporting threshold over the sample period. I do this in order to make sure that banks which began reporting prior to 2006, continue reporting after the threshold was raised from $150 million to $500 million in 2006. I adjust the threshold of $500 million for price level per quarter with base March, 2006. This method of deleting the observations ensures that they are not deleted randomly, but helps to preserve all the observations of the BHCs that once

[54] Federal Reserve Bank of Chicago Bank Holding Company Data is available at http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm.
Also, using the Fed's BHCs' data helps to identify more matches with CRSP since market data come from listed BHCs, rather than their (unlisted) subsidiaries. In addition, decisions regarding investment and risk-taking behavior are usually made on an aggregate basis, thus BHC data are a more accurate representation of the big financial institutions (Casu et al., 2011).

started reporting and continue to do so even after a temporary drop in their total assets. This procedure drops around 50 observations per quarter from 2001 to 2006.

Subsequently, I obtain the BHC market data from the University of Chicago's CRSP database, which I access through WRDS. CRSP holds stock price related data for publicly traded companies. I retrieve quarterly data on the publicly traded BHCs that operated in the U.S. during the period 2001:Q2–2013:Q1. Then, I link two data sources by CRSP—permanent company number (permco*)*, FRB (Federal Reserve Board) entity code—and the institution name from the Federal Reserve Bank of New York (FRBNY)'s research department.[55] I identify BHCs that appeared both in the BHC regulatory database and in CRSP, which yields 769 matches. Subsequently, I compile the final dataset. I eliminate firms with insufficient trades to permit reliable estimates of the firm's market microstructure properties. In particular, I omit any BHC quarter for which the stock had fewer than 100 trades, the average quoted spread exceeded 10 percent of the share price, or the average share price was less than $2. This procedure deletes approximately 20 observations per quarter. I also omit any firm's quarter in which the stock had a split or paid a stock dividend greater than 10 percent, because research suggests there are significant microstructure changes following a split (e.g. Desai et al., 1998). Following Baele et al. (2011), observations from banks with no trading activity for more than 20 percent of the trading days are excluded from the sample to reduce noise in the data. Infrequent trading makes price changes excessively volatile. Illiquid stocks have larger spreads, and small changes in demand can have a substantial impact on price, further distorting real price discovery. I also manually deleted BHCs that had the same data for all quarters but differed in the names in the Fed database, while they had the same PERMCO or CUSIP codes. I deleted 12 BHCs. In addition, I eliminate observations with missing, negative or zero values for total assets, and observations where the loans to assets ratio exceeds 100 percent. Observations that report zero equity capital are also removed. Approximately 50 observations are deleted per quarter. In addition, if the quoted spread is less than or equal to zero (*i.e.* the market is crossed or locked), the data point is excluded from the computation (403 observations are deleted).

[55] To obtain a CRSP identifier for each BHC in my sample I use the dataset prepared by the Federal Reserve Bank of New York (hereafter FRBNY) that links the BHC, bank identifier (RSSDID), and the The Center for Research in Security Prices (hereafter CRSP) identifier (PERMCO). The CRSP-FRB link data is available at http://www.newyorkfed.org/research/banking_research/datasets.html. In the section, where I analyze exposure to ABCP, opacity and systemic risk, I supplement the dataset with matches that I collected manually.

Subsequently, I replaced missing values for the guarantees with zero (around 20 observations per quarter).

This dataset is a departure from the previous studies in that I directly evaluate the effect of the credit and liquidity enhancements to own and third-party ABCP conduits resulting from new data available on the FED regulatory database. I have a dataset for 677 BHCs, of which 37 BHCs are exposed to ABCP.

In the third section of this essay, where I analyze the relationship between exposure to ABCP conduits, information opacity and systemic risk, I link the existing dataset with the systemic risk measures MES and SRISK. My choice of the BHCs' sample is based on the sample of BHCs in Brownlees and Engle (2012), who limit their sample to top financial institutions that played the major role in the recent financial turmoil. My sample consists of 37 BHCs, out of which 23 BHCs are exposed to ABCP via the guarantees that they extended to ABCP conduits.

3.5 Methodology

Following previous studies (e.g. Battaglia and Gallo, 2010), I use the fixed effect[56] panel regressions model with multiple specifications clustered at the BHC level to estimate the effect of the test variables on the information asymmetry.

The model specification is as follows:

$$\text{Info.Asymm}_{i,t=}\beta_i*(\text{ABCPguarantees})_{i,t} +\beta_j*(\text{ Controls})_{i,t} + q_{i,t} +v_{i,t} + \varepsilon_{i,t}, \quad (3.1)$$

where the dependent variable is information asymmetry (Info.Asymm*)*, $\text{ABCPguarantees}_{ijt}$ are guarantee types for individual banks, Controls_{it} is the vector of various bank characteristics, v_i are bank fixed effects, q_t are time dummies and ε_{it} is the bank specific error term.

Information asymmetry is proxied by the bid–ask spread (BAS): $BAS=|Bid-Ask|$, where bid–ask spread is measured as the difference between the highest ending ask and the lowest bid. I alternate this measure and use both quoted spread, which is the difference between the best ask price and best bid price, as well as a relative quoted spread which is the quoted spread scaled by the bid–ask midpoint. Other measures include the effective spread, which

[56] To test whether there is any correlation between the error term and the explanatory variables the Hausman specification test is carried out upon running the fixed effects and random effects regression models (Baltagi, 2008). The null hypothesis that random effects is the appropriated model is rejected. Therefore, a fixed effect model is chosen to control for unobserved time-invariant bank-specific effects. By including sponsor fixed effects, I control for time invariant unobservable sponsor characteristics.

is twice the absolute value of the difference between the trade price and the prevailing bid–ask midpoint, as well as the relative effective spread, which is the effective spread scaled by the quote midpoint.

I follow Erel et al. (2012) who use guarantees to ABCP conduits as indicators as to whether some banks were exposed to ABCP markets.[57] That is, following Erel et al. (2012), I use a dummy variable, named *guarantor* that is equal to 1 if bank is active in ABCP market, *i.e.* the maximum amount of its credit exposure arising from credit or liquidity enhancements provided to ABCP conduit structures is not zero in any quarter between 2001 and 2013. I also examine ABCP by using the absolute values of the guarantees. That is, the main independent variables are guarantees to ABCP (*i.e.* Credit Exposure own conduits and Credit Exposure other conduits to conduit structures in the form of standby letters of credit, subordinated securities: conduits sponsored by the bank, a bank affiliate or the bank's holding company and to conduits sponsored by other unrelated institutions. I also included Liquidity Exposure to own conduits and Liquidity Exposure to other conduits: liquidity provision to conduits sponsored by the bank, a bank affiliate or the bank's holding company and conduits sponsored by other unrelated institutions). This allows me to examine the differences between credit and liquidity guarantees, as well as to explore the differences between guarantees to conduits set up by BHCs themselves and to conduits set up by other BHCs.

The specification utilizes control variables such as BHCs' size, profitability, NPL, capital levels, following previous studies in this area. Controlling for size is important, for various reasons. For example, during 2013, the sample of stocks with market capitalization of less than $1 billion had much larger spreads than mid-cap stocks with market capitalizations ranging from $1 to $5 billion. In contrast, the smallest stocks have exceptionally large spreads. In addition, bank size can also relate to the information environment quality. Larger banks are usually more often followed by the analysts (O'Brien and Bhushan, 1990; Lang and Lundholm, 1996) and they have a richer information environment. As a result, they have lower information asymmetry. Also, larger banks are likely to have a lower stock volatility than smaller banks as noted by Baumann and Nier (2004). I also include trading volume (*Volume*) among the control variables in the opacity regressions, because higher trading

[57] Item BHCKB806 reports the maximum contractual credit exposure remaining for conduits sponsored by the bank or bank affiliate, and BHCKB807 reports the same information for conduits sponsored by other institutions. BHCKB808 reports the unused facilities for liquidity protection for conduits sponsored by the bank or affiliate, and BHCKB809 reports unused liquidity facilities for conduits sponsored by other institutions.

volume is likely to be associated with higher liquidity and lower information asymmetry. As for NPL, I include these as a measure of credit risk (Casu et al., 2013), because *NPL* are also likely to increase information asymmetry. Including NPL is also important in the second regression where I examine the volatility of returns. An increase in asset risk is likely to raise stock price volatility. In some specifications I also use an FDIC Texas ratio as a proxy for the overall troubled loans of the bank which are banks' non-performing assets (excluding government sponsored non-performing loans), divided by tangible common equity and loan loss reserves. I alternate control variable to observe whether this produces any changes in the main results. I also include the profitability measure (*ROA*), because more diversified banks (e.g. those that extend guarantees) are likely to be more profitable. In addition, I use a bank capital ratio, because capital is likely to affect information asymmetry, if for example better-capitalized banks are perceived as being more stable; and it is highly likely that their value will be less volatile. I also include stock return volatility because more volatile stocks are subject to more information asymmetry and disagreement among investors and analysts. Also, standard return volatility can be a proxy for idiosyncratic risk.

As for the endogeneity issues in the opacity and exposure to ABCP regressions (even though it is unlikely that BHCs would be choosing whether to be exposed to ABCP based on their bid–ask spread levels), I still choose to follow Stiroh (2006), Affinito and Tagliaferri (2010) and Casu et al. (2011) and have the explanatory variables lagged one period to relax possible causality problems.

In turn, I winsorize the independent and dependent variables at the 1 percent level to account for data errors and limit the effect of potential outliers. I also cluster error term at the BHC level to allow for correlation in the error terms within the BHCs.

I also examine the differences between the effect of liquidity and credit enhancements on opacity. Although the liquidity and credit guarantees provided essentially the same protection (Acharya et al., 2013), ex ante they were not equivalent (the capital requirements for the credit enhancements were higher). If I do not observe any difference on the effect of information opacity between various types of the guarantees, this will add to my hypothesis that investors may have been ignorant. Also, if I observe differences in the effect of ABCP guarantees on the bid–ask spread, I would expect that the guarantees provided to the third parties may increase information opacity more than the guarantees to conduits set up by the same BHCs' ABCP. Also, if there are significant differences between the impact on information opacity between credit and liquidity, enhancements would show whether

investors accounted for the possibility that their banks were exploiting the regulatory loophole before 2010.

Subsequently, I split time periods into before and after the crisis to account for the difference between the pre-crisis and after the crisis period. If financial crisis made investors more concerned about the prospects of their banks, it might show up in a more significant coefficient of the ABCP guarantees on opacity.

My dataset allows me to explore the link between exposure to ABCP, information opacity and BHCs' returns volatility. I expect to observe that opacity is negatively correlated with returns and positively with increased returns volatility.[58] Thus, I run fixed effect regressions with multiple specifications in the second part of the analysis, where the dependent variable is BHCs' stock returns volatility (I calculate standard deviation on stock returns as a measure of return volatility, following Nijskens and Wagner, 2011).

My basic specification is:

$$R_{it}=\alpha+\beta ABCPGuarantees_{ijt}+\gamma X_{it}+v_i+q_t+\varepsilon_{it} \qquad (3.2)$$

$$\sigma_{it}=\alpha+\beta ABCPGuarantees_{ijt}+\gamma X_{it}+v_t+q_t+\varepsilon_{it} \qquad (3.3)$$

where R_{it} are stock returns, and σ_{it} is stock returns volatility, $Guarantees_{ijt}$ are guarantee types for individual banks, X_{it} is the vector of various bank characteristics, v_{it} are bank fixed effects, $q_{i,t}$ are time dummies and ε_{it} is the bank specific error term. Stock returns volatility is calculated as the standard deviation of daily returns over the three-month period ending on the FR-9YC observation date.[59] Bank stock returns are quarterly stock returns, calculated for each bank by adding daily returns. To eliminate possible disturbances caused by dividend payments, stock splits and other capital actions, I use total return indices for individual stocks.

Subsequently, using the second dataset I examine whether exposure to ABCP had any effect on systemic risk:

$$MES_{it}=\alpha+\beta Guarantees_{ijt}+\gamma X_{it}+v_i+q_t+\varepsilon_{it} \qquad (3.4)$$

[58] Off-balance-sheet activities triggered a substantial increase in the volatility of banks' net operating revenue growth (Acharya et al., 2002; Stiroh, 2004, 2006; Stiroh and Rumble, 2006; Calmès and Liu, 2009; Calmès and Théoret, 2009; De Jonghe, 2009).

[59] Hansel and Krahnen (2007), Jiangli and Pritsker (2008) and Uhde and Michalak (2010) proxy market risk with equity betas. Baele et al. (2011) employ both, and Stiroh (2006) utilizes only volatility. Whereas betas measure the stock's exposure to the market's volatility, stock volatility measures total bank risk as observed by the market. This motivates my choice for equity volatility as the superior risk measure (Stiroh, 2006).

$$SRISK_{it}=\alpha+\beta Guarantees_{ijt}+\gamma X_{it}+v_i+q_t+\varepsilon_{it} \quad (3.5)$$

where MES_{it} and $SRISK_{it}$ are measures of systemic risk, $Guarantees_{ijt}$ are guarantee types for individual banks, X_{it} is the vector of various bank characteristics and ε_{it} is the bank specific error term. I also include information opacity in some of the systemic risk regressions to observe whether information opacity has exerted any effect on the systemic risk.

3.5 Summary Statistics

Summary statistics for main variables employed are reported in Table 3.1 and they are split into summary statistics for BHCs which are exposed to ABCP and which are not in Table 3.2.

The distinguishing features between BHCs that extend these guarantees and those

that do not are the following. In the first dataset, the average quarterly spread between lowest bid and highest ask is $3.6 for BHCs exposed to ABCP and $1.8 for BHCs not exposed to ABCP conduits. That is, univariate findings suggest that banks exposed to ABCP guarantees are significantly more opaque, which confirms my *ex ante* hypothesis.

The main difference between BHCs exposed and those not exposed to ABCP is the size, which has frequently been mentioned in the literature related to the recent financial crisis. I observe that banks that extended protection during the sample period are about 48 times larger than banks that did not.[60] However, not all of the biggest banks sponsored ABCP. For example, in my sample, neither SunTrust Banks, U.S. Bancorp, Washington Mutual Inc. or Wells Fargo & Company have sponsored any ABCP conduits. I also find that BHCs that extend ABCP guarantees are significantly more leveraged. They are also less capitalized. However, they are more liquid, have lower operating costs and are more profitable. In addition, they have lower credit risk. As for stock returns, ABCP guarantors have lower stock returns. I also observe that large banks tend to display higher levels of systemic risk (Figure 3.1 in Appendix 3). In addition, I find that the majority of BHCs that provided guarantees to conduits structured them in the form of the liquidity back-up lines to their own conduits with some systemically risky BHCs significantly providing more liquidity guarantees than credit enhancements.

[60] I include the variable size (millions) because the logarithmic transformation of the size variable distorts the real difference in asset value.

3.6 Results

3.6.1 Opacity

The relationship between the control variables and the bid–ask spread is in line with my expectations in Table 3.4. I find that both the credit exposure and liquidity provision to ABCP increase BHCs' opacity.

Also, I find that larger banks and banks with higher credit risk have higher bid–ask spreads. The finding that large banks are more opaque might be a little surprising because one would expect that large banks may be followed by more analysts or that large banks would disclose more information to the public. However, it seems that large banks were involved in many off-balance sheet operations that actually made those banks more difficult for investors to value. I find that large banks are also more opaque. Securitizing banks had a higher bid-ask spread, which is consistent with previous research that off-balance sheet activities are usually more opaque and are more difficult to monitor than on-balance sheet activities. Among other findings, I observe that banks with lower net operating revenue are also more opaque.

As for other findings, I find that loans do not increase opacity. Although such a result may be surprising at first glance, it becomes more intuitive once one thinks about the nature of banks' loans. Loans are in general homogeneous across banks and are relatively easy to monitor for outsiders, compared to off-balance sheet activities. In addition, I find that higher profitability and higher capital levels are associated with reduced opacity.

Overall, it seems that smaller bid–ask spreads can act as a positive signal because in my data sample it is the better capitalized and more profitable banks, and banks with lower credit risk which have lower level of information opacity.

When I split the sample into two periods—before and after the date when crisis erupted—I find that exposure to ABCP conduits increases information opacity only after the crisis and exerts no effect before the crisis (Table 3.5). That is, once investors became aware of the weakness of the ABCP market and lost confidence in it, they reacted swiftly to withhold further investments because they could not judge the risk of the conduits to which their banks were exposed through providing various guarantees.

In addition, I observe that while liquidity guarantees have been increasing information opacity both before and after the crisis, the credit guarantees increased bid–ask spreads only after the crisis erupted (Table 3.6). This is consistent with the hypothesis that investors were

not aware of all the risks to which banks were exposed when providing guarantees to ABCP conduits. That is, I find that after August 2007, both credit and liquidity guarantees to ABCP conduits had increased information opacity.

Another interesting finding is that banks that were more leveraged before the crisis also had lower spreads, while after the crisis a higher leverage ratio was associated with higher information opacity. The same result holds for banks with higher credit risk. A larger number of non-performing loans only exerted a positive impact on the bid–ask spread after August 2007.

3.6.2 Returns and volatility of returns

I do not observe that exposure to ABCP had any impact on the returns in the first data sample. However, when I run the same regressions using the second dataset, I find that *guarantor* is negative and statistically significant in column 2 and 6 of Table 3.7. That is, I do observe that banks exposed to ABCP conduits had lower returns. Furthermore, the result that exposure to ABCP conduits reduced returns is persistent even after I control for information opacity.

As for the volatility of returns, I observe that exposure to conduits had no significant effect on the volatility of returns in Table 3.8. I do observe however that liquidity guarantees exhibit a positive and statistically significant effect at 10 percent on the volatility of returns.

Among other findings, I observe that larger banks had lower volatility of returns. As for credit risk, results show banks with higher credit risk also had a higher volatility of returns. In addition, consistent with my ex ante hypothesis, my results show that higher information opacity is associated with a higher volatility of returns.

3.6.3 Systemic risk

I do not find evidence that exposure to ABCP increases systemic risk as measured by MES or by SRISK (Tables 3.9 and 3.10).[61] The variable *guarantor* has no effect on systemic risk. However, when I disaggregate guarantor into credit enhancements and liquidity provision to banks' own and third parties' conduits, I find that banks' exposure through liquidity guarantees to BHCs' own set up ABCP conduits increases MES, while liquidity guarantees to ABCP conduits set up by other banks decrease MES (Table 3.9 Column 3).

[61] Measures of systemic risk are in their embryonic stage. However, a mere look at the empirical papers reveals that researchers favor MES over SRISK. Thus, I present initial results using both MES and SRISK. However, later in the analysis, I use only MES as a measure of systemic risk.

The finding that the effect from liquidity provision to own versus liquidity provision to other conduits has the opposite sign is not very surprising because I expected to find significant differences between guarantees extended to own and third-party conduits based on the evidence in the existing literature. For example, Acharya et al. (2010) examine the differences between multi-seller conduits that invest primarily in their assets, originated by their own clients, or banks versus credit arbitrage conduits, which invest mainly in the assets securitized by the other banks and document that the crisis affected more severely conduits that bought other banks' assets. However, what is puzzling is that guarantees to own conduits increase systemic risk even more. I cannot offer any economic rationale for this finding.

Interestingly, when I include the bid–ask spread (*i.e.* Opacity) into the regression of MES on guarantees (Table 3.11 Column 3), the bid–ask spread or opacity is positive and statistically significant, whereas the magnitude of the coefficients on the guarantees decreased.

This is intuitive as it shows that the bid–ask spread captures some of the uncertainty stemming from the guarantees. Banks with more opacity are more difficult to monitor and they might be tempted to take more risk. It is also possible that some banks may deliberately create opacity to disguise some of their excessive risk taking or their increased interconnectedness with other financial institutions. This result is well accorded with the following agent's problem: opacity is valued by bank managers since it makes it more difficult to discipline staff and makes it more difficult to make their performance pay related.

In addition, I observe that banks with higher credit risk also had higher systemic risk in contrast to more profitable banks. That is, my results show that higher profitability significantly reduces MES, consistent with my predictions.

In turn, I find that larger banks have higher systemic risk, the results being statistically and economically significant. This aligns well with the most recent evidence that large financial institutions pose greatest risk for the finance industry. The size effect, however, is not robust across all my specifications. The effect of the size related variables may not be significant given that size is my primary criterion for sample selection in the second dataset; *i.e.* in my systemic risk dataset all the BHCs are large.

The results also show that information opacity increased not only the volatility of returns (Table 3.8), but it also systemic risk (Table 3.11). Among other results in Table 3.11, for instance, I do not find that banks with a higher capital level ratio have lower MES. This would be intuitive to expect, as higher capital levels reduce system-wide fragility due to

capital acting as a potential buffer in absorbing liquidity, information and economic shocks (Demirgüc-Kunt and Angiger, 2014).

3.7 Robustness Tests

I use other measures for the opacity, namely effective spread, quoted spread and the natural logarithm of the average bid–ask spread (Anderson et al., 2009), which are reported as Opacity 1, Opacity 2 and Opacity 3 respectively in the Table 3.12. My main results remain mostly unchanged.

I also alternate other control variables. For example, instead of a size variable, I use the log of market value (the market capital is share price multiplied by the number of ordinary shares in an issue).[62] I also include liquidity in the explanatory variables, because the decreased liquidity of bank assets might increase banking instability and the externalities associated with banking failures as shown in Wagner (2007). Varying control variables has not resulted in any significant change in my main results.

To further test the robustness of my empirical findings, I reran my analysis using a smaller sample of banks with non-zero guarantees (Table 3.14). I focus on this sub-sample, because this is a more homogenous sample that allows me to further investigate the effect of the magnitude of credit enhancements and liquidity provision on banks' opacity, while holding the decision to be exposed to ABCP constant (as in Cheng et al., 2008).

The main results discussed previously remain unchanged. Exposure to ABCP conduits significantly increases information opacity and decreases returns (Column 1 and 2 in Table 3.14). However, it has no effect on returns volatility (Column 4 in Table 3.14).

3.8 Conclusion

Understanding the ABCP market is important to fully understand the recent financial crisis, because financial institutions, even with credible deposit insurance systems in place, are subject to runs via the ABCP programs (Gorton, 2007). The recent financial crisis was a great manifesto of how financial engineering made it virtually impossible to assess all off-balance sheet risk to which BHCs were exposed. It also showed how government may be exposed to runs via off-balance sheet ABCP conduits because these conduits are supported by the banks that have access to the government safety net.

[62] This is a standard variable for the size of the firm in the finance (e.g. Ferreira and Laux, 2007; Rodriguez-Moreno and Pena, 2012) and accounting literature (e.g. Bhen et al., 2008).

Research on the relationship between the complexity of economic transactions and investors' understanding of these transactions remains limited. The evidence on costs (e.g. opacity, lower returns, higher returns volatility, increase in systemic risk) and benefits (e.g. capital arbitrage, diversification) from engaging in off-balance sheet activities is not conclusive.

My study shows that, in the U.S. BHCs that were exposed to ABCP conduits, were perceived by investors as more opaque than BHCs that did not participate in the ABCP market. In particular, my results show that investors realized the risk of ABCP after the crisis started in August 2007, which before the crisis they had regarded as a very liquid and low risk security. This then prompted a general run on all conduits and may have brought down conduits that might have continued had investors had a clear understanding of each conduit's asset composition and quality. This resulted from a lack of transparency in the ABCP structure that prevented investors from differentiating among ABCP conduits.

Apart from the intensifying information asymmetry among market participants, exposure to ABCP conduits also decreased the returns of exposed BHCs. I also find that it was mainly exposure through liquidity provision that increased the volatility of returns. As for the systemic risk, I do not observe that exposure to ABCP through the guarantees would have significantly increased systemic risk. Information opacity, however, is positively correlated with systemic risk. This finding benefits practitioners and legislators who call for improvements in BHCs' information transparency of BHCs. The increase in transparency is a desired policy for enhancing the efficiency of the financial system, i.e. eliminating unwanted by-products of financial innovation. In addition, I distinguish between the pre-crisis and post-crisis period. I find that exposure to ABCP conduits had no effect on information opacity before August 2007, however, it had a statistically significant effect after the crisis, showing that investors could have been ignorant about the exposure of their banks before the crisis; but when the crisis erupted, they had become more aware about the riskiness that ABCP conduits posed to their BHCs which supported these ABCP programs, especially by providing liquidity lines.

An important policy implication that stems from my results is that bank regulators and policymakers should develop risk reporting standards that contribute to a more transparent information environment for market participants. Banks' trading activities need to be better regulated, banks' risk taking requires additional screening and better disclosure. Greater information transparency is likely to have a positive impact on market discipline, which may further help to reduce bank failures.

Although I document that banks exposed to ABCP conduits were subject to greater information opacity, it is obvious that this is not a dichotomous yes-no issue. Securitization transactions can certainly vary significantly from each other with respect to the degree of subordination of ABS retained by an issuer on its balance sheet, the volume of ABS retained by an issuer, contractual recourse obligations (*i.e.*, explicit recourse) and voluntary financial support of securitizations (*i.e.*, implicit recourse). Also, my empirical analysis does not allow me to determine the exact source of information uncertainty. I cannot determine whether the increased opacity is the result of an increase in the inherent difficulty of assessing changes in banks' risk caused by exposure to ABCP or is the result of insufficient disclosure about the impact of retained interests on banks' financial risk. How market participants assess the implications of inherently complex economic transactions is a venue for future research.

To conclude, I attempted to close the gap showing that the Modigliani-Miller style equivalence between BHCs exposed to ABCP and those not exposed to ABCP may hold: banks that set up ABCP conduits might have benefited from the regulatory capital relief associated with moving assets off balance sheet and from providing financing alternatives for their clients. However, setting up the ABCP conduits was also costly because the exposure to conduits increased information opacity, which in turn increased BHCs' systemic risk.

Chapter 4

Breaking up Big Banks

4.1 Introduction

The evolution of U.S. financial legislation reflects a long-running public debate about the appropriate size and scope of banking firms. As noted in Barth et al. (2012), financial institutions have been continuously growing in size. The assets of the top 50 companies in 2011 were roughly equal to total U.S. GDP, which represents about a four-fold increase in four decades. In the fourth quarter of 2011, the combined assets of the five biggest companies totaled about 60 percent of U.S. GDP. By contrast, in 1970 the corresponding figure was only 10 percent. For the top ten companies, the figures increased from 14 percent to 75 percent.[63]

The striking growth in size and importance of BHCs subsidiaries dates back almost entirely to the period after the passage of the Gramm–Leach–Bliley Act 1999, allowing the banks to engage in a broad range of financial activities in various states, including securities underwriting and dealing, insurance underwriting, and merchant banking activities, all of which led to intensified competition in the banking industry. Banks have also faced increased competition in wholesale markets, due to increasingly deeper and more efficient financial markets (e.g., high-yield commercial debt, CP, equity finance) which have provided banks' business customers with alternatives to traditional bank loans.

Well-managed banks responded to these competitive pressures by becoming more cost efficient and more revenue-efficient, which aligns well with the classic economic theory that suggests that when banks grow in size, there might be a significant number of benefits accompanying such expansion, for example, increasing economies of scale and an increase in the banks' bargaining power. This includes offering customers a wider range of new nontraditional fee-based products, selling increased amounts of existing fee-based products, pricing fee-based products more efficiently, improving the quality of fee-based products and services and minimizing costs by reducing the number of employees and introducing new technologies.

[63] A historic perspective on "too big to fail" is provided in Barth et al. (2012)

There has been a secular trend in recent decades toward enlarging and contracting the allowable scope of BHC activities. In general, it seems that contraction in banking activities usually follows major crises, and expansion is favored in boom years. It is axiomatic to assert that the past couple of years after August 2007 were not the finest or easiest to the banks. For example, since the recent financial crisis there have been several proposals to impose caps on bank size and limit the scope of banking activities, such as the "Volcker rule" provisions of the Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd–Frank Act) in the U.S. prohibiting BHCs from engaging in proprietary trading and limiting their investments in hedge funds, private equity and related vehicles. In particular, the recent financial crisis has brought forward concerns about banks that regulators deem "too big to fail" in the sense that their failure would pose serious systemic risks, which has prompted calls for regulatory limits on bank size (Reich, 2008; O'Driscoll, 2009). A Brussels proposal that attempts to break up big banks and hive off risky activities has recently been agreed by E.U. finance ministers (excluding the U.K.) as of June, 2015)). This has produced much discussion.

Recent petitions to break up "too-big-to fail" banks and pass new laws similar to the last century's Glass-Steagall Act have come in various shapes and flavors.[64] For example, Johnson and Kwak (2010: 214) argue that "*no financial institution [s]hould be allowed to control or have an ownership interest in assets worth more than a fixed percentage of U.S. GDP*" (they propose a 4 percent ownership ratio). Others suggest various alternatives including levies or progressively higher capital requirements on large banking firms to encourage them to shed assets. Big banks oppose efforts to break them up, reasoning that their larger size makes them more efficient. Also, the treatment of large banks as "too big to fail" could generate scale economies by lowering the risk premiums demanded by creditors of large banks, thereby giving them a funding advantage over smaller banks.

The assessment of the extent of scale economies is important for a full analysis of the costs and benefits of any policy intervention to limit the size of banks. Policymakers should consider the loss of any scale benefits when determining the net benefit of limiting the size of banks. Although bankers often claim that banks can lower costs by expanding in size,

[64] For example, E. Warren's calls on Congress to break up the big banks: "U.S. Senator Elizabeth Warren on Wednesday called on lawmakers to break up big banks and change tax rules that benefit Wall Street. She said lawmakers should break big down and limit the U.S. Federal Reserve's ability to lend in a crisis so that big institutions cannot count on a bailout" (Reuters, April 15, 2015).

many policymakers and academics remain skeptical (e.g. Stern and Feldman, 2009; Greenspan, 2010; Haldane, 2010).

A frequently mentioned rationale for splitting large banks is that larger banks can enjoy cheaper insurance premiums disconnected from their actual risk levels, and implicit government insurance, since government cannot allow huge banks to collapse. This means they can essentially gamble for resurrection and expect to be bailed out if things go wrong. That is, it is possible that operating costs are no lower in big banks, but simply that large banks benefit from implicit guarantees. However, it may be the case BHCs become more efficient as they grow in size and subsequently can reduce their operating costs which will have a positive effect on a wider society and bank fees decrease, consistent with the classic economic theory. In that case, government-mandated size limits are likely to be a deadweight loss and constitute an unnecessary or even unfair form of intervention in financial markets.

In this chapter, I focus primarily on the costs which banks control internally. Thus, as far as banks' operating costs are concerned, it is true that while banks cannot generally choose what regulations to comply with, as these are most often exogenous, they are free to choose their operating costs. I examine questions such as whether banks obtain more bargaining power as they grow in size and thereby can reduce their operating costs, or whether some costs increase proportionally with size or perhaps some costs grow more rapidly than the growth of banks' assets. For example in Chapter 3, there exists some empirical evidence that size is positively correlated with opacity, and for that reason many of the banks' costs might rise (e.g. audit, legal fees, FDIC premiums) as it is more difficult to evaluate banks' exposure to various risks. On the other hand, postage and IT costs can decrease, as these may constitute monthly fixed costs which when spread over a larger sized entity will increase operating revenue or alternatively decrease efficiency ratios. This is important because banks typically pass on these costs to customers or shareholders.

The recent financial crisis has not been solely an economic phenomenon, but a legal one as well. It has brought to light much of banks' wrongdoing. A frequently mentioned but perhaps less pronounced feature of big banks is that for a long time they have been shielded from legal responsibility for their misconduct. As noted by some leading U.S. judges, some banks have become "too big to jail" (Rogoff, 2016). Term "too big to jail" was coined to describe the theory that certain financial institutions, even if they engage in criminal misconduct, should be considered immune from prosecution due to their sheer size and their influence on the economy. A mere look at the levels of the recent tsunami of legal settlements shows why politicians have been as active as ever in trying to break up big banks and

eliminate the incentive for banks to become simultaneously "too big to fail" and "too big to jail". [65]

Litigation risk has been of paramount importance, especially after the mounting charges and litigation settlements related in particular to market manipulation litigation, U.S. mortgage-related issues, product mis-selling litigation, tax evasion litigation, U.S. embargo issues, misrepresentation litigation, and company-specific issues. The penalties for such behavior are sobering. For example, since 2009 litigation costs have grown four years in a row, and banks on both sides of the Atlantic have paid out a total of $178 billion in litigation costs; banks' legal bills have also swelled with them (WSJ, 2014). During the first nine months of 2014, banks in the U.S. and the E.U. paid out $60 billion to settle legal claims. That was up from $46 billion in 2013, $44 billion in 2012 and $22 billion in 2011, as noted in the most recent research by Boston Consulting Group (BCG) and references in FT (2015). Even though U.S. banks have settled the bulk of claims arising from pre-crisis mortgages, BCG predicts that potential litigation risks remain substantial. For example, as of 2014 JPMorgan Chase said that it was involved in legal proceedings on more than 20 fronts, including investigation by the U.S. Department of Justice (DoJ) into whether the bank bought car loans that had been priced according to the race and ethnicity of the borrower.

The exact litigation costs vary based on data sources. For example, a British study came up with higher figures. According to the U.K. based CCP Research Foundation, the total post-crisis litigation cost aimed at the biggest global banks since 2010 hit $300 billion over a five-year rolling period (FT, 2015). Differences may come from various estimation techniques in quantifying losses, such as foregone profits or clients' attrition, the order to keep higher capital requirements or the prohibition from involvement in some type of lending business; or damage to a bank's reputation[66] might constitute another form of penalty (*i.e.* the regulatory actions do not have to be material).

Much of post-crisis litigation was mortgage related. For example, from 2010 through the end of third-quarter 2013, together the six "too big to fail" and "too big to jail" banks paid $85.75 billion in credit and mortgage-related settlement costs. Bank of America paid out

[65] Elaborate discussion on litigation issues are provided in 'Litigation Handbook' prepared by OCC, available at http:// www.occ.gov/publications/publications-by-type/comptrollers-handbook/pub-ch-m-litigation-and-other-legal- matters.pdf.

[66] Reputational risk is the potential that negative publicity regarding an institution's business practices, whether true or not, will cause a decline in the customer base, incur costly litigation, or revenue reductions. (SR 95-51). For instance, the "reputational penalty" is estimated to be 7.5 times the total amount of penalties imposed by the U.S. Securities and Exchange Commission on the 585 firms subject to enforcement actions for financial misrepresentation between 1978 and 2002, as noted in Karpoff, et al. (2008).

$43.9 billion; JPMorgan Chase paid out $26.4 billion; Wells Fargo paid out $9.5 billion; Citigroup paid out $4.7 billion; Goldman Sachs paid out $920 million; and Morgan Stanley paid out over $329 million. In addition to settlement monies, since 2008 the six banks have also had to repurchase ("buyback") $98.9 billion worth of bad mortgages they stuffed into collapsed mortgage-backed securities they sold to investors around the globe (SEC, 2015). However, these elements of the credit crisis and mortgage-related settlements are not the only measure of banks' misbehavior.

Reasons for other large recent fines include e.g. the manipulation of foreign-exchange markets. Bank of America paid $250 million to the OCC and has also agreed to pay $180 million to settle a lawsuit by private investors who accused the bank and others of manipulating foreign-exchange rates. In turn, Citigroup and J.P. Morgan paid more than $1 billion each in fines to various regulators. Bank of America is the third bank to settle investor claims related to the $5.3 trillion-a-day currency market. JPMorgan Chase & Co settled for $99.5 million in January, and Switzerland's UBS AG settled for $135 million in March. Another example of fines with U.S. regulators includes HSBC which settled a deferred prosecution agreement with the U.S. DoJ for $1.9 billion after the British bank facilitated money laundering. The amount included $655 million in civil penalties and $1.25 billion forfeiture, approved in July 2013. This has been the largest penalty placed on a bank for violating Bank Secrecy Act (hereafter BSA). A majority of sources (e.g. WSJ, FT) document that the majority of costs originate with U.S. regulators' legal claims; typically banks in the U.S. face much higher costs compared to other countries and occurrences of banks suing each other is more rare.

So far, it has been noted that the largest banks are balancing the risk of paying penalties while generating significant revenue from such wrongdoing. A glance at the frequency of litigation settlements (Table 4.2a and Table 4.3a in Appendix 4) may supports the notion that fines do not act as efficient deterrents against engaging in financial misconduct. Therefore, in the U.S. in particular, the regulatory authorities have increased their appetite to pursue litigation against banks.

Litigation risk is of interest on its own. Litigation risk is different from other risks that banks may face. What distinguishes litigation risk from most other risks is that litigants lack a mechanism to dispose of litigation risk (Molot, 2009). Virtually any other risk that a business faces can be spread out or eliminated via the market by purchasing some form of insurance. Also, if a new business line is too costly or risky for a bank to pursue on its own, it can find a larger partner and undertake a joint venture, or it can raise capital for the project

through public or private markets, in the form of debt or equity. When it comes to litigation risk, however, a bank that is sued is generally stuck with this risk. Insurance companies do not sell after-the-event insurance policies for lawsuits that have already been filed and there does not exist a market in which litigants can trade away litigation risk. Neither the legal profession, nor the insurance industry or the capital markets have yet found a way to relieve litigants of risk. The Federal Deposit Insurance Corp. (FDIC) said that a $4.4 billion increase in legal expenses for a small number of large banks was the key factor in a 7 percent drop in the banking sector's earnings for the fourth quarter of 2014. FDIC-insured commercial banks and savings institutions reported aggregate net income of $36.9 billion in the quarter, which was down $2.9 billion from earnings of $39.8 billion for the same quarter in 2013, mostly due to the rise in litigation costs at the large banks, according to a statement.

The motivation, contribution, originality and value of my study are the following. As for the contribution, I examine in detail BHCs' operating costs. Given the mixed findings of previous studies on the economies of scale in the banking industry, I analyze "too big to fail" BHCs in the U.S. from the perspective of the economies of scale from 2001:Q2 to 2014:Q1. I explore this issue using a much larger universe of banks than that of the existing study by the Clearing House (CH, 2011) on the banks' economies of scale. My sample is around two hundred times larger than that of CH and I use publicly available data from audited regulatory filings, as opposed to the proprietary internal management information used by the CH. I examine the extra costs citizens or shareholders will have to face if banks are broken into smaller banks and whether these costs are passed directly to bank customers or are translated into reduced firm value for shareholders. My choice is motivated by the paramount interest in the recent financial press in banks' incentive to grow in size, in litigation risk, in marketing expenses and the consequences from the newly cooked regulations that will affect "too big to fail", "too big to jail" banks and their expenses.

I also provide some fresh evidence on litigation charges. I compile a novel dataset on 341 litigation charges, which to the best of my knowledge has not been used in any previous studies. It has been a significant effort to collect and classify expenses and I was the first to focus on banks' litigation expenses. Thus, I am not are aware of any study which focuses on the characteristics of the banks and their litigation charges. This is surprising, given that the costs of litigation are colossal, especially once aggregated across the industry. More generally, my research also has implications for the literature on systemic risk. I test whether systemically more risky banks are also more likely to be involved in alleged financial wrongdoing. I also examine whether alleged financial wrongdoing is cyclical. I also shed

light on the banks' advertising and marketing expenses (AME). I examine whether AME are also cyclical. I analyze these three topics separately and then I discuss them jointly because they are interrelated.

The purpose of this chapter is threefold. Section 4.2 presents an overview of the related literature on the economies of scale in the financial sector. It mainly focuses on the scale of economies from the perspective of banks' operating costs. Then it presents the evidence on "too big to jail" and issues related to litigation. Subsequently, it touches on marketing expenses. It sheds light on bank marketing expenses and their impact on BHCs' stock prices and profitability. Data, methodology and summary statistics are discussed in Section 4.3 and 4.4. Section 4.5 discusses the results. Finally, robustness checks and conclusion are presented in Section 4.6 and 4.7, respectively.

Before proceeding, one caveats is in order. First, I do not want to overstate my ambitions. In the litigation part of this chapter, my aim is to invite more discussion and provide avenues for future research in the area of banking litigation, as more data become available.

4.2 Related Literature

4.2.1 Economies of scale and "too big to fail"

Economies of scale permit larger firms to produce their products and provide their services at lower average costs per unit than smaller firms (Shepherd, 1979). That is, as firms produce more, they spread fixed input costs over a larger quantity of output, thus lowering per unit average costs. This ability to manufacture products and to provide services at a lower average cost should translate directly into higher profits, while also possibly creating significant barriers to entry into any industry in which economies of scale are present, as noted in Bain (1954).

Advantages associated with increasing scale can be gained from a variety of factors (Scherer, 1980). For example, at the product or service level, expanding firms can invest in specialized and more efficient equipment, machinery, and technology, which lower per unit production costs. Firms also have incentives to further improve the speed and efficiency of these resources, and engage in efforts that further enhance the efficiency of their production processes and increase output. Increasing output also allows employees to specialize in their tasks and gain proficiency; as a result, increasing scale also produces experience or learning effects, which have been found to exist in nearly all industry settings (Wright, 1936; Asher, 1956; Shepherd, 1979; Rosenberg, 1982).

Overall, studies on economies of scale in the banking industry produced mixed findings. Studies have confirmed the existence of economies of scale and diseconomies of scale. The earliest studies of scale economies in the banking industry, estimated during an era when U.S. banking organizations were on average much smaller than today, found evidence of modest economies of scale. For example, Mitchell and Onvural (1996) document that increasing levels of production in large banks is usually cost efficient; but they also found that there is relatively little to gain by increasing the scale of production. Thus, their study provides additional confirmation that the minimum efficient scale can be achieved in relatively modest-sized banks and that the average cost curve for most banking institutions is relatively flat. In contrast, in a study of commercial banks and savings and loan associations, using data from the 1960s, Benston (1972) found consistent economies of scale, indicating that larger banks and financial institutions enjoy significant cost advantages. Kim (1986) found that credit unions exhibit modest economies of scale, especially in their mortgage lending and investment activities. In an extensive review of the literature on economies of scale in financial institutions published prior to 1988 Clark (1988) concludes that smaller financial firms may be at a cost disadvantage compared to larger, more diversified banking firms. Others, using more flexible cost functions, found that these scale economies were only limited to small banks (Benston et al., 1982; Berger and Humphrey, 1991,1992; Peristiani, 1997), which would support the idea of breaking up big banks.

A number of studies, however, find evidence of scale economies even among the largest banking firms Feng and Serletis, 2010; Wheelock and Wilson, 2012; Hughes and Mester, 2013). These findings, in contrast to the previous evidence, oppose limits on the size of banks that would undercut economies of scale in banking.

The first systematic effort to examine and quantify the benefits that large banks provide to consumers, companies, and governments, as well as the U.S. economy as a whole is that by the Clearing House (CH, 2011). This study, which relies on proprietary data from a relatively low number of institutions, documents that large U.S. banks provide benefits for companies, consumers, and governments totaling an estimated $50 billion to $110 billion annually. Banks larger than $500 billion provide over half of the total benefit. It is also noted in the CH report that large banks spur innovation and economic growth, which could not be achieved if big banks were broken into smaller entities. For example, as noted in CH (2011), sophisticated and costly IT platforms allow large banks to provide global reporting and

compliance, helping investors monitor and analyze their positions. However, this innovation may also lead to costly future litigation.

Smaller banks could not generate the volumes needed to make worthwhile the investment necessary to develop such reporting systems and global compliance expertise. Dedicated platforms and broad regulatory experience allow large custodians to undertake these activities much more efficiently and expertly than even large customers might on their own. This study estimates total annual benefits from large banks spreading innovation to be around $15 billion to $30 billion. CH analysis estimates that aggregate benefits from online bill payment, debit cards, credit cards, wire transfers, automated clearing house, check processing, and trade processing economies of scale associated with these seven services are $10 billion to $25 billion per year. This is not surprising. Many innovations require a large customer base to succeed, which is either impossible to achieve for small banks or will require many small banks to act together to capture the benefits of innovation.[67]

Furthermore, as noted in several Uniform Bank Performance Reports (hereafter UBPR),[68] large banks tend to have lower efficiency ratios (*i.e.* banks are more efficient) because they generate more non-interest income compared to smaller banks. It is also noted that cost efficiencies are usually the underlying rationale for mergers and acquisitions. Costs savings in personnel expenses, occupancy expense, goodwill impairment, intangible amortization and other expenses are the main drivers of bank mergers and acquisitions. However, large banks are also perceived as having deep pockets and therefore attract greater levels of litigation[69].

In contrast to studies that find positive effects stemming from banks as they grow in size, many studies have concluded that expanding banks will eventually reach a point where average costs stop decreasing and start to increase. Benston et al. (1982) modeled a translog cost function to estimate U-shaped average cost curves, and their analysis found that the largest banks face significant diseconomies of scale. In a comparable study, Clark (1996) concluded that the average cost curve for banks is relatively flat with diseconomies of scale found only among the smallest and largest banks. Clark (1996) also notes that a lower efficiency ratio would generate higher ROA. In other words, the more efficient banks are

[67] Innovations include: ATMs, Online bill pay, DealerTrack, Fraud prevention, ACH, Wire, Check imaging.
[68] UBPR reports were retrieved from http://www.ffiec.gov/ubpr.htm on June 6, 2015.
[69] Author is grateful to Prof. Simon Wolfe for raising this comment.

not necessarily more profitable, because banks' concentration on reducing costs may actually contribute to poor investment decisions and increased risk taking.

As far as other reasons behind banks' operating costs are concerned, it has also been frequently mentioned in the literature that firms are operating inside their production possibilities frontier because of agency conflicts, management problems, or other inefficiencies, so-called X-inefficiencies[70] (Berger and Humphrey, 1991; Berger et al., 1993).

Overall, from around 220 articles[71] discussing large banks, 47 percent discuss the risk of large banks, 21 percent focus on the market effects, 12 percent examine the internal efficiencies of large banks (including economies of scale) and the remaining 20 percent focus on the scope of products and services. As for the views on costs versus benefits 71 percent of the studies on risk hold a view that large banks are more risky with the remaining 29 percent claiming the opposite. As for the internal efficiencies, 52 percent of the studies find negative effects stemming from the larger size of the banks, while 48 percent find that as banks grow in size they are actually becoming more internally efficient. As for scope, approximately 88 percent of the studies analyzed find large benefits to the general economy stemming from large banks. Large banks provide a broad set of products and services that smaller banks cannot provide at all, or at least cannot provide in an equally integrated and comprehensive manner.

In conclusion, the literature provides mixed evidence on the relationship between bank size and the various aspects of bank performance. Broader economic consequences of imposing caps on bank size are also not clear.

4.2.2 Litigation overview

There is a relative scarcity of economic studies on litigation settlements in the banking industry. The majority of existing literature focuses on market reaction to the announcement of the litigation charges, providing mixed findings. Another strand of the literature focuses on corporate governance of the banks that have faced litigation charges (e.g. board independence or the characteristics of CEOs of those banks). The lack of studies is primarily because data on litigation settlements have been confidential for a relatively long time. In

[70] The concept of X-inefficiency was introduced by Harvey Leibenstein (1966).

[71] These 220 academic articles are relevant articles from the past three years published in a selection of top economics and finance journals and articles cited in FSOC report and the Independent Commission on Banking: Vickers Report (2011).

what follows, I present an overview on bank enforcement actions and several facts from recent industry publications and the financial press.

Enforcement actions can take one of two forms: (1) informal understandings between banks and their supervisors; (2) more formal actions, which are enforceable in the courts. Prior to 1989, however, the public never learned about the vast majority of enforcement actions, with which supervisors used to bring banks into compliance with consumer regulations and safety and soundness standards. In 1989, despite objections from various supervisory agencies in the US, Congress mandated disclosure of the most serious formal actions, cease-and-desist orders. Soon after, the Congress expanded disclosure requirements, directing that the public be notified about all formal enforcement actions.

For example, the Securities and Exchange Commission (hereafter SEC) did require depository institutions, with publicly traded stock, to disclose enforcement actions deemed "material." In addition, the Office of the Comptroller of the Currency (hereafter OCC)—on a limited, case-by-case basis—disclosed the facts surrounding its enforcement actions (Combating Fraud, Abuse, and Misconduct in the Nation's Financial Institutions (OCC, 1989). The Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) and the Crime Control Act of 1990 required supervisory agencies for the first time to publicly disclose final, formal enforcement actions as well as any modifications or terminations of the actions (Gilbert and Vaughan, 2001). In the debate over FIRREA, the House of Representatives questioned the secrecy about enforcement actions, noting that bank supervisors were alone among federal regulators in keeping civil enforcement actions confidential (FIRREA 1989: 470). The House also asserted that confidentiality served only to perpetuate banker misconduct and exacerbate the problems of troubled institutions. Disclosure, in contrast, would inform taxpayers about the effectiveness of the bank regulatory system, warn depository institutions about the types of conduct that would not be tolerated and the financial community about particular problem banks (OCC, 1989).[72] It is also supposed to strengthen market discipline because an announcement that a supervisor had imposed a formal action warns depositors that serious regulatory compliance or safety and soundness issues exist in the affected institution. That is, from 1990 onwards supervisors have begun to announce publicly the imposition of formal enforcement actions.

[72] A concise summary of financial firms' litigation matters is available at http://www.occ.gov/publications/publications-by-type/comptrollers-handbook/pub-ch-m-litigation-and-other-legal-matters.pdf.

The changes in 1990 in publicly announcing enforcement actions provides a quasi-experimental setting to test whether putting confidential supervisory information in the public domain will spark bank runs or whether it will enhance depositor discipline. Gilbert and Vaughan (2001) measure depositor reaction to 87 Federal Reserve announcements of enforcement actions. They compare deposit growth rates and yield spreads before and after the announcements at the sample banks and a control group of peer banks. Their findings do not show any evidence of unusual deposit withdrawals or spread increases at the sample banks following the announcements of enforcement actions. These results suggest that depositors were not sensitive to enforcement actions, nor did they alter their behavior when formal actions were announced.

In contrast, Cummins et al. (2006) show in their analysis, which covers all publicly reported banking and insurance operational risk events which affected a total of 403 bank and 89 insurance company events in the U.S. from 1978 to 2003, and which caused operational losses of at least $10 million, a strong, statistically significant negative stock price reaction to announcements of operational loss events. Other studies also reveal that operational loss events have a strong, statistically significant negative stock price impact on announcing firms (Cummins et al., 2005; Perry and de Fontnouvelle, 2005).

My study relates partly to recent research on personal liability for financial misconduct, as well as the effects of misconduct on CEO compensation and on the determinants and economics of corporate misconduct.

For example, Karpoff et al. (2008) examine the fortunes of all 2,206 individuals identified as responsible parties for all 788 SEC and DoJ enforcement actions for financial misrepresentation from January 1, 1978 through September 30, 2006. They report that 93 percent lost their jobs by the end of the regulatory enforcement period. Most were certainly fired. The likelihood of redundancies increases with the cost of the misconduct to shareholders and the quality of the firm's governance. This is motivated by prior research which shows that firm shareholders endure large losses when their firms are accused of misconduct; but there is little evidence on whether the individual perpetrators suffer direct financial costs for the damages they caused.

As for the factors related to the propensity to engage in financial misconduct, extant literature has pointed to a lack of monitoring by the board (Beasley, 1996; Agrawal and Chadha, 2005; Chidambaran et al., 2012; Hegde and Zhou, 2014; Khanna et al., 2014) outside investors (Wang et al., 2010), or various other parties (Dyck et al., 2010; Kedia and Rajgopal, 2011). Hence, the literature primarily studies litigation and fraud from the

perspective of corporate governance on the role and design of corporate boards (e.g., Adams et al., 2010; Coles et al., 2012, 2014; Field et al. 2013; Minton et al., 2014; Hagendorff et al., 2015a, 2015b). My study is also partly related to the studies on governance and risk taking in the banking industry (Beltratti and Stulz, 2012; Adams and Ragunathan, 2013; Ellul and Yerramilli, 2013; Minton et al., 2014). Relative to other bank risk measures studied in the literature, enforcement actions provide a suitable identification of the effectiveness of internal governance. This is because enforcement actions provide an unambiguous external indicator of undesirable conduct in the industry.

A number of studies link fraud to the compensation of executives (e.g., Johnson et al., 2009). The often-mentioned misconduct by CEOs documented in the literature has been manipulating short-term performance to enjoy higher payouts. Persons (2006), who examines the impact of fraud and lawsuit revelations on U.S. top executive turnover and compensation, shows that out of all financial firms involved in fraud only a small number reduced their executive cash compensation and only a tiny percentage changed their top executives.

Apart from questions related to financial misconduct and whether the bank board matters for firm outcomes, it was misconduct in the mortgage markets that received much attention following the recent financial crisis, primarily in the legal literature, and to a lesser extent in the financial literature. Much of the literature examines the main legal issues that will play an important role in the extensive litigation in the residential mortgage market including a) the Rule 10b-5 class-action lawsuits that have already been filed against the banks pending the Employee Retirement Income Security Act (1974) (ERISA) litigation, b) the causes-of-action available to mortgage-backed security (hereafter MBS) and collateralized debt obligation (CDO) purchasers, and c) litigation against the rating agencies (see Bethel et al., 2008).

In contrast to the existing literature, my key question is the following. Which observable bank characteristics, are most closely correlated with bank propensity to face litigation? In particular, I analyze “too big to jail” issue and whether it is observed in the data that large banks were more often involved in financial misconduct and whether litigation charges had any impact on the banks’ probability of insolvency. Certainly, the quality of the board is the missing variable in my analysis, but I hope to capture this omitted variable by including fixed effects in my regressions.

Some evidence points to the fact that until recently the federal government shielded big banks from criminal prosecution. The government was concerned that convictions may

damage the financial system. One of the top Federal Reserve officials explicitly acknowledged this practice, which was long denied by the Obama administration.[73] Both Republican and Democratic lawmakers have long suspected that federal prosecutors did not pursue guilty pleas because they were afraid of the consequences, *i.e.* that the potential unraveling of a giant bank would endanger the global economy. For example, in 2012 the U.S. Attorney General Eric Holder posited that it becomes difficult for the DoJ to prosecute financial institutions that have become so large that criminal charges would "*have a negative impact on the national economy, perhaps even the world economy*." Certain charges, such as money laundering, could potentially cut a bank off from existing pools of investors such as pension funds and ultimately cost the bank its charter to operate in the United States. Holder's testimony sparked criticism that just as the federal government had deemed some banks "too big to fail" during the financial crisis, so too had the DoJ determined that some banks were "too big to jail." Holder later denied his previous comments after a public outcry in March 2013. Another statement: "*We were not willing to find those firms guilty before, because we were worried that if we found them guilty, that could somehow potentially destabilize the financial system*," was made by the president of Federal Reserve Bank of New York William Dudley.[74] For that reason, it has been reported that corporations are sometimes able to agree with the Department of Justice (hereafter DoJ) to have an offshore entity take the hit and enter the guilty plea. Such was the case in 2012, when UBS agreed to pay about $1.5 billion to settle LIBOR rigging charges, and a unit in Japan, where much of the wrongdoing occurred, pleaded guilty to criminal fraud.

There exist other media and government reports that found widespread regulatory failures at the Federal Reserve, specifically at Dudley's branch in New York. Former New York Fed employee Carmen Segarra also released tapes showing higher-ups at the New York Fed ordering lower-level regulators to go easy on Goldman Sachs.[75]

However, I am not aware of any empirical studies that examine this issue of "too big to jail", nor of any analysis that would examine the effect of criminal charges against large financial institutions on the global economy or systemic risk, potentially undermining a key DoJ argument for why the world's biggest banks have escaped indictment.

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[73] The notion that government shielded big banks from prosecution has been addressed in Huffington Post on 21 November, 2014, available at http://www.huffingtonpost.com/2014/11/21/fed-too-big-to-jail_n_6201476.html.

[74] Ibid.

[75] Tapes were retrieved from http://www.thisamericanlife.org/radio-archives/episode/536/the-secret-recordings-of-carmen-segarra on 6 June, 2014.

Putting the "too big" rhetoric aside, the obvious fact is that no corporate entity can literally be "jailed." If for example the DoJ does pursue criminal charges against an entity, a common outcome is a settlement coupled with large fines. For instance, in 2012, HSBC agreed to a deferred prosecution agreement with the DoJ to settle allegations of money laundering. In that settlement, HSBC was required to pay $1.92 billion in forfeiture and fines, but avoided actual criminal indictment. All the above motivates me to examine whether large banks were more actively engaged in wrongdoing and how litigation settlements related to the size of the banks.

In Chapters 2 and 3 I found that large banks had higher systemic risk, were more opaque and securitized more often. In this chapter, I want to examine whether large banks have lower operating costs and whether they were involved in financial misconduct and faced litigation charges more frequently than smaller banks.

4.3 Data and Variables Construction

The data, in particular, FR-9YC forms, are retrieved from the Federal Reserve Bank of Chicago via WRDS. The core sample is a panel of all publicly traded U.S. BHCs that report on form FR-9YC,[76] which is filed quarterly on a consolidated basis by all U.S. BHCs with over $150 million in assets ($500 million after 2006). I examine BHCs with over $500 million in total assets because BHCs with total consolidated assets of less than $500 million are generally not required to file FR-9YC forms.

The FR-9YC reports contain detailed consolidated financial statements and other data for U.S. BHCs. As noted earlier, in March 2006, the minimum reporting size for BHCs was increased from $150 million to $500 million. This significantly skews the sample. To overcome this problem, I delete all the observations that do not reach the minimum reporting threshold over the sample period. I do this in order to make sure that banks that began reporting prior to 2006 have continued reporting since the threshold was raised from $150 million to $500 million in 2006. I adjust the threshold of $500 million for price level per quarter with base March 2006. This method of deleting the observations ensures that they are not deleted randomly, and helps to preserve all BHC observations that once started reporting and continue to do so even after a temporary drop in their total assets. I delete

[76]BHCs are companies that own or control one or more commercial banks. Most banks in the U.S. are owned by BHCs. Currently, about 84 percent of commercial banks in the U.S. are part of a BHC structure.

approximately 50 observations per quarter. My data set covers the period from 2001:Q2 to 2013:Q4.

I use the detailed information on the vast range of BHCs' non-interest expenses filed by BHCs in the memoranda of their quarterly regulatory FR-9YC filings. Since 2001, more than one-third of total non-interest expenses are classified in the FR-9YC as part of a broad "other non-interest expenses" category. The category "other non-interest expenses" represents more than one-third of industry non-interest expenses. The 11 standardized memoranda categories are: (i) data processing expenses; (ii) advertising and marketing expenses; (iii) directors' fees; (iv) printing, stationery and supplies; (v) postage; (vi) legal fees and expenses; (vii) FDIC insurance assessments; (viii) accounting and auditing expenses; (ix) consulting and advisory expenses; (x) ATM and interchange expenses; (xi) telecommunications expenses (see FR-9YC Schedule HI Memorandum Item 7). In addition, space is provided for BHCs to report additional "write-in" expense items that were not captured by the standardized fields and where the expense item exceeds 10 percent of total other non-interest expenses. This can be travel expenses, payments to insurance holders, software development, litigation settlements or even meals, as was reported by some smaller BHCs. BHCs record items for amounts greater than $25,000 that also exceed 3 percent of total other non-interest expenses. Note that non-interest expenses do not include loan losses due to defaults, trading losses, gains and losses on owned securities, or taxes; these are recorded in other parts of the income statement.

As for the three biggest other non-standardized fields, they pose some difficulties. It is particularly challenging to classify and analyze items recorded in the write-in expense fields, because they are reported using non-standardized language by each BHC. Therefore, I manually examined more than 30,000 text strings in the Schedule HI of FR-9YC. This involved manually skimming through about 5,500 individual "write-in" text fields reported by individual BHCs. That is, I examine more than 5,000 various expenses, manually typed by BHCs. I search for words which include settlements actions, litigation and alike. Banks do not use uniform names and there are significant numbers of typos. Some reported write-in items are difficult to interpret. For instance, while I can easily infer that litigation means litigation, other expenses may be less straightforward. In the end I am left with 341 litigation occurrences where expenses are first, second or third as identified in "Other non-interest expenses", which constitute more than 10 percent of other expenses. I drop ambiguous observations. I identify 130 "clean" occurrences where banks face litigation costs as the first highest item, 123 as second highest, and 90 as third highest. Text usually appeared as

"INCOME ON LITIGATION SETTLEMENT", "RECOVERY ON LEGAL EXPENSES", "LAWSUIT SETTLEMENT", "INCOME FROM LITIGATION SETTLEMENT", "LITIGATION SETTLEMENT", or "LEGAL SETTLEMENT". Sometimes I observe the reason for the payment, e.g. "LAWSUIT TO A SOFTWARE VENDOR & THIS IS SETTLEMENT" or "IRS SETTLEMENT EXPENSES TO BE PAID". Note on the legal expenses: I do not aggregate legal fees and litigation settlement here. Some part of this finding may reflect the fact that small banks may lack internal legal teams, for which legal expenses would be recorded as part of compensation, and thus have higher external legal fees.

Although some data on the charges faced by institutions and chief executive officers (hereafter CEOs) or chief financial officers (hereafter CFOs) are available on the SEC website,[77] there is no central database that includes all of the litigation charges faced by banks. Bank regulators, specifically the Fed, the OCC, and the New York Department of Financial Services (NYDFS) are the main bodies dealing with banks' wrongdoing and some data are available. Also, the FDIC's Legal Division provides some aggregate information. However, the institution does not report PLC cost and recovery information by individual institution. Thus, that information cannot be used it.

Quantifying all the litigation settlements is difficult as a single event may lead to numerous overlapping investigations and proceedings, either by multiple federal and state agencies and officials in the U.S., or in some instances by regulators and other governmental officials in non-U.S. jurisdictions (e.g. Citigroup in Japan). Therefore, for analysis of the litigation settlements, I rely entirely on the FR- 9YC forms only.

I proceed by eliminating observations with missing, negative or zero values for total assets, and observations where the loans to assets ratio exceeds 100 percent. Observations that report zero equity capital are also removed. Approximately 50 observations are deleted per quarter. In turn, I winsorize the independent and dependent variables at the 1 percent level to account for data errors and limit the effect of potential outliers, which is a standard procedure in similar studies.

As far as the independent variables (efficiency ratios and detailed expenses) in the first part of this essay are concerned, I proceed as follows. Typically, BHCs enter expenses with a positive sign, while some entries have a negative sign, thus I use my judgment and convert

[77]Limited data on the charges faced by institutions and their CEOs and CFOs are available on the SEC website http://www.sec.gov/spotlight/enf-actions-fc.shtml.

them into positive or leave those observations as missing. In total, I have changed the sign for 67 entries where expenses are written with a negative sign, because the majority of BHCs write expenses in positive terms, understanding that these are the expenses. It is reasonable to believe that a typo in the sign may have occurred.

Subsequently, to analyze stock prices and returns, I link FR-9YC forms with CRSP. I used the FRBNY link[78] to match regulatory identification numbers (RSSD ID) to the PERMCO, used by the CRSP. The RSSD ID is a unique identifier assigned to commercial banks or BHCs by the Federal Reserve. The dataset yields 769 PERMCO-RSSD links from January 1, 2000 to December 31, 2013.

4.3.1 Dependent variables

Just as in calculating the efficiency ratio, where I divide non-interest expenses by net income (interest plus non-interest income), I calculate ratios for all the expenses dividing the expenses by the bank's net income. Thereby, I obtain 14 separate efficiency measures that are used as dependent variables.

4.3.2 Control variables

Apart from the main variable of interest such as the logarithm of total assets or the size, the control variables in the first specification include BHCs' non-performing loans (a proxy for credit risk), capital level (Tier 1) and profitability; relative profitability (the bank's financial performance relative to its peers over the past three years (RELROE) is also used as a proxy for the quality of its management,[79] a variable used by DeYoung and Rice (2004) to approximate for management quality. The aim is to relax the omitted variable bias, if the quality of the bank's management correlates with both size and expenses. Apart from the standard control variables mentioned above. I also control for the asset shares held in various types of loans and assets. For instance, I include trading assets, securities, cash, fixed assets. I also include bank revenue composition. Copeland (2012) finds that there is a positive relationship between the relative importance of nontraditional income sources and asset size.

[78] FRBNY link is available at http://www.newyorkfed.org/research/banking_research/datasets.html.

[79] RELROE equals bank i's ROE minus the median ROE among the banks in bank i's asset class, calculated each year from t-3 through t-1 and then averaged. I used five asset classes: less than $100 million; $100 million to $500 million; $500 million to $1 billion; $1 billion to $10 billion; and more than $10 billion, all measured in 2001 dollars. I note that RELROE may reflect things other than bank management quality, such as the local competitive, economic, and regulatory conditions faced by the bank during the past three years. However, I expect that the time dummies and state dummies in my regressions should absorb much of this variation.

Copeland (2012) classifies income into three types: traditional, securitization, and nontraditional. These categories are constructed so that income earned from new financial services would fall into either the securitization or nontraditional category. The traditional category contains the classic sources of income that most banks have relied upon over time, such as interest and fee income on loans, service charges on deposit accounts, fees for providing payment services, and income from fiduciary activities. Nontraditional income comes from five sources: a) net interest income from trading assets; b) venture capital revenues; c) investment banking; d) insurance income; and e) trading revenues. The securitization category captures income related to creating, servicing or selling securitized assets, while the nontraditional category contains sources of income related to the capital markets.

Following previous research (deYoung and Rice, 2003), I include the share of income that banks derive from interest income, investment banking income, trading income and fiduciary income (including insurance activities related income), three of which constitute a lion's share of revenue composition. I also include other income (e.g. safe deposit box rent, income and fees from ATMs, income and fees from the printing and sales of checks and miscellenous income) among the control variables. I also include the ratio of deposits to total assets because banks still heavily rely on deposits, including those banks that are regarded as severely diversified banks. I also include the amount of securitized assets.

Furthermore, following DeYoung (2014), I include the ratio of full-time-employees-to-total assets as a proxy for personalized service or as a proxy for human error in the workplace. I significantly vary a number of control variables to capture various aspects of banks' performance. I also include banks' foreign loans to capture their exposure to foreign individuals, firms and governments. I also control for BHC complexity using the complexity indicators from the Fed database. The FED categorizes BHCs into various complexity categories.[80] Finally, I normalize control variables by dividing them by the size of the BHC.

[80]As noted on the FRB's website, for small BHCs with total consolidated assets of $5 billion or less, attributes rows with date starting on or after 01/01/2002 must use values from 3 to 8 for complex institutions. A value of 2 should be used for any size company to indicate noncomplex institutions, unless there are factors that indicate complexity and that have been overridden by supervisory judgment, in which case a value of 9 should be used. The complexity indicators are the following: 3 = Complex: Nonbank Financial Factors. Nature and scale of non-bank activities warrant designation as complex for supervisory purposes; 4 = Complex: High Risk Activities. Company engages, either directly or through its subsidiaries, in significant non-banking activity having an inherently high-risk profile. Examples include securities broker/dealer activities, insurance underwriting and merchant banking; other activities may also trigger this designation if identified by the supervisory Reserve Bank as high-risk in nature; 5 = Complex: Public Debt. Company issues significant debt to the general public such that unsophisticated investors may be at risk of loss; 6 =

In one subsection where I analyze bank litigation, I also use the systemic risk measure MES from VLab linking it with the BHCs' data set from the Fed.

4.4 Summary Statistics

4.4.1 Non-interest expenses

Summary statistics for the main variables used in this study are reported in Table 4.1. In what follows, I present the distinguishing features of the BHCs' non-interest expenses.

I observe that compensation constitutes the highest non-interest expense, followed by other expenses on fixed assets and premises, data processing, and advertising and marketing expenses. For banks which report other "first highest", "second highest" and "third highest" expenses, these expenses can be as high as banks' expenditure on compensation. I sort other non-interest expenses and observe the following. In general, univariate findings show that litigation expenses are high in total magnitude, and they predominantly appear on the FR-9YC forms of the largest BHCs. The highest non-standardized other non-interest expenses are those of METLIFE, INC. in the amount of $35, 257.253 for "POLICY BENEFITS ON INSURANCE PRODUCTS". Metlife dominates the highest expenses. This seems natural because this is an insurance-based industry, and thus their expenses are likely to appear in other non-classified expenses.

Among the other highest expenses for large banks when not divided by bank size, I find that merger and acquisition, and restructuring costs constitute a significant part of all expenses for the Bank of America. Also, foreclosure expenses, operating losses and travel expenses are frequently mentioned by large and small banks.

Other significant "highest expenses" are those of American Express where card member rewards constitute a company's other highest expenditure. However, when I scale the above expenses by operating revenue, other ratios appear to dominate the overall picture of the highest expenses. I present the ratios because from the whole economy's perspective especially when one considers litigation settlements that accrue to the regulatory agencies

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Complex: Management Factors. Management practices such as the nature of inter-company transactions or centralized risk management policies and procedures warrant designation as complex for supervisory purposes; 7 = Complex: Multiple Factors. Company meets two or more criteria for the complex designation, more than one of which are material in the judgment of the supervisory Reserve Bank. While the intensity of the supervisory approach may not differ from other complex companies, this designation alerts examiners to the presence of more than one factor; 8 = Complex: Supervisory Judgment. Company does not appear to be complex as described in SR 02-01, however, at the discretion of the supervisory Reserve Bank, it is designated as a complex organization for supervisory purposes.

or are repaid as compensation to victims of financial crime, while the ratios might be more interesting for inter-bank comparisons.

When I examine the expense ratios, I observe that for some BHCs among highest "other expenses" are underwriting and distribution expenses, death claims, travel expenses and entertainment, fraud losses, Office of the Comptroller of the Currency (hereafter OCC) fund, supervisory examination fees, reserves, compliance, charitable contributions; marketing and servicing fees on payday loans are also listed among the highest expenses. Among "other expenses", acquisitions fees, provision for government investigations and loss provision, and state franchise tax are also frequently mentioned.

Data on expenses also provide an insight into the occurring trends from 2001 to 2014. For example, I note that the number of full-time employees per dollar of operating income has fallen precipitously over time, while industry-wide labor expenses have declined only marginally and have actually increased at the average bank. These conflicting trends provide evidence that new banking products and production methods require a more highly skilled work force and, hence, higher salaries and benefits to attract and retain these workers. For example, while low-wage bank tellers have become less necessary due to ATMs and online banking, high-wage finance and information professionals have become more necessary to manage these systems and the growing array of products offered around them.

Data also reveal a stable upward trend in AME scaled by bank total assets from 2001 to 2014. I observe that during and after the 2007–2009 crisis in contrast to the number of employees and compensation or litigation expenses, AME have not exhibited any cyclical behavior, *i.e.* AME have not undergone any drastic cuts, and have been been relatively stable over the entire sample period with only a moderate decrease during the crisis. AME have been steadily climbing since the third quarter of 2009. Data show that AME of the BHCs with more than $10 billion of assets reached around 3 percent of net revenue in 2013. Once again, banks are reaching heights observed at the peak of the last decade. Over 2001–2014 average ratio of marketing expenses to total assets was around 1 percent. For example, Citi spent $451 million on brand advertising in 2007, while $30 million went toward launching the "Let's Get It Done" slogan. Citi says it expects to spend another $20–30 million on their refreshed "Citi Never Sleeps" campaign.[81] AME vary between banks, but the average spending of the industry is pretty stable across the years.

[81] Citi spending plans are available at http://thefinancialbrand.com/446/citi-never-sleeps/.

As far as the complexity indicator is concerned, the majority of BHCs in my sample are classified as non-complex institutions, *i.e.* 171,908 observations are of Complexity=2; 5,895 are Complexity=9; 2,179 are BHCs which have Complexity=6; 978 are Complexity= 8; 1,084 are Complexity=7.

Among other features, univariate statistics show significant differences between small and large banks. For example, small BHCs received over 60 percent of their nontraditional income from investment banking. In contrast, medium and large BHCs relied upon trading revenue, investment banking and insurance income to roughly the same extent. Further, net interest income from trading assets is substantially higher for medium and large BHCs relative to small ones. I also find that the MES was higher for larger banks.

4.4.2 Litigation

Summary statistics for banks involved in litigation and those which were not involved in litigation are presented in Table 4.2. In Table 4.1b I observe that 2004 was a relatively litigious year in terms of the magnitude of litigation settlements. Then from 2004 onward up to the financial crisis, there was relatively little litigation followed by a boom of litigation after 2008. In particular, I observe an unprecedented average litigation amount from 2010 onward. Recent evidence in the press shows that 2014 has been even more litigious; however my data sample ends at 2014. What I do observe in Table 4.2a is that some banks face litigation settlements continuously over many quarters.

As for the litigation sample, I have 341 litigation occurrences with 118 BHCs involved in them. One limitation on carrying out a more thorough analysis is that FR-9YC forms do not reveal why some litigation settlements have occurred; only two or three entries provide such specific information. I also note that in my analysis I focus only on monetary costs because it is impossible to capture other costs (e.g. prohibition for banks to pay out dividends or any other non-monetary punishment or losses from pending litigation that may also prevent banks from engaging into profitable businesses or raising debt).

Hence, I have 118 banks that paid litigation settlements one or more times and which were a significant, *i.e.* more than 10 percent of other highest non-interest expenses, amount of their expenses and thus were reported in 9-YC forms, BHCs that appear to be continuously facing significant litigation settlements include: Discover Financial Services, Goldman Sachs, First Bancorp of Durango, Chinatrust Corp. or CTBC Capital Corp., Synovus Financial Corp., CIB Marine Bancshares Inc., International Bancshares Corp., Citigroup

Inc., Bank of America Corp. (primarily claims from the financial crisis tied to the sale of mortgage-backed securities that defaulted) and JPMorgan Chase&CO.

4.5 Methodology

To examine the relationship between banks' size and their operating costs, I estimate regressions with BHC-fixed effects, and time dummies. Thus I examine only changes in size within BHCs. I use fixed effects to capture characteristics specific to the banks that are fixed; for example, a bank's culture. I also cluster error terms at the BHC level to allow for correlation in the error terms within the BHCs. I also follow previous studies (e.g. Stiroh, 2006; Affinito and Tagliaferri, 2010; Casu et al., 2011) and have my explanatory variables lagged one period to relax potential problems of endogeneity.

The model specification is as follows:

$$ExpenseRatio_{i,t} = \beta_i * (Size)_{i,t-1} + \beta_j * (Controls)_{i,t-1} + q_t + v_i + \varepsilon_{i,t} \quad (4.1.)$$

I begin with standard control variables and then I control for more factors such as the composition of BHC assets, the composition of revenue, funding structure, concentration and banks' complexity.

I then proceed to the litigation regressions.

I estimate several probit and logit regressions to examine the likelihood that banks with certain characteristics will engage in more wrongdoing and be detected.

$$Pr(Litigation=1) = \beta i * (Size)i,t-1 + \beta j * (Controls)_{i,t-1} + qi,t + \varepsilon i,t \quad (4.2)$$

I also run simple panel regressions with BHC-fixed effect and time dummies clustered at BHC level to see whether litigation settlements increase with bank size.

$$LitigationAmount_{i,t} = \beta i * (Size)_{i,t-1} + \beta j * (Controls)_{i,t-1} + q_{i,t} + v_{i,t} + \varepsilon_{i,t} \quad (4.3)$$

My control variables include banks' size, profitability, leverage, credit risk, capital level, portfolio risk (risk-weighted assets), auditing fees as higher expenditures in auditing may diminish litigation risk, employees to total assets ratio, compensation in banks, because more workers are likely to reduce strategic errors and better paid workers may have more incentives to exert more effort, and opacity levels and complexity levels. I also include

foreign loans since dealing in foreign jurisdictions can significantly affect legal risk.[82] Among other variables, I include securitized assets because they have been at the center of the recent litigation debate surrounding mortgage markets.

I examine banks' characteristics and examine whether the negative change in some of them stimulates banks to engage in financial wrongdoing as a means of boosting their performance. For instance, the corporate fraud literature suggests that a firm's risk might relate to a firm's tendency to commit wrongdoing. Many cases of misconduct are discovered when bank fundamentals indicate increased risk. For example, Povel et al. (2007) argue that CEOs of high-growth firms that exhibit a downturn are more likely to commit financial misconduct. Thus, I control for portfolio risk and systemic risk. In addition, some studies document that more systemically risky BHCs or banks with higher returns volatility or stock turnover may induce supervisors to monitor these banks more closely (Wang, 2013); thus I include stock returns and returns volatility to account for the probability of higher detection. In addition, I estimate other regressions that may provide some further insight into bank litigation issues. For example, it has been noted that litigation and uncertainty surrounding potential liability may depress a bank's stock price. Therefore I regress BHC stock prices on their litigation settlements.

Finally, I perform some simple analysis to gain an insight into banks' advertising and marketing expenses (hereafter AME). I run fixed effects panel regressions to observe whether higher AME increased banks' returns and whether higher AME actually attracted more deposits.

4.6 Results

4.6.1 Economies of scale

In Table 4.4 the coefficient of non-interest expense is negative and statistically significant, which which shows that there are significant economies of scale for large banks. In particular, when I disaggregate expenses, I find that larger BHCs enjoy lower Compensation, Expenses on Premises and Fixed Assets, Data Processing Expenses,

[82] Legal risk is subsumed in operational risk. Examples of operational risk events include the Nasdaq odd-eighths pricing scandal in 1994, the 1995 bankruptcy of Barings Bank due to a rogue trader, the brokerage firm conflict of interest scandal in 2002, and the 1990s fines and lawsuits against Prudential Financial for misleading sales presentations. In response to these and other events, major institutions have been developing sophisticated operational risk measurement and management systems. The Basel Committee on Banking Supervision has also incorporated a new minimum capital charge for operational risk as part of the Basel II Capital Accord (Basel Committee, 2001), and major ratings firms have begun to consider operational risk in assigning corporate financial ratings (Moody's Investors Service, 2003).

Directors Fees, Postage Expenses, Accounting and Auditing Expenses, Consulting and Advisory Expenses and Legal fees (all coefficients are negative and statically significant).

Some results are intuitive. For example, large BHCs can enjoy lower postage expenses, consulting or auditing, or data processing, because large BHCs are able to spread the fixed component of these costs over a larger total base of operating revenue or total assets. As for legal expenses, many large BHCs have their own legal departments and thus it is normal that their expenses are lower compared to those of smaller BHCs that have to use external legal services. The negative coefficient on compensation is however surprising. Large banks enjoy economies of scale in compensation that is a significant part of the total non-interest expenses. I did not expect to observe economies of scale on compensation.

As for other results, I observe diseconomies of scale in the following areas: amortization and goodwill expenses, FDIC deposit insurance assessments, printing and stationery supplies and AME. For the first two categories, I do not have any economic interpretation of why this might be the case. However, for FDIC insurance premiums assessments, it is possible that FDIC takes into account the possible contagion risk stemming from the large banks, implicit "too big to fail" guarantees and relaxed market monitoring of large banks, resulting in higher premiums being charged to these banks. This however changes once I include deposits (the estimated coefficient remains negative although not statistically significant). This coefficient is likely to shrink further if my regression specification includes a control for the fraction of insured deposits, rather than total deposits. As for AME, the fact that larger banks have higher AME may be because reputation may play a huge stake and thus big banks choose to have expensive billboards and flashy logos.

To conclude, I observe significant economies and diseconomies of scale for large BHCs once I split expenses into sub-categories. Overall, I cannot conclude that bank expenses will skyrocket if large banks are split into smaller banks. These results remain robust after I include more control variables (Tables 4.5 and 4.6).

I emphasize that a number of caveats apply to my results. My reduced form of statistical correlations supports the existence of significant economies of scale in the banking sector. Caution, however, should be exercised when drawing a causal interpretation from them. Although my regressions control for a wide range of BHC characteristics, firm size may still correlate with omitted variables that are also associated with lower expenses, such as the quality of management, since above average profitability might not fully capture the quality of management. This caveat however also seems to apply more generally to the existing literature on scale economies in banking.

4.6.2 Litigation

I find that larger BHCs are more often involved in litigation settlements. Regarding BHCs' characteristics and litigation, I find that size is the only variable which would be associated with the probability of facing litigation charges as well as higher litigation settlement amounts, and it is robust across all specifications (probit and logit and OLS regressions in Tables 4.7- Table 4.9).

That is, in contrast to the legal fees, which decrease as banks grow in size, I find that litigation settlements relate positively to bank size, which means that large banks face larger penalties. This contradicts the statements that larger banks continuously avoid charges or face lower punishment. Certainly, to examine this issue in more detail and address Dudley's statements that large banks often could avoid all charges for all their wrongdoing, I would need to have data on the reasons why banks faced these charges. Regrettably, this is limited by data availability as only a small number of banks fill this information into "other expenses" on FR-9YC forms.

In turn, in Table 4.7 (Column 3), I also find that systemic risk is positive and statistically significant in litigation regressions. That is, more systemically risky banks are also more likely to be involved in misconduct.

In Table 4.9, I also find that a higher foreign loans ratio increases the litigation amount (Column 4 and Column 5). This may suggest that banks lending to other banks are exposed to the rules of foreign jurisdictions and naturally face higher uncertainty. I also observe that the litigation amount significantly increases with investment banking income and insurance related activities such as fiduciary income (Table 4.8 and Table 4.9). This is intuitive as investment banking and insurance activities are more complex activities than for example simple deposit taking and thus they carry more legal risk. Interestingly and contrary to my expectations, opacity (the bid–ask spread) is not significant in litigation regressions (Table 4.8). This result is a venue for future study.

I also observe that banks that have a higher credit risk (*i.e.* non-performing loans) have higher litigation costs, which may be an indication that banks that have a higher credit risk engage in more wrongdoing (Column 2 in Tables 4.7, 4.8 and 4.9*)*. This may seem intuitive if for example banks that have more non-performing loans anticipated that these non-performing loans would turn into charge-offs and banks are trying to engage in some activities to generate higher revenues to cover potential future losses. I also find that BHCs with more employees have a lower risk of facing litigation charges. This may indicate that

more workers reduce human error or that more employees may provide better monitoring and better discipline within the bank; consequently, the bank faces fewer litigation charges. In addition, higher compensation is also negatively correlated with litigation settlement amounts, which from the perspective of operational risk suggests that more workers and better paid workers may reduce errors in the bank and reduce the amount of litigation settlements (Table 4.8 Column 4).

I also observe that when small banks face litigation charges these are usually smaller than charges faced by large banks, possibly indicating that small BHCs engage in less severe wrongdoing since they do not have the "too big to jail" implicit cover; high fines may force them straight into terminating their businesses (Column 4 in Tables 4.7 and 4.8). In addition, I find that higher legal fees correlate negatively with litigation settlements, which suggests that it may be worth hiring more expensive lawyers (Column 4 in Table 4.7); however, results are not persistent across different specifications. Overall, it seems reasonable to conclude that litigation is the new cost of doing business and it is important to account for it when considering the design of new financial regulations.

4.6.3 Advertising and marketing expenses

I find that higher AME increase banks' returns and attract more bank deposits (Tables 4.10 and 4.11). However, based on the economics magnitude of the coefficient, one may infer that may have more to do with the reputation and the company's brand positioning than with anything else. I also find that AME are fairly constant and vary little with the economic cycles. Finally, systemically more risky banks spend less on AME (Table 4.12) than banks which are less systemically risky.

4.7 Robustness Checks

The efficiency ratio may be distorted in periods when net operating income is temporarily low, such as for example during the 2007–2009 crisis. Therefore, I test the sensitivity of my results to other normalizations of non-interest expenses, for example, by dividing the expenses by the level of capital. However, the results remain unchanged.

As for the litigation section of this chapter, my major concern is the sample selection bias and the assumption that the detection of bank misconduct is perfect. That is, I can only observe the detected misconduct (once an enforcement action has been issued), but not the population of all committed cases of misconduct. This has also been pointed out by Zingales et al. (2010). They note that by focusing on discovered frauds, two biases are introduced. First, I do not observe frauds that were committed but which were never detected. Second, I

do not observe fraud which was detected but which never entered the public domain. Also, since the data available are only about the cost of the litigation, I cannot draw any conclusions as to whether banks were punished proportionately to the severity of their committed crime. However, Zingales et al. (2010) note that the intense public scrutiny of large U.S. firms, the ability to go back in time and sue based on past wrongdoing, and the strong incentives to sue by plaintiff lawyers is likely to diminish this problem. Therefore, there is so much one can do about it other than rely on efficiency of plaintiff lawyers and on the intense public scrutiny and hope that the detection of the bank misconduct is nearly perfect.

Finally, I drop the 67 observations from my sample that have negative entries for expenses and rerun the regressions. This procedure does not result in significant changes in the coefficients of interest (Table 4.14).

4.8 Conclusion

Legislative changes over the past decades have been conducive to BHCs becoming more complex by expanding in size and scope, as well as to increased engagement in cross-border and cross-state businesses.

Following the recent financial crisis, there is still widespread concern that large banking firms remain "too big to fail". There is no consensus, however, among the bank researchers on the optimal size of banks, and no clear evidence as to what effect imposing a cap on bank size will have on bank operating revenues.

Control of expenses remains a high priority as regulatory costs continue to rise. Therefore, in this chapter I describe the typical structure of BHCs non-interest expenses and examine the areas in which large banks enjoy significant economies of scale. These are the benefits that could be lost if limits on bank size are imposed.

My findings show that overall, large banks enjoy economies of scale. In particular, significant economies of scale are found in auditing, consulting and legal fees, as well as expenses on fixed assets and premises, compensation and data processing. These economies of scale are likely to be lost once banks are split up. I also show that not all costs decrease as banks grow in size. Therefore, the argument that breaking up big banks will result in skyrocketing operating costs may be exaggerated. In addition, I observe diseconomies of scale in amortization expenses, goodwill, FDIC insurance premiums, printing and stationery supplies and AME.

What seems very evident is that technological progress and investment in technologies may face difficult times. This is because it was predominantly large banks that invested in innovation because they had a large client base and resources to invest. If large banks are split into parts, technological progress might be more challenging to achieve.

Limiting the size of banks could be an appropriate policy goal, but only if the benefits of doing so exceeded the attendant reductions in scale economies, *e.g.* if systemic risk is significantly reduced.

Another important aspect in this discussion is whether this loss in economies of scale would constitute a deadweight economic loss. Unfortunately, this is a challenging aspect to evaluate. There is a possibility that large banking firms have a greater bargaining power vis-à-vis their suppliers and employees. Thus, they can enjoy lower operating costs. If cost differences are due only to bargaining power effects, then limiting the size of the largest BHCs would not necessarily generate deadweight economic loss, but would rather simply constitute a redistribution of resources from banks to the employees or external suppliers of banking services.

As far as litigation risk is concerned, litigation costs play an important role in the discussion of breaking up "too big to jail" BHCs. My findings indicate that large banks face a higher probability of litigation risk, however, it is too early to affirm that litigation risk will decrease if the banks are broken up into bits.

Misconduct in banking undermines the general public's confidence in the safety and soundness of the banking sector. Thus, it seems rational to make those who were ultimately responsible for what went wrong in the bank personally liable for their mistakes so that the tab is not simply picked up by shareholders. In other words, instead of breaking up big banks, it seems more rational to impose harsher individual penalties for bankers to discipline them and generally to encourage more integrity in the banking sector until more data is gathered. In addition, personal liability is likely to reduce banks' legal fees if bankers who are guilty for the financial misconduct of the banks had to pay these fees out of their own pockets.

In general, the determinants of a bank's misconduct is an important topic, which has wider implications for the broader economy. It would be interesting to examine whether various litigation charges and settlements have been proportionate to the severity of the misconduct, and whether large banks have been treated more favorably than smaller banks. As noted by Judge Rakoff (2015), there is usually a lack of proportionality between the fine imposed and

the company's annual profits. That topic is an avenue for future research when data becomes available.

Chapter 5

5.1 Conclusion

This thesis addresses key issues that were brought to light during the recent financial crisis. In particular, the financial crisis revealed how closely interconnected were many of the world's largest financial institutions through a web of short-term loans, ABS, ABCP, credit guarantees, and liquidity provision to SPVs, and also how legal frameworks and regulatory loopholes facilitated the financial crash.

In particular, I focus on banks' securitization activities, liquidity, and credit enhancements to ABCP conduits, banks' opacity and returns volatility, as well as systemic risk. I focus on these issues primarily because existing literature provides mixed findings in this area. Empirical studies provide no conclusive evidence on the effect of securitization on banks' credit risk, profitability and capital levels. While securitization and credit risk transfer techniques allow banks to move risks outside their balance sheet as well as to achieve portfolio diversification more efficiently it could also lead banks to engage in excessive risk taking by using the liquidity obtained from securitization to issue new riskier credits. Consequently, banks may end up with a higher credit risk because banks keep the junior tranche in securitization and because they extend guarantees to own and third parties' SPVs.

My analysis shows a positive relationship between securitization and credit risk. My results also show that securitization decreases BHCs' profitability, particularly since the crisis. In turn, securitization increased BHCs' capital levels. This aligns well with regulatory capital arbitrage because banks did not have to hold regulatory capital for the securitized assets. However, I find evidence that some banks might have been risk averse or if they had understood the risk of the securitization activities, they chose to increase their capital buffers above the level required by the regulators.

In the third chapter, I examine opacity in the banking sector stemming from their exposure to the ABCP market. It is documented both in theoretical and empirical literature that securitization transactions are so complex that their disclosure generates disagreements even among security analysts with similar levels of expertise and provides a level of worldliness that is challenging even for sophisticated institutional investors. The existing literature mainly focuses on the benefits of ABCP programs. For example, it emphasizes that the ABCP market has been very competitive compared to other money market instruments

because it provides a high-quality credit profile as well as exemption from registering with the SEC. It also allowed banks to increase their capital levels and diversify their assets.

I build on these studies and investigate some other issues, in particular the effect of financial innovation on banks' information opacity. Given that many financial innovations (e.g., securitization, derivatives, hybrid securities, etc.) extensively rely on inherently complex structures, it is important to investigate how investors understand them is important. Thus, I address the costs that stem from the exposure to ABCP. Negative externalities from increased opacity are abundant. For example, increased opacity raises concerns about bank stability due to the lack of information surrounding a bank's assets, increases in the volatility of returns, increases in a bank's funding cost, or an increase in the volatility of returns, which in turn may significantly increase systemic risk. Hence, even though the vast majority of ABCP programs have credit ratings from major rating agencies, the specific assets held in the programmes are not widely known. That is, asset holdings of ABCP conduits are not transparent and thus it is difficult to assess the risk profile of the banks exposed to ABCP.

My results show that it was difficult for investors to understand fully the risks of their banks being exposed to various credit and liquidity support mechanisms of ABCP programs. These guarantees also contributed to a higher returns volatility for these BHCs. In addition, although I do not find evidence that guarantees to ABCP conduits exert a direct effect on the accumulation of systemic risk, I do find evidence that it was the opacity and bank size which significantly increased systemic risk.

From an economic standpoint, conduits are less regulated but they still have recourse to fully regulated banks through various guarantees which have access to government safety nets funded by taxpayers. It is likely that without such guarantees conduits, which are important for efficient risk sharing in the economy, may not survive adverse economic times.

The main policy implication from the second chapter is that eliminating uncertainty and making complex transactions more transparent, rather than constraining the scope of banks' activities may be a step toward a more robust and safer financial system. Certainly, transparency is not free and involves a delicate cost–benefit tradeoff (Kohn, 2011), however, it appears that more disclosure, as opposed to prohibiting banks to engage in some activities, is a better tool to fix financial markets.

In the fourth chapter, I examine two phenomena: the "too-big-to fail" and "too big to jail" incentives for banks to grow in size. To address these issues, I focus on banks' operating costs. Again, while the majority of the existing literature focuses on the negative effects of

big banks, such as increased systemic risk, I look at the positive side and the benefits large banks can offer to their clients and shareholders. For example, operating costs of large banks are often smaller, as banks, for example, exhibit economies of scale, and can also offer cheaper products. That is, when evaluating the consequences of breaking up big banks, it is important to examine the benefits that large banks bring to the economy.

My findings that large banks have higher systemic risk and are more opaque are consistent with most of the recent literature. However, the research that suggests that limits on bank size could increase the costs of providing banking services is not conclusive. I am the first to examine all the non-interest expenses and conclude that operating costs go down, *ceteris paribus*, as banks grow in size. That is, banks enjoy economies of scale, but not in all areas. To elaborate, expense ratio regression results indicate that while regulatory limits on the size of banks may be justified to limit the number of institutions deemed too big to fail, such limits could raise the cost of providing banking services by preventing banks from exploiting economies of scale, in particular in the technology sector. A consequence is that this can slow down innovation. In addition, it is worth noting that securitization programs have been structured primarily by large banks because of the high initial costs to set up SPVs. Therefore, if large banks are broken up, it will be more challenging to revitalize securitization markets. All in all, the problem of "too big to fail" is more complex than it seems.

Government's support for "too big to fail" banks during the crisis has taken different forms, from loan guarantees to direct injections of public funds into banks. The expectation of that support constitutes an implicit public subsidy to large banks because it allows banks to borrow at cheaper rates than they would if the possibility of that support did not exist. The cost of such government support to the taxpayers is very high. For example, the IMF notes that in 2012, the implicit subsidy given to global systemically important banks represented up to $70 billion solely in the United States.

"*If the crisis has taught a single lesson, it is that the too-big-to-fail problem must be resolved,"* declared U.S. Federal Reserve Chairman Ben Bernanke in 2010 when testifying before the U.S. Financial Crisis Inquiry Commission. He noted that "*despite efforts to end too-big-to-fail, the financial markets believe that the government will bail out major financial institutions should they falter*".

It has to be noted, however, that the idea that some financial institutions are too big to fail is not new. These issues were mentioned long before the crisis of 2007 (*e.g.* Freixas, 1997).

However, it is only since the recent crisis that policymakers have actually addressed the incentive for banks to grow too large and too systemically risky.

Although it is true that large banks are more opaque, as shown in the third chapter of this thesis, my results in the third chapter indicate that breaking up big banks might induce a significant loss of economies of scale. Therefore, it seems more appropriate to address the incentive of banks to become "too big to fail", by replacing the expectation of bailouts with a clearly structured policy of how regulators would go about liquidating insolvent banks including large systemically important financial institutions (SIFIs), without causing any damage to the broader economy. In addition, introducing revised capital requirements that involve contingent capital and capital charges based on the firm's contribution to systemic risk would allow successful banks to grow to whatever is truly their most efficient and unsubsidized size.

Some of these issues have already been addressed by the Dodd–Frank Act of 2010, which imposes new rules and oversight over banks and other financial firms, and which also aims to end "too big to fail" by creating a new process for resolving failures of large financial firms in a way that subjects the creditors of such firms to losses.

The phenomenon that has not been addressed in the regulations though is the one of "too big to jail". That is, there exists some evidence that large banks have been enjoying bailouts but also were essentially shielded from criminal prosecutions. As shown in the fourth chapter, large banks more often engage in financial misconduct. I observe multiple occurrences of the same big banks being punished, which may indicate that current measures of misconduct prevention may not be effective enough to deter banks from engaging in wrongdoing. Certainly, larger banks may be more complex and thus are more likely to commit errors. Controlling for complexity, however, I find that this is not the case, and that there must be some other reasons why large banks are more often not complying with the regulations such as for example the implicit guarantee from the government, *i.e.* where banks anticipate that government may shield them from costly litigation. Overall, I cannot exclude the possibility of the "too big to jail" phenomenon. This has to be weighed in the discussion about breaking up big banks.

In conclusion, it seems that more supervision and disclosure and the elimination of overreliance on government support, might be a more appropriate measures for preventing future financial crises rather than breaking up big banks. In other words, since as noted in CH (2011) confidentiality served only to perpetuate banker misconduct and exacerbate the problems of troubled institutions, higher transparency is likely to increase bankers'

misconduct, warn the financial community about serious regulatory compliance or safety and soundness issues that exist in the affected institutions, reduce opacity, decrease systemic risk and strengthen market discipline.

Appendix 1

Table 1-1 - Balance sheet structure

1	2
Balance Sheet Structure	
Total Assets	BHCK2170
Liquidity Ratio: Liquid Assets/Total Assets	(BHCK0081 + BHCK0395 + BHCK0397 + BHCK1754 + BHCK1773)/BHCK2170
Loan Ratio: Loans/Total Assets	BHCK 2122/BHCK2170
Trading Ratio: Trading Assets/Total Assets	BHCK3545/BHCK2170
Deposit Ratio: Deposits/Total Assets	(BHCK3517+ BHCK3404)/BHCK3368
Capital Ratio: Equity Capital/Total Assets	BHCK3210/BHCK2170
Real Estate Loan Ratio: Real Estate Loans/Total Loans	BHCK1410/(BHCK2122 + BHCK2123)
C&I Loan Ratio: Commercial And Industrial Loans/Total Loans	(BHCK1763 + BHCK1764)/(BHCK2122 + BHCK2123)
Consumer Loan Ratio: Consumer Loans/Total Loans	(BHCKB538 + BHCKB539 + BHCK2011)/(BHCK2122 + BHCK2123)
Other Loan Ratio: Other Loans/Total Loans	(BHCK2122 + BHCK2123 - BHCK1410 - BHCK1763 - BHCK1764 - BHCKB538 - BHCKB539 -BHCK2011)/(BHCK2122 + BHCK2123)
Regulatory Capital: Tier I Leverage Ratio	BHCK7204
Regulatory Capital: Tier I Risk-Based Capital Ratio	BHCK7206
Regulatory Capital: Total Risk-Based Capital Ratio	BHCK7205
Interest Income/ Net Operating Revenue	BHCK4074/(BHCK4074 + BHCK4079)
Interest Margin: Net Interest Income/Total Assets	BHCK4074/BHCK3368
Return On Equity (ROE): Net Income/Equity Capital	BHCK4340/BHCK3519
Return On Assets (ROA) Net Income/Total Assets	BHCK4340/BHCK3368
RWATA Ratio: Risk-Weighted Assets/Total Assets	BHCKA223/BHCK2170
NPL Ratio: Non-Performing Loans/Total Loans	(BHCK5525 + BHCK5526 - BHCK3506 - BHCK3507)/BHCK3516
Charge-Off Ratio: Net Charge-Offs/Total Loans	(BHCK4635 - BHCK4605)/BHCK3516
Loan Loss Provision Ratio: Quarterly Provision For Loan Losses/Total Loans	BHCK4230/BHCK3516
Loan Loss Allowance Ratio: Allowance For Loan Losses/Total Loans	BHCK3123/BHCK3516
Securitization Ratio: Securitized Assets/Total Assets	(BHCKB705 + BHCKB706 + BHCKB707 + BHCKB708 + BHCKB709 + BHCKB710 + BHCKB711)/BHCK2170
Credit Enhancement Ratio Credit Enhancements/Total Assets	(BHCKB712 + BHCKB713 + BHCKB714 + BHCKB715 + BHCKB716 + BHCKB717 + BHCKB718 + BHCKC393 + BHCKC394 + BHCKC395 + BHCKC396 + BHCKC397 + BHCKC398 + BHCKC399 +BHCKC400 + BHCKC401 + BHCKC402 + BHCKC403 + BHCKC404 + BHCKC405 + BHCKC406)/BHCK2170
Credit Enhancement/Securitization Ratio: Credit Enhancements/Securitized Assets	(BHCKB712 + BHCKB713 + BHCKB714 + BHCKB715 + BHCKB716 + BHCKB717 + BHCKB718 +BHCKC393 + BHCKC394 + BHCKC395 + BHCKC396 + BHCKC397 + BHCKC398 + BHCKC399 +

1	2
Balance Sheet Structure	
Credit-Enhancing Interest-Only Strip Ratio Credit-Enhancing Interest-Only Strips/Total Assets	(BHCKB712 + BHCKB713 + BHCKB714 + BHCKB715 + BHCKB716 + BHCKB717 +BHCKB718)/BHCK2170
Subordinated Security Ratio Subordinated Securities/Total Assets	(BHCKC393 + BHCKC394 + BHCKC395 + BHCKC396 + BHCKC397 + BHCKC398 + BHCKC399)/BHCK2170
Subordinated Securities/Securitized Assets	(BHCKC393 + BHCKC394 + BHCKC395 + BHCKC396 + BHCKC397 + BHCKC398 + BHCKC399)/
Standby Letter Of Credit Ratio: Standby Letters Of Credit/Total Assets	(BHCKC400 + BHCKC401 + BHCKC402 + BHCKC403 + BHCKC404 + BHCKC405 + BHCKC406)/BHCK2170
Standby Letter Of Credit/Securitization Ratio: Standby Letters Of Credit/Securitized Assets	(BHCKC400 + BHCKC401 + BHCKC402 + BHCKC403 + BHCKC404 + BHCKC405 + BHCKC406)/
Liquidity Provision Ratio: Liquidity Provision Commitments/Total Assets	(BHCKB726 + BHCKB727 + BHCKB728 + BHCKB729 + BHCKB730 + BHCKB731 + BHCKB732)/BHCK2170
Liquidity Provision/Securitization Ratio: Liquidity Provision Commitments/Securitized Assets	(BHCKB726 + BHCKB727 + BHCKB728 + BHCKB729 + BHCKB730 + BHCKB731 + BHCKB732)/(BHCKB705 + BHCKB706 + BHCKB707 + BHCKB708 + BHCKB709 + BHCKB710 + BHCKB711)
Seller’s Interest Ratio: Seller's Interest/Total Assets	(BHCKB761 + BHCKB762 + BHCKB763 + BHCKB500 + BHCKB501 + BHCKB502)/BHCK2170
Seller's Interest/Securitized Assets	(BHCKB761 + BHCKB762 + BHCKB763 + BHCKB500 + BHCKB501 + BHCKB502)/(BHCKB705 + BHCKB706 + BHCKB707 + BHCKB708 + BHCKB709 + BHCKB710 + BHCKB711)
Chargeoffsec Ratio: Net Charge-Offs On Securitized Assets/Securitized	(BHCKB747 + BHCKB748 + BHCKB749 + BHCKB750+ BHCKB751 + BHCKB752 + BHCKB753 - BHCKB754 - BHCKB755 - BHCKB756 - BHCKB757 - BHCKB758 - BHCKB759 - BHCKB760)/(BHCKB705 + BHCKB706 + BHCKB707 + BHCKB708 + BHCKB709 + BHCKB710 + BHCKB711)
Liquidity Provision Commitments To Other Institutions' Securitizations/Total Assets	BHCKB783 + BHCKB784+ BHCKB785+ BHCKB786+ BHCKB787+ BHCKB788 + BHCKB789)/BHCK2170
The Maximum Contractual Credit Exposure Remaining For Conduits Sponsored By The Bank Or Bank Affiliate	BHCKB806
Maximum Contractual Credit Exposure Remaining For Conduits Sponsored By Other Institutions	BHCKB807
Unused Facilities For Liquidity Protection For Conduits Sponsored By The Bank Or Affiliate	BHCKB808
Unused Liquidity Facilities For Conduits Sponsored By Other Institutions	BHCKB809
Net Operating Revenue: Net Interest Income+ Non-Interest Income	BHCK4074 + BHCK4079
Trading Revenue	BHCKA220
Fiduciary Income	BHCK4070 + BHCKC887 + BHCKC385 + BHCKC387
Investment Banking Income	BHCKB491 + BHCKC886 + BHCKC888
Service Charges On Deposit Accounts In Domestic Offices	BHCK4884

1	2
Balance Sheet Structure	
Net Servicing Fees (Incl. Income From Servicing Real Estate Mortgages, Credit Cards, And Other Financial Assets Held By Others)	BHCKB492
Non-Interest Expense	BHCK4093
Compensation (Salaries And Employee Benefits)	BHCK4135
Premises And Fixed Assets	BHCK4217
Amortization Expense (Incl. Impairment Losses For Other Intangible Assets	BHCKC232
Goodwill Impairment	BHCKC216
Data Processing Expenses	BHCKC017
Advertising And Marketing Expenses	BHCK0497
Directors' Fees	BHCK4136
Printing, Stationery, And Supplies	BHCKC018
Postage	BHCK8403
Legal Fees	BHCK4141
Fdic Deposit Insurance Assessment	BHCK4146
Accounting And Auditing	BHCKF556
Consulting And Advisory	BHCKF557
Atm And Interchange	BHCKF558
Telecommunications Expenses	BHCKF559
Description Of The "Write-In" Components Of Other Non-Interest Expenses Reported In Schedule Hi: Memoranda Of The Fr -9yc, which Exceed 10 Percent Of Total Other Non-Interest Expenses.	
Other Expenses	BHCK8565
Other Expenses	BHCK8566
Other Expenses	BHCK8567

Appendix 2

Systemic risk

2.1 Systemic risk[83]

This appendix provides definitions for measures of systemic risk. In the expressions below, $\text{Crisis}_{t:t+T}$ is as an indicator variable that defines if there is a financial crisis between dates t and $t + T$. The expected capital shortfall of bank i in case of such a crisis is defined as:

$$CS_{i,t:t+T} = E_{t-1}[\theta A_{i,T} - W_{i,T} | Crisis_{t:t+T}]$$

It measures how much capital would be needed for that bank as to be correctly capitalized after the crisis. It should be noticed that if the resulting capital shortfall is very large, one obtains a link with the notion of *too big to fail*, which remains a source of concern for governments and regulators.

The expected capital shortfall can be rewritten in terms of parameters that are measured from the balance sheet or estimated econometrically:

$$CS_{i,t:t+T} = [\theta(L_{i,t} - 1) - (1 - \theta)(1 - LRMES_{i.t:t+T})]W_{i,t}$$

In this expression $L_{i,t} = A_{i,t}/W_{i,t}$ is the *financial leverage* and $LRMES_{i,t:t+T}$ is the *long-run marginal expected shortfall* of the bank, *i.e.*, the sensitivity of its equity return to the evolution of the world market in case of a financial crash. The market capitalization ($W_{i,t}$) and the financial leverage ($L_{i,t}$) are readily available from market and accounting data, respectively. What remains to be estimated is *LRMES*.

2.2. Long-run Marginal Expected Shortfall

LRMES is defined as the sensitivity to a (hypothetical) 40% semiannual market decline:

$$LRMES_{i,t:t+T} = -E_{t-1}\left[R_{i,t:t+T} | R_{M,t:t+t} \leq -40\%\right]$$

where T = 6 months and cumulative returns are defined as:

[83] Based on the notes and related documents available at http://vlab.stern.nyu.edu/welcome/risk/.

$$R_{i,t:t+T} = exp\left(\sum_{j=1}^{T} r_{i,t+j}\right) - 1$$

And

$$R_{M,t:t+T} = exp\left(\sum_{j=1}^{T} r_{M,t+j}\right) - 1$$

with $r_{i,t}$ and $r_{M,t}$ the daily log-return of firm *i* and the daily log-return of the market at date *t*, respectively.

LRMES is particularly difficult to estimate because it corresponds to an extremely rare event. We had only three 40 percent market crashes over the last century (1929, 2000 and 2008). Brownlees and Engle (2010) advocated for two complementary approaches to estimate the *LRMES*:

The first (direct) approach consists of estimating *LRMES* as the expected return of the firm in case of a 40 percent semi-annual decline in the market return. Directly estimating the *LRMES* relies on simulation of the model over *T* periods using all information available at date *t*. It is estimated by:

$$LRMES_{i,t:t+T} = \frac{\sum_{s=1}^{S} R_{i,t:t+T}^{(s)} + I\left(R_{M,t:t+T}^{(s)} \leq -40\%\right)}{\sum_{s=1}^{S} I\left(R_{M,t:t+T}^{(s)} \leq -40\%\right)}$$

where $R_{i,t:t+T}^{(s)}$ and $R_{M,t:t+T}^{(s)}$ are simulated by the model described below, and $\mathcal{I}(x) = 1$ if *x* is true and 0 otherwise. This approach will provide accurate estimates of the true expectation provided the number of simulated data is sufficiently large. I use $S = 50\,000$ draws.

In the second (indirect) approach, *LRMES* is based on the expected return of the firm in case of a (relatively modest) 2 percent decline in the daily market return, which is then extrapolated to match a 'once-per-decade" crisis. The sensitivity to a 2 percent daily world market decline, called short-run MES (*SRMES*) is defined as:

$$SRMES_{i,t} = -E_t\left[R_{i,t+1} | R_{M,t+1} \leq -2\%\right]$$

Then under some (not too straightforward) assumptions, the *LRMES* can be approximated by:

$$LRMES_{i,t:t+T} = 1 - exp\left(-k\ SRMES_{i,t}\right)$$

The parameter k has been estimated via extreme value theory. For $T = 6$ months, it was found to be $k = 18$. This approximation allows a much faster estimation of the risk measures, but does not allow a multifactor approach.

The worldwide systemic risk measures from NYU Stern's Volatility Lab are based on the indirect approach. A single factor (the World market) is used to estimate the *LRMES*. (Volatility Lab also reports risk measures based on the direct approach for U.S. financial institutions, assuming a single factor approach).

2.3. Systemic Risk of Financial Institutions

I define the systemic risk of bank i as the expected capital shortfall when it is positive:

$$SRISK_{i,t:t+T} = max\left(CS_{i,t:t+T}, 0\right)$$

Having a negative capital shortfall means that the firm has more equity than required by the prudential ratio θ, so that the firm is not at risk.

An important property of the SRISK measure is that it allows aggregation. MES of a given country or the entire financial system can be defined as:

$$LRMES_{F,t:t+T} = -E_{t-1}\left[R_{F,t:t+T} | R_{M,t:t+T} \leq -40\%\right]$$

where $R_{F,t:t+T}$ denotes the cumulative return of the financial industry between t and $t + T$. As the return of the industry is just the value-weighted sum of the return of the N financial institutions($R_{F,t:t+T} = \sum_{i=1}^{N} w_{i,t} R_{i,t:t+T}$, with $w_{i,t} = W_{i,t} / \sum_{i=1}^{N} W_{i,t}$), the marginal contribution of a given institution to the overall *LRMES* is simply the *LRMES* of the institution. The aggregate MES is therefore obtained by aggregation:

$$LRMES_{F,t:t+T} = \sum_{i=1}^{N} w_{i,t} LRMES_{i,t:t+T}$$

Similarly, the systemic risk of the entire financial system is:

$$SRISK_{F,t:t+T} = \sum_{i=1}^{N} w_{i,t}\, SRISK_{i,t:t+T}$$

SRISK is based on the assumption that the book value of the (long-term) debt Dit of the bank will remain constant over the six-month horizon while its market Capital MVit will decrease by its six-month return in a crisis, called the LRMES. SRISK of bank i at time t is defined by where Rmt+h is the return of the market index from period t to period t + h (h = 6 months), k is the prudential capital ratio (8% for US financial firms), and LRMESit = -Et(Rit+h|Rmt+h ≤ -40%). Compared to other market-based measures of systemic risk like the CoVaR of Adrian and Brunnermeier (2010) or the Distress Insurance Premium of Huang et al., (2012), an interesting feature of SRISK is that it is a function of size and leverage which are two characteristics that the regulator finds particularly relevant when measuring the solvency risk of banks.

$$\begin{aligned} SRISK_{it} &= E_t[k(D_{it+h} + MV_{it+h}) - MV_{it+h} | R_{mt+h} \leq -40\%] \\ &= kD_{it} - (1-k) * MV_{it} * (1 - LRMES_{it}) \end{aligned}$$

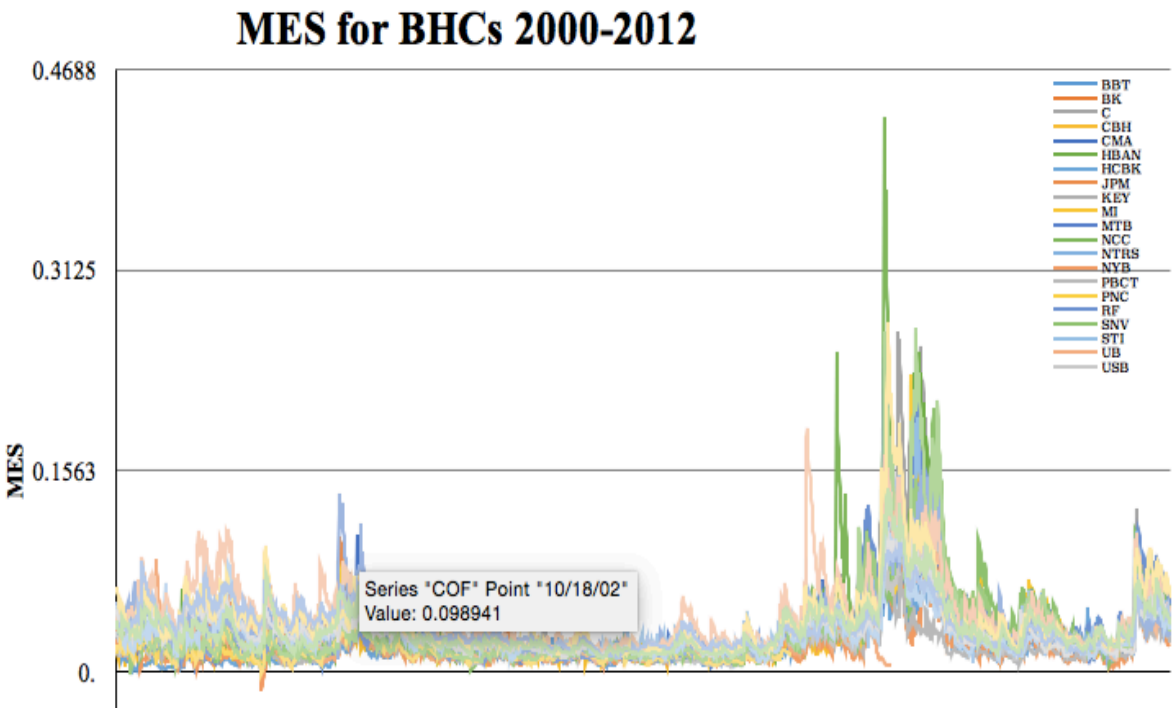
The SRISK can be written as a function of size, leverage and risk and is defined as:

$$SRISK_{it} = MV_{it}\{k(Lvg_{it} - 1) - (1-k)(1 - LRMES_{it})\}$$

where Lvgit is the quasi-market leverage defined as the ratio of quasi-market assets to market Capital (Lvgit = (MVit + Dit)=MVit). Therefore, the capital shortfall of a bank will be large if the bank is large, highly leveraged and highly sensitive to an aggregate shock as measured by LRMESit.

Appendix 3

Figure 3-1 - Systemic risk from 2000 to 2012



Note: Bank codes are provided in Table 4.1a.

Source: Author's calculations, based on statistical analysis of FR -9YC data.

Appendix 4

Table 4-1a - BHCs used in systemic risk regressions

1 Ticker	2 BHC Name
BAC	Bank Of America Corp
BBT	B B & T Corp
BK	Bank New York Inc
C	Citigroup Inc
CBH	Commerce Bancorp Inc Nj
CMA	Comerica Inc
HBAN	Huntington Bancshares Inc
HCBK	Hudson City Bancorp Inc
JPM	J P Morgan Chase & Co
KEY	Keycorp New
MI	Marshall & Ilsley Corp New
MTB	M & T Bank Corp
NCC	National City Corp
NTRS	Northern Trust Corp
NYB	New York Community Bancorp Inc
PBCT	Peoples United Financial Inc
PNC	P N C Financial Services Grp Inc
RF	Regions Financial Corp New
SNV	Synovus Financial Corp
STI	Suntrust Banks Inc
UB	Unionbancal Corp
USB	U S Bancorp Del
WB	Wachovia Corp 2nd New
WFC	Wells Fargo & Co New
ZION	Zions Bancorp
AMP	Ameriprise Financial Inc
AXP	American Express Co
BEN	Franklin Resources Inc
CBSS	Compass Bancshares Inc
COF	Capital One Financial Corp
FITB	Fifth Third Bancorp
SEIC	S E I Investments Company
ETFC	E Trade Financial Corp
GS	Goldman Sachs Group Inc
MS	Morgan Stanley Dean Witter & Co
SCHW	Schwab Charles Corp New
TROW	T Rowe Price Group Inc

Table 4-2a - Frequency of BHCs involved in litigation

1 Legal name	2 Freq.	3 Legal name	4 Freq.
1ST Centennial Bancorp	2	Heartland Financial USA, Inc.	1
Access National Corporation	6	Heritage Oaks Bancorp	2
ACNB Corporation	2	High Country Financial Corporation	2
Alliance Financial Services, Inc.	8	Hometown Community Bancorp, Inc.	3
Amboy Bancorporation	7	HSBC North America Inc.	2
Americorp	1	HSBC USA Inc.	2
Amsouth Bancorporation	2	International Bancshares Corporation	5
ANB Corporation, The	1	J.P. Morgan Chase & co.	2
Associated Banc-Corp	5	JPMorgan Chase & co.	26
Banctrust Financial Group, Inc.	2	K Capital Corporation	2
Bank of America Corporation	14	Mackinac Financial Corporation	1
Bank of Commerce Holdings	2	Mercantile Bancorp, Inc.	2
Belmont Bancorp	6	Mid-America Bancorp	3
Beverly Hills Bancorp Inc.	1	Mountain National Bancshares, Inc.	2
BOH Holdings, Inc.	1	National Bancorp, Inc.	1
Boston Private Financial Holdings, Inc.	1	National Bancshares, Inc.	3
Bostonfed Bancorp, Inc.	1	National City Corporation	4
Bremer Financial Corporation	2	National Commerce Financial Corporation	4
Business Bancshares, Inc.	2	NB Holdings Corporation	2
Capital Bank Financial Corp.	1	New Century Bancorp, Inc.	2
Capital One Financial Corporation	3	Northeast Bancorp	3
Centennial First Financial Services	3	Northern Trust Corporation	1
Central Bancorp, Inc.	3	Old National Bancorp	1
Central Bancshares, Inc.	1	Pacific City Financial Corporation	2
Chinatrust Capital Corporation	8	Pacwest Bancorp	1
CIB Marine Bancshares, Inc.	5	Pontotoc Bancshares Corp.	2
Citicorp	3	Provident Financial Services, Inc.	1
Citigroup Holdings Company	3	Pulaski Financial Corp.	4
Citigroup Inc.	16	R&G Financial Corporation	4
Citizens Commerce Bancshares, Inc.	1	Raymond James Financial, Inc.	3
Comerica Incorporated	3	Regions Financial Corporation	4
Commerce Bancshares, Inc.	1	Riggs National Corporation	2
Commerce National Financial Services, Inc.	1	Saehan Bancorp	7
Community Bancshares, Inc.	2	Santander Holdings USA, Inc.	2
Community West Bancshares	3	Simmons First National Corporation	4
Coppermark Bancshares, Inc.	4	Simplicity Bancorp, Inc.	1
CU Bank Shares, Inc.	1	South Financial Group, Inc., The	4
CVB Financial Corp.	1	Southern Illinois Bancorp, Inc.	1
Discover Financial Services	8	Southern Michigan Bancorp, Inc.	1
Drew Bancshares, Inc.	1	State Financial Services Corporation	1
Enterprise Financial Services Corp.	1	State Street Corporation	1
Evergreenbancorp, Inc.	1	Sterling Financial Corporation	1
Fidelity D&D Bancorp, Inc.	1	Stifel Financial Corp.	1
Financial Investors of the South, Inc.	1	Summit Financial Group, Inc.	1
First Bancorp	1	Synovus Financial Corp.	6
First bancorp. of durango, Inc.	12	Taunus Corporation	1
First Citizens Bancorp	3	Taylor Capital Group, Inc.	3

1 Legal name	2 Freq.	3 Legal name	4 Freq.
First Commonwealth Financial Corporation	1	Tri City Bankshares Corporation	3
First National Bancshares, Inc.	1	U.S. Bancorp	2
First National Community Bancorp Inc.	1	U.S. Trust Corporation	1
First National Of Nebraska, Inc.	1	UCBH Holdings, Inc.	2
First Regional Bancorp	1	UMB Financial Corporation	1
FNB United Corp.	1	Umpqua Holdings Corporation	5
FSB Mutual Holdings, Inc.	3	Wachovia Corporation	2
Goldman Sachs Group, Inc., The	4	Washington Trust Bancorp, Inc.	4
Grand Bankshares, Inc.	3	Webster Financial Corporation	3
Great Southern Capital Corporation	1	West Coast Bancorp	1
Harris Bankcorp, Inc.	3	Westamerica Bancorporation	3
Harris Financial Corp.	2	Total	341

Table 4-3a - BHCs significantly involved in litigation settlements during 2001–2014

1	2	3	4	5	6	7
Year	Frequency of Litigation	Average Litigation Settlement ($m)	S.D.	Median	Min	Max
2001	17	64,685	28,700.00	54,686.00	5,111.00	150,000.00
2002	32	72,231	14,338.00	79,876.00	19,898.00	89,779.00
2003	17	4,960	2,320.00	6,765.00	200.00	7,059.00
2004	41	919,539	97,877.00	988,997.00	62,999.00	999,978.00
2005	13	666,190	130,988.00	666,890.00	34,002.00	878,999.00
2006	6	5,654	970.00	4,674.00	1,389.00	6,787.00
2007	16	23,542	16,876.00	20,548.00	1,002.00	57,657.00
2008	51	8,751	2,100.00	8,788.00	1,201.00	9,876.00
2009	8	30,563	5,600.00	32,569.00	14,560.00	34,565.00
2010	32	883,612	502,320.00	912,022.00	345,983.00	998,787.00
2011	33	1,058,921	60,898.00	1,098,921.00	9,800.00	220,001.00
2012	42	1,073,620	67,677.00	1,073,550.00	1,789.00	250,505.00
2013	33	2,181,125	89,009.00	2,198,600.00	1,890.00	300,911.00

Source: Author's calculations, based on statistical analysis of FR-9YC data.

Appendix 5

Tables

Chapter 2 Tables

Table 2-1a - Global Securitisation Issuance in 2011 (€ Billions)

1	2	3	4	5	6
	2011:Q1	**2011:Q2**	**2011:Q3**	**2011:Q4**	**Total**
US	118.5	115.3	86.2	77	397
Europe	16.4	24.5	9.7	20.5	71
Asia	10.2	19.9	13.1	14.9	58
Total	145.1	159.6	108.9	112.4	526

Source: Dealogic , 2012

Table 2-1b - European and US Securitisation Issuance (€ Billions)1

1	2	3
Year	**US**	**Europe**
2000	1,088.00	78.2
2001	2,308.40	152.6
2002	2,592.70	157.7
2003	2,914.50	217.3
2004	1,956.60	243.5
2005	2,650.60	327
2006	2,455.80	481
2007	2,147.10	453.7
2008	933.6	711.1
2009	1,358.90	414.1
2010	1,276.70	382.9
2011	1,013.70	367.2

Source: Bloomberg, Dealogic, Thomson Reuters, SIFMA

[1] Note: historical data for the Asian markets was not available.

Chapter 2 Tables

Table 2-1 - Summary Statistics

1 Variable	2 N	3 Mean	4 S.D.	5 Min	6 Max
Total Assets ($million)	51797	11208.82	87527.71	5.670409	2010457
Size	51797	6.9646	1.365825	1.735261	14.51387
Leverage	50704	.0914207	.0829077	0	12.46
Liquidity Ratio	50517	.2434069	.1237085	0	.9641692
Profitability	51793	.0047919	.0128509	-.2526283	1.590221
Charge-off Ratio	51752	.0037013	.0088443	-.0165576	.4626626
NPL Ratio	41891	.0193815	.3439997	0	70.10714
Efficiency	51793	.6971697	.5697971	0	104.2148
Loan Ratio	51797	.667493	.1359254	0	.9727224
Real Estate Loan Ratio	51639	.7268647	.1686279	0	1
Consumer Loan Ratio	51639	.065387	.0929127	0	1
Commercial Loan Ratio	51639	.156215	.102705	0	1
Other Loan Ratio	51793	.2328314	.286721	0	17.04168
Sec.Residential	51797	.0083474	.1187858	0	8.389473
Sec.Home Equity	51797	.0001805	.0036998	0	.2198979
Sec. Credit Cards	51797	.0012652	.0303578	0	1.586849
Sec. Auto Loans	51797	.0002483	.0046506	0	.2202682
Sec. Commercial	51797	.0001707	.0038248	0	.5279339
Sec. Other	51797	.001396	.0413102	0	3.410772
Third Party Credit Enh. Ratio	51797	.0003074	.0052552	0	0.1262455
Third Party Liquidity Prov. Ratio	51797	.00003	.0008538	0	0.0090673

Note: This table reports the variable's name, mean, standard deviation, minimum- and maximum value of the individual bank time-series averages, and number of observations. The sample period is from 2001Q2 to 2013 Q1. The sample contains 1718 BHCs. The variables are reported in the $ millions. Variables are winsorized at 1% and definition of the variables are provided in the Appendix 1.

Table 2-2 - Summary statistics

1	2	3	4	5	6	7	8	9	10	11	12
			Non-securitizers						Securitizers		
Variables	N	Mean	S.D.	Min	Max	N	Mean	S.D.	Min	Max	Difference
Total Assets ($million)	42078	2255153	15807.62	5670409	673258.2	9718	49978.37	194691.2	1514452	2010457	2116.19%
Size	42078	6705206	.9600697	1735261	1341988	9718	8087742	2097511	5020224	1451387	20.62%
Leverage	41250	1173971	3615802	3290556	3236246	9452	1212761	3905444	3290556	3236246	3.30%
Capital Ratio	41250	.1255117	.0440338	.0245	.3278	9452	.1206075	.0448628	.0245	.3278	-3.91%
Liquidity Ratio	41102	.2458106	.1202668	.0352983	.6056811	9414	.2325863	.1176384	.0352983	.6056811	-5.38%
Profitability	40902	.1617221	.3268365	-1772282	.7996585	9448	.1802781	.3269352	-1772282	.7996585	11.47%
RWATA Ratio	41250	.7271226	.1141493	.3861856	.9793449	9452	.7273649	.1166916	.3861856	.9793449	0.03%
Charge-off Ratio	40849	.1514844	.2976703	-.0648922	18718	9446	.1871332	.3209441	-.0648922	18718	23.53%
NPL Ratio	33901	-4925533	140892	-8988984	-2312795	7989	-4696984	1209251	-8988984	-2312795	-4.64%
Efficiency	42074	.6905404	.1710661	.3590868	1526493	9718	.6790775	.166846	.3590868	1526493	-1.66%
Loan Ratio	42078	.6726463	.1290071	.204754	.900983	9718	.6498939	.13946	.204754	.900983	-3.38%
Real Estate Loan Ratio	41950	.7391402	.1556766	.1121248	.9898053	9688	.6777965	.1936344	.1121248	.9898053	-8.30%
Consumer Loan Ratio	41950	.0583395	.068634	.0002593	.4091289	9688	.0805341	.0911376	.0002593	.4091289	38.04%
Commercial Loan Ratio	41950	.153409	.0972814	.0013215	.5290162	9688	.1618466	.0944183	.0013215	.5290162	5.50%
Other Loan Ratio	41950	.0450097	.0679336	0	.4181471	9688	.0673518	.088965	0	.4181471	49.64%
Non-interest Income	42074	.2177203	.1264514	-.0148132	.8109758	9718	.30659	.1729796	-.0148132	.8109758	40.82%
Sec.Residential	42099	0	0	0	0	9718	.0372347	.1491731	0	1475278	.
Sec.Home Equity	42099	0	0	0	0	9718	.0009047	.0073445	0	.131932	.
Sec. Credit Cards	42099	0	0	0	0	9718	.0066227	.0673503	0	1315795	.
Sec. Auto Loans	42099	0	0	0	0	9718	.0012796	.0098796	0	.1657618	.
Sec. Commercial	42099	0	0	0	0	9718	.0007964	.0053467	0	.070414	.
Sec. Other	42099	0	0	0	0	9718	.0050435	.0312801	0	.4357904	.
Credit Enh. Ratio	42099	0	0	0	0	9718	.0016322	.0118354	0	.3820765	.
CEI Ratio	42099	0	0	0	0	9718	.0004559	.0032891	0	.0580378	.
SUB Ratio	42099	0	0	0	0	9718	.0005518	.0035607	0	.0578376	.
SLC Ratio	42099	0	0	0	0	9718	.0007485	.0106116	0	.3820765	.
Liquidity Prov. Ratio	42099	0	0	0	0	9718	.0001593	.0019518	0	.0588027	.
Third Party Credit Enh. Ratio	42099	.0001428	.0028396	0	.1262455	9718	.0002115	.0022472	0	.0766659	48.13%
Third Party Liquidity Prov. Ratio	42099	3.240	.0001342	0	.0090673	9718	.0001119	.0018352	0	.0547001	3353.77%

Note: This table reports the variable's name, mean, standard deviation, minimum- and maximum value of the individual bank time-series averages, and number of observations. This is done per observation, grouped by banks which securitize and which do not securitize at any point in time in the sample period of 2001Q2 to 2013 Q1. The sample contains 1718 BHCs, of which 299 BHCs securitize their assets. The variables are reported in the $ millions. Variables are winsorized at 1% and definition of the variables are provided in the Appendix 1. The mean differences in percentage terms between banks that securitize and those that do not securitize are also reported.

Table 2-3 - Correlation matrix

1 Variables	2 Securitization dummy	3 Sec.Residential	4 Sec.Home Equity	5 Sec. Credit Cards	6 Sec. Auto Loans	7 Sec. Commercial	8 Sec. Other	9 RWATA	10 Non-performing loans	11 Profitability	12 Capital	13 Size	14 Credit Enh. Ratio	15 Liquidity Prov. Ratio	16 Third Party Credit Enh. Ratio	17 Third Party Liquidity Prov. Ratio
Securitization dummy	1.0000															
Sec.Residential	0.3610*	1.0000														
Sec.Home Equity	0.1815*	0.4049*	1.0000													
Sec. Credit Cards	0.1452*	0.0070	0.0006	1.0000												
Sec. Auto Loans	0.1907*	0.0099	0.0083	0.0308*	1.0000											
Sec. Commercial	0.2189*	0.0399*	0.1437*	0.1230*	0.0199*	1.0000										
Sec. Other	0.2366*	0.0597*	0.0987*	0.1401*	0.0044	0.0393*	1.0000									
RWATA	0.0113	-0.0141*	-0.0019	0.0652*	0.0263*	-0.0201*	0.0533*	1.0000								
Non-performing loans	0.0032	0.0058	0.0009	-0.0004	-0.0023	-0.0004	-0.0006	-0.0095	1.0000							
Profitability	0.0175*	0.0062	0.0022	0.0230*	0.0555*	0.0027	0.0159*	-0.0508*	-0.3802*	1.0000						
Capital	-0.0100	-0.0078	-0.0186*	0.0078	0.0806*	-0.0312*	0.0323*	-0.1902*	-0.0021	-0.3216*	1.0000					
Size	0.4833*	0.2108*	0.1517*	0.1274*	0.0725*	0.1521*	0.1125*	-0.0368*	0.0024	-0.0056	-0.0173*	1.0000				
Credit Enh. Ratio	0.2139*	0.0845*	0.1471*	0.0476*	0.0209*	0.1271*	0.0727*	-0.0066	0.0002	0.0033	-0.0189*	0.2908*	1.0000			
Liquidity Prov. Ratio	0.0925*	0.0184*	0.1324*	0.0297*	0.0248*	0.0803*	0.1384*	-0.0028	-0.0006	0.0017	-0.0102	0.1140*	0.0578*	1.0000		
Third Party Credit Enh. Ratio	0.2331*	0.1000*	0.0434*	0.0946*	0.0202*	0.0535*	0.0813*	-0.0288*	0.0001	0.0027	-0.0204*	0.3353*	0.6124*	0.1265*	1.0000	
Third Party Liquidity Prov. Ratio	0.1874*	0.0264*	0.0474*	0.0458*	0.0349*	0.0253*	0.0835*	-0.0152*	-0.0003	0.0009	-0.0164*	0.2487*	0.3416*	0.3635*	0.4660*	1.0000

Note: The table reports pairwise correlations between the main regression variables. * indicates significance at 1%. Definition and construction of the variables are provided in Appendix 1.

Table 2-4 - Treatment effect model. Securitization and BHCs' performance measures

1	2	3	4	5	6	7	8	9	10	11
	(First-stage)	(Second-stage)	(First-stage)	(Second-stage)	(First-stage)	(Second-stage)	(First-stage)	(Second-stage)	(First-stage)	(Second-stage)
Variables	**Secdummy**	**RWATA**	**Secdummy**	**ΔRWATA**	**Secdummy**	**NPL**	**Secdummy**	**Profitability**	**Secdummy**	**Capital**
Loan ratio	-0.653	0.518***	-0.657	-1.369***	-0.468	0.598	4.020***	-0.0899	-1.016*	-0.148***
	(0.602)	(0.037)	(0.596)	(0.280)	(0.430)	(0.470)	(0.692)	(0.069)	(0.558)	(0.022)
Credit Enhancements	0.574*	-0.04***	0.562*	2.520***	0.179**	0.131**	0.127*	0.029***	0.448	-1.17***
	(0.306)	(0.007)	(0.329)	(0.704)	(0.071)	(0.005)	(0.067)	(0.002)	(0.278)	(0.232)
Liquidity Provision	9.587**	-0.0740	9.643**	-2.349	6.432***	-5.370**	4.017***	0.0826	10.37**	-0.0672***
	(4.674)	(0.146)	(4.523)	(1.489)	(1.573)	(2.516)	(1.311)	(0.234)	(4.169)	(0.023)
Seller's Interest	3.505***	0.133***	3.800***	-0.875	1.191**	-0.0694	2.032***	0.312***	3.644***	-0.0305***
	(1.312)	(0.040)	(1.333)	(0.567)	(0.515)	(0.320)	(0.682)	(0.058)	(0.921)	(0.010)
Third Part. Credit Enhancements	0.057	-0.026	0.057	-0.104	0.011	0.043	0.836	-0.005	-0.063	-0.030
	(0.204)	(0.043)	(0.147)	(0.206)	(0.124)	(0.115)	(0.708)	(0.028)	(0.170)	(0.021)
Third Part. Liquidity Provision	2.374	0.307***	2.342	-2.445***	2.087**	-1.950**	4.437***	0.176	1.626	-0.146***
	(2.918)	(0.041)	(2.802)	(0.624)	(0.822)	(0.825)	(0.719)	(0.159)	(2.075)	(0.017)
Size	0.236***	0.0043**	0.234***	0.026	0.125***	-0.026	0.311***	0.013***	0.212***	-0.0082***
	(0.048)	(0.002)	(0.048)	(0.016)	(0.027)	(0.019)	(0.030)	(0.003)	(0.042)	(0.007)
Profitability	-0.056	-0.0056*	-0.066	0.170**	0.490***	-0.719***	0.142*		-0.604***	0.0015
	(0.088)	(0.003)	(0.083)	(0.077)	(0.059)	(0.046)	(0.076)		(0.068)	(0.001)
Liquidity	-1.735**	-0.020	-1.696**	-0.036	-0.351	-0.577	-1.257*	-0.034	-1.645***	0.021
	(0.698)	(0.035)	(0.683)	(0.266)	(0.483)	(0.480)	(0.664)	(0.070)	(0.623)	(0.021)
Expenses	-0.327	-0.0056	-0.347	0.179	-0.490***	0.436***	0.456**	-0.759***	-1.313***	-0.023***
	(0.224)	(0.009)	(0.218)	(0.132)	(0.161)	(0.124)	(0.187)	(0.021)	(0.224)	(0.005)
Non-performing loans	0.122***	0.00085	0.119***	0.0650***	0.793***		0.0284	-0.0386***	0.0709*	0.000360
	(0.041)	(0.001)	(0.040)	(0.011)	(0.027)		(0.028)	(0.002)	(0.041)	(0.001)
Capital	1.315	-1.011***	1.044	0.782	0.166	1.183	27.38***	0.184	-0.218	
	(1.447)	(0.099)	(1.349)	(0.793)	(0.945)	(0.865)	(1.211)	(0.134)	(1.252)	
Non-interest income	1.178***	0.0277**	1.114***	-0.501***	0.863***	-0.481**	0.456*	0.355***	1.277***	0.000939
	(0.309)	(0.014)	(0.294)	(0.129)	(0.233)	(0.208)	(0.245)	(0.034)	(0.274)	(0.007)
Secdummy		0.0216*		-0.258*		1.659***		-0.292***		0.0396***
		(0.012)		(0.138)		(0.040)		(0.030)		(0.001)
Fad	0.0139***		0.0141***		0.00631***		0.00475***		0.0102***	
	(0.004)		(0.004)		(0.001)		(0.001)		(0.003)	
Constant	-2.108**	0.579***	-2.029**	-0.0978	2.227***	-5.609***	-11.71***	0.513***	-0.565	0.366***
	(0.851)	(0.052)	(0.842)	(0.438)	(0.598)	(0.589)	(0.842)	(0.089)	(0.793)	(0.022)

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) RWATA	4 (First-stage) Secdummy	5 (Second-stage) ΔRWATA	6 (First-stage) Secdummy	7 (Second-stage) NPL	8 (First-stage) Secdummy	9 (Second-stage) Profitability	10 (First-stage) Secdummy	11 (Second-stage) Capital
Observations	47,296	47,296	47,296	47,296	47,216	47,216	47,296	47,305	47,305	47,296
Clusters	1506	1506	1506	1506	1508	1508	1506	1508	1508	1506
Wald ChiSq	18195	18195	2630	2630	17279	17279	6983	12393	12393	6983
Rho	-0.116	-0.116	0.0575	0.0575	-0.892	-0.892	-0.897	0.588	0.588	-0.897
ChiSq H0: Rho = 0	3,471	3,471	5,503	5,503	2562	2562	548.1	49.89	49.89	548.1
P-val H0	0.0624	0.0624	0.0190	0.0190	0	0	0	0	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables are lagged one quarter. I also include quarter dummies, which are not reported. “Fad” is also lagged one quarter. Credit risk (RWATA and NPL), profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. Robust standard errors (clustered at the bank level) reported in parentheses***, **, * signify statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2-5 - Treatment effect model. Securitization and credit risk

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA
Sec. residential				-0.00966 (0.025)						-0.0179 (0.030)
Sec. home equity				-0.571 (0.592)						-1.083 (0.733)
Sec. credit card				0.0860*** (0.030)						0.0277 (0.036)
Sec. auto loans				1.083*** (0.384)						1.122*** (0.280)
Sec. commercial				-1.068 (1.597)						-2.180 (1.90)
Sec. other				0.739*** (0.121)						0.590*** (0.070)
Loan ratio	-0.563 (0.612)	0.528*** (0.046)	-0.641 (0.602)	0.521*** (0.031)						
Size	0.248*** (0.047)	0.00432** (0.001)	0.236*** (0.048)	0.00481*** (0.001)	0.248*** (0.048)	-0.00723*** (0.001)	0.248*** (0.048)	-0.00722*** (0.001)	0.241*** (0.049)	-0.00638*** (0.001)
Profitability	-0.0426 (0.088)	-0.00546 (0.003)	-0.0510 (0.088)	-0.00540* (0.003)	-0.0723 (0.081)	-0.0104*** (0.003)	-0.0729 (0.081)	-0.0105*** (0.003)	-0.0804 (0.083)	-0.00975*** (0.003)
Liquidity	-1.621** (0.702)	-0.00981 (0.038)	-1.679** (0.686)	-0.00550 (0.026)	-1.114** (0.471)	-0.473*** (0.025)	-1.114** (0.471)	-0.473*** (0.024)	-1.133** (0.469)	-0.461*** (0.019)
Expenses	-0.292 (0.225)	-0.00533 (0.009)	-0.320 (0.223)	-0.00336 (0.008)	-0.278 (0.224)	-0.0381*** (0.011)	-0.279 (0.224)	-0.0383*** (0.011)	-0.304 (0.225)	-0.0344*** (0.009)
Non-performing loans	0.135*** (0.041)	0.000533 (0.001)	0.124*** (0.041)	0.000637 (0.001)	0.135*** (0.042)	0.00203* (0.001)	0.134*** (0.042)	0.00200* (0.001)	0.121*** (0.041)	0.00221** (0.001)
Capital	1.306 -1.466	-1.005*** (0.117)	1.139 -1.373	-1.066*** (0.079)	0.873 -1.443	-1.201*** (0.133)	0.873 -1.441	-1.202*** (0.132)	1.119 -1.414	-1.266*** (0.089)
Non-interest income	1.371*** (0.304)	0.0295** (0.014)	1.158*** (0.301)	0.0188 (0.012)	1.218*** (0.302)	-0.0363*** (0.013)	1.214*** (0.302)	-0.0367*** (0.013)	1.082*** (0.300)	-0.0394*** (0.013)
Credit Enhancements	-3.15**		(0.306)	0.563* (1.22)			-5.05***		(0.311)	0.570* (1.52)
Liquidity Provision	-0.244 (0.209)			9.505** (4.619)			-0.130 (0.205)			9.659** (4.037)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) RWATA
Third Part. Credit Enhancements			0.0521 (0.202)	-0.0180 (0.032)					0.0811 (0.174)	-0.0343 (0.038)
Third Part. Liquidity Provision	2.360 (2.972)	0.328*** (0.034)					2.141 (2.831)	0.324*** (0.046)		
Secdummy		0.0305** (0.011)				0.0179 (0.014)		0.0163 (0.015)		0.00840 (0.012)
Fad	0.0143*** (0.004)		0.0140*** (0.004)		0.0153*** (0.004)		0.0154*** (0.004)		0.0148*** (0.004)	
Securitized assets					0.0987*** (0.032)					
Loans: real estate					-0.199*** (0.718)	0.597 (0.069)	-0.191*** (0.719)	0.594 (0.069)	-0.200*** (0.837)	1.066 (0.061)
Loans: commercial					-0.0207 (0.816)	-0.200 (0.077)	-0.0175 (0.815)	-0.208 (0.077)	-0.0218 (0.916)	0.354 (0.065)
Loans: consumer					-0.199** (1.0450	1.429 (0.082)	-0.213*** -1.045	1.422 (0.082)	-0.200** (1.131)	1.737 (0.066)
Loans: other					1.441 (1.047)	-0.215*** (0.069)	1.436 -1.044	-0.214*** (0.069)	1.936* -1.114	-0.212*** (0.066)
Constant	-2.278*** (0.845)	0.568*** (0.065)	-2.095** (0.853)	0.581*** (0.044)	-3.261*** -1.006	1.368*** (0.084)	-3.255*** (1.006)	1.367*** (0.083)	-3.737*** (1.084)	1.365*** (0.069)
Observations	47,296	47,296	47,296	47,296	47,295	47,295	47,295	47,295	47,295	47,295
Clusters	1506	1506	1506	1506	1506	1506	1506	1506	1506	1506
Wald ChiSq	7874	7874	19252	19252	7003	7003	7009	7009	18753	18753
Rho	-0.167	-0.167	-0.129	-0.129	-0.0766	-0.0766	-0.0716	-0.0716	-0.0494	-0.0494
ChiSq H0: Rho = 0	7.018	7.018	2.865	2.865	1.019	1.019	0.878	0.878	0.528	0.528
P-val H0	0.00807	0.00807	0.0905	0.0905	0.313	0.313	0.349	0.349	0.467	0.467

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables are lagged one quarter. I also include quarter dummies, which are not reported. “Fad” is also lagged one quarter. Credit risk (RWATA and NPL), profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. Robust standard errors (clustered at the bank level) reported in parentheses***, **, * signify statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2-6 - Treatment effect regressions: credit risk taking (ΔRWATA) and securitization

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA
Sec. residential						0.119 (0.260)				0.104 (0.283)
Sec. home equity						-1.963 (4.565)				-0.154 (4.911)
Sec. credit card						0.199 (0.908)				0.435 (0.955)
Sec. auto loans						2.072 (1.746)				2.595 (2.190)
Sec. commercial						-5.042 (5.128)				-2.254 (5.893)
Sec. other						-0.198 (0.614)				0.472 (0.808)
Loan ratio	-0.570 (0.598)	-1.372*** (0.272)	-0.571 (0.598)	-1.383*** (0.273)	-0.656 (0.596)	-1.389*** (0.284)				
Size	0.245*** (0.047)	0.0208 (0.015)	0.245*** (0.047)	0.0200 (0.015)	0.234*** (0.048)	0.0260 (0.016)	0.245*** (0.048)	0.0509*** (0.016)	0.238*** (0.048)	0.0576*** (0.016)
Profitability	-0.0610 (0.082)	0.172** (0.077)	-0.0611 (0.082)	0.173** (0.077)	-0.0666 (0.083)	0.169** (0.077)	-0.0767 (0.079)	0.193** (0.078)	-0.0842 (0.081)	0.189** (0.078)
Liquidity	-1.584** (0.679)	-0.0588 (0.262)	-1.585** (0.679)	-0.0732 (0.264)	-1.696** (0.682)	-0.0424 (0.271)	-1.116** (0.468)	1.154*** (0.170)	-1.141** (0.466)	1.180*** (0.172)
Efficiency	-0.323 (0.217)	0.180 (0.132)	-0.324 (0.217)	0.181 (0.132)	-0.347 (0.218)	0.178 (0.132)	-0.287 (0.219)	0.254** (0.129)	-0.312 (0.221)	0.249* (0.129)
Non-performing loans	0.130*** (0.040)	-0.0655*** (0.011)	0.130*** (0.040)	-0.0652*** (0.011)	0.119*** (0.040)	-0.0650*** (0.011)	0.134*** (0.041)	-0.0706*** (0.011)	0.121*** (0.041)	-0.0696*** (0.011)
Capital	0.966 (1.349)	0.864 (0.781)	0.966 (1.349)	0.873 (0.782)	1.045 (1.349)	0.709 (0.812)	0.813 (1.418)	1.707** (0.808)	1.114 (1.414)	1.567* (0.821)
Non-interest income	1.273*** (0.290)	-0.542*** (0.129)	1.273*** (0.290)	-0.540*** (0.129)	1.114*** (0.294)	-0.508*** (0.130)	1.173*** (0.286)	-0.275** (0.132)	1.059*** (0.289)	-0.262** (0.133)
Credit Enhancements					0.562* (0.329)	1.92 (1.31)			0.559* (0.320)	2.73* (1.47)
Liquidity Provision					9.650** (4.526)	-2.157 (1.372)			9.690** (3.978)	-2.273 (1.760)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA
Third Part. Credit Enhancements					0.0573	-0.0681			0.0814	0.0159
					(0.147)	(0.219)			(0.152)	(0.219)
Third Part. Liquidity Provision					2.342	-2.459***			2.132	-2.047***
					(2.802)	(0.615)			(2.775)	(0.619)
Secdummy		-0.283**		-0.260*				-0.231		-0.253
		(0.129)		(0.135)				(0.145)		(0.168)
Fad	0.0147***		0.0147***		0.0141***		0.0159***		0.0152***	
	(0.004)		(0.004)		(0.004)		(0.004)		(0.004)	
Securitized assets										
Loans: real estate							0.531	0.891*	1.027	0.756
							(0.697)	(0.467)	(0.815)	(0.483)
Loans: commercial							-0.346	0.947*	0.266	0.797
							(0.750)	(0.494)	(0.870)	(0.508)
Loans: consumer							1.297	0.664	1.671	0.529
							(0.996)	(0.480)	(1.102)	(0.492)
Loans: other							1.352	0.309	1.907*	0.185
							(1.007)	(0.516)	(1.095)	(0.538)
Constant	-2.180***	-0.0755	-2.179***	-0.0611	-2.029**	-0.0660	-3.129***	-2.659***	-3.653***	-2.533***
	(0.832)	(0.426)	(0.832)	(0.427)	(0.842)	(0.442)	(0.962)	(0.580)	(1.045)	(0.599)
Observations	47,296	47,296	47,296	47,296	47,296	47,296	47,295	47,295	47,295	47,295
Clusters	1506	1506	1506	1506	1506	1506	1506	1506	1506	1506
Wald ChiSq	2196	2196	2203	2203	2703	2703	2205	2205	2745	2745
Rho	0.0561	0.0561	0.0537	0.0537	0.0575	0.0575	0.0507	0.0507	0.0575	0.0575
ChiSq H0: Rho = 0	6.550	6.550	5.790	5.790	5.308	5.308	4.122	4.122	3.771	3.771
P-val H0	0.0105	0.0105	0.0161	0.0161	0.0212	0.0212	0.0423	0.0423	0.0521	0.0521

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables are lagged one quarter. I also include quarter dummies, which are not reported. "Fad" is also lagged one quarter. Credit risk (RWATA and NPL), profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. Robust standard errors (clustered at the bank level) reported in parentheses***, **, * signify statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2-7 - Treatment effect regressions: credit risk (NPL) and securitization

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL
Sec. residential						0.255 (0.166)				0.179 (0.158)
Sec. home equity						3.172 (2.554)				3.465 (2.195)
Sec. credit card						1.050*** (0.398)				1.823*** (0.517)
Sec. auto loans						-1.253 (1.443)				-2.421** (1.200)
Sec. commercial						1.040 (3.323)				3.328 (3.782)
Sec. other						-0.651 (0.425)				-0.604 (0.456)
Loan ratio	-0.416 (0.418)	0.576 (0.464)	-0.415 (0.420)	0.606 (0.463)	-0.485 (0.438)	0.633 (0.471)				
Size	0.131*** (0.026)	-0.0310 (0.019)	0.132*** (0.026)	-0.0318* (0.019)	0.125*** (0.027)	-0.0263 (0.019)	0.132*** (0.026)	-0.0337** (0.016)	0.129*** (0.027)	-0.0321* (0.016)
Profitability	0.493*** (0.058)	-0.714*** (0.045)	0.490*** (0.058)	-0.715*** (0.045)	0.487*** (0.059)	-0.721*** (0.045)	0.483*** (0.056)	-0.721*** (0.045)	0.474*** (0.058)	-0.728*** (0.045)
Liquidity	-0.290 (0.475)	-0.603 (0.478)	-0.271 (0.476)	-0.558 (0.478)	-0.394 (0.497)	-0.541 (0.479)	0.0614 (0.296)	-1.027*** (0.233)	0.0140 (0.306)	-1.028*** (0.233)
Expenses	-0.477*** (0.159)	0.443*** (0.124)	-0.484*** (0.160)	0.439*** (0.124)	-0.498*** (0.163)	0.431*** (0.124)	-0.465*** (0.157)	0.420*** (0.118)	-0.485*** (0.162)	0.405*** (0.118)
Capital	0.145 (0.915)	1.185 (0.855)	0.107 (0.916)	1.159 (0.858)	0.280 (0.971)	1.224 (0.864)	-0.0595 (0.941)	1.022 (0.871)	0.179 (0.997)	1.103 (0.868)
Non-interest income	0.933*** (0.229)	-0.512** (0.208)	0.919*** (0.229)	-0.525** (0.209)	0.872*** (0.238)	-0.482** (0.208)	0.836*** (0.214)	-0.441** (0.181)	0.799*** (0.220)	-0.435** (0.182)
Credit Enhancements					0.179*** (0.067)	8.49 (9.04)			0.177*** (0.064)	3.08 (8.33)
Liquidity Provision					6.629*** (1.555)	-5.378** (2.532)			6.515*** (1.273)	-4.349*** (1.542)
Third Part. Credit Enhancements					0.0139 (0.130)	0.0273 (0.128)			-0.00548 (0.112)	0.0600 (0.110)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) NPL
Third Part. Liquidity Provision					2.045**	-1.852**			1.362	-0.580
					(0.819)	(0.778)			(0.987)	(0.589)
Secdummy		1.661***		1.636***				1.644***		
		(0.039)		(0.040)				(0.038)		
Non-performing loans	0.796***		0.794***		0.791***		0.797***		0.791***	
	(0.027)		(0.027)		(0.028)		(0.028)		(0.028)	
Fad	0.00646***		0.00648***		0.00632***		0.00676***		0.00661***	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Securitized assets				0.290**						
				(0.135)						
Loans: real estate							-1.852**	2.909***	-1.635**	2.992***
							(0.743)	(0.871)	(0.811)	(0.888)
Loans: commercial							-2.290***	2.877***	-2.036**	2.964***
							(0.776)	(0.897)	(0.851)	(0.912)
Loans: consumer							-1.865**	3.654***	-1.596*	3.744***
							(0.864)	(0.927)	(0.924)	(0.922)
Loans: other							-1.393	2.394**	-1.132	2.529**
							(0.919)	(1.005)	(0.996)	(1.028)
Constant	2.134***	-5.557***	2.123***	-5.576***	2.220***	-5.645***	3.700***	-7.913***	3.456***	-8.019***
	(0.581)	(0.583)	(0.585)	(0.581)	(0.604)	(0.588)	(0.822)	(0.901)	(0.884)	(0.917)
Observations	47,216	47,216	47,216	47,216	47,216	47,216	47,215	47,215	47,215	47,215
Clusters	1508	1508	1508	1508	1508	1508	1508	1508	1508	1508
Wald ChiSq	6421	6421	6440	6440	17712	17712	6841	6841	18501	18501
Rho	-0.893	-0.893	-0.893	-0.893	-0.891	-0.891	-0.892	-0.892	-0.891	-0.891
ChiSq H0: Rho = 0	2613	2613	2586	2586	2538	2538	2616	2616	2541	2541
P-val H0	0	0	0	0	0	0	0	0	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables are lagged one quarter. I also include quarter dummies, which are not reported. “Fad” is also lagged one quarter. Credit risk (RWATA and NPL), profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. Robust standard errors (clustered at the bank level) reported in parentheses***, **, * signify statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2-8 - Treatment effect regression: profitability and securitization

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability
Sec. residential				0.131*** (0.031)						0.153*** (0.031)
Sec. home equity				-0.0963 (0.520)						0.432 (0.497)
Sec. credit card				0.125** (0.058)						0.192*** (0.073)
Sec. auto loans				1.017 (1.226)						0.636 (1.090)
Sec. commercial				1.024 (0.944)						0.938 (0.945)
Sec. other				0.0768 (0.115)						-0.0297 (0.120)
Loan ratio	-0.917* (0.552)	-0.0733 (0.068)	-1.015* (0.550)	-0.0767 (0.069)						
Size	0.223*** (0.042)	0.0141*** (0.003)	0.212*** (0.042)	0.0132*** (0.003)	0.232*** (0.041)	0.0129*** (0.003)	0.232*** (0.041)	0.0124*** (0.003)	0.225*** (0.041)	0.0118*** (0.003)
Liquidity	-1.573** (0.615)	-0.0118 (0.068)	-1.663*** (0.617)	-0.0169 (0.070)	-0.844** (0.415)	0.0150 (0.030)	-0.874** (0.414)	0.0243 (0.030)	-0.859** (0.408)	0.0204 (0.031)
Expenses	-1.274*** (0.221)	-0.759*** (0.021)	-1.314*** (0.220)	-0.760*** (0.021)	-1.186*** (0.226)	-0.737*** (0.021)	-1.181*** (0.220)	-0.738*** (0.021)	-1.228*** (0.218)	-0.739*** (0.021)
Non-performing loans	0.0811** (0.041)	-0.0387*** (0.002)	0.0711* (0.040)	-0.0389*** (0.002)	0.0805* (0.043)	-0.0391*** (0.002)	0.0834* (0.043)	-0.0396*** (0.002)	0.0711* (0.042)	-0.0399*** (0.002)
Capital	-0.152 (1.230)	0.171 (0.134)	-0.227 (1.244)	0.177 (0.133)	0.221 (1.298)	0.257** (0.128)	0.269 (1.296)	0.239* (0.129)	0.394 (1.283)	0.264** (0.131)
Non-interest income	1.435*** (0.271)	0.356*** (0.034)	1.299*** (0.273)	0.349*** (0.034)	1.300*** (0.267)	0.305*** (0.034)	1.326*** (0.265)	0.295*** (0.034)	1.219*** (0.267)	0.292*** (0.034)
Credit Enhancements			0.458 (0.279)	2.34*** (2.19)					0.457* (0.275)	2.50*** (2.30)
Liquidity Provision			10.50*** (4.067)	0.0578 (0.259)					10.81*** (3.706)	0.143 (0.273)
Third Part. Credit Enhancements			-0.0665 (0.167)	-0.00730 (0.030)					-0.00615 (0.169)	-0.000462 (0.029)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Profitability
Third Part. Liquidity Provision			1.613	0.234					1.314	0.201
			(2.004)	(0.149)					(1.974)	(0.141)
Secdummy		-0.303***				-0.287***		-0.307***		
		(0.030)				(0.032)		(0.029)		
Profitability	-0.594***		-0.604***		-0.598***		-0.595***		-0.608***	
	(0.068)		(0.068)		(0.069)		(0.069)		(0.068)	
Fad	0.0107***		0.0100***		0.0118***		0.0117***		0.0109***	
	(0.003)		(0.003)		(0.003)		(0.003)		(0.003)	
Securitized assets								-0.173***		
								(0.029)		
Loans: real estate					0.907	0.162	0.928	0.176*	1.418*	0.209*
					(0.648)	(0.112)	(0.639)	(0.106)	(0.734)	(0.110)
Loans: commercial					0.257	0.192*	0.263	0.211*	0.863	0.247**
					(0.720)	(0.116)	(0.711)	(0.110)	(0.804)	(0.114)
Loans: consumer					1.828**	0.515***	1.836**	0.533***	2.204**	0.557***
					(0.918)	(0.124)	(0.913)	(0.119)	(1.012)	(0.121)
Loans: other					2.015**	0.416***	2.025**	0.440***	2.572***	0.479***
					(0.919)	(0.125)	(0.915)	(0.117)	(0.963)	(0.122)
Constant	-0.742	0.490***	-0.553	0.498***	-2.664***	0.207*	-2.667***	0.193*	-3.144***	0.160
	(0.773)	(0.087)	(0.782)	(0.089)	(0.873)	(0.124)	(0.865)	(0.117)	(0.922)	(0.121)
Observations	47,305	47,305	47,305	47,305	47,304	47,304	47,304	47,304	47,304	47,304
Clusters	1508	1508	1508	1508	1508	1508	1508	1508	1508	1508
Wald ChiSq	4173	4173	12868	12868	4110	4110	4165	4165	12694	12694
Rho	0.586	0.586	0.594	0.594	0.576	0.576	0.583	0.583	0.592	0.592
ChiSq H0: Rho = 0	51.32	51.32	55.87	55.87	44.14	44.14	52.36	52.36	57.84	57.84
P-val H0	0	0	0	0	0	0	0	0	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables are lagged one quarter. I also include quarter dummies, which are not reported. “Fad” is also lagged one quarter. Credit risk (RWATA and NPL), profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. Robust standard errors (clustered at the bank level) reported in parentheses***, **, * signify statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2-9 - Treatment effect regression: capital level (Tier 1) and securitization

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital
Sec. residential						0.0047 (0.004)				0.00714* (0.004)
Sec. home equity						-0.237 (0.147)				-0.175 (0.161)
Sec. credit card						0.0199** (0.008)				-0.00724 (0.019)
Sec. auto loans						0.161 (0.131)				0.159 (0.153)
Sec. commercial						-0.636** (0.307)				-0.509* (0.276)
Sec. other						0.122** (0.055)				0.186** (0.093)
Loan ratio	3.954*** (0.797)	-0.144*** (0.024)	3.956*** (0.797)	-0.143*** (0.024)	4.014*** (0.708)	-0.147*** (0.020)				
Size	0.320*** (0.030)	-0.00843*** (0.000)	0.321*** (0.030)	-0.00844*** (0.000)	0.316*** (0.031)	-0.00797*** (0.000)	0.227*** (0.032)	-0.00543*** (0.000)	0.225*** (0.033)	-0.00491*** (0.000)
Profitability	0.132* (0.077)	0.00184 (0.001)	0.131* (0.077)	0.00181 (0.001)	0.149* (0.076)	0.00170 (0.001)	0.0615 (0.075)	0.00364** (0.001)	0.0819 (0.075)	0.00365** (0.001)
Liquidity	-1.294* (0.724)	0.0244 (0.023)	-1.279* (0.719)	0.0249 (0.024)	-1.099 (0.670)	0.0229 (0.020)	-4.880*** (0.322)	0.156*** (0.006)	-4.674*** (0.318)	0.157*** (0.006)
Expenses	0.470** (0.193)	-0.0245*** (0.005)	0.467** (0.193)	-0.0245*** (0.005)	0.475** (0.185)	-0.0231*** (0.004)	0.251 (0.198)	-0.0169*** (0.005)	0.262 (0.188)	-0.0155*** (0.004)
Non-performing loans	0.0325 (0.027)	0.000314 (0.000)	0.0313 (0.027)	0.000300 (0.000)	0.0286 (0.028)	0.000371 (0.000)	0.0302 (0.027)	0.000322 (0.000)	0.0225 (0.028)	0.000429 (0.000)
Leverage ratio	0.207*** (0.014)	-0.00687*** (0.000)	0.206*** (0.014)	-0.00686*** (0.000)	0.202*** (0.014)	-0.00686*** (0.000)	0.203*** (0.013)	-0.00681*** (0.000)	0.198*** (0.013)	-0.00679*** (0.000)
Non-interest income	0.585** (0.229)	-0.00184 (0.007)	0.576** (0.228)	-0.00199 (0.007)	0.373 (0.244)	-0.000622 (0.007)	0.0563 (0.227)	0.0145** (0.006)	-0.119 (0.230)	0.0153** (0.006)
Credit Enhancements					0.129** (0.059)	-1.37*** (2.69)			0.0942 (0.058)	-7.82*** (2.607)
Liquidity Provision					4.255*** -1.235	-0.0812*** (0.030)			6.157*** -1.363	-0.143*** (0.042)
Third Part. Credit Enhancements					0.824 (0.622)	-0.0251 (0.017)			0.712 (0.561)	-0.0215 (0.015)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Capital
Third Part. Liquidity Provision					4.310***	-0.145***			4.959***	-0.160***
					(0.732)	(0.016)			(1.004)	(0.025)
Secdummy		0.0395***		0.0392***		0.0389***		0.0431***		0.0391***
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Capital	27.33***		27.31***		26.21***		27.15***		26.14***	
	(1.252)		(1.251)		(1.292)		(1.181)		-1.223	
Fad	0.00492***		0.00494***		0.00491***		0.00567***		0.00557***	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Securitized assets										
Loans: real estate							2.360**	-0.0576*	2.868***	-0.0715**
							(0.960)	(0.030)	(0.997)	(0.030)
Loans: commercial							3.357***	-0.107***	3.988***	-0.122***
							(1.016)	(0.032)	(1.017)	(0.031)
Loans: consumer							2.755**	-0.0562*	3.173***	-0.0728**
							(1.147)	(0.033)	(1.159)	(0.031)
Loans: other							3.308***	-0.0762**	3.533***	-0.0904***
							(0.987)	(0.032)	-1.057	(0.033)
Constant	-11.70***	0.365***	-11.70***	0.365***	-11.57***	0.363***	-9.807***	0.273***	-10.19***	0.283***
	(0.947)	(0.025)	(0.946)	(0.025)	(0.859)	(0.021)	(1.068)	(0.032)	-1.109	(0.032)
Observations	47,296	47,296	47,296	47,296	47,296	47,296	47,295	47,295	47,295	47,295
Clusters	1506	1506	1506	1506	1506	1506	1506	1506	1506	1506
Wald ChiSq	2914	2914	2916	2916	7276	7276	3156	3156	7468	7468
Rho	-0.899	-0.899	-0.899	-0.899	-0.895	-0.895	-0.903	-0.903	-0.899	-0.899
ChiSq H0: Rho = 0	534.5	534.5	534.8	534.8	572.0	572.0	609.7	609.7	651.3	651.3
P-val H0	0	0	0	0	0	0	0	0	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables are lagged one quarter. I also include quarter dummies, which are not reported. “Fad” is also lagged one quarter. Credit risk (RWATA and NPL), profitability and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. Robust standard errors (clustered at the bank level) reported in parentheses***, **, * signify statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2-10 - Treatment effect regressions. Sub-periods. Credit risk and securitization

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) RWATA1	4 (First-stage) Secdummy	5 (Second-stage) RWATA2	6 (First-stage) Secdummy	7 (Second-stage) RWATA3	8 (First-stage) Secdummy	9 (Second-stage) RWATA4
Loan ratio	-0.647 (0.888)	0.372*** (0.044)	-1,343 (1.186)	0.398*** (0.040)	-1,042 (0.745)	0.556*** (0.043)	-1.056 (1.086)	0.533*** (0.053)
Size	0.266*** (0.076)	0.00198 (0.002)	0.0473 (0.081)	0.00470* (0.002)	0.163** (0.069)	0.00485* (0.002)	0.290*** (0.072)	0.00457* (0.002)
Profitability	0.128 (0.290)	0.00504 (0.007)	-0.255 (0.321)	0.0375*** (0.011)	-0.00781 (0.092)	-0.0170*** (0.004)	-0.127 (0.114)	0.00527 (0.004)
Liquidity	-1.517 (0.954)	-0.0777** (0.037)	-0.795 (1.083)	-0.0481 (0.041)	-2.557*** (0.762)	0.0145 (0.047)	-2.029* (1.14)	-0.0038 (0.051)
Expenses	-1.334** (0.576)	0.00332 (0.015)	-0.451 (0.552)	0.0158 (0.016)	0.0461 (0.213)	-0.0175 (0.011)	-0.427 (0.323)	0.0169 (0.012)
Non-performing loans	0.157** (0.070)	-0.000438 (0.001)	0.0843 (0.062)	-0.00219* (0.001)	0.114** (0.055)	0.00423*** (0.001)	0.129* (0.071)	-0.00135 (0.002)
Capital	-0.106 (2.925)	-1.633*** (0.141)	-6.325 (6.17)	-1.702*** (0.152)	3.307 (2.35)	-0.884*** (0.142)	-0.207 (1.407)	-0.747*** (0.102)
Leverage ratio	0.0153 (0.033)	-0.0192*** (0.001)	-0.0208 (0.057)	-0.0204*** (0.002)	0.0149 (0.015)	-0.00710*** (0.000)	0.00327 (0.012)	-0.00615*** (0.000)
Non-interest income	1.638*** (0.428)	0.0205 (0.016)	0.251 (0.532)	0.0131 (0.018)	0.663* (0.379)	0.0196 (0.018)	0.746* (0.412)	0.0200 (0.021)
Credit Enhancements	5.283*** (1.377)	-0.0418 (0.029)	238.1*** (82.08)	-0.0620* (0.032)	3.461*** (0.432)	-0.0110 (0.038)	115.9* (64.14)	-0.118*** (0.021)
Liquidity Provision	8.896** (3.661)	-0.212 (0.144)	9.784** (3.988)	-0.114 (0.085)	428,395*** (31.772)	0.329*** (0.068)	480.7*** (93.84)	0.877*** (0.203)
Third Part. Credit Enhancements	11.43 (7.135)	-0.622*** (0.045)	-1.05 (5.857)	-0.172*** (0.032)	0.324 (0.205)	-0.0263 (0.040)	-4.338** (2.104)	0.0190*** (0.007)
Third Part. Liquidity Provision	-0.148 (1.463)	0.292*** (0.023)	2.791 (4.267)	0.335*** (0.075)	-36.36 (25.73)	0.181 (0.193)	-54.77 (48.24)	2.403 (1.634)
Secdummy		0.0484*** (0.013)		0.0433* (0.022)		0.00938 (0.017)		0.0109 (0.016)
Fad	0.00937 (0.005)		0.0200*** (0.005)		0.0201*** (0.005)		0.00494 (0.008)	
Constant	-1,645 (1.452)	0.891*** (0.069)	0.335 (2.209)	0.861*** (0.070)	-1.95 (1.232)	0.565*** (0.057)	-1.973 (1.203)	0.468*** (0.064)
Observations	12,470	12,470	12,760	12,760	11,322	11,322	10,744	10,744
Clusters	1278	1278	1266	1266	1130	1130	1105	1105
Wald ChiSq	4302	4302	4290	4290	2864	2864	3232	3232

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) RWATA1	4 (First-stage) Secdummy	5 (Second-stage) RWATA2	6 (First-stage) Secdummy	7 (Second-stage) RWATA3	8 (First-stage) Secdummy	9 (Second-stage) RWATA4
Rho	-0.321	-0.321	-0.393	-0.393	-0.0258	-0.0258	-0.0636	-0.0636
ChiSq H0: Rho = 0	8,116	8,116	3,14	3,14	0.0846	0.0846	0.593	0.593
P-val H0	0.00439	0.00439	0.0764	0.0764	0.771	0.771	0.441	0.441

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A number 1 on the dependent variable denotes sub-period 1. A number 2 on the dependent variable denoted sub-period 2. A number 3 on the dependent variable denotes sub-period 3. A number 4 on the dependent variable denotes sub-period 4. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-11 - Treatment effect regressions. Sub-periods. Credit risk taking and securitization

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) ΔRWATA1	4 (First-stage) Secdummy	5 (Second-stage) ΔRWATA2	6 (First-stage) Secdummy	7 (Second-stage) ΔRWATA3	8 (First-stage) Secdummy	9 (Second-stage) ΔRWATA4
Loan ratio	-1.168 (1.094)	-1.799*** (0.448)	-1.168 (1.094)	-1.618*** (0.538)	-0.773 (0.756)	-2.422*** (0.627)	-0.870 (1.057)	-0.592 (0.617)
Size	0.0325 (0.098)	0.00186 (0.019)	0.0515 (0.084)	0.00236 (0.024)	0.169** (0.068)	-0.0700** (0.033)	0.306*** (0.065)	0.179*** (0.043)
Profitability	-0.560 (0.184)	0.0576 (0.237)	-0.360 (0.254)	0.0476 (0.237)	-0.0389 (0.091)	0.169 (0.128)	-0.0996 (0.101)	0.0764 (0.110)
Liquidity	-1.104 (1.014)	0.00660 (0.466)	-1,104 (1.014)	0.00630 (0.506)	-2.001** (0.798)	0.745 (0.604)	-2.035* (1.104)	0.412 (0.600)
Efficiency	-0.544 (0.533)	0.531 (0.291)	-0.569 (0.525)	0.477 (0.291)	-0.00684 (0.223)	-0.0441 (0.233)	-0.345 (0.283)	0.227 (0.211)
Non-performing loans	0.0994 (0.087)	-0.0668*** (0.023)	0.0874 (0.060)	-0.0554*** (0.016)	0.104** (0.053)	-0.0721*** (0.026)	0.0990 (0.065)	-0.111*** (0.028)
Capital	-3.222 (3.058)	0.438 (1.218)	-3,145 (3.058)	0.218 (1.218)	3,217 (2.106)	0.105 (1.457)	0.490 (1.432)	1,753 (1.573)
Leverage ratio	-0.0119 (0.022)	0.00650 (0.021)	-0.0229 (0.033)	0.00740 (0.018)	0.0132 (0.014)	0.0322** (0.013)	0.0104 (0.011)	0.00586 (0.011)
Non-interest income	0.227 (0.498)	-0.684* (0.321)	0.137 (0.508)	-0.514* (0.271)	0.946*** (0.360)	-0.639** (0.289)	0.712* (0.385)	-0.710*** (0.211)
Credit Enhancements	235.2*** (87.66)	-0.142 (0.112)	229.2*** (78.97)	-0.139 (0.222)	0.290*** (0.093)	3.31 (103)	10.70 (6.669)	5.11* (2.63)
Liquidity Provision	8.44*** (3.444)	0.441 (0.990)	10.45*** (3.503)	0.351 (0.890)	385,701*** (32.249)	-6.186*** (1.055)	549.1*** (77.06)	-10.33*** (1.309)
Third Part. Credit Enhancements	-9.777 (13.77)	-0.279 (0.199)	-9,52 (11.59)	-0.197 (0.163)	0.283 (0.200)	0.0877 (0.185)	-0.423 (0.611)	-0.140 (0.411)
Third Part. Liquidity Provision	4.998 (4.994)	-6.755*** (1.788)	4.624 (4.063)	-6.396*** (1.72)	-46.79* (26.43)	-17.85*** (1.838)	-58.85 (45.11)	-20.90 (20.95)
Secdummy		0.0311 (0.155)		0.0218 (0.140)		0.149 (0.181)		-0.598 (0.468)
Fad	0.0287*** (0.006)		0.0225*** (0.005)		0.0192*** (0.005)		0.00454 (0.007)	
Constant	0.0009 (1.886)	0.977 (0.996)	0.0108 (1.733)	0.949 (0.826)	-2.261* (1.198)	1.703* (0.894)	-2.580** (1.194)	-2.861*** (0.928)
Observations	11,770	11,770	12,760	12,760	11,322	11,322	12,704	12,704
Clusters	1266	1266	1266	1266	1130	1130	1134	1134
Wald ChiSq	290.6	290.6	288.6	288.6	985.4	985.4	3183	3183

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) ΔRWATA1	4 (First-stage) Secdummy	5 (Second-stage) ΔRWATA2	6 (First-stage) Secdummy	7 (Second-stage) ΔRWATA3	8 (First-stage) Secdummy	9 (Second-stage) ΔRWATA4
Rho	-0.0299	-0.0299	-0.0222	-0.0222	0.0210	0.0210	0.141	0.141
ChiSq H0: Rho = 0	0.450	0.450	0.399	0.399	0.835	0.835	2,667	2,667
P-val H0	0.628	0.628	0.528	0.528	0.361	0.361	0.102	0.102

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A number 1 on the dependent variable denotes sub-period 1. A number 2 on the dependent variable denoted sub-period 2. A number 3 on the dependent variable denotes sub-period 3. A number 4 on the dependent variable denotes sub-period 4. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-12 - Treatment effect regressions. Sub-periods. Credit risk and securitization

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) NPL1	4 (First-stage) Secdummy	5 (Second-stage) NPL2	6 (First-stage) Secdummy	7 (Second-stage) NPL3	8 (First-stage) Secdummy	9 (Second-stage) NPL4
Loan ratio	-0.314 (0.670)	0.814 (0.712)	-0.274 (0.670)	0.965 (0.682)	-0.480 (0.571)	0.546 (0.483)	-0.441 (0.753)	0.0394 (0.651)
Size	0.157*** (0.045)	0.000466 (0.028)	0.127*** (0.045)	0.000886 (0.018)	0.131*** (0.040)	-0.0374* (0.022)	0.138*** (0.043)	-0.0429* (0.025)
Profitability	0.455** (0.186)	-0.640*** (0.162)	0.755** (0.186)	-0.779*** (0.262)	0.709*** (0.066)	-0.791*** (0.046)	0.529*** (0.092)	-0.649*** (0.056)
Liquidity	-0.554 (0.695)	0.182 (0.698)	-0.654 (0.696)	0.191 (0.548)	-0.432 (0.572)	-0.912* (0.488)	-0.172 (0.832)	-1.185* (0.677)
Expenses	-0.415 (0.376)	-0.177 (0.314)	-0.415 (0.376)	-0.217 (0.314)	-0.0985 (0.156)	0.146 (0.116)	-1.241*** (0.241)	0.948*** (0.146)
Non-performing loans	0.772*** (0.045)		0.772*** (0.045)		0.918*** (0.037)		1.025*** (0.056)	
Capital	2.319 (1.563)	-0.645 (1.587)	2.307 (1.113)	-0.685 (1.507)	2.900* (1.654)	-1.557 (1.199)	-3.156** (1.281)	2.199** (0.855)
Leverage ratio	0.0282 (0.018)	-0.0209 (0.018)	0.0992 (0.018)	-0.0287 (0.018)	0.0127 (0.010)	-0.00110 (0.007)	-0.0261*** (0.009)	0.0271*** (0.005)
Non-interest income	0.725** (0.320)	-0.0130 (0.318)	0.225** (0.258)	-0.0330 (0.293)	0.833*** (0.289)	-0.679*** (0.232)	0.894*** (0.298)	-0.636*** (0.233)
Credit Enhancements	2.918*** (0.476)	-1.617*** (0.328)	2.905*** (0.476)	-1.917*** (0.328)	2.494*** (0.274)	-1.345*** (0.251)	3.091*** (0.429)	-1.580*** (0.252)
Liquidity Provision	4.882*** (1.602)	-4.100** (1.994)	3.872*** (1.301)	-2.200** (1.742)	253.76 0	-2.102*** (0.698)	164.4*** (27.95)	-6.825*** (1.931)
Third Part. Credit Enhancements	4.169 (3.345)	0.919* (0.497)	3.269 (1.237)	0.819* (0.003)	0.307*** (0.107)	-0.169** (0.081)	-0.278 (0.177)	0.147** (0.057)
Third Part. Liquidity Provision	0.800 (0.537)	-1.189* (0.623)	-5.082 (0.989)	-0.928 (0.890)	-4.081 (7.094)	-0.827 (1.337)	-3.425 (34.24)	8.511 (22.40)
Fad	0.00260 (0.002)		0.00180 (0.002)		0.00609** (0.002)		0.00237 (0.003)	
Secdummy		1.743*** (0.060)		1.385*** (0.053)		1.485*** (0.043)		1.316*** (0.050)
Constant	1,263 (0.965)	-5.245*** (0.978)	1.263 (0.905)	-5.245*** (0.898)	2.227** (0.893)	-4.712*** (0.640)	3.425*** (0.966)	-4.288*** (0.796)
Observations	12,389	12,389	12,500	12,050	11,321	11,321	10,741	10,741
Clusters	1279	1279			1130	1130	1104	1104
Wald ChiSq	1408	1408	2323	2323	3886	3886	1653	1653

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) NPL1	4 (First-stage) Secdummy	5 (Second-stage) NPL2	6 (First-stage) Secdummy	7 (Second-stage) NPL3	8 (First-stage) Secdummy	9 (Second-stage) NPL4
Rho	-0.893	-0.893	-0.901	-0.901	-0.909	-0.909	-0.910	-0.910
ChiSq H0: Rho = 0	1256	1256	338.0	338.0	1030	1030	327.3	327.3
P-val H0	0	0	0	0	0	0	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A number 1 on the dependent variable denotes sub-period 1. A number 2 on the dependent variable denoted sub-period 2. A number 3 on the dependent variable denotes sub-period 3. A number 4 on the dependent variable denotes sub-period 4. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-13 - Treatment effect regressions. Sub-periods. Profitability and securitization

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) Profitability1	4 (First-stage) Secdummy	5 (Second-stage) Profitability2	6 (First-stage) Secdummy	7 (Second-stage) Profitability3	8 (First-stage) Secdummy	9 (Second-stage) Profitability4
Loan ratio	-0.576 (0.824)	0.0291 (0.067)	-0.546 (0.664)	0.0299 (0.067)	-1.035 (0.74)	-0.352*** (0.119)	-1.847** (0.913)	-0.0611 (0.136)
Size	0.248*** (0.075)	-0.00617 (0.003)	0.248*** (0.087)	-0.00512 (0.002)	0.163** (0.069)	-0.0308*** (0.007)	0.237*** (0.056)	0.0305*** (0.005)
Profitability	0.0397 (0.452)		0.0417 (0.332)		0.0337 (0.127)		-0.581*** (0.111)	
Liquidity	-1.644* (0.907)	0.0343 (0.069)	-2.004* (0.922)	0.0343 (0.057)	-2.533*** (0.757)	-0.125 (0.119)	-2.277** (0.941)	-0.0382 (0.132)
Expenses	-1.193* (0.618)	-0.666*** (0.034)	-1.293* (0.618)	-0.668*** (0.029)	0.0904 (0.235)	-0.692*** (0.036)	-1.284*** (0.289)	-0.702*** (0.037)
Non-performing loans	0.124** (0.061)	-0.008*** (0.002)	0.119** (0.068	-0.009*** (0.001)	0.115** (0.054)	-0.119*** (0.006)	0.0546 (0.069)	-0.0678*** (0.006)
Capital	0.214 (0.207)	0.114 (0.153)	0.204 (3.009)	0.119 (0.153)	3.201 (2.148)	0.348 (0.299)	-1.554 (1.306)	0.576*** (0.165)
Leverage ratio	0.011 (0.025)	-0.003* (0.001)	0.0212 (0.08)	-0.003* (0.002)	0.0152 (0.015)	-0.0118*** (0.003)	-0.019* (0.011)	-0.005*** (0.002)
Non-interest income	1.421*** (0.444)	0.282*** (0.032)	1.2522** (0.575)	0.311*** (0.045)	0.620* (0.361)	0.253*** (0.063)	0.660* (0.366)	0.219*** (0.049)
Credit Enhancements	5.226*** (1.309)	0.0773 -(0.05)	5.886*** (1.779)	0.056 (0.07)	3.441*** (0.412)	-0.079 (0.138)	4.134*** (1.003)	0.424*** (0.092)
Liquidity Provision	8.365** (3.490)	-0.273* (0.15)	8.322** (3.88)	-0.273* (0.15)	397.786*** (32.448)	-1.022*** (0.236)	307.7*** (97.91)	1.166** (0.47)
Third Part. Credit Enhancements	3.254 (3.267)	-0.215*** (0.049)	1554 (3.889)	-0.207*** (0.056)	0.312* (0.18)	-0.0416 (0.074)	-0.781 (0.501)	0.0367* (0.02)
Third Part. Liquidity Provision	0.731 (1.347)	-0.176*** (0.056)	0.981 (1.356)	-0.176*** (0.056)	-37.14 (25.47)	0.172 (0.358)	-35.22 (40.46)	-13.34*** (4.438)
Fad	0.0119** (0.006)		0.0213** (0.009)		0.0202*** (0.006)		0.00495 (0.006)	
Secdummy		0.00393 (0.037)		0.00844 (0.027)		0.0577 (0.059)		-0.385*** (0.034)
Constant	-1.687 (1.373)	0.573*** (0.091)	-1.68 (1.312)	0.646*** (0.091)	-1.978* (1.198)	0.577*** (0.163)	-0.067 (1.054)	0.0955 (0.165)
Observations	12,474	12,474	12,01	12,010	11,322	11,322	10,744	10,744
Clusters	1279	1279	1260	1260	1130	1130	1105	1105
Wald ChiSq	1474	1474	1570	1570	2329	2329	1347	1347

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) Profitability1	4 (First-stage) Secdummy	5 (Second-stage) Profitability2	6 (First-stage) Secdummy	7 (Second-stage) Profitability3	8 (First-stage) Secdummy	9 (Second-stage) Profitability4
Rho	-0.0028	-0.0028	-0.00199	-0.00199	-0.0509	-0.0509	0.678	0.678
ChiSq H0: Rho = 0	0.000938	0.000938	0.000738	0.000738	0.851	0.851	45	45
P-val H0	0.976	0.976	0.84	0.84	0.356	0.356	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A number 1 on the dependent variable denotes sub-period 1. A number 2 on the dependent variable denoted sub-period 2. A number 3 on the dependent variable denotes sub-period 3. A number 4 on the dependent variable denotes sub-period 4. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-14 - Treatment effect regressions. Sub-periods. Securitization and capital levels

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) Capital1	4 (First-stage) Secdummy	5 (Second-stage) Capital2	6 (First-stage) Secdummy	7 (Second-stage) Capital3	8 (First-stage) Secdummy	9 (Second-stage) Capital4
Loan ratio	5.053*** (0.889)	-0.155*** (0.020)	5.001*** (0.999)	-0.122*** (0.030)	2.734*** (0.871)	-0.122*** (0.020)	-4.821** -2,025	-0.198*** (0.041)
Size	0.332*** (0.048)	-0.00701*** (0.000)	0.435*** (0.048)	-0.00801*** (0.000)	0.280*** (0.045)	-0.00712*** (0.000)	0.123** (0.061)	-0.00140 (0.001)
Profitability	0.412** (0.200)	-0.00263 (0.003)	0.555** (0.190)	-0.00189 (0.006)	0.0735 (0.079)	0.00190 (0.001)	0.161 (0.109)	0.00767*** (0.002)
Liquidity	-1.201 (0.846)	0.0210 (0.018)	-1.102 (0.998)	0.0450 (0.017)	-2.373*** (0.730)	0.0182 (0.020)	-1,312 (1.949)	-0.0327 (0.041)
Expenses	0.508 (0.423)	-0.0267*** (0.008)	0.908 (0.873)	-0.0178*** (0.009)	0.194 (0.196)	-0.0102** (0.004)	-1.258*** (0.336)	-0.0467*** (0.009)
Non-performing loans	0.0725* (0.039)	-0.000339 (0.000)	0.2525* (0.069)	-0.000119 (0.000)	0.0455 (0.037)	-0.00160** (0.000)	0.186*** (0.056)	0.00445*** (0.001)
Capital	32.01*** (0.026)		34.05*** (0.019)		30.58*** (0.018)		-23.02*** (0.017)	
Non-interest income	0.749** (0.369)	-0.00220 (0.008)	0.599** (0.377)	-0.00110 (0.008)	-0.0861 (0.364)	0.00897 (0.009)	0.377 (0.376)	0.0154 (0.009)
Credit Enhancements	3.054*** (0.592)	-0.0331*** (0.008)	3.054*** (0.892)	-0.0399*** (0.001)	2.217*** (0.360)	-0.0354*** (0.009)	2.528*** (0.525)	0.0487*** (0.012)
Liquidity Provision	3.130** (1.458)	-0.0334* (0.019)	3.129** (1.668)	-0.0399* (0.022)	5.37 (2.708)	-0.0660* (0.037)	203.1*** (36.18)	0.358*** (0.071)
Third Part. Credit Enhancements	11.03*** (2.341)	-0.269*** (0.009)	11.03*** (2.322)	-0.304*** (0.009)	1.219*** (0.348)	-0.0395*** (0.009)	-1.294** (0.590)	-0.00662 (0.006)
Third Part. Liquidity Provision	1.906*** (0.692)	-0.0642*** (0.009)	2.046*** (0.512)	-0.0644*** (0.008)	-0.824 (9.68)	-0.359*** (0.055)	-81.67* (42.58)	-3.243*** (1.039)
Fad	0.00398 (0.002)		0.005*** (0.002)		0.00863*** (0.002)		0.0001 (0.003)	
Secdummy		0.0342*** (0.001)		0.0342*** (0.001)		0.0389*** (0.001)		-0.0487*** (0.002)
Constant	-14.58*** (1.199)	0.388*** (0.022)	-14.66*** (1.779)	0.298*** (0.011)	-10.37*** (1.277)	0.313*** (0.021)	7.702*** (2.392)	0.399*** (0.044)
Observations	12,470	12,470	11,970	11,970	11,322	11,322	10,744	10,744
Clusters	1278	1278	1190	1190	1130	1130	1105	1105
Wald ChiSq	2189	2189	1980	1980	1681	1681	1960	1960
Rho	-0.865	-0.865	-0.868	-0.868	-0.887	-0.887	0.875	0.875

1 Variables	2 (First-stage) Secdummy	3 (Second-stage) Capital1	4 (First-stage) Secdummy	5 (Second-stage) Capital2	6 (First-stage) Secdummy	7 (Second-stage) Capital3	8 (First-stage) Secdummy	9 (Second-stage) Capital4
ChiSq H0: Rho = 0	134.0	134.0	144.0	144.0	147.6	147.6	212.7	212.7
P-val H0	0	0	0	0	0	0	0	0

Note: Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A number 1 on the dependent variable denoted sub-period 1. A number 2 on the dependent variable denoted sub-period 2. A number 3 on the dependent variable denoted sub-period 3. A number 4 on the dependent variable denoted sub-period 4. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-15 - Treatment effect model. Securitization and BHCs' performance measures (variables winsorized at 2.5%)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Profitability
Loan ratio	-0.651	0.520***	-0.656	-1.343***	-0.478	0.588	-1.027*	-0.155***	4.019***	-0.0887
	(0.601)	(0.036)	(0.576)	(0.281)	(0.431)	(0.390)	(0.557)	(0.021)	(0.688)	(0.068)
Credit Enhancements	0.573*	-0.406***	0.561*	0.252***	0.179**	0.131**	0.448	-0.111***	0.127*	0.291***
	(0.306)	(0.737)	(0.329)	(0.071)	(0.072)	(0.051)	(0.278)	(0.002)	(0.067)	(0.017)
Liquidity Provision	9.587**	-0.0740	9.643**	-2.349	6.432***	-5.370**	10.37**	-0.0672***	4.017***	0.082
	(4.674)	(0.146)	(4.523)	(1.489)	(1.573)	(2.516)	(4.169)	(0.023)	(1.311)	(0.234)
Third Part. Credit Enhancements	0.0574	-0.0267	0.0572	-0.104	0.0113	0.0426	-0.064	-0.0300	0.836	-0.00511
	(0.204)	(0.042)	(0.139)	(0.206)	(0.114)	(0.117)	(0.171)	(0.021)	(0.708)	(0.028)
Third Part. Liquidity Provision	2.374	0.307***	2.341	-2.444***	2.088**	-1.939**	1.627	-0.145***	4.438***	0.176
	(2.918)	(0.040)	(2.804)	(0.624)	(0.822)	(0.825)	(2.075)	(0.017)	(0.719)	(0.159)
Size	0.235***	0.00428**	0.234***	0.030	0.125***	-0.026	0.212***	-0.08***	0.311***	0.0130***
	(0.048)	(0.001)	(0.048)	(0.016)	(0.027)	(0.019)	(0.042)	(0.006)	(0.030)	(0.003)
Profitability	-0.0561	-0.00576*	-0.0667	0.170**	0.490***	-0.720***	-0.604***	0.016	0.142*	
	(0.088)	(0.003)	(0.083)	(0.077)	(0.059)	(0.046)	(0.068)	(0.016)	(0.076)	
Liquidity	-1.735**	-0.020	-1.696**	-0.0362	-0.351	-0.577	-1.646***	0.0212	-1.257*	-0.035
	(0.698)	(0.035)	(0.683)	(0.266)	(0.483)	(0.480)	(0.623)	(0.021)	(0.664)	(0.070)
Expenses	-0.327	-0.051	-0.347	0.179	-0.490***	0.436***	-1.313***	-0.0238***	0.456**	-0.759***
	(0.225)	(0.091)	(0.218)	(0.132)	(0.161)	(0.124)	(0.224)	(0.005)	(0.187)	(0.021)
Non-performing loans	0.123***	0.000485	0.119***	-0.0650***	0.793***		0.0709*	0.000360	0.0284	-0.0386***
	(0.041)	(0.001)	(0.040)	(0.011)	(0.027)		(0.041)	(0.054)	(0.028)	(0.002)
Capital	1.315	-1.011***	1.045	0.782	0.166	1.183	-0.218		27.38***	0.184
	(1.447)	(0.099)	(1.349)	(0.793)	(0.945)	(0.865)	(1.252)		(1.211)	(0.134)
Non-interest income	1.178***	0.027**	1.114***	-0.501***	0.863***	-0.481**	1.277***	0.0939	0.456*	0.355***
	(0.309)	(0.014)	(0.294)	(0.129)	(0.233)	(0.208)	(0.274)	(0.007)	(0.245)	(0.034)
Secdummy		0.0216*		-0.258*		1.659***		0.0396***		-0.292***
		(0.012)		(0.138)		(0.040)		(0.001)		(0.030)
Fad	0.0139***		0.0141***		0.00631***		0.0102***		0.00475***	
	(0.004)		(0.004)		(0.001)		(0.003)		(0.001)	
Constant	-2.108**	0.579***	-2.029**	-0.0979	2.227***	-5.609***	-0.565	0.366***	-11.71***	0.513***
	(0.851)	(0.052)	(0.842)	(0.438)	(0.598)	(0.589)	(0.793)	(0.022)	(0.842)	(0.089)
Observations	47,296	47,296	47,296	47,296	47,216	47,216	47,305	47,296	47,296	47,305
Clusters	1506	1506	1506	1506	1508	1508	1508	1506	1506	1508

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Profitability
Wald ChiSq	18195	18195	2630	2630	17279	17279	12393	6983	6983	12393
Rho	-0.116	-0.116	0.0575	0.0575	-0.892	-0.892	0.588	-0.896	-0.896	0.589
ChiSq H0: Rho = 0	3.471	3.471	5.503	5.503	2562	2562	49.89	548.1	548.1	49.88
P-val H0	0.062	0.062	0.019	0.019	0	0	0	0	0	0

Note: The table shows the results of the robustness tests where variables are winsorized at 2.5%. Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-16 - Treatment effect model. Securitization and BHCs' performance measures (variables winsorized at 5%)

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Profitability
Loan ratio	-0.652	0.520***	-0.656	-1.343***	-0.478	0.578	-1.028*	-0.155***	4.019***	-0.089
	(0.601)	(0.036)	(0.576)	(0.281)	(0.431)	(0.390)	(0.557)	(0.021)	(0.688)	(0.068)
Credit Enhancements	0.573*	-0.406***	0.561*	0.252***	0.179**	0.131**	0.448	-0.111***	0.127*	0.291***
	(0.311)	(0.737)	(0.329)	(0.071)	(0.072)	(0.051)	(0.278)	(0.002)	(0.067)	(0.017)
Liquidity Provision	9.587**	-0.0740	9.643**	-2.349	6.432***	-5.370**	10.37**	-0.0672***	4.017***	0.082
	(4.674)	(0.147)	(4.523)	(1.489)	(1.573)	(2.516)	(4.169)	(0.023)	(1.311)	(0.234)
Third Part. Credit Enhancements	0.0574	-0.0267	0.0572	-0.104	0.0113	0.0426	-0.064	-0.0300	0.836	-0.00511
	(0.204)	(0.042)	(0.139)	(0.206)	(0.114)	(0.117)	(0.171)	(0.021)	(0.708)	(0.028)
Third Part. Liquidity Provision	2.374	0.307***	2.342	-2.448***	2.088**	-1.939**	1.627	-0.145***	4.438***	0.176
	(2.919)	(0.040)	(2.804)	(0.624)	(0.822)	(0.825)	(2.075)	(0.017)	(0.719)	(0.159)
Size	0.235***	0.00428**	0.234***	0.0256	0.125***	-0.026	0.212***	-0.08***	0.311***	0.0130***
	(0.048)	(0.001)	(0.048)	(0.016)	(0.027)	(0.019)	(0.042)	(0.006)	(0.030)	(0.003)
Profitability	-0.0561	-0.00576*	-0.0667	0.170**	0.490***	-0.720***	-0.604***	0.016	0.142*	
	(0.088)	(0.003)	(0.083)	(0.077)	(0.059)	(0.046)	(0.068)	(0.016)	(0.076)	
Liquidity	-1.735**	-0.020	-1.696**	-0.0362	-0.351	-0.577	-1.646***	0.0212	-1.257*	-0.035
	(0.698)	(0.035)	(0.683)	(0.266)	(0.483)	(0.480)	(0.623)	(0.021)	(0.664)	(0.070)
Expenses	-0.327	-0.051	-0.347	0.179	-0.490***	0.436***	-1.313***	-0.0238***	0.456**	-0.759***
	(0.225)	(0.091)	(0.218)	(0.132)	(0.161)	(0.124)	(0.224)	(0.005)	(0.187)	(0.021)
Non-performing loans	0.123***	0.000485	0.119***	-0.0650***	0.793***		0.0709*	0.000360	0.0284	-0.0386***
	(0.041)	(0.001)	(0.040)	(0.011)	(0.028)		(0.041)	(0.054)	(0.028)	(0.002)
Capital	1.315	-1.011***	1.045	0.782	0.166	1.183	-0.218		27.38***	0.184
	(1.447)	(0.099)	(1.349)	(0.788)	(0.945)	(0.865)	(1.252)		(1.211)	(0.134)
Non-interest income	1.178***	0.027**	1.114***	-0.501***	0.863***	-0.481**	1.277***	0.093	0.456*	0.355***
	(0.309)	(0.014)	(0.294)	(0.129)	(0.233)	(0.208)	(0.274)	(0.007)	(0.245)	(0.034)
Secdummy		0.0216*		-0.258*		1.659***		0.0396***		-0.292***
		(0.012)		(0.138)		(0.040)		(0.001)		(0.031)
Fad	0.0138***		0.014***		0.006***		0.010***		0.005***	
	(0.004)		(0.004)		(0.001)		(0.003)		(0.002)	
Constant	-2.108**	0.579***	-2.029**	-0.0979	2.227***	-5.609***	-0.566	0.368***	-11.71***	0.513***
	(0.851)	(0.052)	(0.842)	(0.438)	(0.598)	(0.589)	(0.793)	(0.023)	(0.842)	(0.08)
Observations	47,296	47,296	47,296	47,296	47,216	47,216	47,305	47,296	47,296	47,305
Clusters	1506	1506	1506	1506	1508	1508	1508	1506	1506	1508

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) Capital	(First-stage) Secdummy	(Second-stage) Profitability
Wald ChiSq	18195	18195	2630	2630	17279	17279	12393	6983	6983	12393
Rho	-0.116	-0.116	0.0575	0.0575	-0.892	-0.892	0.588	-0.896	-0.896	0.589
ChiSq H0: Rho = 0	3.471	3.471	5.503	5.503	2562	2562	49.89	548.1	548.1	49.88
P-val H0	0.062	0.062	0.020	0.020	0	0	0	0	0	0

Note: The table shows the results of the robustness tests where variables are winsorized at 5%. Securitization is the endogenous treatment variable. Secdummy shows the first-stage selection regression output. Control variables (including quarter dummies, not reported) are lagged one quarter. Credit risk, profitability, and Capital are not included in their own respective outcome regressions. A Wald test against the hypothesis that all coefficients are zero is included as a goodness of fit indicator, as is the likelihood ratio test against the null hypothesis that rho is zero. ***, **, * signify statistical significance at the 1, 5, and 10% level, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table 2-17 - Instrumental Variable Analysis

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Capital
Loan ratio	0.987	0.320***	-1.956	0.484***	0.384***	0.880***	0.170**	0.897**	0.970***	-0.205***
	(0.601)	(0.036)	(2.856)	(0.026)	(0.02)	(0.025)	(0.082)	(0.082)	(0.025)	(0.009)
Credit Enhancements	0.788*	-0.406***	0.561*	0.111***	0.179**	0.989**	0.127*	0.291***	0.448	-0.111***
	(0.411)	(0.737)	(0.329)	(0.019)	(0.055)	(0.023)	(0.067)	(0.017)	(0.278)	(0.002)
Liquidity Provision	0.987**	-0.076	0.567**	0.298	-0.00539	-0.0486	0.417***	0.082	0.935**	-0.072***
	(0.067)	(0.147)	(0.523)	(0.889)	(0.089)	(0.143)	(0.111)	(0.234)	(0.169)	(0.023)
Third Part. Credit Enhancements	0.0574	-0.0267	0.0572	-0.104	1.124***	0.0624	0.836	0.0462	0.0272	-0.0300
	(0.204)	(0.087)	(0.179)	(0.306)	(0.06)	(0.143)	(0.708)	(0.137)	(0.128)	(0.021)
Third Part. Liquidity Provision	0.874	0.307***	0.342	-2.448***	2.088**	-0.739**	0.438***	0.068	0.056	-0.165***
	(0.919)	(0.040)	(0.804)	(0.624)	(0.762)	(0.025)	(0.099)	(0.143)	(0.187)	(0.017)
Size	0.235***	0.102**	0.989***	0.0256	0.125***	-0.026	0.311***	0.0009	0.212***	-0.08***
	(0.048)	(0.197)	(0.009)	(0.016)	(0.027)	(0.019)	(0.030)	(0.113)	(0.042)	(0.021)
Profitability	-0.078	-0.007	-0.987	-0.0135	0.901***	-0.880***	0.982*		-0.804***	0.786
	(0.012)	(0.001)	(0.071)	(0.085)	(0.009)	(0.096)	(0.094)		(0.008)	(0.026)
Liquidity	0.0564**	0.954**	0.028	0.0697	-0.351	-0.577	-1.257*	-0.035	-1.646***	0.0212
	(0.022)	(0.227)	(0.078)	(0.089)	(0.483)	(0.480)	(0.664)	(0.070)	(0.623)	(0.021)
Expenses	-0.327	-0.051	-0.347	-0.00184	-0.490***	0.436***	0.456**	-0.759***	-1.313***	-0.0238***
	(0.225)	(0.091)	(0.218)	(0.091)	(0.161)	(0.124)	(0.187)	(0.021)	(0.224)	(0.005)
Non-performing loans	0.123***	0.000485	0.119***	-0.000565	0.793***		0.0284	-0.0386***	0.0709*	0.000360
	(0.041)	(0.001)	(0.040)	(0.011)	(0.028)		(0.028)	(0.002)	(0.041)	(0.054)
Capital	0.714***	-0.493***	0.085	0.692	0.266	0.183	0.738	0.984	-0.118	
	(0.045)	(0.058)	(0.379)	(0.988)	(0.875)	(0.965)	(1.211)	(0.534)	(1.298)	
Secdummy		3.845***		-0.348***		0.603***		-0.607***		3.930***
		(0.873)		(0.098)		(0.057)		(0.057)		(0.901)
Fad	1.957***		3.057***		2.008***		0.687***		1.724***	
	(0.625)		(0.627)		(0.634)		(0.234)		(0.545)	
Constant	-0.618	-9.398***	-0.840	-0.730	-10.17***	-0.049***	-0.616***	0.0426*	-0.617***	-0.0548***
	(1.472)	(2.264)	(1.468)	(1.469)	(0.577)	(0.003)	(0.026)	(0.022)	(0.026)	(0.013)
Observations	47,296	47,296	47,296	47,296	47,216	47,216	47,296	47,305	47,305	47,296
R squared	0.43	0.20	0.41	0.14	0.44	0.15	0.45	0.15	0.43	0.14

1	2	3	4	5	6	7	8	9	10	11
Variables	(First-stage) Secdummy	(Second-stage) RWATA	(First-stage) Secdummy	(Second-stage) ΔRWATA	(First-stage) Secdummy	(Second-stage) NPL	(First-stage) Secdummy	(Second-stage) Profitability	(First-stage) Secdummy	(Second-stage) Capital
KP rank Wald LM Statistic	8.9		7.9		6.3		8.8		8.6	
KP rank Wald F Statistic	13.68		13.86		14.50		13.30		13.33	

Note: The table shows the results of the robustness tests. It presents a fixed effects IV estimation of the effect of securitization on bank credit risk, credit risk taking, profitability and capital levels. The first column reports the results of the first stage, where securitization decision is instrumented by a variable "fad" which captures peer pressure for other BHCs to securitize. The second column reports the results of the second stage of the estimation. Standard errors clustered at the BHC-level are reported in parentheses. *, **,*** indicate significance at 10%, 5%, and 1% levels, respectively.

Chapter 3 Tables

Table 3-1 - Summary statistics

1 Variables	2 N	3 Mean	4 S.D.	5 Min	6 Max
Size	18167	22946.49	135730.2	154.9316	2010457
Bid-ask spread (Opacity)	18063	0.2079175	0.4234211	-1.689999	21.51
Non-performing loans	18110	-4.729568	1.320777	-8.605924	-2.303523
Liquidity	17826	0.2286671	0.1156221	0.0352983	0.6056811
Profitability	17697	0.1543765	0.346202	-1.772282	0.7996585
Efficiency	18167	0.6783338	0.1740417	0.3590868	1.526493
Capital (Tier1)	17863	0.1233322	0.0387057	0.0245	0.3278

Note: This table reports the variable's name, mean, standard deviation, minimum- and maximum value of the individual bank time-series averages, and number of observations.

Table 3-2 - Summary Statistics

1	2	3	4	5	6	7	8	9	10	11	12
			Exposed to ABCP					Not exposed to ABCP			
Variables	N	Mean	Sd	Min	Max	N	Mean	Sd	Min	Max	Difference
Size	17413	7691.784	40036.97	154.9316	1020380	754	375241.1	526991.8	1825.36	2010457	4778.47%
Size (ln)	17413	7.464538	1.303144	5.042984	13.83568	754	11.83736	1.5095	7.509533	14.51387	58.58%
Non-performing loans	17357	-4.737027	1.324182	-8.605924	-2.303523	754	-4.557627	1.228012	-8.605924	-2.467341	-3.79%
Liquidity	17073	.2271248	.113254	.0352983	.6056811	754	.2636361	1.1562443	.0352983	.6056811	16.08%
Profitability	16966	.1512809	.347698	-1.772282	.7996585	754	.2262233	.300839	-1.772282	.7996585	49.54%
Efficiency	17413	.6800459	.1751673	.3590868	1.526493	754	.6387946	.14003	.2590868	1.526493	-6.07%
Leverage	17109	11.48435	3.075858	3.290556	32.36246	754	13.61497	2.77757	5.589715	24.8139	18.55%
Capital (Tier1)	17109	.12443	0.0388647	.0245	.3278	754	0.0984218	.0238974	.0643	.2025	-20.90%
Bid-ask spread	17380	-1.760032	9.194627	-97.105	113.25	754	-3.615575	3.057902	-29.02	-.1900001	105.43%

Note: This table reports the variable's name, mean, standard deviation, minimum- and maximum value of the individual bank time-series averages, and number of observations. The statistics are reported for banks exposed to ABCP conduits and for the banks not exposed to ABCP conduits. The percentage difference and statistical significance are also presented (p-value).

Table 3-3 - Correlation Matrix

1 Variables	2 Size	3 Capital (Tier1)	4 Liquidity	5 Profitability	6 Non-performing loans	7 Opacity	8 CREDIT EXPOSURE own conduits	9 LIQUIDITY EXPOSURE: own conduits	10 CREDIT EXPOSURE other conduits	11 LIQUIDITY EXPOSURE: other conduits
Size	1.0000									
Capital (Tier1)	-0.0774*	1.0000								
Liquidity	0.1292*	0.4017*	1.0000							
Profitability	0.0155	0.2309*	0.0973*	1.0000						
Non-performing loans	0.0708*	-0.0628*	-0.1624*	-0.3728*	1.0000					
Opacity	0.0591*	-0.0054	-0.0291*	-0.0287*	0.0842*	1.0000				
CREDIT EXPOSURE own conduits	0.5780*	-0.0738*	0.0687*	0.0126	0.0337*	0.0302*	1.0000			
LIQUIDITY EXPOSURE: own conduits	0.1080*	-0.0333*	0.0092	0.0114	-0.0008	0.0164	0.0540*	1.0000		
CREDIT EXPOSURE other conduits	0.7492*	-0.0792*	0.0923*	0.0079	0.0307*	0.0341*	0.6095*	0.1201*	1.0000	
LIQUIDITY EXPOSURE: other conduits	0.4517*	-0.0640*	0.0894*	0.0098	0.0278*	0.0295*	0.3484*	0.3440*	0.4857*	1.0000

Note: The table reports pairwise correlations between the main regression variables. * indicates significance at 1%. Definition and construction of the variables are provided in Appendix 1.

Table 3-4 - Opacity and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 Opacity
Non-performing loans	0.015*** (0.005)
Credit exposure own conduits	2.09 (2.56)
Credit exposure other conduits	7.88** (3.25)
Liquidity exposure: own conduits	17.6*** (2.90)
Liquidity exposure: other conduits	6.08* (3.59)
Size	0.102*** (0.016)
Profitability	-0.045*** (0.008)
Liquidity	-0.082 (0.063)
Efficiency	0.050*** (0.018)
Capital	0.048 (0.132)
Constant	-0.983*** (0.137)
Observations	17,031
Number of entities	602
R-squared	0.098

Note: Results from fixed effects regressions of the bid-ask spread on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-5 - Opacity and credit enhancements and liquidity provision to ABCP conduits before and after the crisis

1 Variables	2 Opacity	3 Opacity
Size	0.109*** (0.026)	0.227*** (0.051)
Liquidity	0.0405 (0.109)	0.380*** (0.141)
Profitability	0.0554* (0.028)	-0.0200 (0.015)
Efficiency	0.0343 (0.055)	0.0287 (0.049)
Non-performing loans	0.00109 (0.007)	0.130*** (0.022)
Capital	0.438 (0.312)	1.112*** (0.313)
Non-interest income	0.0838 (0.090)	-0.181 (0.112)
Returns Volatility	-2.226*** (0.633)	0.0290* (0.015)
Guarantor after Crisis		0.1000** (0.042)
Guarantor before Crisis	-0.0635 (0.079)	
Constant	-0.997*** (0.252)	-1.689*** (0.411)
Observations	4,036	3,343
Number of entity	501	419
R-squared	0.022	0.107

Note: Results from fixed effects regressions of the opacity on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-6 - Opacity and credit enhancements and liquidity provision to ABCP conduits before and after the crisis

1 Variables	2 Opacity before crisis	3 Opacity after crisis
Credit exposure	-2.93 (4.00)	5.79 (4.49)
Credit exposure	5.38e (7.87)	-2.13* (1.23)
Liquidity exposure: conduits sponsored	9.32* (4.77)	1.55*** (4.47)
Liquidity exposure: conduits sponsored	6.23 (1.48)	1.57*** (5.37)
Non-performing loans	-0.00319 (0.004)	0.0753*** (0.011)
Capital	0.217 (0.299)	1.114*** (0.277)
Leverage ratio	-0.00807** (0.003)	0.00534*** (0.001)
Profitability	0.0107 (0.020)	-0.0189* (0.010)
Size	0.190*** (0.019)	0.172*** (0.033)
Constant	-1.583*** (0.178)	-1.440*** (0.292)
Observations	9,273	7,107
R-squared	0.032	0.045
Number of entity	531	441

Note: Results from fixed effects regressions of the opacity on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-7 - Returns volatility and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 Returns	3 Volatility	4 Returns	5 Volatility	6 Returns	7 Volatility
Size	0.00121 (0.009)	-0.108*** (0.025)	0.00148 (0.008)	-0.118*** (0.020)	0.00137 (0.008)	-0.109*** (0.019)
Liquidity	0.0999 (0.07)	-0.324* (0.160)	0.0888 (0.068)	-0.322** (0.152)	0.0986 (0.068)	-0.314** (0.152)
Efficiency	0.045 (0.056)	0.084** (0.041)	0.0421 (0.057)	0.0972** (0.043)	0.0433 (0.056)	0.0970** (0.042)
Non-performing loans	-0.00645 (0.004)	0.055*** (0.008)	-0.005 (0.003)	0.0511*** (0.008)	-0.00568 (0.003)	0.0490*** (0.008)
Capital	0.165 (0.306)	-0.889* (0.472)	0.179 (0.316)	-0.236 (0.517)	0.0898 (0.302)	-0.264 (0.540)
Leverage ratio	-0.00483 (0.003)	0.000171 (0.004)	-0.00460 (0.003)	0.00270 (0.004)	-0.00506 (0.003)	0.00215 (0.004)
Guarantor	-0.029** (0.011)	0.00387 (0.025)			-0.028** (0.011)	-0.00311 (0.025)
Opacity			-0.00165 (0.001)	0.0132*** (0.003)	-0.00155 (0.001)	0.0129*** (0.003)
Constant	-0.0444 (0.138)	1.710*** (0.307)	-0.0475 (0.144)	1.640*** (0.256)	-0.0246 (0.140)	1.546*** (0.251)
Observations	15,088	15,089	15,089	15,090	15,088	15,089
R-squared	0.021	0.074	0.019	0.148	0.023	0.143
Number of entity	589	582	589	582	589	582

Note: Results from fixed effects regressions of the returns and volatility on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-8 - Volatility and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 Volatility	3 Volatility
Size	0.0289*** (0.003)	0.0285*** (0.003)
Opacity	0.0228*** (0.002)	0.0228*** (0.002)
Liquidity	-0.138*** (0.015)	-0.138*** (0.014)
Profitability	-0.0364*** (0.002)	-0.0363*** (0.002)
Efficiency	0.0101 (0.007)	0.0102 (0.006)
Non-performing loans	0.0226*** (0.000)	0.0227*** (0.000)
Capital	0.0795** (0.035)	0.0826** (0.035)
Non-interest income	0.0290** (0.012)	0.0288** (0.012)
Guarantor	-0.00569 (0.007)	
Credit exposure own conduits		2.97 (3.01)
Credit exposure other conduits		2.17 (2.92)
Liquidity exposure: own conduits		4.01** (1.56)
Liquidity exposure: other conduits		-3.89 (3.38)
Constant	-0.00660 (0.027)	-0.00439 (0.027)
Observations	15,394	15,394
Number of entity	582	582
R-squared	0.423	0.424

Note: Results from fixed effects regressions of the volatility of returns on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-9 - Systemic risk and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 MES	3 MES
Capital	0.0619 (0.043)	0.0739 (0.046)
Profitability	-0.0290*** (0.003)	-0.0284*** (0.003)
Non-performing loans	0.00414*** (0.001)	0.00462*** (0.001)
Size	0.00781 (0.004)	0.00545 (0.004)
Credit exposure own		7.48 (5.50)
Credit exposure other		7.06 (8.12)
Liquidity exposure own		2.62** (9.62)
Liquidity exposure other		-1.31*** (0.466)
Guarantor	0.00197 (0.081)	
Constant	-0.0423 (0.058)	-0.0154 (0.050)
Observations	976	976
R-squared	0.239	0.261
Number of permco	31	31

Note: Results from fixed effects regressions of the systemic on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-10 - Systemic risk and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 SRISK	3 SRISK
Capital	-0.0012 (0.074)	-0.0001 (0.074)
Profitability	0.00636 (0.014)	0.00637 (0.015)
Non-performing loans	0.08641* (0.046)	0.08841* (0.047)
Size	0.00982 (0.006)	0.00995 (0.006)
Credit exposure own		0.000187 (0.000)
Credit exposure other		-0.000840* (0.000)
Liquidity exposure own		7.920 (8.140)
Liquidity exposure other		0.000675 (0.001)
Guarantor	0.0304 (0.063)	
Constant	0.0601 (0.004)	0.0601 (0.004)
Observations	975	975
R-squared	0.161	0.162
Number of permco	31	31

Note: Results from fixed effects regressions of the systemic on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-11 - Systemic risk and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 MES	3 MES
Opacity		0.00199*** (0.001)
Credit exposure own	7.910 (5.900)	9.010 (5.720)
Credit exposure other	1.090 (0.886)	1.140 (0.757)
Liquidity exposure own	2.450** (1.070)	1.980** (0.819)
Liquidity exposure other	-1.280* (0.701)	-1.010* (0.539)
Size	0.00652 (0.005)	0.00490 (0.004)
Profitability	-0.0258*** (0.007)	-0.0245*** (0.006)
Liquidity	-0.0216 (0.028)	-0.0183 (0.023)
Efficiency	0.00851 (0.017)	0.0125 (0.017)
Non-performing loans	0.00624*** (0.002)	0.00525*** (0.002)
Capital	-0.0195 (0.063)	0.0475 (0.064)
Non-interest income	0.00105 (0.013)	-0.00216 (0.010)
Constant	-0.0105 (0.065)	-0.0139 (0.050)
Observations	976	976
Number of entity	33	33
R-squared	0.255	0.330

Note: Results from fixed effects regressions of the systemic on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects (not reported). Standard errors are clustered by bank and by year. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-12 - Opacity and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 Opacity 1	3 Opacity 2	4 Opacity 3
Credit exposure own conduits	0.002 (0.004)	0.029 (0.011)	0.028 (0.002)
Credit exposure other conduits	0.071* (0.003)	0.008 (0.043)	0.008 (0.042)
Liquidity exposure: own conduits	0.018 (0.029)	0.019*** (0.009)	0.018*** (0.010)
Liquidity exposure: other conduits	0.068** (0.020)	0.077* (0.001)	0.068*** (0.002)
Size	0.222*** (0.008)	0.102*** (0.018)	0.103*** (0.019)
Profitability	-0.04*** (0.008)	-0.050*** (0.092)	-0.056*** (0.098)
Liquidity	-0.081 (0.063)	-0.078 (0.063)	-0.079 (0.063)
Non-performing loans	0.0149*** (0.005)	0.023*** (0.003)	0.031*** (0.004)
Capital	0.0478 (0.132)	0.087 (0.132)	0.098 (0.132)
Constant	-0.983*** (0.137)	-1.33*** (0.127)	-1.73*** (0.139)
Observations	17,031	17,031	17,031
Number of entities	602	602	602
R-squared	0.089	0.076	0.076

Note: Results from fixed effects regressions of different opacity measures on the exposure to ABCP and other explanatory variables. Regressions include BHC-fixed effects and quarter-fixed effects. Standard errors are clustered by bank. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-13 - Opacity, stock returns, volatility and systemic risk

1 Variables	2 Returns	3 Returns	4 Returns	5 Volatility	6 Volatility	7 Volatility	8 MES	9 MES	10 MES
Market Value	0.034 (0.094)	0.038 (0.094)	0.012 (0.094)	-0.190*** (0.025)	-0.191*** (0.025)	-0.189*** (0.025)	0.091 (0.047)	0.089 (0.056)	0.089 (0.055)
Liquidity	0.089 (0.010)	0.009 (0.010)	0.088 (0.010)	-0.445* (0.260)	-0.545* (0.260)	-0.444* (0.260)	-0.03*** (0.004)	-0.029*** (0.004)	-0.03*** (0.004)
Efficiency	0.044 (0.062)	0.059 (0.087)	0.0449 (0.056)	0.084** (0.041)	0.087** (0.041)	0.078** (0.054)	0.003*** (0.002)	0.004*** (0.001)	0.004*** (0.005)
Non-performing loans	-0.00645 (0.004)	-0.00645 (0.004)	-0.006 (0.004)	0.0554*** (0.009)	0.0554*** (0.009)	0.0554*** (0.009)	0.00545 (0.004)	0.00545 (0.030)	0.00545 (0.003)
Capital	0.165 (0.306)	0.165 (0.306)	0.165 (0.306)	-0.889* (0.472)	-0.889* (0.472)	-0.889* (0.472)	7.480 (5.500)	7.480 (5.500)	7.480 (5.500)
Guarantor	-0.0288** (0.012)	-0.0288** (0.012)	-0.0288** (0.012)	0.00387 (0.025)	0.00387 (0.025)	0.00387 (0.025)	0.262 (0.090)	2.620** (0.962)	2.620** (0.962)
Opacity 1	-0.026			0.0132***			0.031 (0.025)		
Opacity 2		-0.005			0.023***			0.033 (0.022)	
Opacity 3			-0.006 (0.002)			0.014*** (0.004)			0.039*** (0.046)
Constant	0.094 (0.138)	0.894 (0.138)	0.054 (0.138)	1.780*** (0.307)	1.872*** (0.307)	1.987*** (0.307)	1.985*** (0.307)	1.562 (0.307)	1.710*** (0.008)
R-squared	0.022	0.025	0.027	0.087	0.074	0.079	0.098	0.089	0.079
Number of entity	589	589	589	589	589	589	34	34	34

Note: Results from fixed effects regressions of returns, return volatility, and systemic risk on different opacity measures. Regressions include BHC-fixed effects and quarter-fixed effects. Standard errors are clustered by bank. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 3-14 - Opacity and credit enhancements and liquidity provision to ABCP conduits

1 Variables	2 Opacity	3 Returns	4 Volatility
Credit exposure own conduits	0.226*** (0.001)	0.029 (0.011)	0.015 (0.025)
Credit exposure other conduits	0.091* (0.036)	-0.008 (0.043)	0.008 (0.042)
Liquidity exposure: own conduits	0.029** (0.011)	-0.019*** (0.009)	0.018 (0.120)
Liquidity exposure: other conduits	0.05*** (0.019)	-0.077* (0.001)	0.068 (0.250)
Size	0.222*** (0.008)	0.102** (0.018)	0.201** (0.019)
Profitability	-0.04*** (0.007)	-0.050*** (0.092)	-0.056*** (0.098)
Liquidity	-0.081 (0.062)	-0.078 (0.07)	-0.09 (0.08)
Non-performing loans	0.021*** (0.005)	-0.023*** (0.004)	0.031*** (0.004)
Capital	0.09 (0.132)	0.087 (0.14)	0.098 (0.198)
Constant	-0.977*** (0.137)	-1.33*** (0.127)	1.73*** (0.139)
Observations	875	875	875
Number of entities	23	23	23
R-squared	0.088	0.099	0.077

Note: Results from fixed effects regressions of opacity, returns, return volatility, on exposure to credit and liquidity exposure for a smaller sample of banks with non-zero guarantees. Standard errors are clustered by bank. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Chapter 4 Tables

Table 4-1 - Summary statistics expenses

1 Variable	2 Obs	3 Mean	4 Std. Dev.	5 Min	6 Max	7 Mean ratio
Compensation	75610	96440.25	950401.1	0	3.70e+07	.3641608
Premises Fixed Assets	75604	21722.34	206761	0	8290000	.0933336
Amortization	67987	4239.423	49875.96	0	2578000	.0052985
Goodwill	67946	2642.991	134974.9	0	2.48e+07	.0049724
Data Processing	67254	5054.459	72099.8	0	4482000	.0228452
Advertising Marketing	67008	6532.368	83678.11	0	3147001	.0127717
Director Fees	66578	60.33284	184.3265	0	24879	.0034494
Printing Stationery	66836	726.5661	18359.98	0	1195000	.0058384
Postage	66535	1035.279	17132.87	0	995443	.0036994
FDIC deposits	45518	109.9999	3289.532	0	429941	.0021243
Accounting Audit	25444	252.958	2542.272	0	175000	.0062782
Consulting Advisory	25447	7301.448	117321.3	0	5613000	.0077305
ATMs & int	25430	383.4751	2973.58	0	343292	0.0073766
Telecommunication	25449	3928.305	59885.7	0	4573000	0.0084702
Legal Exp	66427	1519.31	28289.14	0	2639000	0.0064727
1st Highest Oth Exp	61600	27677.97	542624.3	0	3.53e+07	0.374028
2nd Highest Oth Exp	53861	11322.69	140081.1	0	7406000	0.2858667
3rd Highest Oth Exp	48793	5968.099	73882.97	0	3892000	0.1938448

Note: This table reports the variable's name, mean, standard deviation, minimum- and maximum value of the individual BHC's time-series averages, and number of observations.

Table 4-2 - Summary statistics for BHCs involved and not involved in litigation

1	2	3	4	5	6	7	8	9	10	11
	Litigation=0					Litigation=1				
Variable	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Size	75279	8287896	7.17e+07	7071	2.37e+09	341	3.76e+08	7.36e+08	164797	2.46e+09
Capital	72995	13.38682	13.35549	.03	1581	324	12.71725	6.777708	1.02	62.56
NPL	73303	8.355874	2.083561	0	18.11211	331	11.51087	3.491519	.6931472	18.12966
Trading Revenue	74780	10413.03	303899.5	-2.62e+07	2.34e+07	339	1017138	2838635	-9791000	1.98e+07
Net Operating Revenue	74561	276300.4	2616855	-18912	1.10e+08	336	1.08e+07	2.23e+07	2896	1.00e+08
Non-interest Expenses	75269	177948.5	1687383	0	8.28e+07	341	7525112	1.59e+07	2041	8.01e+07
Efficiency ratio	74558	.6823939	.2143139	-8.212121	12.16838	336	.7593116	.4116059	.2337783	6.63896
Legal Expenses ratio	65400	.0064306	.0170324	-.7149621	1.316802	315	.015206	.0302485	0	.2505489
Telecommunication Expenses ratio	24587	.0084701	.0075394	-.0117451	.1985158	194	.0084888	.0072642	0	.037803
ATMs Expenses ratio	24568	.0073988	.0115216	-.0061599	.1782112	194	.0045572	.0134489	0	.0755277
Consulting Advisory ratio	24584	.0076742	.0152673	-.2149621	.6175857	194	.0148592	.018506	0	.0721549
Accounting Audit ratio	24581	.0062886	.0097963	-.061368	.8739195	194	.004956	.0083302	0	.051311
FDIC deposits ratio	45227	.0021179	.0087006	-.5975379	.3167956	173	.0037972	.0082395	0	.0437919
Postage ratio	65507	.0037051	.0058237	-.0030697	.1157148	316	.0025144	.0042393	0	.0185767
Printing Stationery Expenses ratio	65808	.0058477	.0071442	0	.1034483	316	.0038925	.0063412	0	.0443821
Director Fees ratio	65551	.0034574	.0065218	0	.3597786	315	.0017957	.004389	0	.025018
Advertising Marketing ratio	65985	.0127467	.0130098	0	.2111835	316	.0179922	.0160383	0	.0851704
Data Processing Expenses ratio	66224	.0228525	.0292929	-.1714015	4.237705	318	.0213154	.0193271	0	.0950718
Goodwill I ratio	66913	.0047906	.0885366	0	6.116233	317	.0433404	.367834	0	6.06672
Amortization Expenses ratio	66954	.0052831	.0169311	-.0121455	2.838158	317	.0085507	.010162	0	.0612818
Premises Fixed Assets ratio	74544	.0933528	.0367087	-.5767046	2.315182	336	.0890758	.0376916	.0187872	.2381724
Compensation Expenses ratio	74559	.3642402	.0908435	-2.033144	6.036655	336	.3465381	.0978769	.1200493	.7290925
Non-interest Expense ratio	74558	.6823939	.2143139	-8.212121	12.16838	336	.7593116	.4116059	.2337783	6.63896
1st Highest Oth Exp ratio	40241	.3759505	.5693862	-3.872159	13.24824	336	.1437865	.2514334	.0000288	1.944388
2nd Highest Oth Exp ratio	26242	.287942	.4552278	-4.776515	13.22171	299	.1037187	.1916743	.0000134	1.628918

1	2	3	4	5	6	7	8	9	10	11
	Litigation=0					Litigation=1				
Variable	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
3rd Highest Oth Exp ratio	14755	.195432	.3257018	1.870	10.00693	208	.0812534	.1505938	.0000121	.8956813
Employees ratio	75279	.0003077	.0003474	0	.0311525	341	.0002451	.0001691	.0000246	.002012
Trading Income ratio	74061	.0020066	.0228647	-1.422907	.6141494	334	.02578	.0676629	-.149044	.542329
Investment Banking income ratio	28467	.0071592	.0476521	0	1.029981	210	.0250479	.044015	0	.300574
Other Income ratio	65318	.0065406	.0163351	0	.8001625	315	.0032954	.0061996	0	.0434195
Total Deposits ratio	72263	.7891008	.1120842	0	.9979186	328	.6787587	.1666667	.0385794	.9124814
Foreign Loans ratio	74817	.0002949	.0041888	0	.2656964	339	.001889	.003892	0	.0169343
Litigation settlements ratio						341	572726.3	1533824	47	1.11e+07

Note: This table reports the variable's name, mean, standard deviation, minimum- and maximum value of the individual bank time-series averages, and number of observations. This is done per observation, grouped by bank which have litigation settlements reported in the 9-YC forms and which do not at any point in time in the sample period of 2001Q2 to 2013 Q4.

Table 4-3 - Correlation matrix

1 Variables	2 Size	3 Efficiency	4 Compensation	5 Premises Fixed Assets	6 Amortization	7 Goodwill I	8 Data Processing	9 Advertising Marketing	10 Director Fees	11 Printing Stationery	12 Postage	13 FDIC insurance	14 Accounting Audit	15 Consulting Advisory	16 ATMs&int	17 Telecommunication
Size	1.0000															
Efficiency	-0.0133*	1.0000														
Compensation	-0.1376*	0.7135*	1.0000													
Premises Fixed Assets	-0.1055*	0.6110*	0.5281*	1.0000												
Amortization	0.1474*	0.1500*	0.0040	0.0813*	1.0000											
Goodwill I	0.0458*	0.4957*	0.0402*	0.0727*	0.0611*	1.0000										
Data Processing	-0.0741*	0.1784*	0.1159*	0.0838*	0.0140*	0.0130*	1.0000									
Advertising Marketing	0.1122*	0.1333*	0.1264*	0.1154*	0.0137*	0.0099	0.0818*	1.0000								
Director Fees	-0.2234*	0.0688*	0.0883*	0.0512*	-0.0358*	0.0075	0.0713*	0.0506*	1.0000							
Printing Stationery	-0.2254*	0.1136*	0.1538*	0.1910*	-0.0033	0.0090	0.0452*	0.1462*	0.2044*	1.0000						
Postage	-0.0224*	0.0653*	0.0671*	0.0687*	0.0178*	0.0049	0.0297*	0.1603*	0.1440*	0.3574*	1.0000					
FDIC insurance	0.0240*	0.3250*	0.2141*	0.1949*	0.0109	0.0638*	0.0918*	0.0488*	0.0895*	0.0911*	0.1175*	1.0000				
Accounting Audit	-0.2758*	0.2833*	0.2634*	0.2722*	-0.0412*	0.0257*	0.1231*	-0.0439*	0.2327*	0.1097*	0.0202*	0.2542*	1.0000			
Consulting Advisory	0.0927*	0.2382*	0.1549*	0.1493*	0.0696*	0.0579*	0.0666*	0.0295*	-0.0023	-0.0549*	-0.0401*	0.2270*	0.1329*	1.0000		
ATMs & int	-0.1492*	0.0108	0.0226*	0.0292*	-0.0257*	-0.0284*	-0.0346*	0.0300*	0.0398*	0.1301*	0.1698*	-0.0058	0.0201*	-0.0123	1.0000	
Telecommunication	-0.0892*	0.2609*	0.3057*	0.3811*	0.0522*	0.0461*	-0.0309*	0.0641*	0.0654*	0.2360*	0.1978*	0.0567*	0.1912*	0.0517*	0.1449*	1.0000

Note: The table reports pairwise correlations between the main regression variables. * indicates significance at 1%. For the definition and construction of the variables see Appendix 1.

Table 4-4 - BHCs' expenses and size

1 Variables	2 Non-Interest Expense	3 Compensation	4 Premises Fixed Assets	5 Amortization	6 Goodwill Imp.losses	7 Data Processing	8 Advertising& Marketing	9 Director Fees	10 Printing & Stationery
Size	-0.0806*** (0.013)	-0.0457*** (0.005)	-0.0150*** (0.002)	0.00590*** (0.001)	0.0228*** (0.005)	-0.00581*** (0.001)	-0.000826 (0.001)	-0.00975*** (0.002)	-0.0146*** (0.003)
Constant	1.721*** (0.175)	0.955*** (0.072)	0.293*** (0.029)	-0.0722*** (0.008)	-0.305*** (0.062)	0.0967*** (0.013)	0.0229*** (0.007)	0.0148*** (0.003)	0.0258*** (0.004)
Observations	71,623	71,625	71,610	65,968	65,926	65,263	65,026	64,599	64,849
R-squared	0.066	0.074	0.039	0.010	0.010	0.014	0.021	0.050	0.047
Number of BHCS	3,008	3,008	3,008	2,926	2,926	2,925	2,924	2,925	2,925

(continued below)

1 Variables	11 Postage	12 FDIC deposit ins.ass.	13 Accounting & Audit	14 ATMs	15 Telecommunications	16 Legal Fees
Size	-0.0105*** (0.002)	0.00323*** (0.001)	-0.00263*** (0.001)	-0.00244** (0.001)	-0.000347 (0.001)	-0.00519*** (0.001)
Constant	0.0169*** (0.003)	-0.0448*** (0.001)	0.0413*** (0.009)	0.0357** (0.016)	0.0111 (0.007)	0.0722*** (0.015)
Observations	64,558	44,515	24,280	24,283	24,287	64,453
R-squared	0.092	0.239	0.014	0.021	0.007	0.048
Number of BHCs	2,924	2.659	1,442	1,442	1,442	2,925

Note: The table presents an analysis of the relationship between size, measured by log of total assets, and efficiency ratio, defined as total non-interest expense normalized by net operating revenue. All explanatory variables are lagged by one quarter. Revenue composition variables are the rolling average for the absolute value of the income share over net operating revenue. See Appendix 1 for further detail on controls included in the models. Models are estimated with robust standard errors and two-way clustering by firm and quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-5 - BHCs' expenses and size

1 Variables	2 Non-Interest Expense	3 Compensation	4 Premises & Fixed Assets	5 Amortization	6 Goodwill Imp. losses	7 Data Processing	8 Advertising & Marketing	9 Director Fees
Size	-0.0860*** (0.011)	-0.0461*** (0.004)	-0.0155*** (0.002)	0.00651*** (0.001)	0.0244*** (0.005)	-0.00564*** (0.001)	-0.000514 (0.001)	-0.0124*** (0.002)
Non-performing loans	0.0189*** (0.002)	0.00322*** (0.001)	0.225*** (0.027)	0.135* (0.007)	0.00113 (0.001)	-0.0015 (0.005)	-0.00465*** (0.001)	0.00642 (0.004)
Profitability	-7.204*** (0.808)	-1.512*** (0.168)	-0.639*** (0.078)	-0.0870*** (0.013)	-2.175*** (0.569)	-0.204*** (0.060)	-0.00698 (0.011)	0.00713** (0.003)
Capital	-5.140 (4.740)	5.880 (0.199)	-1.770 (1.130)	-5.760* (3.430)	2.560 (2.250)	3.130 (5.810)	1.770 (1.620)	-1.990 (1.760)
Constant	1.668*** (0.136)	0.938*** (0.052)	0.285*** (0.022)	-0.0799*** (0.008)	-0.321*** (0.066)	0.0965*** (0.016)	0.0223*** (0.008)	0.0176*** (0.003)
Observations	67863	67865	67851	62726	62731	62063	61875	61481
R-squared	0.175	0.124	0.105	0.012	0.034	0.017	0.024	0.052
Number of BHCs	2817	2817	2817	2733	2732	2734	2731	2732

(continued on the next page)

1 Variables	2 Printing & Stationery	3 Postage	4 FDIC depositinsass	5 Accounting & Audit	6 Consulting & Advisory	7 ATMs	8 Telecom
Size	-0.0163*** (0.003)	-0.0103*** (0.003)	0.00198*** (0.001)	-0.00310*** (0.001)	-0.00320*** (0.001)	-0.00236*** (0.001)	-0.000215 (0.001)
Non-performing loans	0.0122 (0.472)	-9.900* (0.527)	0.0106*** (0.001)	0.292*** (0.009)	0.00555*** (0.001)	0.00203 (0.001)	-0.291 (0.818)
Profitability	-0.00194 (0.005)	0.00527 (0.005)	-0.222*** (0.067)	-0.0238** (0.010)	-0.0886*** (0.024)	-0.00608 (0.005)	-0.0152** (0.007)
Capital	-0.471 (0.938)	-0.773 (0.943)	-0.585 (0.131)	-0.708 (0.257)	0.131 (0.114)	0.345 (0.232)	-0.310 (0.282)
Constant	0.0278*** (0.004)	0.0169*** (0.003)	-0.0343*** (0.009)	0.0453*** (0.010)	0.0428** (0.017)	0.0321*** (0.010)	0.00836 (0.008)
Observations	61702	61441	42543	23125	23128	23116	23132
R-squared	0.05	0.096	0.283	0.018	0.032	0.044	0.009
Number of BHCs	2731	2731	2589	1309	1309	1309	1309

Note: The table presents an analysis of the relationship between size, measured by log of total assets, and efficiency ratio, defined as total non-interest expense normalized by net operating revenue. All explanatory variables are lagged by one quarter. Revenue composition variables are the rolling average for the absolute value of the income share over net operating revenue. See Appendix 1 for further detail on controls included in the models. Models are estimated with robust standard errors and two-way clustering by firm and quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-6 - BHCs' expenses and size

1 Variables	2 Efficiency Ratio	3 ATMs	4 Telecom.	5 Consulting & Advisory	6 Accounting & Audit	7 FDIC insurance	8 Postage
Size	-0.0616** (0.026)	-0.00274*** (0.001)	-0.000158 (0.001)	-0.00393*** (0.001)	-0.00329*** (0.001)	-0.00340 (0.003)	0.00334 (0.003)
Non-performing loans	0.0207*** (0.003)	0.00172 (0.001)	-1.990 (8.200)	0.00604*** (0.002)	0.00265** (0.001)	0.00829*** (0.003)	-2.700 (4.980)
Profitability	-6.761*** (0.835)	-0.00197 (0.005)	-0.0112 (0.007)	-0.0879*** (0.025)	-0.0238** (0.012)	-0.422*** (0.118)	0.00442 (0.003)
Capital	-0.00129 (0.002)	3.280 (2.340)	-3.180 (2.790)	1.140 (0.975)	-1.750 (2.830)	-9.300 (1.310)	6.880 (1.420)
Total Deposits ratio	0.0652 (0.088)	0.00311 (0.006)	0.000609 (0.002)	-0.00238 (0.005)	0.00161 (0.002)	0.0250** (0.011)	-0.00587** (0.002)
Trading Assets ratio	-0.0856 (0.176)	-0.00303 (0.007)	-0.000370 (0.011)	0.0286 (0.021)	-0.000896 (0.005)	-0.00379 (0.017)	0.00240 (0.004)
Investments Real Estate Vent.	0.627*** (0.220)	-0.0109 (0.007)	-0.00490 (0.006)	0.0112 (0.008)	0.0171*** (0.006)	-2.869*** (0.771)	0.000940 (0.004)
Total Loans ratio	-0.290*** (0.051)	-0.00267 (0.002)	-0.00116 (0.001)	-0.00642** (0.003)	-0.00504*** (0.002)	-0.0321** (0.015)	0.00117 (0.001)
Trading Income ratio	-0.0843 (0.171)	0.00212 (0.002)	-0.00732 (0.007)	0.00140 (0.010)	0.000188 (0.003)	0.0145 (0.014)	-0.00498** (0.002)
Fiduciary Income ratio	0.491*** (0.098)	-0.00235 (0.005)	0.00897** (0.004)	0.00380 (0.010)	-0.000292 (0.004)	0.00319 (0.013)	0.000381 (0.003)
lnvestment Banking Income ratio	0.374** (0.183)	0.00178 (0.008)	0.0130 (0.013)	0.0237 (0.019)	0.000420 (0.006)	0.00393 (0.022)	-0.0118*** (0.003)
Other Income ratio	1.455*** (0.301)	0.0798*** (0.031)	0.0387*** (0.011)	0.0109 (0.015)	0.0433*** (0.011)	0.0420 (0.036)	0.0432*** (0.008)
Employees ratio	322.1*** (100.2)	-7.816** (3.736)	-0.395 (2.308)	-5.612 (7.265)	-2.871 (3.120)	-4.361 (9.373)	1.949 (3.973)
Constant	1.404*** (0.402)	0.0390*** (0.012)	0.00728 (0.009)	0.0604*** (0.023)	0.0512*** (0.012)	-0.0248 (0.046)	0.00283 (0.006)
Observations	24,341	21,501	21,516	21,512	21,509	7,471	24,341
R-squared	0.115	0.056	0.016	0.035	0.026	0.371	0.139
Number of BHCs	1,337	1,289	1,289	1,289	1,289	1,046	1,337

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1 Variables	9 Printing & Stationery	10 Director Fees	11 Advertising & Marketing	12 Data Processing	13 Goodwill Imp.losses	14 Amortization	15 Premises & Fixed Assets	16 Legal Fees
Size	0.0158*** (0.004)	-0.00221 (0.003)	0.00550*** (0.001)	-0.00430** (0.002)	0.0617*** (0.019)	0.00612*** (0.001)	-0.0151*** (0.004)	-0.00948*** (0.002)
Non-performing loans	-1.000* (0.568)	-6.340 (5.370)	-0.00453*** (0.001)	0.00660*** (0.002)	0.00236 (0.002)	0.00222** (0.002)	0.0241*** (0.004)	0.0160*** (0.002)
Profitability	0.00970* (0.005)	0.00498 (0.004)	0.000936 (0.008)	-0.0771*** (0.018)	-2.943*** (0.815)	-0.0557*** (0.014)	-0.392*** (0.069)	-0.128*** (0.024)
Capital	2.480 (1.900)	2.060 (1.790)	9.160** (4.510)	-3.910 (4.450)	5.720 (4.770)	-4.410 (4.807)	-7.890 (2.530)	-9.680 (7.500)
Total Deposits ratio	-0.00617*** (0.001)	-0.00297** (0.001)	-0.0100** (0.004)	0.0152*** (0.004)	-0.153** (0.075)	-0.00303 (0.003)	0.0344*** (0.010)	0.0142** (0.006)
Trading Assets ratio	0.00632 (0.007)	0.00153 (0.005)	0.00821 (0.010)	-0.0345** (0.015)	0.0252 (0.070)	0.000488 (0.010)	-0.00142 (0.026)	-0.00657 (0.025)
Investments Real Estate Vent.	0.00460 (0.005)	-0.00293 (0.003)	0.0141 (0.014)	-0.0369*** (0.009)	0.180 (0.192)	0.00571 (0.008)	0.0730*** (0.020)	-0.0824*** (0.018)
Total Loans ratio	0.00281*** (0.001)	0.00203** (0.001)	0.00197 (0.003)	-0.0131*** (0.003)	0.0919*** (0.030)	-0.00166 (0.002)	-0.0379*** (0.008)	-0.0206*** (0.004)
Trading Income ratio	-0.00713*** (0.003)	0.00141 (0.003)	-0.0129* (0.008)	0.00584 (0.006)	-0.0103 (0.034)	-0.000419 (0.006)	-0.0238* (0.014)	0.0152 (0.021)
Fiduciary Income ratio	0.00730** (0.003)	-0.000513 (0.002)	0.0117** (0.005)	0.0419*** (0.009)	0.00975 (0.072)	0.0204*** (0.008)	0.0776*** (0.016)	-0.00300 (0.009)
Investment Banking Income ratio	-0.00442 (0.006)	-0.00886** (0.004)	0.00121 (0.013)	0.0319* (0.018)	0.0123 (0.094)	0.00596 (0.018)	0.0502* (0.027)	0.0254 (0.031)
Other Income ratio	0.0445*** (0.009)	0.0198*** (0.007)	0.0191 (0.015)	0.0397 (0.029)	0.226 (0.167)	0.00552 (0.017)	0.288*** (0.053)	0.0663*** (0.019)
Employees ratio	0.360 (1.535)	-1.459* (0.813)	25.87*** (7.106)	-3.140 (5.561)	103.0 (77.030)	8.413** (3.475)	-14.46 (11.790)	-10.24 (12.630)
Constant	-0.0122* (0.007)	0.00716 (0.005)	-0.0583*** (0.016)	0.0693*** (0.025)	-0.818*** (0.283)	-0.0736*** (0.020)	0.286*** (0.058)	0.125*** (0.030)
Observations	24,341	24,340	24,341	24,340	24,341	24,318	24,341	24,341
R-squared	0.120	0.046	0.064	0.062	0.038	0.059	0.105	0.068
Number of BHCs	1,337	1.337	1,337	1,337	1,337	1,337	1,337	1,337

Note: The table presents an analysis of the relationship between size, measured by log of total assets, and efficiency ratio, defined as total non-interest expense normalized by net operating revenue. All explanatory variables are lagged by one quarter. Revenue composition variables are the rolling average for the absolute value of the income share over net operating revenue. See Appendix 1 for further detail on controls included in the models. Models are estimated with robust standard errors and two-way clustering by firm and quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-7 - BHCs' size, systemic risk and litigation

1 Variables	2 Logit Litigation	3 Probit Litigation	4 OLS Litigation amount
MES	8.329 (6.384)	0.793*** (0.307)	-0.00462 (0.697)
Size	5.960** (5.55)**	1.430*** (0)	1.740*** (0)
Non-performing	0.645** (0.267)	0.00472 (0.005)	0.00997 (0.013)
Capital	-0.171 (0.118)	0.000720 (0.001)	0.000141 (0.002)
Profitability	-21.02 (22.420)	-0.637 (0.563)	-0.929 (0.626)
Constant	-11.71*** (3.538)	-0.0742 (0.065)	(0.073) -0.143 (0.173)
Observations	961	961	961
Number of	31	31	31
R-squared		0.07	0.139
Pseudo-R-squared	0.306	0.209	

Note: This table presents results from probit, logit and OLS regressions of litigation on BHCs' size and systemic risk. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-8 - BHCs' size, opacity and litigation

1 Variables	2 Litigation (logit)	3 Litigation (probit)	4 Litigation amount (OLS)
Size	1.960*** (0.376)	0.0087*** (0.003)	7.025*** (0.09)
Non-performing loans	0.0933*** (0.036)	25.050 (50.616)	8.88*** (1.82)
ROLROE	5.661 (4.075)	1.338 (10.74)	6.588 (13.55)
Capital	0.00103 (0.003)	-11,721 (28.718)	34.21 (29.76)
Legal Fees ratio	181.2*** (59.150)	3.080 (3.133)	-4.538* (2.522)
Employees ratio	45.82 (503.30)	-2.287 (19.26)	
Trading Income ratio	0.798 (1.185)	7.687*** (2.770)	
Investment Banking Income ratio	4.108* (2.489)	1.189e+07** (0.522)	
Foreign Loans ratio		9.745e+07** (3.916e+07)	
Opacity		4.222 (24.891)	
Compensation			-4.802 (2.397)
Constant	-5.037*** (0.457)	-2.811 (8.630)	-1.183 (0.153)
Observations	26,915	1,070	2,880
Number of BHCs	1,373	34	96
Fixed effect			Yes
Time dummies	Yes	Yes	Yes
R-squared			0.601
Pseudo-R-squared	0.306	0.209	

Note: This table presents results from probit, logit and fixed effect regressions of litigation on BHCs' size, opacity and other variables. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-9 - Litigation probit and logit

1 Variables	2 Litigation (logit)	3 Litigation (probit)	4 Litigation (logit)	5 Litigation (probit)
Size	4.680*** (0.940)	1.960*** (0.376)	0.503*** (0.077)	4.030*** (0.990)
Non-performing loans	0.194** (0.094)	0.0933*** (0.031)	-0.0474 (0.043)	-0.0747 (0.123)
Profitability	10.84 (8.993)	5.661 (4.075)	-0.0152 (4.061)	24.56 (16.880)
Capital	0.00274 (0.006)	0.00103 (0.003)	0.00140 (0.002)	-0.0186 (0.049)
Legal Fees ratio	437.6*** (146.300)	181.2*** (59.150)		603.7 (384.7)
Employees ratio	76.60 (1.382)	45.82 (503.3)	438.1 (453.6)	-5.786* (3,373)
Fiduciary Income ratio			-2.433** (1.159)	
Trading Income ratio	0.318 (2.545)	0.798 (1.185)	1.013 (1.246)	-2.372 (3.650)
Investment Banking Income ratio	12.67** (6.153)	4.108* (2.489)	-5.082** (2.554)	-14.47 (9.858)
Opacity				0.00597 (0.024)
Foreign Loans ratio			22.23** (9.426)	325.2*** (61.320)
Constant	11.98*** (1.056)	-5.037*** (0.457)	-10.962*** (1.005)	-6.399*** (1.669)
Observations	26,915	26,915	26,586	7,490
Number of BHCs	1,373	1,373	1,371	411

Note: The table presents results from probit and logit regressions of litigation on BHCs' size, opacity and other variables. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-10 - Advertising & marketing expenses and BHC stock returns

1 Variables	2 Returns
Adverting & marketing	0.147*** (0.005)
Size	0.0260*** (0.002)
Capital	3.450 (4.830)
Non-performing loans	-0.007*** (0.003)
Constant	-0.380*** (0.021)
Observations	14,816
Number of BHCs	531
R-squared	0.033

Note: The table presents results fixed effect regressions of marketing and advertising expenses on BHCs' returns. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-11 - Advertising and marketing expenses and banks' total deposits

1 Variables	2 Total Deposits
Advertising & marketing	58.70** (26.090)
Size	0.218* (0.113)
Non-performing loans	-0.790 (0.586)
Capital	12,131 (11,511)
ROE	-0.196* (0.002)
Trading Revenue	7.892** (4.011)
Investment Banking Income	0.0101 (7.792)
Net Operating Revenue	-1.540 (1.958)
Net Interest Income	7.304*** (2.631)
Constant	-0.003* (0.001)
Observations	7,267
Number of BHCs	407
R-squared	0.278

Note: The table presents results fixed effect regressions of marketing and advertising expenses on BHCs' deposits. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-12 - Marketing and advertising expenses and systemic risk

1 Variables	2 Advertising & Marketing Expenses
Trading Income ratio	-0.0404** (0.015)
Investment Banking Income ratio	-0.0118 (0.044)
Other Income ratio	0.381** (0.172)
Total Deposits ratio	0.00382 (0.020)
Profitability	0.0163 (0.019)
Size	0.00247 (0.005)
Non-performing loans	-0.0024 (0.012)
Capital	5.720 (3.960)
MES	-0.0676** (0.030) (0.004)
Constant	-0.0180 (0.086)
Observations	352
Number of BHCs	27
R-squared	0.470

Note: This table presents results fixed effect regressions of marketing and advertising expenses on BHCs' systemic risk and other variables. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-13 - BHCs' expenses and size

1 Variables	2 Non-Interest Expense	3 Compensation	4 Premises & Fixed Assets	5 Amortization	6 Goodwill Imp. losses	7 Data Processing	8 Advertising & Marketing	9 Director Fees
Size	-0.086*** (0.011)	-0.046*** (0.004)	-0.0155*** (0.002)	0.00651*** (0.001)	0.0244*** (0.005)	-0.00563*** (0.001)	-0.000514 (0.001)	-0.0124*** (0.002)
Non-performing loans	0.0189*** (0.002)	0.00322*** (0.001)	0.0225*** (0.002)	0.0135* (0.007)	0.0113 (0.001)	-0.00151 (0.005)	-0.0465*** (0.009)	6.420 (4.17)
Profitability	-7.204*** (0.808)	-1.512*** (0.168)	-0.639*** (0.078)	-0.0870*** (0.013)	-2.175*** (0.569)	-0.204*** (0.06)	-0.00698 (0.011)	0.00713** (0.003)
Capital	-5.140 (4.740)	5.880 (1.990)	-1.770 (1.130)	-5.760* (3.430)	2.560 (2.250)	3.130 (5.810)	1.770 (1.620)	-1.990 (1.760)
Constant	1.668*** (0.136)	0.938*** (0.052)	0.285*** (0.022)	-0.0799*** (0.008)	-0.321*** (0.066)	0.0965*** (0.016)	0.0223*** (0.008)	0.0176*** (0.003)
Observations	67,796	67,865	67,851	62,726	62,731	61,996	61,875	61,481
R-squared	0.175	0.124	0.105	0.012	0.034	0.016	0.024	0.052
Number of BHCs	2,817	2,817	2,817	2,733	2,732	2,734	2,731	2,732

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1 Variables	2 Printing & Stationery	3 Postage	4 FDIC depositinsass	5 Accounting & Audit	6 Consulting & Advisory	7 ATMs	8 Telecom
Size	-0.0163*** (0.003)	-0.0103*** (0.002)	0.0198*** (0.010)	-0.0310*** (0.010)	-0.0320*** (0.010)	-0.0236*** (0.010)	-0.00215 (0.010)
Non-performing loans	1.220 (0.472)	-9.900* (5.270)	0.0106*** (0.001)	0.00292*** (0.001)	0.00555*** (0.002)	0.00203 (0.003)	-2.910 (8.180)
Profitability	-0.00194 (0.005)	0.00527 (0.005)	-0.222*** (0.067)	-0.0238** (0.010)	-0.0886*** (0.024)	-0.00608 (0.005)	-0.0152** (0.007)
Capital	-4.710 (9.380)	-7.730 (9.430)	-5.850 (1.310)	-7.080 (2.570)	1.310 (1.140)	3.450 (2.320)	-3.100 (2.820)
Constant	0.0278*** (0.004)	0.0169*** (0.003)	-0.0343*** (0.009)	0.0453*** (0.010)	0.0428** (0.017)	0.0321*** (0.010)	0.00836 (0.008)
Observations	61,702	61,441	42,543	23,125	23,128	23,116	23,132
R-squared	0.050	0.096	0.283	0.018	0.032	0.044	0.009
Number of BHCs	2,731	2,731	2,589	1,309	1,309	1,309	1,309

Note: The table presents an analysis of the relationship between size, measured by log of total assets, and efficiency ratio, defined as total non-interest expense normalized by capital. All explanatory variables are lagged by one quarter. Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

Table 4-14 - BHCs' expenses and size

1 Variables	2 Efficiency Ratio	3 ATMs	4 Telecom.	5 Consulting & Advisory	6 Accounting & Audit	7 FDIC insurance	8 Postage
Size	-0.0615** (0.027)	-0.00274*** (0.001)	-0.000158 (0.001)	-0.00393*** (0.001)	-0.00329*** (0.001)	-0.00340 (0.003)	0.00334 (0.001)
Non-performing loans	0.0207*** (0.003)	0.00172 (0.001)	-1.990 (8.200)	0.00604*** (0.002)	0.00265** (0.001)	0.00829*** (0.003)	-2.700 (4.98)
Profitability	-6.761*** (0.835)	-0.00197 (0.005)	-0.0112 (0.007)	-0.0879*** (0.025)	-0.0238** (0.012)	-0.422*** (0.118)	0.00442 (0.003)
Capital	-0.0129 (0.001)	3.280 (2.34)	-3.180 (2.790)	1.140 (0.975)	-1.750 (2.830)	-9.300 (13.100)	6.880 (14.200)
Total Deposits ratio	0.0652 (0.088)	0.00311 (0.006)	0.000609 (0.002)	-0.00238 (0.005)	0.00161 (0.002)	0.0250** (0.011)	-0.00587** (0.002)
Trading Assets ratio	-0.0856 (0.176)	-0.00303 (0.007)	-0.000370 (0.011)	0.0286 (0.021)	-0.000896 (0.005)	-0.00379 (0.017)	0.00240 (0.004)
Investments Real Estate Vent.	0.627*** (0.220)	-0.0109 (0.007)	-0.00490 (0.006)	0.0112 (0.008)	0.0171*** (0.006)	-2.869*** (0.771)	0.000940 (0.004)
Total Loans ratio	-0.290*** (0.051)	-0.00267 (0.002)	-0.00116 (0.001)	-0.00642** (0.003)	-0.00504*** (0.002)	-0.0321** (0.015)	0.00117 (0.001)
Trading Income ratio	-0.0843 (0.171)	0.00212 (0.002)	-0.00732 (0.007)	0.00140 (0.010)	0.000188 (0.003)	0.0145 (0.014)	-0.00498** (0.002)
Fiduciary Income ratio	0.491*** (0.098)	-0.00235 (0.005)	0.00897** (0.004)	0.00380 (0.010)	-0.000292 (0.004)	0.00319 (0.013)	0.000381 (0.003)
lnvestment Banking Income ratio	0.374** (0.183)	0.00178 (0.008)	0.0130 (0.013)	0.0237 (0.019)	0.000420 (0.006)	0.00393 (0.022)	-0.0118*** (0.003)
Other Income ratio	1.455*** (0.301)	0.0798*** (0.031)	0.0387*** (0.011)	0.0109 (0.015)	0.0433*** (0.011)	0.0420 (0.036)	0.0432*** (0.008)
Employees ratio	322.1*** (100.200)	-7.816** (3.736)	-0.395 (2.308)	-5.612 (7.265)	-2.871 (3.12)	-4.361 (9.373)	1.949 (3.973)
Constant	1.404*** (0.402)	0.0390*** (0.012)	0.00728 (0.009)	0.0604*** (0.023)	0.0512*** (0.013)	-0.0248 (0.046)	0.00283 (0.006)
Observations	24,274	21,501	21,516	21,512	21,509	7,471	24,341
R-squared	0.115	0.056	0.016	0.035	0.026	0.371	0.139
Number of BHCs	1,337	1,289	1,289	1,289	1,289	1,046	1,337

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1 Variables	9 Printing & Stationery	10 Director Fees	11 Advertising & Marketing	12 Data Processing	13 Goodwill Imp.losses	14 Amortization	15 Premises & Fixed Assets	16 Legal Fees
Size	0.00158*** (0.000)	-0.000221 (0.000)	0.00550*** (0.001)	-0.00430** (0.002)	0.06171*** (0.019)	0.00612*** (0.001)	-0.0151*** (0.004)	-0.00948*** (0.002)
Non-performing loans	-1.000* (0.568)	-6.340 (5.370)	-0.00453*** (0.001)	0.00660*** (0.002)	0.00236 (0.002)	0.00222** (0.001)	0.0241*** (0.004)	0.0160*** (0.000)
Profitability	0.00970* (0.005)	0.00498 (0.004)	0.000936 (0.008)	-0.0771*** (0.018)	-2.943*** (0.815)	-0.0557*** (0.014)	-0.392*** (0.070)	-0.128*** (0.024)
Capital	2.480 (1.900)	2.060 (1.790)	9.160** (4.510)	-3.910 (4.450)	5.720 (4.770)	-4.410 (4.870)	-7.890 (2.530)	-9.680 (7.500)
Total Deposits ratio	-0.00617*** (0.001)	-0.00297** (0.001)	-0.0100** (0.004)	0.0152*** (0.004)	-0.153** (0.075)	-0.00303 (0.003)	0.0344*** (0.010)	0.0142** (0.006)
Trading Assets ratio	0.00632 (0.007)	0.00153 (0.005)	0.00821 (0.010)	-0.0345** (0.015)	0.0252 (0.070)	0.000488 (0.010)	-0.00142 (0.026)	-0.00657 (0.025)
Investments Real Estate Vent.	0.00460 (0.005)	-0.00293 (0.003)	0.0141 (0.014)	-0.0369*** (0.009)	0.180 (0.192)	0.00571 (0.008)	0.0730*** (0.020)	-0.0824*** (0.018)
Total Loans ratio	0.00281*** (0.001)	0.00203** (0.001)	0.00197 (0.003)	-0.0131*** (0.003)	0.0919*** (0.030)	-0.00166 (0.002)	-0.0379*** (0.008)	-0.0206*** (0.004)
Trading Income ratio	-0.00713*** (0.003)	0.00141 (0.003)	-0.0129* (0.008)	0.00584 (0.006)	-0.0103 (0.034)	-0.000419 (0.006)	-0.0238* (0.014)	0.0152 (0.021)
Fiduciary Income ratio	0.00730** (0.003)	-0.000513 (0.002)	0.0117** (0.005)	0.0419*** (0.009)	0.00975 (0.072)	0.0204*** (0.008)	0.0776*** (0.016)	-0.00300 (0.009)
lnvestment Banking Income ratio	-0.00442 (0.006)	-0.00886** (0.004)	0.00121 (0.013)	0.0319* (0.018)	0.0123 (0.094)	0.00596 (0.018)	0.0502* (0.027)	0.0254 (0.031)
Other Income ratio	0.0445*** (0.009)	0.0198*** (0.007)	0.0191 (0.015)	0.0397 (0.029)	0.226 (0.167)	0.00552 (0.017)	0.288*** (0.053)	0.0663*** (0.019)
Employees ratio	0.360 (1.535)	-1.459* (0.813)	25.87*** (7.106)	-3.140 (5.561)	103.0 (77.03)	8.413** (3.475)	-14.46 (11.79)	-10.24 (12.63)
Constant	-0.0122* (0.007)	0.00716 (0.005)	-0.0583*** (0.016)	0.0693*** (0.025)	-0.818*** (0.283)	-0.0736*** (0.020)	0.286*** (0.058)	0.125*** (0.030)
Observations	24.341	24.34	24.341	24.34	24.274	24.318	24.341	24.341
R-squared	0.120	0.046	0.064	0.062	0.038	0.059	0.105	0.068
Number of BHCs	1,337	1,337	1,337	1,337	1,337	1,337	1,337	1,337

Coefficients with statistical significance at the 10%, 5%, and 1% level are indicated with *, **, and *** respectively, and standard errors are reported below the coefficients in parentheses.

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