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# ESSAYS ON BANK RISK

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**Chapter 1. Systemic Risk in the Interbank Funding Market: Indications through CDS Spreads**



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## Overview

The global financial turmoil that happened towards the end of the first decade of the 21st century has highlighted the risks faced by financial intermediaries, in particular, banks. Under this backdrop, this doctoral thesis presents a series of studies on three particular risks being borne by banks namely, Systemic Risk, Funding Risk, and Credit Risk. We focus on these three risks because these were among the risks that surfaced primarily during the Financial Crisis of 2007/09. Systemic Risk became an issue of great concern, when banks and other financial intermediaries began collapsing one after the other, due to their interconnected exposures through mutual lending. Funding risk, on the other hand, was realized as the confusion in the financial market dried up funding sources. Meanwhile, the matter of Credit Risk was stressed through the loan defaults that the banks had to bear.

In doing these studies, we aim to achieve two goals. First is that we intend to provide a discussion on how these risks may come up. Second is that we seek to find ways on how they may be mitigated. Hopefully, through these exercises, we may be able to find some steps on how to move on from the aftermath of the Financial Crisis of 2007/09. At the same time, we also aspire that these works may provide a valuable contribution to the literature on bank risk management.

In the first chapter that deals with Systemic Risk, we talk about how this risk arises due to interconnections among banks brought about by Interbank Funding Market exposures. The Interbank Funding Market is the banks' usual setting to close their respective cash positions at the end of every business day. Banks that are cash-rich may lend in the said market, while those that are short on cash borrow from this market. As a bank participates in the Interbank Funding Market, it effectively bears the risk of its counterparty/ies. The counterparty/ies, in turn, may also have its own Interbank Funding Market exposures that link it to another set of counterparty/ies. This breeds a situation of Financial Contagion, as in Allen & Gale (2000) and Morris & Shin (2008), where a problem or a failure in one institution may affect most or all of the other institutions linked to it. Thus, participation in the Interbank Funding Market imposes Systemic Risk to the bank that either lends in it or borrows from it.

To drive our point, we empirically show that Interbank Funding Market Exposures is positively related to bank risk. We do this by estimating the Net Interbank Funding Market Exposures of Top Global Banks against the price of Credit Default Swap contracts (CDS Spreads) involving these banks. The

advantage we have in using CDS Spreads as our bank risk indicator is that CDS Spreads are directly quoted on the risk of the underlying debt of the CDS contract and that of the issuer of the underlying debt. This means that the CDS Spreads give a clear picture of risk and one that moves sensitively and therefore quickly, when there are changes in the risk profile.

As we establish a direct relationship between Net Interbank Funding Market exposures and CDS Spreads (and hence, give evidence to the Systemic Risk implication of the Interbank Funding Market), we bring forth the issue to re-assess the common notion, that the Interbank Funding Market is just an end-of-day outlet for excess funds and/or an easy source for needed cash. This leads to the argument that more prudence on the part of the banks is necessary when coming in to the Interbank Funding Market as well as more diligence on the part of the regulators in monitoring this market. At the same time, the Systemic Risk implication of the Interbank Funding Market also stimulate the need for banks to advocate peer monitoring, so as to tame down the risks that they might impose to each other (as participants in the said market). Should this effort push through, it might bring the reward of a more stable banking system.

Our study on the Interbank Funding Market and its Systemic Risk implication is one of the few empirical studies on interbank funding and its accompanying risks, where studies in the past have mostly been theoretical (e.g. Allen & Gale (2000), Morris & Shin (2008), Huang & Ratnovski (2009)). In addition, our usage of CDS Spreads as bank risk indicator is quite novel. So far, only two studies have similarly applied CDS Spreads as bank risk indicator, namely Yu, Fung & Tam (2006) and Völz & Wedow (2009). Our work joins these two studies as among the few to first exploit the information on risk that is possessed by CDS Spreads involving banks.

In the second chapter, we refer to Funding Risk as Illiquidity Risk, to put emphasis to the problem of a cash shortage that a bank may encounter. Banks prevalently experience Illiquidity Risk by being in transactions that could involve sudden or unpredictable demands for cash. In this chapter, we discuss a way by which banks may be able to manage this funding risk by focusing on one type of illiquidity risky transaction that is Loan Commitments.

Loan commitments are contractual agreements that a bank may enter with a client. Under this agreement, the bank is obligated to lend to its client a certain pre-determined amount of funds, at any point in time. Since the client's funding needs may be irregular, the timing and the amount of the takedowns on the loan commitment cannot be anticipated. Consequently, a

bank with a great deal of loan commitment/s could have cash shortages or face Illiquidity Risk.

Earlier literature has shown that the funding problems posed by loan commitments may be met by banks increasing their liquidity buffers (Holmström & Tirole (2000), Kashyap, Rjan & Stein (2002), Cornett, Mcnutt, Strahan & Tehranian (2010)). However, this strategy may be costly in terms of opportunity cost, since liquid assets are in the form of low yielding securities. At the same time, given a positive correlation between deposit withdrawls and loan commimtment takedowns, liquid assets as funding buffers may only be able to do so much. Alternatively, transactions deposits, as a stable and cheap funding source, may be able to alleviate this Illiquidity Risk from loan commitments (Gatev, Schuermann & Strahan (2007)). The study cited makes this case by showing that combining deposit-taking and loan commitments can lower the overall risk profile of the bank. We innovate on this result by turning to another cheap funding source for banks which is Securitization.

As the bank securitizes its loans, the loans are essentially used as collateral to borrow funds. This creates a transformation of otherwise illiquid loans into cash, making Securitization a funding source. Moreover, in the Securitization set-up, the bank does not face a direct liability to the investors (i.e. those who have lent through the purchase of the securities backed by the loans). Thus, the usage of Securitization as a funding vehicle does not involve capital charges on the bank, nor does it entail required reserves. Securitization as a funding facility for the bank is therefore convenient.

Using the analytical framework of Gatev, Schuermann & Strahan (2007), we examine how the risk of banks based in the USA and in Europe may be affected by their respective loan commitment and securitization activities. Employing three different measures of risk, our findings show that loan commitments and securitization as a combined banking activity is negatively related to risk. Securitization then, like deposits can be used by banks to treat the Illiquidity Risk from loan commitments.

While the value of this particular study may be immediately found in its offering of an alternative means to alleviate illiquidity or funding risk, its concentration on Securitization as such funding vehicle gives it further importance. Securitization has been noted to have fostered excessive risk taking and a slack in borrower screening, both of which were catalysts to the Financial Crisis of 2007/09 (Instefjord (2004), Wagner (2005), Güner (2006), Uzun & Webb (2007), Keys, Mukherjee, Seru & Vig (2008), Mian & Sufi (2008), Dell'Arricia, Igan & Laeven (2009), Jiang, Nelson & Vytlacil (2009), Michalak & Uhde (2009), Purnanandam (2009)). As a result of this association with the said crisis, Securitization activity has been at an all time low. Through the

point that Securitization may be a means to hedge against Illiquidity Risk, Securitization receives a redeeming factor that could revitalize its practice.

Complementing the ability of securitization to ease Illiquidity Risk is its property to be used as credit risk management facility. In the process of securitizing loans, the loans are transferred from the bank to the Special Purpose Entity (SPE). In effect, when a bank securitizes its loans, it removes risk from its balance sheet or isolates itself from the said loans. In the third chapter, we talk about how a bank may exactly take advantage of such feature of securitization, in the management of its Credit Risk exposures.

The usage of securitization to handle Credit Risk is not a new concept and may perhaps be one of the most known properties of and motives for securitization. Minton, Sanders & Strahan (2004), Pais (2005), Bannier & Hänsel (2007), Affinito & Tagliaferri (2010) and Panetta & Pozzolo (2010), have all pointed out that securitization might be used to lessen Credit Risk exposures, by showing that banks with more risky assets are more likely to securitize. For our part, we take a further step by investigating on the outcomes as banks securitize. To be more specific, we examine the loan portfolio of the bank and see how its credit risk exposures may change with securitization. At the same time, we also investigate how such change may affect the overall risks and returns that the bank will face.

The study has led us to find that Securitization is associated with more Credit Risk exposures, in terms of a bigger loan portfolio and a larger portfolio share of risky loans. This gives the intuition that the usage of securitization for Credit Risk management may not be for risk removal or isolation, per se. Instead, securitization as a means for Credit Risk managment may have been employed for the freeing up of some space to take on more risk, that is possibly motivated by the interest of getting high returns. This situation may indeed be the case, as results of our empirical analysis show that Securitization is, as well, positively related to overall loan portfolio risk and bank returns.

Furthermore, our estimations have determined that the changes in the loan portfolio brought about by the usage of securitization for Credit Risk management, have also led to an increased diversification of the loan portfolio itself. Moreover, this more even distribution of the portfolio across different loans classes has brought the known diversification benefits of lower portfolio risk and less volatile returns. We take these effects to serve as windfall for the securitizing bank, that may temper its concerns stemming from its increased risk-taking through Securitization.

We point out in our third chapter, that Securitization as a Credit Risk management tool may not just be then contained on the unloading of Credit Risk exposures from the bank's balance sheet. Instead, Securitization for Credit Risk management purposes may involve the very structure of the bank's loan portfolio and its choice of assets.

By showing that Securitization, as a tool for Credit Risk management, involves the creation of some space to take on more risk, and with the side-effect of diversification, this third and last chapter makes a useful contribution to the topic on risk management. The findings of this study carve out an avenue that banks can take, should their credit risk-limits begin to inflict some constraint. At the same time, this chapter, like that of the second one, shows that securitization may still have some value. This third chapter thus also appeals that beyond the crisis, securitization may be a bank activity that is still worth pursuing.

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# Chapter 1. Systemic Risk in the Interbank Funding Market: Indications through CDS Spreads

**Abstract**

Banks look to the Interbank Funding Market to close their cash positions. For banks with excess cash, banks lend to the Interbank Funding Market, making it an investment outlet. Conversely, for banks that are short on cash, the Interbank Funding Market serves a source of needed funds. Simple as the set-up of the Interbank Funding Market may sound, a bank's participation in this market entails exposure to Systemic Risk. That is, as a bank transacts in the Interbank Funding Market, it takes on the risk of its various counterparties that may be linked to each other through the said market. Exploiting the capability of CDS Spreads to price the risk of a debt and/or its issuer, we prove this point by establishing a link between the CDS Spreads of top global banks and their interbank funding market exposures.

JEL Classification: G21, G12, G29
Keywords: Systemic Risk, Interbank Funding Market, CDS Spreads

## I. Introduction

The Interbank Funding Market is a venue for banks to close their cash positions at the end of the day. For cash-rich banks, it is a convenient short-term investment outlet, while for cash-strapped banks it is a major source of quick funding. While the set-up of the Interbank Funding Market is simple, it merits some concern. This is because the Interbank Funding Market breeds an exposure to Systemic Risk among participating banks. That is, when a bank transacts with other banks, it bears the accompanying risk of its counterparties that may also be linked to each other through the Interbank Funding Market itself. In this paper, we seek to point out this Systemic Risk implication from Interbank Funding Market transactions.

Central to our analysis is the usage of the price of Credit Default Swap (CDS) contracts involving top global banks. We employ the price of the CDS contracts of our sample banks, called CDS Spreads, as bank risk indicator. CDS Spreads are a reliable indicator of risk because of the nature of a CDS contract. A CDS contract is a financial derivative that promises to pay a certain amount when a credit event occurs. Thus, a CDS contract provides to its buyer, a form of insurance on the credit risk of a debt (called the underlying debt) and that of the issuer of the underlying debt. In turn, the price of the contract, the CDS Spread, serves as the insurance premium which sets the value of the risk that the insurance protection hedges. Given this direct link between the CDS spread and the risk covered by the CDS contract, the CDS Spread may be a reliable and efficient indicator of risk.

Looking at the CDS Spreads of 64 of the Top 100 Global Banks and their firm-specific information, we have found a positive link between CDS Spreads and Interbank Funding Market exposures. This establishes our point that Interbank Funding Market exposures impose Systemic Risk on banks, which are reflected through the increase in bank risk for every increase in Interbank Funding Market exposure. Our results also show that the direct relationship between CDS Spreads and Interbank Funding Market exposures is stronger among US-based banks, than Non-US-based banks. This suggests that Systemic Risk might be higher among US-based banks than Non-US-based banks, which may be explained by the greater number of US-based banks, that creates the environment for more interbank funding market activity.

In checking for the robustness of our findings, we control for other factors that may have an influence on CDS Spreads such as the yield curve, the illiquidity of the CDS contract priced by the spread, and the state of the economy. Adding these variables does not change our main results but instead strengthen it. Moreover, the significance of these variables in our

robustness test also provides the insight that the CDS Spreads can also be influenced by factors that are not directly related to the risk of the underlying debt and that of its issuer. This means that CDS Spreads may possess much more information other than just credit risk that is worth investigating in the future.

By empirically studying the Systemic Risk implication of participating in the Interbank Funding Market, we add to the relatively few data-oriented studies on interbank funding.[1] Indeed, there might be some need to empirically study the interbank funding market because of its immense activity in the past years. In the United States, alone, the average daily traffic in the Interbank Funding Market is estimated at 525,000 transactions and the average daily volume is at USD 2.1T (Federal Reserve Bank of New York 2007).

More importantly, the point of our study showing the Systemic Risk implication of the Interbank Funding Market, provides a call for a re-assessment of the popular view that the said market is just a vent for excess funds and/or a quick source of funds during cash shortages. Such reconsideration can lead to more prudence on the part of the banks in participating in the Interbank Funding Market and more diligence on the part of the regulators in overseeing the said market. At the same time, the Systemic Risk implications of being in the Interbank Funding Market, provides the motivation for participating banks to foster a monitoring mechanism among each other. The benefit, if such happens, could very well be a more stable banking system.

In addition, by using CDS Spreads as bank risk indicator, we provide some form of novelty. CDS contracts are a relatively new financial product and thus the application of the information that its price, the CDS Spreads, may possess has not yet been very much explored. In recent studies, CDS Spreads have been used as risk indicators of firms but, as much as this study has reviewed, only two works has used it as risk indicators for banks[2]. There has also been no study yet that particularly look at the link between CDS Spreads as a risk indicator and Interbank Funding Market exposures as a risk factor.

The rest of this paper is organized as follows. Section II gives the background and related literature for our study. More specifically, Section II

[1] Most studies on interbank funding market participation and its risks are theoretical (i.e. Allen & Gale (2000), Morris & Shin (2008) and Huang & Ratnovski (2009)). A recent empirical study that touches on interbank funding market participation has been done by Demigruc-Kunt & Huizinga (2009) but this focuses on bank wholesale funding where interbank borrowing by a financial institution is just a component.

[2] i.e. Völz & Wedow (2009) and Yu, Fung & Tam (2006)

talks about the Interbank Funding Market and its risk implications, as well as, Credit Default Swaps and why its price, CDS Spreads, can be a reliable and efficient risk indicator. Section III, on the other hand, presents our data along with the implementation of CDS Spreads as bank risk indicator, in detecting the Systemic Risk from Interbank Funding Market exposures. Section IV discusses our findings and its implications and Section V conducts a robustness test of our findings. Section VI concludes.

## II. Background and Related Literature

### *A. Interbank Funding Market Exposures and Risk*

The Interbank Funding Market is an easy outlet for banks with excess cash to invest their surplus on every closing day (than just leaving them idle). At the same time, it is also considerably the most convenient source of funding for banks that are short on cash at the end of the day. Access to the interbank market is quick and easy, because negotiations can be done over the phone and in electronic platforms. Moreover, settlements are done through electronic payments systems. On the terms of borrowing and lending, the tenors are usually on a very short-term basis (most are just overnight), while the interest rate is based on a reference rate set by the regulator or the central bank.

The ease of transacting in the Interbank Funding Market has made its activity intense and has also made it the largest source of bank wholesale funding. In the US, an average of 525,000 interbank funding transactions happens daily, with an average total volume of USD 2.1T. In a recent study by Demigruc-Kunt & Huizinga (2009), it has been pointed out that more than half of the banks' short-term funding nowadays comes from wholesale funding, of which interbank funding comprises a bulk.

However, a downside of having Interbank Funding Market exposures is its risk implication through the Systemic Risk inherent in interbank funding transactions. Allen & Gale (2000) and Morris & Shin (2008) illustrate this issue of Financial Contagion, which we replicate in Figure 1 below;

Figure 1. Financial Contagion

| Bank 1 | |
|---|---|
| Assets | Liabilities |
| V | |
| | Y |

| Bank 2 | |
|---|---|
| Assets | Liabilities |
| | |
| Y | X |

Suppose that Bank 1 borrows Y amount of funds from Bank 2 in the Interbank Funding Market. Bank 1, in such situation, will treat the Y amount of funds as liabilities, while Bank 2 treats it as assets. Whether the bank is a borrower or a lender in the interbank funding market, it faces Systemic Risk in either situation. In the case where a bank is a borrower (Bank 1), suppose that Bank 2 needs the Y amount of funds to settle its liabilities (X). This means Bank 2 will call the Y amount of funds from Bank 1. When the said Y amount of funds leaves Bank 1, it can be noticed, that Bank 1's assets (V) remain. As these remaining assets have resultantly become unfunded, Bank 1 faces the problem of illiquidity and places it in a risky credit position.

On the case where the bank is a lender (Bank 2), consider a similar situation that Bank 2 will have to settle its liabilities (X) and, to do so, it calls the Y amount of funds it lent to Bank 1. However, suppose that Bank 1 is unable to settle such Y amount of funds, because it has the funds tied up to long-term assets (V) and it has no other funding source (just as in a situation of market distress, for example). Under such situation, Bank 2 also faces an illiquidity problem and the risk of a bank failure.

From the above discussions we find that a bank's exposure to the Interbank Funding Market is risky, because an event of one party in the Interbank Funding Market may affect the other. Considering that one bank may transact with as much banks as it can in the Interbank Funding Market, and that the counterparties of this bank may themselves also transact with each other, the mutual risk impositions described above, breeds a Systemic Risk exposure for every participant in the Interbank Funding Market.

In addition, our above discussions also show that the consequence of the realization of the Systemic Risk in the Interbank Funding Market is that the participant/s in the market, face illiquidity risk and the probability of bank failure. Demigruc-Kunt & Huizinga (2009) gives some support to this point by showing a positive relationship between wholesale funding, which as pointed out, is hugely composed of interbank funding, and bank risk. More specifically, Demigruc-Kunt & Huizinga (2009) points out that as non-deposit funding (an indicator for wholesale funding) increases, the stock price of volatility of the bank (which indicates bank risk) also increases and that the bank's Z-score (which indicates bank health) decreases.

Meanwhile, a specific case that illustrates how the realization of a Systemic Risk from the Interbank Funding Market triggers bank illiquidity and failure may be found in the story of UK-based bank Northern Rock, discussed in Morris & Shin (2008) and Shin (2008). Prior to the Financial Crisis of 2007/09, Northern Rock was highly dependent on wholesale funding, especially interbank funding, where it borrowed funds from fellow banks and other

financial institutions. As the subprime crisis struck in 2007, Northern Rock's wholesale funders had to recall the funds they lent to the bank in order to cover themselves (i.e. Systemic Risk has been realized). This brought Northern Rock to illiquidity problems, which eventually became compounded when the said withdrawals created panic among the bank's retail depositors. Not long after, Northern Rock suffered insolvency, as its assets (which were in mortgages) were unable to produce the funds it needed to meet its obligations.

To summarize, the Interbank Funding Market is a convenient investment outlet for cash-rich banks and a funding source for cash-strapped banks. Though the set-up of the interbank market is simple, we point out that participation in this market maybe risky because of its Systemic Risk implications. That is, since being in the Interbank Funding Market exposes the participant to the credit events of its counterparties, it runs the possibility of facing illiquidity problems and even insolvency (when an event takes place). In the following section, we discuss the instrument by which we empirically show this risk implication from Interbank Funding Market exposures, that is CDS Spreads.

*B. CDS Spreads*

Due to the high incidence of credit events such as bankruptcies and insolvencies in the past decades, financial markets players have gone out to find means of protection from such situations. Among the solutions found is the CDS Contract. A CDS contract is a financial derivative that promises its holder a certain amount on a credit event[3]. In other words, a CDS contract is a form of insurance for its buyer from a credit event.

Standing as the price for such insurance is the CDS Spread, also known as, CDS Premium. By market convention, CDS Spreads, are expressed in basis points (bps) and this together with the amount of protection required (called the notional amount) determines the payment that the CDS contract buyer has to make in exchange for the insurance provided by the contract. To illustrate, suppose that the spread for a CDS contract on Firm A is 300bps[4] and that a buyer wishes to protect himself/herself from a default on Firm A-debt that is worth USD10MM. In this case, the buyer will then have to make a

[3] In most CDS contracts, a credit event may either be or a combination of the following; a. the failure of the debt referred to in the CDS contract (called the underlying debt) to make a principal or an interest payment; b. the bankruptcy of the firm/s (called the reference entity/entities in the CDS contract) that issued the underlying debt and; c. a restructuring of the underlying debt.

[4] A CDS Spread of 300bps is quoted as 3.00 in financial markets.

payment of USD 300,000 annually[5] to enjoy the protection of the CDS contract[6].

It is clear in this set-up of the CDS contract that the CDS spread essentially prices the risk, that the contract-seller takes for protecting the buyer from the credit event. Longstaff, Mithal & Neis (2003) points this out empirically by showing that CDS Spreads precisely reflect the credit risk of the debt that the CDS contract covers or the underlying debt. As such, CDS Spreads may then be considered as a variable that possesses information on the risk of the underlying debt as well as its issuer, which also implies that CDS Spreads can be used as indicator of the risk on such debt and that of its issuer.

Supporting the point above are the numerous studies that establish the strong relationship between CDS Spreads and the credit ratings of the underlying debt and the issuer of such debt. The earliest of these studies is Aunon-Nerin, Cossin, Hricko & Huang (2002), which points out that a credit rating has substantial economic impact on the CDS spread, especially when the CDS contract is insuring sovereign debt[7]. In Longstaff, et.al. (2003), the link between credit ratings and CDS Spreads is pointed out more precisely, where a poorer credit rating on the underlying debt (and/or its issuer) and therefore, higher risk, is associated with a wider CDS spread[8]. Longstaff, et.al. (2003) cites a case that after the downgrade of a firm from A to BB-rating, the CDS spread on the debt issued by the same firm widened from 60 to 110bps. Moreover, Longstaff, et.al. (2003) has observed that there is a wide gap between the CDS Spreads that involve top rated firms and those that involve low rated firms. For example, the study points out that the debt of the firm in their sample with the highest rating of AAA has a CDS spread of 15bps, while the debt of the lowest rated firm with a BB-rating has a spread of 1300bps. Concurring with these points, Houweling & Vorst (2005) has found that CDS Spreads monotonously decrease with credit quality (i.e. higher credit rating categories). Likewise, Fabozzi, Cheng & Chen (2006) has observed that low-credit rated firms are involved in CDS contracts with wider spreads than better credit-rated ones.

Meanwhile, Hull, Predescu & White (2004) has found that CDS Spreads widen when the issuer of the underlying debt is under review for a

[5] The payments are usually paid by instalments that are executed quarterly.
[6] The prevalent length or coverage period of CDS contracts is 5 years.
[7] Specifically, CDS contracts that protect the default of sovereign debt/s are called Sovereign Default Swaps.
[8] Note that when a CDS spread is wider, the CDS contract receives more payment in providing protection. This implies that a higher or wider CDS spread must mean that the underlying debt and/or its issuer is riskier or of poorer credit quality.

downgrade. Moreover, the widening of the CDS Spreads has also been seen to continue all the way to the announcement of the downgrade. In Deutsche Bundesbank (2004), this point is enriched where it has been found that a rise or widening of CDS Spreads happens whenever the issuer of the underlying debt of the CDS contract is downgraded and the exact opposite happens when the said issuer is upgraded. Deutsche Bundesbank (2004) estimates that by the time a ratings downgrade is announced, CDS Spreads involving the downgraded debt issuer would have widened by an average of 68%, while CDS Spreads would have narrowed by 62% when a ratings upgrade is put into effect[9].

Along with the above studies instituting CDS Spreads as risk indicators, it has also been argued by numerous other studies that CDS Spreads as so, may be better than other market-based variables that perform the same function such as bonds spreads and stock prices. Since CDS Spreads are explicitly related to the credit risk of the underlying debt of the CDS contract (as well as the issuer of such debt), its detection of risk changes may then be more accurate (relative to the other market-based risk indicators mentioned). Aunon-Nerin, et. al. (2002) contends that since CDS contracts are written directly on a credit event, their prices (i.e. the CDS Spreads) are free from possible distortions by call features and other covenants, unlike bond prices. At the same time, Norden & Weber (2004) point out that by being concerned only with a credit event, CDS Spreads may not be affected by less relevant noises that can cause price movements, such as in the case of stock prices[10].

Further, CDS Spreads as risk indicators might also be faster in signalling risk changes, than the other market-based risk indicators. For the same reason that CDS Spreads have a direct link to the credit risk covered by the CDS contract, it is highly likely that it is more sensitive and thus react more quickly to factors that may affect such risk. Indeed Longstaff, et. al. (2003), has found that CDS Spreads react earlier than bond spreads by as much as a week, in relation to information about the credit situation of the issuer of the underlying debt of the CDS contract. Similar observations have also been made in Zhu (2004) using data on US firms over a three-year period, as well as, in Blanco, Brennan & Marsh (2005), employing data from the two major financial hubs of New York and London. Deutsche Bundesbank (2004) has also found the same results, using CDS Spreads and bonds spreads involving EU-based firms. In, Norden & Weber (2004) it has been pointed that CDS

[9] The study uses the ratings of all three major ratings companies namely, Fitch, Moody's and Standard & Poors (S&P).

[10] An example of a less relevant noise may be doubts on the integrity or competence of a member in a firm's senior management, which may not necessarily have a close relation to the probability of the firm defaulting on its debt, as well as, on its creditworthiness.

Spreads move 10-30 days earlier than stock prices, in anticipation of a credit rating review concerning the issuer of the underlying debt of the CDS contract. As a new credit rating is announced, the said study has found that CDS Spreads anticipate a downgrade earlier than the stock prices of the issuer of the underlying debt of the CDS contract. In addition, Norden & Weber (2004) has also shown that CDS spread movements, unlike that of stock prices, take into account the old rating of the said issuer, and the average of the new rating/s given to it by the three major ratings agencies.

Taking in the above arguments, Völz & Wedow (2009) has employed CDS Spreads as risk indicator in a study investigating the relationship between risk and bank capital. In the said study, Völz & Wedow (2009) also posit an additional point in support of CDS Spreads as reliable and efficient risk indicators, through the fact that extensive users of CDS contracts are financial market players themselves. The study argues that since the major end-users of CDS contracts are financial market players who possess the skills and the other means to timely capture and analyze market information, then movements in the CDS markets, especially the spreads, must be reflective of the analyses of these agents. Hence, CDS Spreads may also give an easily accessible and collective picture of the market's informed perception on the risk of the underlying debt of the CDS contract and the issuer of the debt. In its findings, Völz & Wedow (2009) point out that the higher the market capitalization of the bank, the narrower is the CDS spread of the contract that insures the debt of the bank. This implies that a well-capitalized bank is of lesser credit risk or of better credit quality.

In summary, a CDS spread prices a CDS contract, which provides protection from a credit event on an underlying debt as well as its issuer. As such, a CDS spread reflects the risk that the CDS contract seller takes on the underlying debt and on the issuer of the debt. Under this set-up the CDS spread may be considered as an indicator of the risk of the underlying debt as well as that of the issuer of this debt. In addition, since the CDS contract is directly engaged to the credit risk of the underlying debt and the debt issuer, the movement of the CDS spread may be tightly hinged on the changes of such credit risk. Given this, the CDS spread, as risk indicator may be very precise, and thus efficient, as opposed to other market-based indicators. With studies supporting this point, the CDS spread has been employed as a risk indicator, particularly by Völz & Wedow (2009), in studying the relationship between bank risk and capitalization. In the following section, we take the same step of using CDS Spreads as bank risk indicator, while investigating the Systemic Risk implication of Interbank Funding Market exposures.

## III. Empirical Analysis

### *A. Data and Methodology*

Given that CDS contracts is a relatively new financial instrument, we consider the likelihood that only the debt of big banks may have CDS contracts on them, just as most CDS contracts are drawn on the debt of big firms. As such, we take a look at the Top 100 Global Banks by assets as of December 2008. We have found that 64 out of the 100 banks have CDS contracts written on them, forming our pool of sample banks. Out of the 64 banks, 31 banks are based in the United States, 30 are based in Europe and 3 are from Asia.

The CDS spread quote that we use for our estimations are the mid-rates on Single-name 5-Year Senior CDS Spreads of the banks. Quotes on 5-Year CDS contracts are the most convenient to use when using CDS Spreads in empirical studies, because 5-Year CDS contracts are the most common ones being written and traded. It is also worth pointing out that under Single-name CDS contracts, the underlying debt are solely the bank's debt (thus called Single-name)[11]. This makes it certain that the premiums on these Single-name CDS contracts is reflective of the riskiness of the debt of the bank, or in other words, the bank itself. We take our quotations of the CDS Spreads from Datastream.

To establish that there is a Systemic Risk implication from Interbank Funding Market exposures, we need to estimate our bank risk indicator against a measure of participation in the Interbank Funding Market. We denote such measure by taking the Net Interbank Funding Market Exposures (*Net IB*) of each of our sample banks. To calculate the *Net IB*, we take all interbank assets less all interbank liabilities, where both interbank assets and interbank liabilities are normalized against the total assets of each bank. This difference is entered into the data set in absolute terms. We do so because as we have discussed above, the Systemic Risk implications from participating in the Interbank Funding Market happens in both instances, whether a bank is a lender or a borrower in the said market.

For US based banks, we source our information on interbank assets and liabilities from the FDIC Call Reports, which are filed by the banks on every quarter with the Federal Reserve System. Our data ranges from 2004-2009[12].

[11] There may be some CDS contracts where the underlying debt is a pool of debt from different firms of the same credit profile or industry. These CDS contracts are usually used for speculation rather than hedging. Since the interest of our paper is to use CDS Spreads as risk indicator, CDS contracts whose underlying debt is a pool of debt, may not be useful to our investigation because the spreads on such contracts cannot purely reflect the risk of one underlying debt and its issuer. Thus, only spreads on Single-name CDS contracts are useful for our analysis.

[12] We begin our sampling period at 2004 because this is the beginning period for CDS spread quotes from DataStream.

In the FDIC Call Reports, interbank assets are reflected in two entries namely "Cash and Balances due from Depository Institutions" (Cash and Balances) and "Securities purchased under agreements to resell". Cash and Balances may be viewed as uncollateralized loans of the reporting bank to other depository institutions. These include checks and drafts in the process of collection and/or settlement, as well as credit card payments, interest payments and loan payments that are expected by the reporting bank from other depository institutions[13]. Demand deposits, loans and advances of the reporting institution to other banks are also part of the said account. "Securities purchased under agreements to resell", meanwhile, represent most of the collateralized loans of the reporting bank to other depository institutions. The said account reflects what is commonly referred to as Reverse Repurchase Agreements (RRP).

On the other hand, interbank liabilities may be found in the entries "Deposits of Commercial Banks and other Depository Institutions" and "Securities sold under agreements to repurchase". The first entry mentioned reflect the uncollateralized borrowings or liabilities of a US-based bank from other banks, while the second entry reflect the Repurchase Agreements (RP) entered into by a US-based bank or its collateralized borrowings from other banks. It is worth mentioning, that although banks may engage in RRPs (in the asset side) and RPs (in the liabilities side) with various institutions and even individual clients, bulk of such transactions involve fellow banks and other financial institutions. RRPs and RPs is a conventional vehicle that banks use in lending to and borrowing from each other in the Interbank Funding Market.

For Non-US based banks, we get our interbank funding market exposures data from Bankscope. Our data from Bankscope is on an annual basis and runs up to 2008. To conform with the frequency of our US-based banks data, we use simple linear interpolation to calculate quarterly estimates. In Bankscope, interbank assets are reported through the entries "Loans and Advances to Banks" and RRPs. "Loans and advances to Banks" is similar to the Cash and Balances entry in the FDIC reports, where they reflect a bank's deposits, loans and items in the course of collection from other banks. Interbank exposure on the liabilities side, alternatively, are reported through the entries "Deposits from Banks" and RPs.

As discussed, Interbank Funding Market participation may be risky for banks. This is because of the Systemic Risk implications of the Interbank Funding Market that may threaten a participating bank with illiquidity and

[13] This applies to the case where the other depository institutions are used by the reporting bank's end clients as settlement banks.

insolvency, should a credit event happens on one (or some) of its counterparty/ies. As such, we expect that our data will show a positive relationship between CDS Spreads and Net Interbank Funding Market Exposures.

However, it is an immediate fact that not all the risk in a bank that may be reflected by the CDS Spreads comes only from the Systemic Risk of Interbank Funding Market exposures. Thus, we control for other risk factors which we represent through the bank's Leverage levels (i.e. Debt/Assets Ratio) and its Stock Returns Volatility[14]. These variables were also used in Aunon-Nerin, et.al. (2002), Blanco, et.al.(2005), Ericsson, Jacobs & Helfenberger (2005) and Tang & Yang (2006) as proxies for the firm's risk dimensions while studying the potential risk information carried by CDS Spreads. We derive our sample banks' Leverage levels through the same balance-sheet data sources mentioned above (i.e. FDIC Call Reports and Bankscope), while Stock Returns Volatility data are calculated based on stock price data from Datastream.

Further, given that the structural model for CDS spread determination also includes the influence of market interest rates[15], we also find the need to control for such variable. Thus, we include a market interest rate (INT) variable in our estimations. For US based banks we use the benchmark 3-month US Treasury bill rate, while for European banks we use the 3-month Euro Repo Benchmark Rate. For our small sample of Asian banks, we employ the respective short-term corporate borrowing benchmark rates of their home economies. We take our interest rates data from Datastream.

With our variables above, we implement panel estimations on our dataset under the following baseline specification:

$$Y_{it} = \alpha_o + \alpha_1 Net\ IB_{it} + \beta X_{it} + \phi_1 INT_{jt} + \varepsilon_{it} \qquad (1)$$

Where: $Y_{it}$ = CDS Spread of bank $i$ at the end of quarter $t$; $Net\ IB_t$ = Net Interbank Funding Market Exposures of bank $i$ at quarter $t$; $X_{it}$ = vector of bank $i$'s other risk parameters at quarter $t$; and $INT_t$ = prevailing market interest of bank $i$'s home economy $j$ at quarter $t$. We note that we anticipate the coefficient of $Net\ IB_t$ to be positive (i.e. $\alpha_1 > 0$) owing to our point that Interbank Funding Market exposures have Systemic Risk implications that puts a bank in the said market in a risky position in terms of illiquidity and insolvency.

[14] We measure stock returns volatility by taking the absolute change in the quarterly stock returns of our sample banks. We calculate quarterly stock returns by first taking the weekly change in the stock prices of our sample banks and then take their quarterly average.

[15] See Ericsson, Reneby & Wang (2006) for a discussion on the structural model of CDS Spread determination.

In executing our baseline specifications we do three sets of estimations, one for US based banks, another for Non-US based banks and the last combines the datasets of both cohorts of banks. Our basis for distinguishing between US based banks and Non-US based banks is to account for the possibility that the US based banks may constitute a different case, given that this cohort of banks is under one regulatory regime and economic system.

*B. Data Analysis*

As an initial analysis of our data before proceeding to our estimations, we rank our sample banks by their average Net Interbank Funding Market Exposures. Through this ranking, we are able to divide them into three groups. We consider banks in the first group, which are those in the top 67$^{th}$ percentile of the ranking, as banks with High Net IB Exposures. Banks in the second group, which are ranked between the 67$^{th}$ and 33$^{rd}$ percentile, are treated as banks with Medium Net IB Exposures. Lastly, we consider banks in the third group, which are at the bottom 33$^{rd}$ percentile, as those with Low Net IB Exposures. Based on these groupings, we take our summary statistics, which we report in Table 1.

Our summary statistics provide a strong indication of a positive correlation between CDS Spreads and Net Interbank Funding Market Exposures. Under any case, whether it may be the case of US banks, Non-US banks or considering all banks, we find that the banks with High Net IB Exposures have markedly higher CDS Spreads, compared to those banks that are not exposed to the interbank funding market as much.

On our control variables, we do not see substantial difference on Leverage across different bank groups. What we may note, though, is that Non-US banks appear to be more leveraged than US banks. On the other hand, there seems to be a slightly positive correlation between CDS Spreads and Stock Returns Volatility. We observed some instances, especially in the Non-US Banks Case and the All Banks Case, where banks with high CDS Spreads also have high Stock Returns Volatility.

*C. Estimation Results*

We report our estimation results in Table 2. The estimation results in Panel 1 concern the 31 US based banks, while Panel 2 presents estimation results involving the Non-US based banks, specifically, the 30 European banks and the 3 Asian banks. The estimation results combining the data of all banks are reported in Panel 3. Each panel contains results under Fixed Effects (FE) and Random Effects (RE) estimations.

Both the FE and RE estimations of the US based banks case show a positive relationship between CDS Spreads and *Net IB*. The coefficients of *Net IB* are also statistically and economically significant in both estimations. This implies that as banks have more Interbank Funding Market exposures, they may be riskier. This result establishes our point that Interbank Funding Market exposures subject banks to Systemic Risk, that can lead to illiquidity problems and insolvency. Likewise, Leverage turns out to be positively and significantly related to CDS Spreads, implying higher risk for banks as they take in more debt to fund their activities. This result concurs with the findings in Aunon-Nerin, et.al. (2002), Ericsson, et.al. (2005) and Tang & Yang (2006), where higher leveraging among firms exhibit positive effects on CDS Spreads. The intuition behind such findings is that more debt, tend to increase the chances of default for a firm, consequently augmenting risks. At the same time, Stock Returns Volatility is also positively related to CDS Spreads. Indeed, firms with more unstable stock returns do tend to be more risky. Meanwhile, market interest rates do not seem to affect the CDS Spreads or the riskiness of the US based banks, as INT is not statistically significant in both estimations.

In Panel 2, which deals with the Non-US based banks case, we find in both FE and RE estimations, the same positive effect from *Net IB* on CDS Spreads. However, this effect of *Net IB* on CDS Spreads is not statistically significant. Instead, what turns out to greatly affect the risk among Non-US banks is INT or the short-term market interest rates. Given that banks' borrowings are mostly on short-term debt[16], higher short-term market interest rates connotes higher refinancing costs for banks, that could compromise their profitability and liquidity and increase their default risks. On our other control variables, both Leverage and Stock Returns Volatility exhibit the same positive and significant effect on CDS Spreads.

Combining both the US based bank and the Non- US based bank cohorts, we find in Panel 3, once again, a positive and statistically significant relationship between CDS Spreads and Net IB. This is the case in both FE and RE estimations. This result points out that Interbank Funding Market exposures is still relevant (even in the Non-US case), despite its insignificance in the Panel 2 estimations. Our results in Panel 3 also show the same risk augmenting effect coming from Leverage and Stock Returns Volatility (although the former is statistically significant only under the FE estimation).

[16] As pointed out in Greenbaum & Thakor (2007) and Huang & Ratnovsky (2009)

## IV. Findings and Implications

Our estimation results have satisfactorily shown that Net Interbank Funding Market exposures have a positive impact on CDS Spreads. Although our estimation results on Non-US based banks show that *Net IB* is statistically insignificant, we cannot use these results as a basis for an outright dismissal of the relevance of Interbank Funding Market exposures on CDS Spreads. This point becomes imperative given that *Net IB* has turned out significant, when all banks are considered. What may be said then is that, even among Non-US banks, it is still likely that Interbank Funding Market exposures have an effect on CDS Spreads (albeit weak)[17]. In our estimations results we have also found that the impact of *Net IB* on CDS Spreads is large enough to be non-negligible. These serve as convincing evidence to our contention that Interbank Funding Market exposures pose Systemic Risk to banks.

Meanwhile, Leverage turning out to also positively affect risk in almost all estimations pushes the case, that the debt levels of banks must be given a risk concern. This is an interesting point considering that most assessments on bank risk focus on the asset side of the bank balance sheet and less on the liabilities side. A further argument in favour of giving more attention to the liabilities side of the bank balance sheet is the large positive impact of market interest rates in the Non-US Case. This is because the channel by which market interest rates affect bank risk, in this case, is through the banks' refinancing costs or on their liabilities. Alongside Leverage, we have found that Stock Returns Volatility also positively affects the riskiness of our banks. This reaffirms the long held point that unstable stock returns is very much correlated with the credit profile of firms.

## V. Robustness Test

### *A. Additional Control Variables*

Our above analysis has established that Interbank Funding Market exposures subject banks to Systemic Risk. Central to this point is our finding that Net Interbank Funding Market exposures have a positive impact on the CDS Spreads of our sample banks, which is our risk indicator. However, our usage of CDS Spreads as risk indicator has a limitation which comes from CDS Spreads being affected by other factors that are not necessarily related to the riskiness of the underlying debt of the CDS contract and the issuer of the debt. Given this, we conduct a robustness test by controlling for these other

[17] This matter will be discussed more in the following section.

variables. The additional control variables we employ in our estimations along with the justifications for their inclusion are as follows;

1. Slope of the Yield Curve (Yield Curve)

Although the slope of yield curve does not directly figure out in the structural model for CDS Spreads determination, the slope of the yield curve has an effect on market interest rates, which, as we have pointed out is a major determinant in the said model. The studies that particularly recognize this point are Aunon-Nerin, et.al. (2002), Blanco, et.al. (2005) and Völz & Wedow (2009). To account for the slope of the yield curve, we include in our estimations the change in the difference between the yields on 10Y and 2Y government bonds of the respective home economies of our sample banks.

2. Illiquidity of the CDS Contracts (CDS_BA)

Another factor that could affect CDS Spreads that is not related to the risk of the underlying debt of the CDS contract and the issuer of the debt, is the illiquidity of the CDS contract. Illiquidity here does not mean the difficulty by which a CDS contract can be transformed into another asset. Rather, illiquidity refers here to the difficulty by which a CDS contract can be bought, or in other words, the absence of a seller of a CDS contract. Thus, an illiquid CDS contract is deemed here as one that is difficult to source or one that has an unanswered demand. The illiquidity of CDS contracts is mostly due to a still slim secondary market, because buyers tend to hold on to the CDS contracts to maturity (along with the underlying debt). At the same time, CDS contract sellers tend to be reluctant to take further positions as soon as they have already exhausted their risk limits in relation to underwriting CDS contracts. The illiquidity of CDS contracts together with the increasing demand for such contracts is believed to push up the prices of the contracts or the CDS Spreads. Among the studies confirming this point is Bongaerts, De Jong & Driessen (2005), which shows that CDS Spreads include a certain premium for the illiquidity of the contract (where this premium accrues to the seller of the CDS contract). Fabozzi, et.al. (2006), on the other hand, points out that CDS contracts with a higher number of trades, have higher CDS Spreads. Further, Tang & Yang (2006) has found that CDS Spreads increase for contracts that are quoted and frequently traded, as well as, for contracts that have an order imbalance and a wide discrepancy in the bid-ask quotes of the CDS Spreads.

In accounting for the illiquidity of the CDS contract, we use the simplest proxy, which is the difference between the bid-ask quotes of the CDS Spreads (CDS_BA). We take the quotes from Datastream. To note, a wider difference between the bid-ask quotes of the CDS spreads indicates that the CDS contract is illiquid and must therefore demand a higher premium, if written.

3. Business Climate

When a good business climate prevails, there are lesser perceived risks, in general. This could lessen the financial market players' anxiety to hedge against defaults, which may result to a lower demand for CDS contracts and cause the CDS Spreads to narrow. In Ericsson, et. al. (2005), the business climate was measured though the S&P 500 Index. Results of the said study show a significant and negative relationship between CDS Spreads and the said stock index, confirming the effect of the business climate on the CDS Spreads. In the same manner, we add the S&P 500 Index as a proxy for the business climate faced by the US-based banks. For Non-US based banks, the stock indices we use are those relevant to their home economies. For example, for sample banks based in Europe, we employ the FTSE Euromid Index as business climate indicator, while for banks based in Japan, we use the Nikkei 500.

4. Financial Crisis/Market Distress Variable (Crisis)

Periods of financial crises or market distress are especially difficult for banks because the money markets dry up on such episodes. With a heightened difficulty in finding funds, the probability of bank failures are high. CDS spreads on contracts involving banks during financial crises may then be higher than usual.

To account for market distress, we use a relatively new indicator introduced in Krishnamurthy & Jorgensen (2008). The said study shows that during times of market distress, credit spreads[18] tend to increase. This is due to the decrease in the yields on government bonds that are brought about by the flight of investors to safe-havens during market distress, while the yields among the investment-grade corporate bonds remain stable[19]. For the US based banks case, we use the spread between Long-term Moody's Aaa Corporate Bond Yields and the US 10Y Treasury Yield. On the other hand for banks based in Europe, we use the spread between the Euro Corporate Bond Benchmark Rate and the 5Y German Government Bond yield[20]. For the Asian banks case, we take the spread between the benchmark yield for Japanese investment-grade corporate bonds and the Japanese government 10Y bond yield. We note that using these indicators for market distress is a better proxy,

[18] Credit spreads here refer to the spread between the average yield of investment-grade corporate bonds over government-issued bonds with similar maturities.

[19] It has been shown in Krishnamurthy & Jorgensen (2008) that indeed during times of market distress the yields on investment-grade corporate bonds are relatively unchanged and if they do so, the decrease is much less than the decrease in government bond yields. Thus, the credit spread widens due to lower government bond yields.

[20] The Euro Corporate Bond Benchmark Rate is based on the yields of investment-grade German corporate bonds with maturities between 3-5 years. Thus, such benchmark rate may be comparable to the yield on the 5Y German Government bond.

than using dummy variables for the periods of financial market instabilities. These spreads are based on yields which are market determined and so allows for a more precise means of capturing the timing and extent of market distress than a dummy variable.

*B. Test Results*

Table 3 shows the estimation results with the additional control variables we have chosen for our robustness test. Like in the previous estimations, Panel 1 shows the estimation results for the US based banks. Panel 2 concerns the Non-US based banks, and Panel 3 deals with All banks.

In the case of US based banks, *Net IB* remain statistically significant and have a positive effect on CDS Spreads. Stock Returns Volatility and Market Interest Rates also remain to be statistically significant and positively related to CDS Spreads. Such results figure out in both the FE and RE estimations. On the additional control variables, the estimation results show that the CDS spreads are positively related to the illiquidity of the CDS contract (CDS_BA) and the credit spreads, while negatively related to the business climate. As previously discussed, the illiquidity of CDS contracts do tend to push up the price of CDS contracts or the CDS Spreads. At the same time, periods of market distress (characterized by high credit spreads), means greater risk of bank insolvency, which will then also increase the CDS spreads involving our sample banks. In the case of the business climate, the higher stock index means that financial market players are more confident and expect less defaults, tempering the need for CDS contracts and thus its premiums. It is, however, worth noting that our estimation results show that the effect of the business climate on CDS spreads is not substantially economically significant, compared that of our other independent variables.

Our results for the Non-US based banks case are similar to that of the US case. What needs emphasis in our results in Panel 2, however, is that *Net IB* is now statistically significant in the FE estimations as opposed to our earlier estimations without our additional control variables. This result supports our earlier contention that Interbank Funding Market exposures are still relevant in the Non-US based banks case.

For the case where we put together both cohorts of banks, we still get parallel results. The statistically significant and positive relationship between CDS spreads and Interbank Funding Market exposures is sustained in both estimations. The same also applies for all our other explanatory variables. This outcome gives a strong support for our earlier findings.

## VI. Concluding Remarks

Due to the Systemic Risk innate in transacting at the Interbank Funding Market, exposures to such market can threaten the participating bank to possible illiquidity and insolvency. We have found credible evidence on this risk implication of Interbank Funding Market exposures on banks, through our findings of a positive relationship between Net Interbank Funding Market Exposures and CDS Spreads (which, as argued, is an efficient and reliable bank risk indicator). The valuable insight of these results is that, they serve as a call to banks to exercise caution on their participation in the Interbank Funding Market. Our findings stand as an appeal to banks to recognize the risks of the said market and not merely dismiss it as a low-risk funding source and/or a convenient short-term investment outlet for excess cash. At the same time, our observations may also push the need for banks to advocate peer monitoring, so as to address the Systemic Risk brought about by the mutual exposures to their respective risks, while being in the Interbank Funding Market. A great benefit, if this is pursued, could be a safer Interbank Funding Market, which could even lead to a stronger banking system. On the part of regulation, our findings may also be a call for regulators to pay close attention to the Interbank Funding Market. This means that the role of the regulators in the said market has to go beyond the monitoring of flows and the setting of the market's reference rate.

In addition, our robustness tests, have shown that while CDS Spreads can sufficiently capture the risk of the underlying debt of the CDS contract and that of the issuer of the debt, CDS spreads may also be determined by other factors. These alternative factors, which have also been found as affecting CDS spreads in other studies, may not be necessarily related to the risk of the underlying debt of the CDS contract and the issuer of such debt. These outcomes give us the point that CDS Spreads may possess much more information and not just the default or credit risk of the debt that it covers. On this note, much then still needs to be studied about CDS Spreads.

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## Table 1. Summary Statistics

| | Net Interbank Funding Market Exposures (Net IB) | | |
|---|---|---|---|
| | Low Exposure (Net IB ≤ 33rd Percentile) | Medium Exposure (33rd Percentile<Net IB ≤ 67th Percentile) | High Exposure (67th Percentile ≤ Net IB) |
| | US based Banks | | |
| CDS Spread | 70.881 | 63.293 | 145.55 |
| Leverage | 86.631 | 85.843 | 86.530 |
| Stock Returns Volatility | 16.098 | 12.869 | 14.282 |
| Sampling Period: 2004:1-2009:3 | | No. of Banks in Each Group: 10 | |
| | Non-US based Banks | | |
| CDS Spread | 44.244 | 40.076 | 49.602 |
| Leverage | 96.353 | 96.203 | 96.147 |
| Stock Returns Volatility | 11.159 | 12.226 | 15.848 |
| Sampling Period: 2004:1-2008:4 | | No. of Banks in Each Group: 11 | |
| | All Banks | | |
| CDS Spread | 62.231 | 51.216 | 85.866 |
| Leverage | 89.137 | 91.482 | 92.956 |
| Stock Returns Volatility | 13.451 | 12.263 | 15.454 |
| Sampling Period: 2004:1-2008:4/2009:3 | | No. of Banks in Each Group: 21 | |

Balance sheet data for US based banks are taken from the FDIC Quarterly Call Reports and runs from 2004-2009:3. Balance sheet data for the Non-US based banks are taken from Bankscope and runs from 2004-2008. CDS Spread and Stock Returns Volatility Data are taken from Datastream.

## Table 2. CDS Spreads and Interbank Funding Market Exposures

| Dependent Variable | CDS Spread | | | | | |
|---|---|---|---|---|---|---|
| | 1:US based Banks | | 2:Non-US based Banks | | 3:All Banks | |
| | FE | RE | FE | RE | FE | RE |
| Independent Variables | | | | | | |
| Net IB | 5.065*** | 5.206*** | 0.766 | 0.073 | 4.652*** | 4.007*** |
| | (3.667) | (3.848) | (1.223) | (0.193) | (4.817) | (4.442) |
| Leverage | 1.904* | 1.681* | 8.838*** | 3.616*** | 1.952** | 0.833 |
| | (1.777) | (1.663) | (3.879) | (3.143) | (2.430) | (1.186) |
| Stock Returns Volatility | 4.344*** | 4.304*** | 2.060*** | 2.169*** | 4.001*** | 4.047*** |
| | (10.935) | (10.893) | (14.592) | (15.945) | (15.253) | (15.554) |
| INT | -5.645 | -5.517 | 15.874*** | 13.394*** | -2.491 | -1.573 |
| | (-0.969) | (-0.949) | (8.638) | (8.367) | (-0.668) | (-0.428) |
| No. Of Obs | 670 | 670 | 557 | 557 | 1227 | 1227 |
| No. Of Banks | 31 | 31 | 33 | 33 | 64 | 64 |
| $R^2$ | 0.370 | 0.370 | 0.505 | 0.505 | 0.381 | 0.381 |

The dependent variable is the CDS Spreads as bank risk indicator. Net IB represents the Net Interbank Funding Market Exposure of each sample bank which is calculated as Interbank Assets less Interbank Liabilities (normalized to Total Assets and in absolute terms). Leverage is measured as the Debt-to-Assets Ratio of each sample bank. Stock Returns Volatility is calculated as the quarterly change in the stock price of each sample bank. INT is the market interest rate. Panel 1 presents the Fixed Effects (FE) and Random Effects (RE) estimation results using the data of US-based banks only. Panel 2 presents the FE & RE estimation results using data of Non-US based (i.e. European and Asian) banks. Panel 3 presents the FE & RE estimation results using the combined data of US and Non-US banks (i.e. All sample banks). Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

## Table 3. CDS Spreads and Interbank Funding Market Expoures with Additional Control Variables

| Dependent Variable | CDS Spread | | | | | |
|---|---|---|---|---|---|---|
| | 1:US based Banks | | 2:Non-US based Banks | | 3:All Banks | |
| | FE | RE | FE | RE | FE | RE |
| Independent Variables | | | | | | |
| Net IB | 1.857*** | 2.223*** | 0.837** | 0.139 | 2.107*** | 1.491*** |
| | (3.133) | (3.616) | (2.261) | (0.583) | (4.873) | (3.982) |
| Leverage | 0.694 | 0.415 | -1.474 | 0.110 | 0.746** | 0.103 |
| | (1.557) | (1.030) | (-1.068) | (0.150) | (2.203) | (0.385) |
| Stock Returns Volatility | 1.282*** | 1.138*** | 0.515*** | 0.647*** | 1.347*** | 1.284*** |
| | (5.578) | (4.476) | (5.230) | (6.771) | (9.289) | (8.335) |
| INT | 11.845*** | 11.303*** | 6.812*** | 4.173*** | 3.348* | 2.081 |
| | (3.381) | (2.846) | (4.421) | (2.901) | (1.910) | (1.186) |
| Yield Curve | -0.019 | -0.018 | 0.004 | 0.005* | -0.025*** | -0.024*** |
| | (-0.681) | (-0.569) | (1.493) | (1.847) | (-4.558) | (-4.166) |
| CDS_BA | 4.853*** | 5.153*** | 5.788*** | 6.300*** | 4.891*** | 5.214*** |
| | (53.439) | (51.156) | (19.588) | (24.097) | (70.245) | (67.785) |
| Business Climate | -0.088** | -0.079* | -0.010*** | -0.004** | -0.010* | -0.007 |
| | (-2.326) | (-1.846) | (-4.271) | (-2.255) | (-1.775) | (-1.577) |
| Crisis | 56.962*** | 56.172*** | 22.210*** | 18.717*** | 59.110*** | 57.097*** |
| | (5.137) | (4.506) | (5.040) | (4.323) | (11.162) | (10.745) |
| No. Of Obs | 669 | 669 | 557 | 557 | 1226 | 1226 |
| No. Of Banks | 31 | 31 | 33 | 33 | 64 | 64 |
| $R^2$ | 0.894 | 0.894 | 0.836 | 0.836 | 0.891 | 0.891 |

The dependent variable is the CDS Spreads as bank risk indicator. Yield Curve is calculated as the change in the difference between the yields on 10Y and 2Y government bonds. CDS_BA is the difference between the Bid-Ask quote of CDS Spreads, which measures the illiquidity of the CDS Contract. Business Climate is measured by the Stock Market Index. The Crisis variable is measured through the spread between the yield of an investment-grade bond and that of a government bond of similar maturity. Panel 1 presents the FE and RE estimation results using the data of US based banks only. Panel 2 presents the FE & RE estimation results using data of Non-US based (i.e. European and Asian) banks. Panel 3 presents the FE & RE estimation results using the combined data of US and Non-US banks (i.e. All sample banks). Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

# Chapter 2. Hedging Illiquidity Risk through Securitization: Evidence from Loan Commitments

**Abstract**

Securitization provides banks with an alternative funding facility, by transforming otherwise illiquid loans to cash. This happens as the loans, when securitized, are used to borrow funds from investors. We investigate the value of this funding role of securitization. In particular, we examine how securitization, through its provision of funding, may serve as a hedge against the illiquidity risk from loan commitments. Looking at quarterly data of banks based in the US and in Europe, we have found that securitization, as a funding facility, can mitigate the illiquidity risk posed by loan commitments. Given that a chief role of banks is to serve as liquidity providers through loan commitments, we take our results as a basis for considering securitization as an important bank funding activity (albeit its risk implications).

JEL Classification: G21, G32, G01
Key words: Securitization, Loan Commitments, Funding Risk, Illiquidity Risk

## I. Introduction

When a bank securitizes its loans, the pool of loans is effectively used as collateral or underlying assets to borrow funds. Securitization then allows the transformation of otherwise illiquid assets to cash. Through this arrangement, securitization provides a funding facility.

This function of securitization as a funding source is considered to have been one of the major motivations for banks to securitize. Karaoglu (2005), Bannier & Hänsel (2007), Martin-Oliver & Saurina (2007) and Affinito & Tagliaferri (2010) point this out clearly, by showing that banks with high liquidity needs, tend to securitize their loans. In the same vein, Panetta & Pozzolo (2010) shows that banks whose asset portfolios are mainly composed of illiquid loans (and are thus highly susceptible to illiquidity shocks), have a high probability of securitizing.

At the same time, many studies have also shown that securitization does augment bank funding. A good number of studies have found that securitization provides banks with additional funds, such that the banks that securitize can grant and/or hold more loans (Cantor & Demsetz (1993), Altunbas, Gambacorta & Marques-Ibanez (2007), Goderis, Marsh, Costello & Wagner (2007), Loutskina & Strahan (2008), Gambacorta & Marques-Ibanez (2011), Loutskina (2011)). In Gambacorta & Marques-Ibanez (2011) and Loutskina (2011) the importance of this funding provision is further stressed, where both studies show that banks with access to securitization[1] can continue to grant and even increase their loans holdings, despite funding shocks. Moreover, Loutskina (2011) has found that securitization may lower the banks' need to hold liquid assets as liquidity buffers, because of the additional funding it affords.

In this study, we add to the discussion on securitization as a funding source by looking at its usage as a hedge against illiquidity risk. If securitization provides a funding facility for banks, then a bank's engagement in securitization may temper risk concerns that arise from being in transactions that impose illiquidity risk. One such transaction which we focus on in this study is loan commitments.

The illiquidity risk implication of loan commitments arises from the obligation of the bank to lend to its client at any point time. Since the client's funding needs may be unpredictable, the timing and the volume of takedowns

[1] Loutskina (2011) defines access to securitization as the "securitzability" of a bank's bank balance sheet, which is determined by the size of the bank's loan portfolio relative to the size of the securitization market of the bank's home economy.

on the loan commitments may be unknown. Given this, a bank with a loan commitment takes on an illiquidity risk exposure that it has to manage.

To go about our exercise, we apply the framework in Gatev, Schuermann & Strahan (2007), which studies the effect of combining deposit-taking with loan commitment activities on bank risk. In the said study, it has been found that engaging in both deposits and loan commitments lowers the risk of banks, as indicated by their respective implied stock returns volatilities. The study reasons that while loan commitments pose illiquidity risk to banks (because of the unpredictable takedowns from clients), transaction deposits, which is a stable and cheap funding source for the banks, can meet the loan commitment takedowns. Hence, bank risk is effectively reduced through transaction deposits supporting illiquidity-risky loan commitments, or what the study calls as the loan commitment-deposit synergy.

Applying the above point to our objective, we look into the synergy of loan commitments and securitization and their effect on bank risk. Like transaction deposits, securitization may be considered as a stable and cheap (or even cheaper) funding source for banks[2]. Thus, we expect that its interaction with loan commitments might also temper the illiquidity risk coming from these loan commitments.

To see this, we use quarterly data from 2001 to 2009 of over 100 US based banks, as well as, quarterly data from 2004-2009 of 27 banks based in Europe[3]. For risk measures, we employ three different proxies namely the Z-score, the Stock Returns Volatilities and the spreads on Credit Default Swaps (CDS) contracts that involve our sample banks. Our results show an inverse relationship between all our risk measures and our loan commitment-securitization synergy variable. This gives evidence of a risk mitigating effect from the combination of loan commitment and securitization as banking activities. Specifically, our findings imply that, like the case of transaction deposits, securitization as a funding source, may have supported loan commitments, creating a hedge on the illiquidity risk from these loan commitments.

By showing that securitization may mitigate the illiquidity risk embodied in loan commitments, our study gives a plus factor for securitization and a window of reconsideration for its continued practice. Through this, our study offers a

[2]Securitization is a stable funding source for banks in the sense that it gives a bank a standby facility to get some cash in exchange for its loans. Securitization may also be a cheaper funding source (relative to deposits) for banks, since the activity is off-balance sheet and requires no reserves.

[3] Our discussion for the case of European banks is found in the Appendix.

good contribution to the debate on securitization. However, we note that our study must not be considered as a pure advocacy of securitization. We have also found that securitization, while providing an illiquidity risk hedge, still has risk implications in itself. These risk issues may stem from securitization misaligning bank incentives, such that banks, take on risk more aggressively and less prudently[4]. Thus, what we have, is a presentation of securitization as a dual-edged sword[5], where used properly it may provide some security but may be fatal when used carelessly[6].

The rest of our paper is organized as follows. Section II provides a brief background on securitization and loan commitments. Section III discusses the related literature on hedging the illiquidity risk implications of loan commitments. Sections IV & V present our empirical analyses. Section VI concludes.

## II. Background

### *A. Securitization as an Additional Funding Source*

Securitization is the process of pooling assets and issuing new securities or debt backed by these assets and their cash flows. Under this set-up, securitization allows the use of illiquid assets or loans (that would have instead stayed in the bank balance sheet) as collateral or underlying assets, for borrowing funds from investors. Hence, securitization creates an alternative funding facility for banks.

What may make securitization a better funding source than others is that it is cheaper. Unlike other forms of funding that involves costly required capital and reserves (e.g. deposits), securitization does not entail such (Pennacchi 1988). This is because the securitization transaction is set up in a way, that the securitizing bank faces no direct liability to the securities holders and that the said investors have no claim on the bank's assets.[7]

There have been many studies that show that banks may have securitizated with the intention of obtaining its funding benefits. Karaoglu (2005) has found that banks with high liquidity needs, in the sense that they have a high level of

[4] Instefjord (2004), Wagner (2005), Güner (2006), Uzun & Webb (2007), Keys, Mukherjee, Seru & Vig (2008), Mian & Sufi (2008), Dell'Arricia, Igan & Laeven (2009), Jiang, Nelson & Vytlacil (2009), Michalak & Uhde (2009), Purnanandam (2009)

[5] As described in Affinito & Tagliaferri (2010)

[6] We discuss on the possible ways to practice securitization prudently in the Conclusion.

[7] In securitization, the securitizing bank or asset originator sells the pool of loans to a Special Purpose Entity (SPE) which, in turn, serves as the issuer of the securities backed by the pool of loans. As such, in the event of a default, the claim of the securities lies not on the bank.

loans relative to deposits, tend to securitize. Similarly, Affinito & Tagliaferri (2010) has seen that Italian banks that are already liquid, by having high deposit levels relative to assets, have lower probabilities of securitizing. Looking into Spanish banks, Martin-Oliver & Saurina (2007) has also observed that the primary reason for banks to securitize is liquidity issues. Specifically, banks whose deposits are too low to sustain their loans and banks with less access to the Interbank Funding Market[8], tend to issue Residential Mortgage Backed Securities (RMBS) in order to satisfy their funding requirements. Likewise, Bannier & Hänsel (2007) has seen that European banks that are less liquid, in terms of having less funds to lend out to other banks, are more likely to securitize through Collateralized Loan Obligations (CLOs)[9]. Meanwhile, using data from a wide sample of banks from 140 countries, Panetta & Pozzolo (2010) have pointed out that banks whose asset portfolios are highly composed of illiquid loans, have a higher propensity to securitze. The study explains that such banks might securitize more, because these banks have a higher concern of facing illiquidity shocks.

At the same time, there have also been a good number of studies that give support to the point that securitization can increase bank funding. A set of these studies point out that the added funding from securitization has been manifested through findings that securitizing banks are able to grant and/or hold more loans (Cantor & Demsetz (1993), Altunbas, et.al. (2007), Goderis, et.al. (2007), Loutskina & Strahan (2008), Gambacorta & Marques-Ibanez (2011), Loustkina (2011)). In Gambacorta & Marques-Ibanez (2011) this is further highlighted, where it has been found that banks that securitize heavily are able to conintue and increase their lending even during periods of funding shocks, such as when there is an increase in policy rates or when there is a crisis scenario. Similarly, Loutskina (2011) has also found that banks with more securitizable balance sheets[10] can sustain their loans activity, despite a period of contractionary monetary policy. In addition, the increased funding from securitization could

[8] Martin-Oliver & Saurina (2007) measures Interbank Funding Market access in terms of the Interbank Liabilities to Total Liabilities ratio, where its findings show that banks with higher Interbank Liabilities/Total Liabilities have a lower probability of securitizing. Given that the Interbank Funding Market is a convenient source for short-term funding, a bank's low tendency to securitize when it has much access to the said market may imply that the purpose of securitizing is to gain some funds.

[9] Bannier & Hänsel (2007) measures bank liquidity by taking the ratio of the amount a bank has lent to other banks relative to the amount borrowed from other banks (Money Lent to Other Banks/Money Borrowed from Other Banks). The study has found that banks that belong to the lowest deciles of such liquidity indicator have a high probability of securitizing.

[10] See Note 1

also be seen through the less need among securitizing banks to hold liquid assets as liquidity buffers. The same study by Loustkina (2011) has shown that banks with more securitizable balance sheets also tend to hold less liquid assets in terms of reverse repurchase agreements (RRPs) and marketable securities.

Building up on the central point of these studies, we look at the importance of securitization as a funding facility in terms of hedging illiquidity risk. Since securitization, provides banks with a funding source, then it may (aside from the effects found in the studies mentioned) have the potential of mitigating the risk concerns imposed by transactions that compromise the liquidity of the bank. In this study, we focus on one such transaction, that of loan commitments, which we discuss in the following section.

*B. Loan Commitments and Illiquidity Risk*

Loan commitments are contractual agreements entered by a bank, to lend to a specific borrower up to a certain amount at pre-specified terms. Loan commitments can be a good source of earnings for banks, because it involves various fees namely a commitment fee (an upfront fee paid as soon as the commitment is made), an annual service fee (which is based on the borrowed amount or the amount that has been taken down), and a usage fee (levied on the unused amount of credit). At the same time, an interest rate is also charged for the amount that has been taken down, which is based on a benchmark interest rate (e.g. prime rate, LIBOR) plus a certain premium[11].

Besides profits, other motivations for banks to offer loan commitments have been put forward. Loan commitments allow banks to have a means of forecasting future loan demands and can also be a way for banks to foster strong relations with its clients and keep their reputation as being richly funded[12] (Ergungor 2001). In addition, Kashyap, Rajan & Stein (2002) has pointed out that banks offer loan commitments alongside deposits because this makes further (and hence more efficient) use of costly liquid assets[13] (than merely serving as a back-up for deposit withdrawals).

On the other side of the contract, bank clients avail of loan commitments for several purposes. These include capital structure management, debt repayment, capital investment purposes and liquidity management (Shockley & Thakor

[11] An example of the fee structure of loan commitments may be found in Ergungor (2001).

[12] Since the bank stands ready to lend to a client in a loan commitment contract, this sends a signal that the bank is in a good funding position.

[13] The costliness of liquid assets here is in terms of opportunity costs as liquid assets are usually in the form of low yielding securities.

1996). Loan commitments are also especially useful for firms in times of tight market liquidity or when there is credit rationing, as the contractual agreement assures them of funds (Shockley & Thakor 1996, Ergungor 2001). In Holmström & Tirole (2000), the importance of loan commitments for firms during times of market distress is highlighted by the argument that loan commitment takedowns are more likely to happen during such periods. Further, firms may also go into loan commitments to hedge against interest rate risk (Saidenberg & Strahan 1999). Since the interest rates to be paid on loan commitment takedowns are pre-agreed, firms with loan commitments may be able to save on borrowing costs when interest rates suddenly spike, as opposed to borrowing directly from the commercial paper market.

At the aggregate level, the importance of loan commitments has been recognized through its substantial contribution to bank liquidity creation. Current estimates show that about 80% of Commercial and Industrial (C&I) loans have come from loan commitment takedowns and close to 50% of total bank liquidity creation stems from loan commitments. It is also worth noting that loan commitments is a vital activity for banks in their liquidity creation function, because the relationship nature of a loan commitment contract gives banks the comparative advantage in such activity over other financial institutions (Saidenberg & Strahan 1999).

However, the downside of loan commitments is that they pose illiquidity risk to the bank involved in such contract. This illiquidity risk imposition of loan commitments comes from the bank being obligated to lend to its client, the pre-agreed amount (in part or in full) at any point in time. Given that the funding requirements of firms may be difficult to forecast, the timing and volume of loan commitment takedowns may be close to unknown. We note that the difficulty in anticipating the funding needs of the bank's clients may persist, despite a long relationship that the bank may have kept with its clients. A reason for this persistence would be that the funding requirements may be influenced by unpredictable market factors, such as a dry-up in market liquidity that results to credit rationing. The tendency for loan commitments to impinge on the bank's funding position, has been observed in Cornett, McNutt, Strahan & Tehranian (2010). The study has found that banks with high loan commitments had to restrict new lending during the Financial Crisis of 2007/09. Cornett, et. al. (2010) points out that this decreased lending capacity among banks with much loan commitments was caused by the sudden and large takedowns on the contracts resulting from the funding drought in the said crisis.

Hence, due to its responsibility of providing standby financing to its client with possibly unpredictable cash requirements, a bank that is a party to a loan commitment is exposed to having funding problems. In the next section, we review some of the ways by which banks have attempted to adress such illiquidity risk.

## III. Related Literature

An immediate means for banks to manage to the potential funding problems posed by loan commitments is by having financial futures contracts that could supply the banks with the needed funds to meet the eventual loan commitment takedowns. However, a limitation of this strategy is that financial futures contracts may only be useful in answering loan commitment takedowns, if the banks can accurately predict the said takedowns, so as to coincide the timing of the futures contracts. As shown in Ho & Saunders (1983) and Koopenhaver (1985), the illiquidity risk of loan commitment takedowns may not be fully hedged through financial futures contracts, owing to the unpredictability of the takedowns.

In Holmström & Tirole (2000) and Cornett, et.al. (2010), it has been cited that a way for banks to manage loan commitment takedowns is to hike up their liquid assets holdings. Kashyap, et. al. (2002) has provided a demonstration of this point, by showing that banks holding liquid assets may not only be for the purpose of backing deposit withdrawals, but also loan commitment takedowns. Liquid Assets as a funding buffer may, however, have some drawbacks. First is that holding them, as mentioned, can be costly[14]. At the same time, should deposit withdrawals and loan commitment takedowns happen simultaeously, liquid assets as funding back up for both events might have to make a compromise.

Going a step further, Gatev, et.al.(2007) has shown that while deposits and loan commitments may create a more efficient use of liquid assets (as a liquidity buffer), deposits can also serve as a hedge on the illiquidity risk posed by loan commitments. Using the implied stock returns volatilities of 100 publicly traded US banks, as risk indicator, Gatev, et.al. (2007) has first shown that loan commitments are positively related to the stock returns volatilities of the said banks. With loan commitments having such positive effect on bank risk, this

[14] See Note 13

implies that loan commitments do have illiquidity risk implications. However, as loan commitments interact with transaction deposits, the study has found that this interaction between loan commitments and deposits have a negative effect on the stock returns volatility. In other words, the loan commitment-deposit synergy (as the study calls it), lowers bank risk. The explanation for such result is that deposits are a cheap funding source for banks, which may then give banks an easy means of meeting loan commitment takedowns. Thus, when banks take in deposits alongside loan commitments, they may be hedging the illiquidity risk implications of the loan commitments, reflected by the negative impact of the loan commitment-deposit synergy variable on bank risk.

In further analyses, Gatev, et. al. (2007) points out that this interaction between loan commitments and deposits may be stronger when market liquidity is tight. Splitting the dataset between periods of high market liquidity and low market liquidity[15], the study has found that the negative effect of the loan commitment-deposit synergy variable on bank risk is more economically significant on the periods of low market liquidity. This stronger hedging potential of transaction deposits for the tight market liquidity periods may be due to the greater deposit inflows and spike in loan commitment takedowns during the said periods. During times of market distress, banks experience more deposit inflows as they are perceived as safe havens due to deposit insurance and access to central bank liquidity support (Gatev & Strahan 2003). Meanwhile, under times of low market liquidity, banks also encounter more loan commitment takedowns due to credit rationing (Gatev & Strahan 2004). Thus, with more deposit taking and loan commitment takedown activity on periods of tight market liquidity, the hedging mechanism of deposits, shown by the loan commitment-deposit synergy variable, becomes more important in such periods.

As we have pointed out, securitization provides banks with a funding facility. Moreover, we have also raised that securitization as a funding source for banks may be cheap (even cheaper than deposits), because being an off-balance sheet transaction, it does not require reserves and also does not involve a capital charge. From these, there is thus the possibility that securitization, like deposits, could also provide a hedge on the illiquidity risk posed by loan commitments. We investigate on this point in our following empirical analysis.

[15] A time of high market liquidity has been defined in the paper as the periods where the actual commercial paper vs. treasury bill spread is equal or below the average spread (75 basis points (bps)), while times of low market liquidity are periods where the spread is above the average spread. Usage of the spread between a commercial paper rate and a Treasury bill rate as an indicator for market liquidity is explained and demonstrated in Krishnamurthy & Jorgensen (2008).

## IV. Empirical Analysis

*A. Data and Methodology*

To examine the capability of securitization to hedge against the illiquidity risk embodied in loan commitments, we follow the framework in Gatev, et.al. (2007), cited above. Hence, we take a measure for bank risk and examine its relationship with the bank's loan commitments, as well as, its relationship with the interaction between the bank's loan commitments and securitization activity or the loan commitment-securitization synergy variable. We also control for the bank's securitization activity, separately, given that securitization does not affect bank funding only and may, in fact, also affect bank risk[16]. Our baseline specification using panel estimation is thus as follows:

$$Y_{it} = \alpha_0 + \alpha_1 Loan\ Commitments_{it} + \alpha_2 Securitization_{it} + \alpha_3 Loan\ Commitments_{it} * Securitization_{it} + \varepsilon_{it} \quad (1)$$

Where: $Y_{it}$ = risk measure of bank $i$ at period $t$; $Loan\ Commitments_{it}$ = loan commitments of bank $i$ at period $t$; $Securitization_{it}$ = securitization activity of bank $i$ at period $t$; and $Loan\ Commitments_{it} * Securitization_{it}$ = the loan commitment-securitization synergy variable for bank $i$ at period $t$.

To implement Equation (1), we take the balance sheet data of the Top 150[17] FDIC-member banks[18], using the quarterly Call Reports they have submitted from 2001 to 2009. Eliminating banks with missing Call Reports and banks that may have been absorbed through mergers or may have closed, we are left with 129 US-based banks. As indicator for bank risk, we take the respective Z-scores of our sample banks. The Z-score is calculated as the Return on Assets (ROA)+Captal-to-Assets Ratio (CAR)/Standard Deviation of the ROA. The Z-score is a measure of bank health in such a way that it indicates the number of standard deviations that the ROA of the bank has to fall before it defaults. Thus, the greater the number of standard deviations or the higher the Z-score, the healthier is the bank. We note that in Morris & Shin (2008), it has been shown that illiquidity risk is an important component of bank credit risk. Thus, usage of the Z-score which indicates overall bank credit risk, may be sufficient in capturing the illiquidity risk implications of loan commitments.

[16] As cited in the introduction, studies have shown that securitization may increase the incentives for banks to be more aggressive and less prudent in taking risks (See Note 4). Given this, securitization, on its own, may have an impact on the risk outcome of the bank.

[17] In terms of Total Assets

[18] As these banks are FDIC-member banks, our sample banks are therefore US based banks. However, we also implement our exercise on 27 European banks. The results of which are discussed in the Appendix.

In measuring loan commitments, we take the level of Unused Loan Commitments (ULCs) reported by the banks. ULCs are the loan commitments or the portion of the loan commitments that are outstanding and have not yet been taken down by the banks' clients as of the reporting date. ULCs are thus the loan commitments that remain to pose illiquidity risk to the bank. We normalize ULCs to the banks' reported Net Loans. Given the illiquidity risk implications of loan commitments, higher loan commitments (relative to net loans) must then increase bank risk or lower bank health. Thus we expect that *Loan Commitments* must be negatively related to the Z-score (i.e. $\alpha_1 < 0$).

Meanwhile, to measure securitization activity (*Securitization*), we take the sum of the amount of Bank Assets Sold and Securitized, and the Loans and Leases held for Sale reported by the banks. In this way we get to capture both the current and potential securitization activity of the banks. We normalize this figure to the bank's Total Assets. We have mentioned that studies have pointed out that securitization may make the banks take on more risk[19]. This would lead us to expect that securitization would lessen bank health. However, there have also been studies that argue that securitization can allow banks to manage risk[20], relieve their capital constraints[21] and improve bank returns[22]. Given these opposing views on securitization, we thus not make a negative or a positive expectation on the effect of securitization on the Z-score.

With our measures for loan commitments and securitization, we can then create an interaction term of both variables, to derive our loan commitment-securitization synergy variable. In Gatev, et.al. (2007), the hedging of the illiquidity risk from loan commitments by deposits was observed through the loan commitment-deposit synergy variable having a negative effect on bank risk. In our case, we similarly expect that our loan commitment-securitization synergy variable must also be negatively related to bank risk or that it should be positively related to bank health. Our results must then show that the coefficient for *Loan Commitments*Securitization* must be positive (i.e. $\alpha_3 > 0$).

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[19] See Note 4

[20] Minton, Sanders & Strahan (2004), Bannier & Hänsel (2007), Goderis, Marsh, Costello & Wagner (2007), Panetta & Pozzolo (2010), Albertazzi, Eramo, Gambacorta & Salleo (2011)

[21] Calomiris & Mason (2003), Minton, et. al. (2004), Karaoglu (2005), Pais (2005), Affinito & Tagliaferri (2008), Panetta & Pozzolo (2010)

[22] Thomas (1999), Pais (2005), Karaoglu (2005), Bannier & Hänsel (2007), Goderis, et. al. (2007), Jiangli & Pritzker (2008)

*B. Data Analysis*

As a first step in our data analysis, we rank our sample banks based on their respective average levels of securitization activity for the entire sample period. Following such, we classify the banks into three groups which we shall call the High-Securitizers (banks above the 67th percentile of the ranking), the Mid-Securitizers (banks between the 33rd and 67th percentile) and the Low-Securitizers (banks below the 33rd percentile). Each bank group has 43 sample banks. We take the summary statistics of these three groups, which we report in Table 1.

From Table 1 we can see that banks in the High-Securitizers Group have substantially higher Loan Commitments than banks in the Mid and Low-Securitizers Group. This observation gives us some support to the point that securitization may indeed mitigate the illiquidity risk from loan commitments in the sense that the banks that securitize much, appear to be also the banks that can bear much loan commitments. Meanwhile, looking at the trend of our dependent variable, the Z-score, we can see that the Z-score is decreasing monotonically on the level of securitization activity. Given this, we get the impression that securitization, could compromise the banks' health or entails increased bank risk. However, considering that the banks in the High-Securitizers Group are also the banks with the most loan commitments, the particularly low average Z-score of the banks in the High-Securitizers Group might also be due to the illiquidity risk posed by loan commitments. We get a clearer picture of this issue in the following discussion of our estimation results.

*C. Estimation Results*

The estimations results of our baseline specification are reported in Panel 1 of Table 2. All our explanatory variables are statistically and economically significant. *Loan Commitments* is negatively related to the Z-score, as expected. This implies that loan commitments do pose illiquidity risk to banks and so corrodes the bank's health or increases its risk profile. As seen in Panel 1, a unit increase in Loan Commitments decreases bank health by about 0.37 units.[23]

Turning to securitization activity, our results also show a negative relationship between *Securitization* and the Z-score, pointing out that securitization, on its own, may also decrease bank health. This finding may be due to the increased risk taking that securitization brings, as found by the studies we have mentioned earlier.

[23] Setting aside the possible hedging effect of Securitization

On our main variable of interest, we can see in Panel 1 of Table 2 that the interaction term of Loan Commitments and Securitization is positively related to the Z-score. We see that a unit increase in our loan commitments-securitization synergy variable increases bank health by 0.72 units. In terms of net effects, we have that a unit increase in securitization activity that accompanies the unit increase in loan commitments, can wipe out the illiquidity risk posed by such loan commitments, while increasing bank health by 0.21 units. Through this result we take that while securitization may be risky in itself (as found earlier), it has the capability of hedging the illiquidity risk from loan commitments. To further confirm and enrich this finding, we do a number of additional empirical analyses in the following section.

## V. Additional Empirical Analyses

We perform three sets of additional empirical analyses. The first set is meant to test for the robustness of our earlier results by adding control variables that are generally known to have an influence on bank health, especially through its liquidity position. Meanwhile, the second set of our additional empirical analysis is meant to deepen our earlier findings, by checking if the hedge on the illiquidity risk from loan commitments provided by securitization stands in both periods of calm and distressed markets. In our third set of additional empirical analysis, we re-do our estimations in the first and second set, but this time using other measures of bank risk, namely stock returns volatilities and the CDS spreads. The purpose of doing our third set of additional empirical analysis is to serve as a further robustness test for our results involving the Z-score as bank risk measure.

### *A. Additional Control Variables*

We cannot discount the fact that bank health may be affected by market factors as well as factors that are specific to the bank. Thus, to account for these market factors we add control variables for the overall situation of the economy (measured by the returns on the S&P 500 Index), the extent of market of liquidity (measured by the spread between the 3-month commercial paper (CP) rate and the 3-month Treasury Bill (Tbill) rate)[24] and the level of market interest rates (measured by the quotes on 1-year Interest Rate Swaps). We source our data for

[24] See Note 15

the S&P 500 Index from Datastream, while our data for the interest rates are taken from the Federal Reserve Database.

For the bank-specific factors, we include in our specification the Log of Assets (to account for bank size), the Liquid Assets to Assets ratio (to account for bank liquidity), the CAR (to account for capitalization) and the Income to Assets ratio (to account for profitability)[25]. Moreover, given the findings in Gatev, et.al. (2007), where deposits can hedge the illiquidity risk from loan commitments, we also add the variables of Change in Deposits-to-Liabilities ratio (Deposit Inflows) and an interaction term between Deposit Inflows and Loan Commitments. Further, considering that Credit Enhancements on securitization activities may also have an effect on the bank's liquidity[26], we account for this in our estimations by including a dummy variable of 1 if the bank extends credit enhancements on its securitization activities. At the same time, we also add a dummy variable of 1 if the bank operates locally (i.e. the bank's branches are concentrated in only a certain state or region). We do this to take note of the depth of the bank's funding base, where banks with smaller (i.e. local) operations may have a less deep funding base, than those that operate on a wide scale (i.e. nationwide). Lastly, we also consider if the bank is owned by a foreign company by adding a variable of 1 if the bank belongs to a foreign holding company. Our basis for adding such control variable is that, banks that are foreign owned may enjoy some support from its holding company (especially during liquidity problems) and may also operate under a different set of rules or strategy. We take all the information we need for our bank-specific control variables from the same quarterly Call Reports submitted to the FDIC by our sample banks.

We report the summary statistics for our additional bank-specific control variables in Table 1. We observe in Table 1 that securitization activity may not be very much related to bank size. As we can see in Table 1, average bank size does not vary much among the different banks, grouped according their extent of securitization activity. However, we find that High-Securitizers have much liquid assets[27], more capital and are more profitable, relative to the banks that

[25] Accounting for the bank's profitability is particularly important as we use the Z-score as the bank risk indicator. This is because the Z-score takes into account, both the bank's profitability and liquidity.

[26] Credit Enhancements are special features in securitization transactions wherein the securitizing bank gives a certain form of guarantee, such as standing ready to settle part of the liability or expected payoffs (in case the underlying loans default). A Credit Enhancement of this form (called a Line of Credit) may have an impact on the bank's liquidity. A comprehensive discussion of Credit Enhancements and its different types may be found in Lea (2006).

[27] This observation is a divergence from the findings in Panetta & Pozzolo (2010) and Loutskina (2011) cited earlier.

securitize less. An explanation for the higher average liquid assets among the High-Securitizers Group is that, due to also having more loan commitments, banks in this group may have opted to also hold more liquidity buffers[28] (despite the hedge on the illiquidity risk from loan commitments that securitization could provide). Meanwhile, the higher average CAR among the High-Securitizers may be due to the capital-relief provided by securitization where, as loans are securitized, they leave the bank balance sheet which frees up some capital[29]. On the higher Income-to-Assets ratio, the High-Securitizers may be more profitable through the profit-augmenting effects of securitization[30]. Lastly, our summary statistics also show that the High-Securitizers have less deposits than the Mid and Low-Securitizers. As we have dicussed, securitization provides a funding facility for banks that may be cheaper than deposits. Hence, banks that securitize much may depart from heavily financing themselves through deposits and use securitization instead.

More importantly, we report our estimation results in Panel 2 of Table 2. We can see in our estimation results that our main variables of interest maintain their statistical and economic significance in relation to our dependent variable, after adding both sets of control variables for market factors and bank-specific factors. The respective relationships of our main variables of interest to bank risk are also sustained. *Loan Commitments* remain negatively related to the Z-score, showing its illiquidity risk implication. We can also still observe the risk implication of securitization activities, with *Securitization* being negatively related to the Z-score. Most notably, we find that the loan-commitment securitization synergy variable is still positively related to the Z-score, and that this positive effect also remains economically larger than the negative effect of *Loan Commitments* on the Z-score. This persistence of the respective impacts of our main variables of interest to our bank risk indicator serves as a strong support for the earlier findings under our baseline specification.

Among our control variables for market factors, the variables that are statistically significant are the spreads on the CP vs Tbill and 1-year Swap Rate. Our CP vs Tbill Spread variable represents the market liquidity situation or market distress. Higher CP vs Tbill spreads indicate a tighter market liquidity or market distress, which makes us expect a negative relationship between this variable and the Z-score. In Panel 2, we indeed see a negative and economically

[28] As pointed out in Holström & Tirole (2000), Kashyap, Rajan & Stein (2002) and Cornett, Mcnutt, Strahan & Tehranian (2010)
[29] See Note 21
[30] See Note 22

significant effect from CP vs Tbill Spread on bank health. On the other hand, the 1-year Swap Rate has a positive and economically significant effect on the Z-score. Interest rate swaps may be an investment outlet for the bank, in the sense that this is the bank's lending rate to other financial institutions. Hence, higher swap rates could mean better profits and, consequently, bank health improvement.

On our bank-specific control variables, we see that the Log of Assets, Liquid Assets/Assets, CAR and Income/Assets are all statistically significant. Log of Assets has a negative and economically significant effect on the Z-score. An explanation for this negative effect is that bigger banks, tend to take in more risk and a wider range of activities, such that bank health may be compromised. Liquid Assets/Assets also has a negative impact on the Z-score, which may be attributed to the costliness of holding liquid assets due to their low yields. Both CAR and Income/Assets, meanwhile, have a positive effect on the Z-score. Since a higher CAR usually means that the bank is more stable, it is then not surprising that this variable increases bank health. On the other hand, higher Income/Assets mean that the bank is profitable which should also imply that the bank is healthy.

We note that our dummy variables for the banks' extension of credit enhancements, their extent of operations and if they are owned by a foreign entity are also statistically significant. However, we withhold the discussion on their respective effects on bank risk, as our main purpose for adding these control variables is to see if controlling for them does not erode our earlier findings. As pointed out, following the addition of our sets of control variables (including the said dummy variables), our results and its implications remain the same.

*B. Periods of Market Distress*

As we have firmly established that securitization can hedge against the illiquidity risk posed by loan commitments, we try to enrich this finding by investigating if this hedge provided by securitization holds in both calm markets and distressed markets scenarios. In Gatev, et.al. (2007), it has been found that deposits can hedge the illiquidity risk from loan commitments in both periods of non-tight market liquidity and tight market liquidity. Further, the study stresses that the illiquidity risk hedge provided by deposits becomes more important, during periods of tight market liquidity or market distress. At the same time, it has also been pointed out in Gambacorta & Marques-Ibanez (2011) and in

Loutskina (2011), that securitization as a funding facility for banks is important during funding shocks. Specifically, the studies have shown that during funding shocks (i.e. tight market liquidity periods), banks that can securitize more can sustain and even increase their granting and holding of loans.

To identify between periods of calm and distressed markets, we follow the strategy employed in Gatev, et.al. (2007). We first take the average CP vs Tbill spread for the entire sample period, which in our case, is at 47bps. Given this figure, we compare it with the actual CP vs Tbill spread, for each period. The periods whose actual spreads are equal or below the average spread are considered as the periods of non-tight market liquidity (i.e. calm markets), while those whose spreads are above the average spread are the tight market liquidity periods (i.e. distressed markets). We have found that our periods of calm markets[31] are the periods 2001-2007:2 and 2009:3-2009:4, while our periods of distressed markets[32] are from 2007:3 to 2009:2. It is interesting to note that our periods of tight market liquidity, greatly coincide with the Financial Crisis of 2007/09. Having identified these periods, we then split our sample according to these periods and re-estimate our equations (including our additional control variables). The results for periods of calm markets are in Panel 3 of Table 2, while those for the periods of distressed markets are in Panel 4 of Table 2.

We find in both Panels 3 and 4 that *Loan Commitments* and the loan commitment-securitization synergy variable retain their statistical and economic significance as well their respective effects on the Z-score. *Loan Commitments* is still negatively related to the Z-score, again implying illiquidity risk. At the same time, the loan commitment-securitization synergy variable also stays positive in relation to the Z-score. However, comparing the respective coefficients of *Loan Commitments* and the loan commitment-securitization synergy variable in Panels 3 and 4, we do not see that securitization can hedge the illiquidity risk coming from loan commitments more on the periods of tight market liquidity, than on the periods of non-tight market liquidity. In fact, during the periods of market distress, securitization may be hedging the illiquidity risk from loan commitments only partially (than hedging it completely, as in the periods of calm markets). To point this out in economic terms, during the market distress periods, the illiquidity risk implication of a unit increase in loan commitments is a decrease in bank health of 1.48 units, which can be tempered down to 0.84

[31] The periods where the CP vs. Tbill spread is equal or below the average spread of 47bps. See Krishnamurthy & Jorgensen (2008) for explanation and demonstration of using the spread the CP vs. Tbill spread as indicator for market liquidity.

[32] The period where the CP vs. Tbill spread is above the average spread of 47bps.

units, for an accompanying unit increase in securitization activity. However during the periods of calm markets, the decrease in bank health amounting to 0.51 units for every increase in loan commitments, can be completely covered by the 0.68 units increase in bank health brought by an increase in securitization activity (that accompanies the unit rise in loan commitments).

Given these results, what we can say then is that securitization can provide a hedge against the illiquidity risk posed by loan commitments in both periods of tight and non-tight market liquidity. However, at the times of market distress, the hedging effect of securitization may not be stronger, unlike that which has been found by Gatev, et.al. (2007), in the case of deposits. In fact, the hedging effect of securitization might be weakened, when market liquidity is tight. What may explain this particular finding is that during periods of market distress, banks may not be able to enjoy inflows from securitization (as much as it may in the case of deposits). Considering that our period of tight market liquidity here is the period of the Financial Crisis 2007/09, this may just be the case. During the recent financial crisis, the securitization market collapsed and securitization inflows of the banks during the said periods came mostly just from the intervention of the Federal Reserve Bank.

*C. Alternative Bank Risk Measures*

Using a balance sheet-based measure of bank risk, that is the Z-score, we have pointed out the capability of securitization to hedge against the illiquidity risk posed by loan commitments. Further, using the same bank risk measure, we have also shown that the said hedging ability of securitization may also apply in both times of calm markets and distressed markets. In this section we seek a further confirmation of our findings by using market-based bank risk measures namely, Stock Returns Volatility and CDS Spreads.

*i. Using Alternative Risk Measures 1: Stock Returns Volatility*

One of the most commonly used risk measure for firms, including banks, is the Stock Returns Volatility. To measure Stock Returns Volatility of our sample banks, we take the quarterly change of their stock returns. To get the banks' quarterly stock returns, we first take the weekly change in their stock prices and then average the figures by quarter. We derive our stock price information from Datastream. Unfortunately, not all of the 129 banks in our sample have complete data on their stock prices. We then had to eliminate these banks with no or incomplete stock price data. This lowers our number of sample banks to 68.

Unlike the Z-score, the implication of stock return volatilities is that the higher it is, the more risky is the bank. This changes the expected signs of our coefficients. We now expect that $\alpha_1, \alpha_2 > 0$, due to the respective risk implications of *Loan Commitments* and *Securitization* that we have found in our previous estimations. At the same time, we expect that $\alpha_3 < 0$ , as securitization accompanying loan commitments, hedges the illiquidity risk from loan commitments.

Table 3 reports our estimation results using the stock returns volatility as bank risk indicator. Results concerning the entire sample period (Panel 1) show that all our variables of interest are statistically and economically significant. They also have their expected signs. We find a positive relationship between *Loan Commitments* and Stock Returns Volatility, showing anew the illiquidity risk posed by loan commitments. There is also a positive relationship between *Securitization* and Stock Returns Volatility, pointing out the risk implications of securitization activities. Securitization activities, however, hedge illiquidity risk (just as before), as seen through the loan commitment-securitization synergy variable being negatively related to Stock Returns Volatility. With these results, we get a verification of our earlier finding on the Z-score.

Meanwhile, in Panel 2, we present the estimation results for the non-tight market liquidity period. We see that our results are still maintained under periods of calm markets. On the other hand, Panel 3, which concerns the estimations results for the periods of distressed markets, shows that Loan Commitments and the loan commitment-securitization synergy variable are no longer statistically significant. Nonetheless, the said variables still bear their expected signs. We take these results in Panels 2 & 3 as a confirmation of our findings in the previous section, that there might have been a weakened capability of securitization to hedge against the illiquidity risk from loan commitments, during the periods of market distress that we have considered.

On our control variables, we highlight the respective effects of Deposit Inflows and the interaction term between Loan Commitments and Deposit Inflows. Deposit Inflows has a positive effect on Stock Returns Volatility, while the interaction term between Loan Commitments and Deposit Inflows has a negative effect. The effects of the variables are significant in Panels 1 and 3. This set of results concurs with the findings in Gatev, et. al. (2007).

*ii. Using Alternative Risk Measures 2: CDS Spreads*

A relatively new risk indicator that is gaining popularity is CDS Spreads. CDS spreads price contracts (called CDS contracts) that are made to serve as protection against a credit event, such as a default by an entity specified in the contract. Hence, being a price for protection against credit risk, CDS spreads have been viewed as a reliable risk indicator.[33]

Since CDS are a new concept, our data set gets a little limited in this exercise. For this specification, we only have 43 sample banks. These 43 sample banks are the only banks in our original sample of 129 banks that are involved in CDS contracts, where they are specified as the sole entity in the said contracts (i.e. Single-name CDS Contracts)[34]. An additional limitation to our data is that our series of CDS spread quotes from Datastream begins at 2004.[35] Thus, our sample period gets reduced to 2004-2009.

Like stock returns volatility, higher CDS spreads mean higher risks. Our expected signs for the coefficients of our key variables will therefore be the same as that of our estimation with the stock returns volatility. We report our estimation results in Table 4. Our variables of interest continue to be all statistically and economically significant and bear as well their expected signs. This is the case whether we consider our entire sample period or distinguish between periods of calm markets and distressed markets. Both loan commitments and securitization are found to still pose risks to the banks, shown by their positive effect on CDS spreads. At the same time, the illiquidity risk posed by loan commitments may still be toned down by securitization, with the loan commitment and securitization interaction term having a negative effect on CDS spreads. Our results with the CDS Spreads as bank risk indicator, thus sustain our earlier findings on the illiquidity risk hedge by securitization.

## VI. Concluding Remarks

As loans that have been securitized are used as underlying assets to borrow funds through debt, securitization transforms otherwise illiquid loans to cash. In this way, securitization provides banks with an alternative funding facility. Many studies have shown, that banks may have used securitization to address their funding issues. Some studies have also found that there is indeed funding

[33] See Longstaff, Mithal & Neis (2003)

[34] We note that only CDS spreads on Single-name CDS contracts are eligible for use as risk indicator of certain firm because such spreads directly and solely price the risk being taken by the CDS contract seller on the firm or the issuer of the underlying debt.

[35] This is also the case for other databases.

from securitization, as evidenced by secrutizing banks being able to grant and hold more loans, and save on costly liquidity buffers. In this study, we add to the value of securitization as a funding source, by showing that securitization may also be used to mitigate possible funding problems. In particular, we have shown that securitization, through its provision of a funding facility, can hedge against the illiquidity risk that loan commitments pose (due to the unpredictability of the takedowns on these contracts).

Given that a chief role of banks is to serve as liquidity providers and that loan commitments is an important tool for the banks in playing this said function, the ability of securitization to ease the illiquidity risk of loan commitments may serve as basis for the continued practice of securitization. However, with securitization having been greatly involved in the Financial Crisis of 2007/09, confidence in securitization transactions both on the side of banks and on the side of investors have been low. Compounding to the concerns of sustaining securitization as a bank activity are the many studies that have shown its risk implications, which this study has also found.

At the core on the risk issues of securitization is the erosion of bank incentives to prudently take risks. This springs from securitization giving banks a means to isolate themselves from loans that they may eventually deem to risky. Since loans leave the balance sheet when they are securitized, banks therefore experience a removal of risk. As found in a good number of studies, banks have exploited this property of securitization by taking on more and even too much risk and/or by being negligent in their screening and monitoring of borrowers[36]. However, this misalignment of incentives is not without solution. Chiesa (2008), for example, demonstrates that through an optimal level of Credit Enhancements in securitization transactions, banks may retain enough risk exposures on their securitized loans[37]. The result of such would be that the incentive for banks to continue to monitor their loans is restored. Likewise, in Albertazzi, Eramo, Gambacorta & Salleo (2011), it has been pointed that if banks securitize with the sole intention of having it as a sustainable funding source, then the securitizing banks will be motivated to ensure that their loans are of good quality.

The challenge of efficiently using securitization as a funding facility then, lies on the way a bank executes it and/or structures its securitization deal. If a bank structures its securitization transactions, where the incentives towards prudent

[36] See Note 4

[37] The form of Credit Enhancement referred to in this study is the bank giving its securitization investors the option to sell back the underlying loans at a given price. Thus, some form of retention of risk exposure takes place as the loan may return to the bank balance sheet at any point in time.

risk-taking are maintained, then such securitizing bank may reap much benefit from the capability of securitization to hedge against illiquidity risk. Securitization as a funding facility is then like a tricky tool, its inadequate usage can create a mess but its careful use makes it work just right.

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## Table 1. Summary Statistics

| Sampling Period: 2001:4-2009:4, Total No. Of Banks: 129, No. of Banks in Each Group: 43 | Volume of Securitization Activities/Assets (Sec) | | |
|---|---|---|---|
| | Low-Securitizers (Sec ≤ 33rd Percentile) | Mid-Securitizers (33rd Percentile<Sec≤ 67th Percentile) | High-Securitizers (67th Percentile< Sec) |
| Loan Commitments | 126.730 | 56.103 | 378.860 |
| Log of Assets | 16.372 | 16.569 | 16.963 |
| Liquid Assets/Assets | 6.940 | 8.657 | 13.224 |
| CAR | 10.862 | 10.965 | 14.200 |
| Income/Assets | 0.619 | 0.445 | 0.900 |
| Deposits/Liabilities | 71.844 | 79.464 | 66.747 |
| Z-score | 26.110 | 21.382 | 17.497 |
| Stock Returns Volatility | 1.525 | 2.166 | 1.417 |
| CDS Spread | 62.705 | 54.562 | 135.430 |

Balance sheet data are taken from FDIC Quarterly Call Reports. The Z-score is calculated as ROA+CAR/SD ROA which measures the number of standard deviations a bank's ROA has to fall before it defaults. Stock Returns Volatility is measured as the quarterly change in stock returns of every bank. Stock Returns Volatility refers to 68 sample banks only. CDS Spread refers to 43 sample banks only. CDS spread data runs from 2004-2009 only. Stock returns data and CDS spread data are taken from Datastream.

**Table 2. Securitzation and Illiquidity Risk with Z-score as Bank Risk Indicator**

| | Dependent Variable: Z-score | | | |
|---|---|---|---|---|
| | Entire Period (2001:4-2009:4) | | Non-Tight Period (2001:4-2007:2,2009:3-2009:4) | Tight Period (2007:3-2009:2) |
| | 1 | 2 | 3 | 4 |
| Independent Variables | | | | |
| Loan Commitments | -0.368*** | -0.583*** | -0.512*** | -1.480*** |
| | (-14.618) | (-16.754) | (-15.183) | (-11.382) |
| Securitization | -0.150*** | -0.148*** | -0.140*** | -0.092*** |
| | (-31.140) | (-25.335) | (-25.374) | (-6.323) |
| Loan Commitments*Securitization | 0.724*** | 0.662*** | 0.679*** | 0.638*** |
| | (15.418) | (12.450) | (13.063) | (4.291) |
| *Control Variables for Market Situation* | | | | |
| S&P 500 Index Returns | - | 0.003 | -0.069 | -0.029 |
| | | (0.079) | (-1.428) | (-0.682) |
| CP vs Tbill Spread | - | -0.726*** | - | - |
| | | (-2.762) | | |
| 1-Year Swap Rate | - | 0.143*** | 0.124** | -0.581*** |
| | | (2.684) | (2.518) | (-3.820) |
| *Control Variables for Bank Specific Factors* | | | | |
| Log of Assets | - | -0.393*** | -0.175** | -1.722*** |
| | | (-5.128) | (-1.998) | (-11.081) |
| Liquid Assets/Assets | - | -0.037*** | 0.015 | -0.060*** |
| | | (-4.203) | (1.549) | (-4.987) |
| CAR | - | 0.562*** | 0.447*** | 1.241*** |
| | | (27.892) | (23.525) | (24.104) |
| Income/Assets | - | 1.045*** | 0.531*** | 2.852*** |
| | | (9.178) | (4.922) | (11.772) |
| Deposit Inflows | - | 0.634 | 0.100 | -5.549* |
| | | (0.732) | (0.145) | (-1.800) |
| Loan Commitments*Deposit Inflows | - | -0.045 | -0.036 | 0.494 |
| | | (-1.117) | (-0.949) | (1.059) |
| Local Dummies | No | Yes | Yes | Yes |
| Foreign Dummies | No | Yes | Yes | Yes |
| Credit Enhancements | No | Yes | Yes | Yes |
| Observations | 3783 | 3655 | 2643 | 883 |
| No. Of Banks | 129 | 129 | 129 | 129 |
| R-squared | 0.326 | 0.533 | 0.686 | 0.730 |

Table 2 (Previous Page) Notes: The dependent variable is the Z-score as bank risk indicator. Securitization is calculated as the reported level of Bank Assets Sold and Securitized and Loans and Leases Held for Sale (normalized to Total Assets). Market Return is the return on the S&P 500 Index. CP vs Tbill Spread is the difference between the 3-month Non-Financial Commercial Paper Rate and the 3-month Tbill Rate. Swap Rate is the 1-year Interest Rate Swaps. All data for the market control variables are taken from Datastream. Panels 1 & 2 present the estimation results for the entire sample period of 2001:4-2009:4. Panel 1 presents the baseline specification. Panel 2 adds market control variables and control variables for bank-specific characteristics. Panel 3 presents the estimation results for the Non-Tight Market Liquidity Period (2001:4-2007:2, 2009:3-2009:4). Panel 4 presents the estimation results for the Tight Market Liquidity Period (2007:3-2009:2). The Non-Tight Market Liquidity Period is defined as the period where the CP vs Tbill spread is equal or below the average level throughout the sample period of 2001-2009. The Tight Market Liquidity Period is defined as the period where the CP vs Tbill spread is above the average level throughout the sample period. The calculated average CP vs Tbill spread for the entire sample period is 47bps. Since Market Liquidity is already accounted for in Panels 3 and 4, the CP vs Tbill as control variable for Market Liquidity is taken out in the specification. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

**Table 3. Securitization and Illiquidity Risk with Stock Returns Volatility as Bank Risk Indicator**

| | Dependent Variable: Stock Returns Volatility | | |
|---|---|---|---|
| | Entire Period (2001:4-2009:4) | Non-Tight Period (2001:4-2007:2,2009:3-2009:4) | Tight Period (2007:3-2009:2) |
| | 1 | 2 | 3 |
| Independent Variables | | | |
| Loan Commitments | 0.624*** | 0.535*** | 0.570 |
| | (3.777) | (4.319) | (1.198) |
| Securitization | 0.051*** | 0.017** | 0.124*** |
| | (4.332) | (2.087) | (3.443) |
| Loan Commitments*Securitization | -0.482*** | -0.385*** | -0.007 |
| | (-3.038) | (-3.813) | (-1.190) |
| *Control Variables for Market Situation* | | | |
| S&P 500 Index Returns | 0.099 | 0.864*** | -0.755*** |
| | (1.012) | (10.613) | (-4.963) |
| CP vs Tbill Spread | 6.901*** | - | - |
| | (10.943) | | |
| 1-Year Swap Rate | -2.067*** | -0.951*** | -4.403*** |
| | (-16.402) | (-11.500) | (-8.397) |
| *Control Variables for Bank Specific Items* | | | |
| Log of Assets | 0.255 | -0.185* | 0.554 |
| | (1.577) | (-1.777) | (1.159) |
| Liquid Assets/Assets | 1.164 | -0.001 | 0.033 |
| | (0.877) | (-0.041) | (0.730) |
| CAR | -0.009 | -0.024 | -0.075 |
| | (-0.358) | (-1.343) | (-0.752) |
| Income/Assets | -2.010*** | -0.845*** | -2.373*** |
| | (-10.914) | (-5.985) | (-5.271) |
| Deposit Inflows | 6.216*** | 2.231** | 12.354** |
| | (3.554) | (2.190) | (2.388) |
| Loan Commitments*Deposit Inflows | -0.617** | -0.080 | -2.673** |
| | (2.254) | (-0.588) | (-2.533) |
| Local Dummies | Yes | Yes | Yes |
| Foreign Dummies | Yes | Yes | Yes |
| Credit Enhancements | Yes | Yes | Yes |
| Observations | 1897 | 1369 | 461 |
| No. Of Banks | 68 | 68 | 68 |
| R-squared | 0.264 | 0.234 | 0.310 |

Table 3 (Previous page) Notes: The dependent variable is the Stock Returns Volatility as bank risk indicator. Stock Returns Volatility is measured as the quarterly change in stock returns of every bank. Note that higher Stock Returns Volatility mean more risk. Thus, the expected signs of our key variables are the inverse of what we expected with the Z-score as bank risk indicator. Panel 1 presents the estimation results for the entire sample period with market control variables and control variables for bank-specific characteristics. Panel 2 presents the estimation results for the Non-Tight Market Liquidity Period (2001:4-2007:2, 2009:3-2009:4). Panel 3 presents the estimation results for the Tight Market Liquidity Period (2007:3-2009:2). Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

**Table 4. Securitization and Illiquidity Risk with CDS Spreads as Bank Risk Indicator**

| | Dependent Variable: CDS Spread | | |
|---|---|---|---|
| | Entire Period (2001:4-2009:4) | Non-Tight Period (2001:4-2007:2,2009:3-2009:4) | Tight Period (2007:3-2009:2) |
| | 1 | 2 | 3 |
| Independent Variables | | | |
| Loan Commitments | 2.049*** | 0.516* | 5.786*** |
| | (3.954) | (1.804) | (3.570) |
| Securitization | 0.443*** | 0.174*** | 1.499*** |
| | (5.134) | (3.158) | (4.934) |
| Loan Commitments*Securitization | -3.012*** | -1.226*** | -7.529*** |
| | (-5.027) | (-3.292) | (-4.008) |
| *Control Variables for Market Situation* | | | |
| S&P 500 Index Returns | 3.630*** | 3.817*** | 2.580*** |
| | (5.272) | (6.500) | (2.723) |
| CP vs Tbill Spread | 27.191*** | - | - |
| | (6.439) | | |
| 1-Year Swap Rate | -9.331*** | -2.794*** | -23.617*** |
| | (-10.439) | (-5.483) | (-6.602) |
| *Control Variables for Bank Specific Items* | | | |
| Log of Assets | -0.646 | 1.614*** | -11.723*** |
| | (-0.624) | (2.777) | (-3.024) |
| Liquid Assets/Assets | 0.333*** | 0.221*** | 1.016*** |
| | (4.006) | (4.026) | (4.170) |
| CAR | -0.212 | 0.214** | -1.007 |
| | (-1.309) | (2.388) | (-1.551) |
| Income/Assets | -6.884*** | -1.717** | -11.048*** |
| | (-4.891) | (-2.040) | (-2.829) |
| Deposit Inflows | 6.923 | 3.737 | 55.400 |
| | (0.956) | (0.955) | (1.642) |
| Loan Commitments*Deposit Inflows | -0.618 | 0.028 | -11.214** |
| | (-0.664) | (0.050) | (-2.566) |
| CDS_BA | 10.933*** | 12.756*** | 8.869*** |
| | (43.341) | (44.529) | (23.224) |
| Local Dummies | Yes | Yes | Yes |
| Foreign Dummies | Yes | Yes | Yes |
| Credit Enhancements | Yes | Yes | Yes |
| Observations | 967 | 642 | 283 |
| No. Of Banks | 43 | 43 | 43 |
| R-squared | 0.794 | 0.857 | 0.809 |

Table 4 (Previous page) Notes: The dependent variable is the CDS Spreads, as bank risk indicator. Note that higher CDS Spreads mean more risk. Thus, the expected signs of our key variables are the inverse of what we expected with the Z-score as risk indicator. Panel 1 presents the estimation results for the entire sample period with market control variables and control variables for bank-specific characteristics. Panel 2 presents the estimation results for the Non-Tight Market Liquidity Period (2001:4-2007:2, 2009:3-2009:4). Panel 3 presents the estimation results for the Tight Market Liquidity Period (2007:3-2009:2). CDS_BA is the gap between the bid-ask quote of the CDS spread. CDS_BA is added in the specifications for the CDS spread to take into account the demand and supply of the CDS contract (see Bongearts, De Jong & Driessen 2005). Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

**Appendix: The Case of the European Banks**

Having established that securitization can be used as a hedge against the illiquidity risk from loan commitments among US banks, we consider here the case of European banks. Due to limitations in data sources, we have a smaller dataset for this exercise, involving only the top 27 European banks, with the quarterly series running from 2004 to 2009. We source our balance sheet data for our European banks from Bankscope.

Since Bankscope does not provide information on the securitization activity of our sample banks, we measure securitization activity in a way similar to that of Loutskina (2005). We estimate quarterly securitization activity for each bank by multiplying the reported level of bank loans to the ratio of securitized loans to total loans of the bank's home economy. Mathematically:

$$Securitization\ Activity_{it} = Loans_{it} * \frac{Securitized\ Loans_{jt}}{Aggregate\ Loans_{jt}} \quad \text{(A1)}$$

where, $Loans_{it}$ is the reported loans of bank $i$ at quarter $t$, $Securitized\ Loans_{jt}$ is the aggregate amount of securitized loans of home economy $j$ of bank $i$ at quarter $t$ and $Aggregate\ Loans_{jt}$ is the aggregate amount of loans of home economy $j$ of bank $i$ at quarter $t$.

The total amount of securitized loans of each European economy is reported by the European Securitization Forum (ESF), while the aggregate level of loans may be sourced from the central banks of the respective home economies of our sample banks.

Given these estimates for securitization activity, we normalize them against Total Assets, and use the averages for our entire sample period to rank our sample banks. Like what we have done with the US banks, we divide the sample banks into three groups based on the extent of their average securitization activity. The summary statistics of our European sample banks (broken into groups) is reported in Table A1. Just as in the case of US banks, we see that the High-Securitizers have higher Loan Commitments, and thus may have more capability of bearing illiquidity risk. However, we cannot glean from Table A1 that more securitization as well as more loan commitments, strictly involves higher risk for the European banks. While Stock Returns Volatility increase as we move from the Low to the High-Securitizers Group, the High-Securitizers, at the same time, have higher Z-scores and lower CDS spreads compared to the Low-Securitizers.

Table A2 reports our estimation results with different bank risk measures. Panel 1 shows the estimations results with the Z-score as the bank risk indicator.

We find that the results are the same as that of the US case. Loan Commitments negatively affects the Z-score, just as *Securitization* is also negatively related to the Z-score. At the same time, our loan commitment-securitization synergy variable is positively related to the Z-score. These results point out that the hedging capability of securitization against the illiquidity risk coming from loan commitments, may also be applicable to the case of European banks.

Our results in Panel 1 are supported by the findings in Panels 2 and 3. Panel 2 presents the results with the Stock Returns Volatility as bank risk indicator, while Panel 3 does the same with the CDS Spreads as bank risk indicator. We note, however, that in the case of Panel 3, we only have 21 sample banks because these are the only banks that have active quotes for their CDS spreads. We can see in both Panels 2 and 3 that loan commitments increase bank risk, while the loan commitment-securitization synergy variable decreases bank risk.

## Table A1. Summary Statistics for the Case of European Banks

| Sampling Period: 2004:4-2009:4, Total No. Of Banks: 27, No. of Banks in Each Group: 9 | Volume of Securitization Activities/Assets (Sec) | | |
|---|---|---|---|
| | Low Securitizers (Sec ≤ 33rd Percentile) | Mid-Securitizers (33rd Percentile < Sec ≤ 67th Percentile) | High-Securitizers (67th Percentile ≤ Sec) |
| | 1 | 2 | 3 |
| Loan Commitments | 39.926 | 33.739 | 46.712 |
| Log of Assets | 11.368 | 12.249 | 13.534 |
| Liquid Assets/Assets | 22.438 | 18.842 | 20.065 |
| CAR | 5.061 | 5.368 | 4.689 |
| Income/Assets | 0.579 | 0.609 | 0.503 |
| Deposits/Liabilities | 56.291 | 62.129 | 56.599 |
| Z-score | 25.768 | 24.406 | 46.260 |
| Stock Returns Volatility | 12.688 | 13.517 | 13.736 |
| CDS Spread | 80.274 | 56.485 | 56.780 |

Securitization activity of each bank is calculated by multiplying the reported amount of loans to the ratio of the securitized loans to total loans of the home economy of the bank. Balance sheet data for our European Banks are taken from Bankscope. Unused Loan Commitments are reported in Bankscope as Committed Credit Lines. The Z-score is calculated as ROA+CAR/SD ROA which measures the number of standard deviations a bank's ROA has to fall before it defaults. Stock Returns Volatility is measured as the absolute quarterly change in stock returns of every bank. CDS Spread refers to only 21 sample banks. Stock returns data and CDS spread data are taken from Datastream.

## Table A2. Securitization and Illiquidity Risk, the Case of European Banks

| | Dependent Variable | | |
|---|---|---|---|
| | Z-Score | Stock Returns Volatility | CDS Spreads |
| Sampling Period: 2004:4-2009:4 | 1 | 2 | 3 |
| Independent Variables | | | |
| Loan Commitments | -0.205*** | 0.101* | 0.643*** |
| | (-4.828) | (1.711) | (2.998) |
| Securitization | -3.619*** | 4.660*** | 17.729*** |
| | (-4.184) | (4.012) | (4.329) |
| Loan Commitments*Securitization | 0.136*** | -0.081*** | -0.338*** |
| | (7.199) | (-3.444) | (-3.911) |
| *Control Variables for Market Situation* | | | |
| FTSE EuroTop Index Returns | -0.004 | -0.003 | -0.009 |
| | (-1.426) | (-0.757) | (-0.811) |
| Commercial Paper vs Gbond Spread | 1.386 | 8.170*** | 54.443*** |
| | (1.647) | (6.556) | (14.673) |
| 1-Year Swap Rate | -1.370*** | -0.470 | 0.282 |
| | (-5.493) | (-0.986) | (0.168) |
| *Control Variables for Bank Specific Items* | | | |
| Log of Assets | 0.234 | -0.497 | -0.043 |
| | (0.461) | (-1.030) | (-0.024) |
| Liquid Assets/Assets | 0.434*** | -0.001 | -0.345 |
| | (8.034) | (-0.003) | (-1.488) |
| CAR | 3.120*** | -0.816** | 2.479 |
| | (11.010) | (-2.236) | (1.629) |
| Income/Assets | 17.738*** | -3.632** | -14.897*** |
| | (13.111) | (-2.237) | (-2.615) |
| Deposit Inflows | -15.465 | -36.506 | -37.112 |
| | (-0.759) | (-0.937) | (-0.307) |
| Loan Commitments*Deposit Inflows | 0.468 | 0.361 | -3.073 |
| | (0.846) | (0.365) | (-1.061) |
| Observations | 296 | 295 | 258 |
| No. Of Banks | 27 | 27 | 21 |
| R-squared | 0.887 | 0.513 | 0.766 |

Table A2 (Previous Page) Notes: In Panel 1, the dependent variable is the Z-score as bank risk indicator. In Panel 2, the dependent variable is the Stock Returns Volatility as bank risk indicator. In Panel 3, the dependent variable is the CDS Spreads as bank risk indicator. Note that higher Stock Returns Volatility as well as CDS Spreads mean more risk. Thus, the expected signs of our key variables are the inverse of what we expected with the Z-score as risk indicator. As proxy for the overall economic situation, we use the returns on the FTSE EuroTop Index. To measure the extent of market liquidity, we take the CP vs Gbond Spread which is the spread between the EU Midterm Bond Rate and the 5Y German Government Bond Rate. 1-Year Swap Rate which represents market interest rates is the 1-year Euro Interest Rate Swaps. All data for the market control variables are taken from Datastream. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

# Chapter 3. Credit Risk Management through Securitization: Effect on Loan Portfolio Choice

**Abstract**

We study how banks take advantage of securitization as a credit risk management tool. In theory, banks may handle their credit risk exposures by using securitization to unload risky loans from their balance sheets. Using data on 129 FDIC-member banks, we have found that while banks indeed use securitization to manage their credit risk exposures, they do not necessarily do so by totally isolating themselves from risk. Instead, they exploit the credit risk management property of securitization to take on greater risk, in pursuit of high returns. As banks carry out this strategy, the banks' loan portfolios are complimentarily diversified, giving banks diversification benefits. These benefits serve as windfall, which, in turn, tempers the banks' concerns on the higher risks that they have taken.

JEL Classification: G21, G32, G01
Key words: Securitization, Portfolio Choice, Diversification

## I. Introduction

Bank engagement in securitization lies on two rationales. One is that securitization provides the bank with an additional funding source and the other is that it can be a risk management tool. The former point is explained by the transformation of otherwise illiquid loans to liquid assets, where these loans are securitized and used to borrow funds through a Special Purpose Entity (SPE). By this mechanism, securitization helps banks with their funding matters. In Karaoglu (2005) and Martin-Oliver & Saurina (2007), for example, it has been observed that banks with deposit levels that are too low relative to the size of their loan portfolios tend to securitize their loans, in an effort to address the said issue. On the other hand, Loustkina (2011) has found that banks with loan portfolios that are more "securitizable"[1], hold less liquid assets[2] because the additional funding from securitization makes the holding of such costly liquidity buffers less necessary.

Alternatively, the risk management role of securitization comes in two forms. First, which is related to its funding provision, is that securitization can serve as a hedge against liquidity problems. In Loutskina (2011), this was pointed out in terms of banks having more securitizable loans in their balance sheets, as being able to continue and grant more loans even during funding shocks. Meanwhile, in Cabiles (2011), we have shown that banks engaging much in securitization can take on more loan commitments, whose unpredictable takedowns may pose illiquidity risk to banks.

The other risk management role of securitization comes in providing banks with a means to handle their credit risk exposures. When the loans are securitized and transferred to the SPE, the loans leave the bank balance sheet. This results to the banks being isolated from the risk of the loans that they have securitized. Many studies have shown that banks attempt to take advantage of this credit risk management property of securitization. For example, Minton, Sanders & Strahan (2004), Pais (2005), Bannier & Hänsel (2007), Affinito & Tagliaferri (2010) and Panetta & Pozzolo (2010), have all shown that banks with more risky assets tend to securitize more. However, what may have been missed in these studies is an examination of what happens as the banks securitize. That

[1] Loutskina (2011) measures loan portfolio securitizability as the size of the bank's loan portfolio multiplied by the depth of the securitization market of the bank's home economy.

[2] Liquid Assets is defined in Loutskina (2011) as marketable securities plus Federal Funds Sold (i.e. Reverse Repurchase Agreements).

is, these studies have shown that banks securitize, so that they might take some loans out of their balance sheets and tone down their credit risk exposures. But, these studies have not shown if the removal of loans through securitization has indeed made banks get rid of risk and has, therefore, reduced the credit risk that they respectively face. In this paper, we intend to provide the continuation of this discussion, where we attempt to look at how the loan portfolios of banks change, in terms of size and composition, with securitization. Moreover, we also investigate what such change (if any) implies on the risks and returns that the banks eventually face.

Using data on 129 member banks of the Federal Deposit Insurance Company (FDIC), we initially look at how securitization may affect the size of the bank's loan portfolio. We observe that banks that securitize more (i.e. banks with medium to high levels of securitization activity) have relatively bigger loan portfolio size, than those that securitize less. While these findings may be due to the additional funding provided by securitization[3], such explanation may not be enough. Having more funds (through securitization) does help in increasing a bank's loan portfolio, but matters on risk exposures also come at play. Thus, we argue that the increase in the loan portfolio size that come with securitization could as well be driven by securitization giving banks a means of getting rid of risk, that makes the banks more flexible in granting and holding loans. In this sense, we may then consider that the credit risk management property of securitization can increase the banks' loan portfolio size.

Subsequently, we look at the composition of the banks' respective loan portfolios, alongside their securitization activities. We view loan portfolio composition in terms of the share of the different loans classes on the banks' balance sheet. We consider five loans classes namely, Real Estate, Commercial & Industrial (C&I), Consumer, Farm and Others[4]. A clear observation we make is that the portfolio share of Consumer Loans is bigger (smaller) for the banks with high (low) securitization activity, while that of Real Estate Loans is smaller (bigger) among banks that securitize much (less). This suggests that the portfolio share of Consumer Loans increases with securitization activity, while that of Real Estate Loans decreases. In addition, given that Real Estate Loans are the most securitized loans by banks while Consumer Loans are securitized much less, we

[3] As pointed out by numerous studies such as Cantor & Demsetz (1993), Altunbas, Gambacorta & Marquez-Ibanez (2007), Loutskina & Strahan (2008) and Gambacorta & Marques-Ibanez (2011).
[4] The loans class "Others" refers to Acceptances and Receivables discounted by banks.

also get the impression that banks may have increased their holdings of Consumer Loans, through the securitization of their Real Estate Loans.

We attribute the above occurrence to the high risks of Consumer Loans and Real Estate Loans and to the high positive covariance of risk between the said loans classes. Looking at the default rates of the different loans classes, we observe that Consumer Loans and Real Estate Loans have the highest default rates, with the former having higher default rates than the latter. This makes the two said loans classes the riskiest loans that banks can hold. At the same time, we also observe that Consumer Loans and Real Estate Loans have the highest positive covariance of defaults. This means that holding both Consumer Loans and Real Estate Loans simultaneously may be too risky, which requires the banks to unload one class of loans when they hold on to the other. Since Consumer Loans are more monitoring intensive than Real Estate Loans[5], banks may have opted to hold on to Consumer Loans, where holding and closely monitoring this loans class could realize its high potential interest income (that comes with its observed high risk[6]). At the same time, the banks may have also unloaded Real Estate Loans (while holding Consumer Loans) because Real Estate Loans are easier to securitize, owing to the collateralization of this loans class[7].

With these observations and its accompanying explanations, we may then consider the idea that banks may have increased their loan portfolios towards more Consumer Loans, by taking some Real Estate Loans out of their balance sheet through securitization, which consequently gives them more space to take on the risky but high-yielding Consumer Loans. This implies that the banks' employment of the credit risk management property of securitization may be in the direction of being exposed to greater risk, while pursuing high returns.

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[5] Consumer Loans are monitoring intensive because these loans are uncollateralized loans to individuals, where the failure of such a loan gives zero pay-off to the bank (i.e. the bank must monitor the Consumer Loans to almost surely avoid losses). On the other hand, Real Estate Loans are collateralized loans for residential home purchases, where the failure of such a loan can still pay-off the bank through its seizure of the collateral (i.e. the bank does not need to strongly monitor a Real Estate Loan because, should (at worst) the loan fails, the bank can still receive a pay-off by taking the collateral).

[6] As the risk-reward principle posits.

[7] The ease of securitizing a loan may depend on the appeal of such loan to serve as the underlying asset which backs the debt issued in the securitization transaction. This appeal, in turn, rests on the value of the loan itself. A collateralized loan's value is derived from the likelihood that it successfully pays-off *and* from its collateral. Meanwhile, an uncollateralized loan's value is derived *solely* from the said probability of a successful pay-off. A loan that is collateralized may then be of higher value, as opposed to an uncollateralized one, and is then also of higher appeal as an underlying asset in a securitization transaction. It thus follows that a collateralized loan, such as a Real Estate Loan, is easy or easier to securitize (relative to an uncollateralized loan such as a Consumer Loan).

To test our inference, we implement a series of empirical estimations. First, we look at the relationship between securitization and loan portfolio size, to verify our initial observation that banks may have engaged in securitization, so that they can enlarge their loan portfolios. Employing the data on our 129 FDIC member banks, we find such confirmation through a positive relationship between securitization and total loans holdings. Next, we check if this increase in the loan portfolio, through securitization, is indeed geared towards holding Consumer Loans. Our results show that securitization is positively related to the portfolio share of Consumer Loans, establishing the above point. In our following empirical analysis, we seek to prove that banks have used securitization to be able to take on higher risk, embodied in the increased holding of Consumer Loans above. Using loan defaults as indicators of loan portfolio risk, we find that securitization has a positive effect on the overall loan portfolio risk of our sample banks. This implies that banks may have exposed themselves to higher risk as they securitize, contrary to risk-unloading that has been expected of securitization (in principle). Lastly to see if the banks have done so to get higher returns, we take the banks' Return on Assets (ROA) and Return on Equity (ROE) and estimate them against securitization activity. With securitization being positively related to both the ROA and the ROE, we come to the conclusion that banks have certainly made use of the credit risk management property of securitization to engage in greater risk, so that they may reap high returns.

However, we also find that the above returns achieved through securitization, though high, are volatile. We draw this after observing a positive effect by securitization on the volatilities of the ROA and that of the ROE. The implication of this finding is that although the high risk-taking may be accompanied by high returns, the instability of such returns may pose a concern to the banks. This concern could sequentially compromise the banks' interest in continuing to engage in securitization. In such a situation, a certain windfall that would convince the banks to sustain their securitization activities may be necessary. We find this windfall as we look into the diversification effects of securitization.

With our earlier finding that securitization can lead to the increase in the portfolio share of Consumer Loans, we consider that with securitization, the diversification of the banks' respective loan portfolios may have also changed. Using a modified Herfindahl-Hirschman Index (*HHI*) as an indicator for loan portfolio diversification, we find that securitization activity is positively related

to loan portfolio diversification or that securitization can make the banks' respective loan portfolios more diversified. Further analysing this point leads us to find that the alteration of the loan portfolio composition towards diversification, may also allow banks to enjoy the beneficial effects of diversification, namely reduced overall loan portfolio risk and lower returns volatility. Through these positive side-effects, the concerns on increased risk and unstable returns found earlier could be offset. As such, the banks may be motivated to continue and conveniently take on greater risk through securitization, and enjoy the accompanying high returns.

Our study makes a number of contributions to the literature on securitization. First, our work builds up on earlier studies that view securitization as a means for banks to increase their loan-taking activities. Our study goes further on this point by showing that securitization may not only increase the size of the bank's loan portfolios, but may also change the composition of the loan portfolio towards more risky loans and diversification. Second and more importantly, our study adds to the literature on securitization as a risk management tool, where it shows that securitization may not necessarily be used for absolute risk isolation or reduction. Instead, our study points out that securitization is a risk management tool in the sense that it can be used by banks to take on more credit risk in pursuit of high yields, while also reaping the benefits of loan portfolio diversification. Lastly, our study also contributes to the ongoing discussions on the value of securitization. Following its involvement in the recent financial crisis, securitization has had an unfavourable reputation. By showing that securitization has risk-taking, profit-augmenting and diversification effects, our study points out that securitization may still have some significance.

The rest of our paper is organized as follows; Section II provides a short background on the credit risk management property of securitization and our preliminary data analysis. Section III provides a discussion of the literature related to our study. Section IV presents our empirical analyses in two parts. Section V gives some further analyses involving securitization and loan portfolio diversification. Section VI concludes.

## II. Background and Preliminary Analysis

Among the properties of securitization that motivate banks to engage in such activity is its provision of a means to manage credit risk. When a bank securitizes, it transfers the pool of loans to be securitized to an SPE. This movement takes the loans out of the bank balance sheet, which effectively

isolates the bank from the risk on these loans. Minton, et. al. (2004), Pais (2005), Bannier & Hänsel (2007), Affinito & Tagliaferri (2010) and Panetta & Pozzolo (2010) have all demonstrated that the banks that securitize more are those with more risky assets. These studies imply that banks may have actually taken advantage of this credit risk management property of securitization.

However, what these past discussions may have left off is an investigation on the changes that the banks experience, as they securitize. While the studies mentioned above may have argued the point that banks securitize with the goal of isolating themselves from risky loans, the studies have not, for example, shown if banks do indeed have less risky loan portfolios as they securitize. We fill in this gap by looking at the effects of securitization on the banks' loan portfolio in terms of size and composition, as well as, on the resulting risk and returns profiles of the banks.

To go about our analyses, we first look at the securitization and loan portfolio data of the Top 129[89] member banks of the FDIC from 2001-2010[10]. We begin by taking the average securitization activity[11] of each our sample banks for our entire sample period. Using the average securitization activity of each bank, we rank our banks from the highest securitization activity to the lowest. This ranking allows us to cut our sample banks into three groups, where banks above the 67th percentile of the ranking are considered as the banks that engage much in securitization (i.e. High-Securitizers), those between the 67th and 33rd percentile of the ranking are taken as the medium securitizing banks (i.e. Mid-Securitizers) and, the banks at the bottom 33rd percentile of the ranking are treated as the banks that securitize the least (i.e. Low-Securitizers). With this grouping of our sample banks, we can take the average attributes of their loan portfolios (by group). This gives us a bird's eye-view of the relationship between securitization activity and the banks' loan portfolio, which we report in Table 1.

We can find in Table 1, that securitization may lead to a larger loan portfolio. Looking at the Total Loans to Assets ratio, we find that the High and the Mid-Securitizers have bigger loan portfolios than the Low-Securitizers. On the one hand, banks that securitize much may be able to have more loans because

[8] In Terms of Assets.

[9] We started with the Top 150 FDIC Member banks but due to mergers and closures within our sample period, as well as, missing reports, our number of sample banks gets trimmed to 129.

[10] We begin at 2001:4 since this is the period when the FDIC member banks have started reporting their Securitization Activities.

[11] We measure the Securitization Activity of our sample banks through its reported Bank Assets Sold & Securitized normalized to Total Assets.

securitization provides them with the funds that they need to do so[12]. However, we must take into account that the holding of loans is not just about having the funds to loan out, but also the tolerance or the space to bear the risk posed by the loans. As such, the larger loan portfolios among the heavy securitizing banks could also be an effect of the credit risk management property of securitization. That is, since securitization provides the banks with a vent for loans that they may eventually deem too risky, banks that are much engaged to securitization may be more accommodating or flexible in giving loans. Hence, securitization may increase the loan portfolio size of the banks.

Considering this increase in the loan portfolio associated with securitization, we look at next how securitization may also change the composition of the loan portfolio. We view the composition of the loan portfolio in terms of the different loans classes that the banks hold. We consider five loans classes namely, Real Estate, C&I, Consumer, Farm and Others[13]. To able to see the effect of securitization on the composition of the loan portfolio, we take the portfolio shares of each loans class among our sample banks. We report the average of these portfolio shares per bank group in Table 1. From Table 1, the clear observations we can make are that the portfolio share of Consumer Loans (i.e. Consumer Loans/Total Loans) increases monotonically with securitization, while that of Real Estate Loans decreases monotonically with securitization. Given this we find that securitization seems to be associated with more holdings of Consumer Loans (relative to other loans classes) as well as lesser holdings of Real Estate Loans (relative to other loans classes).

With these opposing trends between the holdings of Consumers Loans and that of Real Estate Loans in relation to securitization, we entertain the possibility that banks may have increased their Consumer Loans holdings through the securitization of Real Estate Loans. We get support for this idea in Figure 1, where we find that Real Estate Loans are the loans that have been primarily securitized by banks, and that banks have been securitizing Consumer Loans less. Figure 1 presents the quarterly share of securitized loans to total loans outstanding of each loans class from 2001-2010. We can see in Figure 1 that, throughout the period we consider, banks have been predominantly securitizing Real Estate Loans, while Consumer Loans have not been securitized as much by banks. In fact, towards the time when securitization has been a popular activity among banks (i.e. 2006), we see in Figure 1 that the securitization of Real Estate

[12] See Note 3.
[13] See Note 4.

Loans have had some increase while that of Consumer Loans have remained flat. In addition, we also find in Figure 1 that even when securitization has fallen out of favour at about 2009 (due to its involvement with the subprime crisis), Real Estate Loans is still the leading loans class that is being securitized.

We attribute this likely scheme of securitizing Real Estate Loans to hold Consumer Loans to the high risks of these two loans classes and to the high positive covariance of risk between these two loans classes. In Figure 2, we plot the default rates of our different loans classes. We can observe in Figure 2 that Consumer Loans have the highest default rates among the different loans classes, followed by Real Estate Loans[14]. This means that the said two loans classes may be the riskiest loans that the banks can hold. Meanwhile, in Table 2, we report the covariances of the default rates of our different loans classes. We can see that the pair of loans classes with the highest positive covariance of risk is that of Consumer Loans and Real Estate Loans. Combining these two observations imply that simultaneously holding Consumer Loans and Real Estate Loans may be too risky for banks. That is, since Consumer Loans and Real Estate Loans are the riskiest loans classes that banks can hold, and that these two loans classes have a very high positive risk covariance, holding much of the two of them at one time, may exhaust a bank's tolerance for risk (i.e. risk limits). Thus, it may be then be necessary for the bank to unload one loans class (i.e. the Real Estate Loans), when holding the other loans class (i.e. the Consumer Loans). Considering that Consumer Loans are loans to individuals that have no collateral, Consumer Loans require more monitoring, where doing so can realize its high potential returns (associated with its high risk)[15]. As such, banks may have chosen to hold more Consumer Loans, as opposed to Real Estate Loans. In addition, banks may have also securitized Real Estate Loans (as they hold Consumer Loans) because the collateralization of Real Estate Loans, makes it easier for this loans class to be securitized, than the uncollateralized Consumer Loans (and even the other loans classes). The ease of securitizing a loan may depend on the value of such loan to serve as the underlying asset that backs the debt in a securitization transaction. Real Estate Loans, by being collateralized,

[14] We note that we can see in Figure 2 that the default rates of Real Estate Loans may have caught up with that of Consumer Loans in 2008:2. However, we must consider that this period may have been triggered by an exogenous shock, namely the bursting of the US Housing Market Bubble. Following the US Housing Market Collapse, we can see in Figure 2 that Consumer Loans still have relatively higher default rates than Real Estate Loans.

[15] See Notes 5 & 6.

surpass Consumer Loans and other loans classes in such qualification, because the collateral of Real Estate Loans pushes up that value[16].

From our above discussion, we may construe that securitization must have been used by banks, not necessarily to totally isolate themselves from risk (as the theory may expect). Rather, what we have is that banks may have taken advantage of the credit risk management property of securitization, by using it as a means to gain the flexibility to take on higher risk and consequently enjoy the high returns promised by such risk increase. To put this in terms of our observations above, through the securitization of Real Estate Loans (which takes these loans out of the balance sheet), banks have managed to gain some space to increase their loan portfolios towards Consumer Loans. As we find, Consumer Loans is the riskiest loans class that banks can hold implying that the banks' taking in of Consumer Loans through securitization, is an increase in risk taking. Moreover, as we point out, banks have held on to more Consumer Loans to be able to monitor them intensively and realize the high potential returns that their high risk promises. Given this, the banks' expansion of its loan portfolio towards risky Consumer Loans through securitization, may be in the pursuit of high returns.

To confirm our hypothesis we employ our data on the 129 member banks of the FDIC in a series of estimations. First, we test if securitization does have a positive relationship with loan portfolio size, to verify our point that securitization has been used by banks to gain more flexibility in taking on loans. Next, we look at the relationship between securitization and the portfolio share of Consumer Loans, to see if the increase in the loan portfolio of the banks has indeed been towards Consumer Loans. Following this, we investigate if securitization is positively related to the overall loan portfolio risk of the bank, which will establish that banks have changed their loan portfolios through securitization, in the direction of taking on higher risk. Lastly, we examine if securitization is also positively related to the returns of the bank, to see if the above move of increasing risk exposures has been motivated by the interest of getting high returns[17]. However, before we proceed to these analyses we briefly discuss the literature related to our study.

[16] See Note 7.
[17] Which may be achieved with the complimentary increased monitoring of the risky exposures

## III. Related Literature

Our study is primarily related to Cebenoyan & Strahan (2004) that looks into bank engagement in loan sales, which is an analogue to securitization[18]. In Cebenoyan & Strahan (2004), it has been observed that banks that actively sell their loans can increase their risky loans holdings in the form of Commercial Real Estate loans and C&I loans. In other words, the study has found that loans sales have an effect on the bank's loan portfolio, where such portfolio gets to admit more risky loans. Following this change in the loan portfolio, the study investigates if the bank's risk and returns may have been affected. The study's results show that the volatility of loan defaults are not statistically correlated with loan sales, implying that the increase in risky loan holdings stemming from loan sales does not necessarily translate to a higher overall risk profile for the bank. At the same time, the study has observed that loan sales are also not statistically related to the ROA and ROE of the banks, but are instead negatively related to the volatility of the ROA and that of the ROE. These suggest that risky loan holdings brought about by loan sales may not also compromise the bank's returns and that it may even make the banks' returns more stable. The conclusion that may be drawn from the study is thus, that loan sales serve as a risk management tool for the bank, wherein it allows the bank to take on higher risk without exacerbating the bank's overall risk profile and, at the same time, gives the bank the benefit of more stable returns.

On studies that focus on securitization, our study is related to Goderis, Marsh, Costello & Wagner (2007), Dione & Harchaoui (2003) and Loutskina (2011). In Goderis et. al. (2007), it has been found that securitization by means of issuing Collateralized Loan Obligations (CLOs) allows banks to relieve themselves of risk constraints, such that they can increase their targeted level of loans and increase their interest income from such bigger loan portfolio. Dione & Harchaoui (2003), on the other hand, has pointed out that increasing levels of securitization tend to increase the risk-weighted assets to assets ratio among Canadian banks, implying that securitization permits banks to expand to risky

[18] Like securitization, the loans are sold to third parties under loans sales and, hence, leave the bank balance sheet, isolating the bank from the risk of these loans. The difference (among others) in the case of loan sales is that, the loans are sold directly to investors, which makes the investors' risk exposures contingent on the loans that they have respectively bought. On the other hand, in the case of securitization, the loans are sold to the SPE, which in turn, issues debt backed the loans it has purchased to the investors. In effect, the risk exposures of the investors, in securitization, rely on the pool of loans that backs the SPE-issued debt. Notwithstanding this difference, however, loan sales and securitization are, as mentioned, similar in terms of the risk management property that they provide to banks.

loans. Likewise, Loutskina (2011) has shown that banks with more securitizable loan portfolios can continue to lend to the C&I Sector, and even increase this lending during periods of funding shocks. The said study points out that C&I loans may be the riskiest and least liquid types of loans that banks can grant.

In addition, our study is also connected with Pavel & Phillis (1987) and Panetta & Pozzolo (2010), through our later discussion on the diversification effect of securitization. In Pavel & Phillis (1987), it has been found that banks participate in loan sales to have more diversified loan portfolios. The said study has shown that banks that are less diversified are more likely to sell their loans and that the banks that have done so attain more diversified loan portfolios (as opposed, to those that have not engaged in loan sales). On the other hand, Panetta & Pozzolo (2010) has found that banks that securitize tend to end up with more diverse loan portfolios. Specifically, the study has observed, that banks that have securitized, have loan portfolio compositions that are more equally distributed among mortgages, leases and other loans.

## IV. Empirical Analyses

We divide our empirical analyses into two parts. The first part deals with the banks' usage of securitization to make changes in their loan portfolios, in terms of size and composition. For the second part of our analysis, we examine if such changes made by banks through securitization are in the interest of taking in greater risk, to reap high gains.

To review, we implement our empirical analysis using our data on the 129 member banks of the FDIC from 2001-2010. The balance sheet data of our sample banks are found in their submitted Call Reports that are accessible at the FDIC website. The Call Reports are available on a quarterly basis.

For all our estimations, we measure securitization activity by taking the sum of Bank Assets Sold and Securitized reflected in our banks' Call Reports. We normalize this figure to Total Assets. This variable for securitization activity, which we shall note as *Securitization*, will be our main variable of interest in our empirical analyses.

### *A. Securitization and the Bank Loan Portfolio*

#### *i. Loan Portfolio Size*

We begin our empirical analysis with the test on the banks' usage of securitization to gain more flexibility in holding more loans. We do this by

looking at the relationship between securitization and loan portfolio size. Our specification is as follows:

$$Y_{it} = \alpha_o + \alpha_1 Securitization_{it-1} + \beta X_{it-1} + \varepsilon_{it} \quad (1)$$

Where: $Y_{it}$ = Total Loans Holdings or Loan Portfolio Size of bank *i* at the end of quarter *t*; $Securitization_{it-1}$ = securitization activity of bank *i* at the beginning of quarter *t*; and $X_{it-1}$ = vector of bank-specific control variables of bank *i* at the beginning of quarter *t*.

To measure Loan Portfolio Size, we take the reported Total Loans and normalize it to Total Assets (Total Loans/Assets). We expect that *Securitization* should be positively related to Total Loans/Assets (i.e. $\alpha_1 > 0$). As we have argued securitization creates a vent for the banks to rid themselves of risk. With this facility, a bank may then be more accommodating in granting and holding loans, which leads to an increase in its loan portfolio size.

To account for the other factors that may have an influence on the banks' loans holdings (besides securitization), we add bank-specific control variables in our specification. The bank-specific factors we consider are Bank Size (measured through the Log of Assets), Capitalization (measured through the Capital-to-Assets Ratio) and the size of the bank's Traditional Funding Base (measured through Core Deposits/Assets). We also take into account if the bank operates within only one state or region (Local Bank Dummy) and if the bank is affiliated to a foreign bank holding company (Foreign Bank Dummy), as these characteristics may also have an influence on the size of the bank's loan portfolio[19].

The summary statistics of the control variables involved in our estimations are also reported in Table 1. We can observe from our summary statistics that banks that securitize more, are bigger and better-capitalized. These bank characteristics may lend support to the banks, as they hold more loans through securitization. We also observe that banks that securitize more are less dependent on traditional funding. As we move from the Low-Securitizers group to the High-Securitizers group, we observe that Core Deposits/Assets is

[19] Local banks may have less market coverage than national banks and thus may have smaller loan portfolios. Foreign banks, on the other hand, due to their reputation and larger market coverage, may have larger loan portfolios.

decreasing. This could be due to the other property of securitization, which is that of being a funding facility[20].

In implementing our specification, we employ bank fixed effects (FE) and panel instrumental variables (IV) regressions. In our IV regressions, we use as instruments the previous period's[21] Securitization Activity, Bank Size, Capitalization and Traditional Funding Base. Moreover, we also use as instruments a measure for the extent of Credit Enhancements[22] that a bank offers on its securitization transactions, as well as, a measure for riskiness of the loans that the banks have securitized[23]. The previous period's Securitization Activity, Credit Enhancements and riskiness of securitized loans affects our dependent variable (i.e. loan portfolio size), only through our main explanatory variable[24] (i.e. the beginning of the quarter's Securitization Activity ($Securitization_{it-1}$)). Maintenance of our results in the FE estimations under our IV estimations, will then rule out the issue of reverse causality between securitization and loan portfolio size.

In addition to using the two above estimation processes, we also execute our specification under three different periods. The first period we consider

[20] See Karaoglu (2005), Martin-Oliver & Saurina (2008) and Loutskina (2011) for studies on the funding property of securitization.

[21] Given that we use a one-period lag on our independent variables, these instruments mentioned will then take a two-period lag.

[22] Credit Enhancements are special features that banks may offer on their securitization transactions to make their deals more attractive. For a comprehensive discussion on Credit Enhancements and its various types, see Lea (2006). In this study, the Credit Enhancements that we consider are Subordinated Securitization and Lines of Credit. We measure the extent by which our sample banks offer these features by taking the ratio of the Amount of Credit Enhancements to the Total Amount of Securitized Loans (i.e. Total Amount of Subordinated Securitization Retained by the Bank/Total Bank Assets Sold and Securitized, Lines of Credit on Securitized Loans/Total Bank Assets Sold and Securitized). Data on Credit Enhancements are reported in the FDIC Call Reports.

[23] We measure the riskiness of our sample banks' securitized loans by taking the default rate of the banks' securitized loans. We calculate the default rate as the ratio of the Amount of Securitized Loans in Default to the Total Amount of Securitized Loans (i.e. Total Amount of Securitized Loans in Default/Total Bank Assets Sold and Securitized).

[24] The said instrumental variables have no direct effect on the observed loan portfolio size, but may only be related to it through Securitization Activity (which, as argued, may have a positive relationship on the loan portfolio size). A bank that has had a large Securitization Activity for the previous period may be able to securitize more in the following periods, as its previous securitization activity could allow it to build a certain expertise and reputation in carrying out the transaction (Albertazzi, Eramo, Gambacorta & Salleo (2011)). Likewise, a bank that offers much Credit Enhancements on its securitization transactions may also be able to securitize more, because the Credit Enhancements serve as guarantees that the securitization transactions involve good quality underlying assets and that it will pay-off its investors, even if a default in the underlying assets happen (Thomas (1999), Gorton & Souleles (2005), Ashcraft & Schuermann (2007)) . Meanwhile, a bank with risky securitized loans may find its securitization activity limited, as its high incidence of defaulting securitized loans may signal that the underlying assets on its securitization transactions are of poor quality.

encompasses our entire sample period from 2001:4-2010:4. For the second period, we consider only 2001:4-2009:2 (which is the period when securitization has been popularly practiced by banks), while the third period concerns only 2009:3-2010:4 (which is the period when banks have mainly shied away from securitization[25]). We differentiate between these periods to be able to establish if, even at the time when securitization has already been unpopular due to its entanglement with the subprime crisis, banks can still use it to be able to hold more loans.

Our estimation results are reported in Panel 1 of Table 3 and in Panel 1 of Table 4. Both the FE and IV estimation results are presented in Tables 3 & 4. In Table 3 the results concern the entire sample period of 2001:4-2010:4, while in Table 4 the results are differentiated according to when securitization was in favour (2001:4-2009:2) and when it has been less so (2009:3-2010:4). We find in both FE and IV estimations in Panel 1 of Table 3 that *Securitization* is positively related to Loan Portfolio Size, as expected. Our results show that this effect of *Securitization* is, as well, statistically and economically significant. This finding establishes the point that banks may have used securitization to take in more loans. As we have pointed out, securitization gives the bank the option to unload loans, should they deem some loans too much to bear. Given this outlet, banks may then be more flexible in holding loans, which can inflate their portfolios. In Panel 1 of Table 4, we see that this point applies in both periods when securitization was popular and when it was otherwise. We find that in both differentiated periods, the FE and IV estimations still show a positive relationship between *Securitization* and Loan Portfolio Size

On the control variables all our results in Panel 1 of Table 3 and Panel 1 of Table 4, show that Log of Assets is negatively related to Total Loans/Assets. Though this may be an unexpected result, this can be explained by big banks being more involved in other activities such as fee-based services (e.g. securities underwriting, loan syndication, etc.). Involvement in these other activities tends to compromise the bank's interest-income driven activities, specifically, loans. Hence, the negative relationship observed between loan holdings and bank size. On the other hand, the Capital-to-Assets Ratio (CAR) has come out positively related to total loans holdings, also in all estimations reflected in Panel 1 of Table 3 and Panel 1 of Table 4. This result is straightforward, as more capitalized banks are more capable of bearing loan exposures.

[25] This period may be observed in Figure 1 as the horizon where there has been a steep drop in the securitization of Real Estate Loans (as well as Consumer Loans) and that there has been no recovery since then on in the securitization of loans (irrespective of class).

*ii. Loan Portfolio Composition*

Having established that banks use securitization to expand their loan portfolios, we proceed to investigate if such, as we have earlier observed, is geared towards holding more Consumer Loans. To do this, we re-estimate Equation (1) with the portfolio share of Consumer Loans (Consumer Loans/Total Loans) as dependent variable. In our estimations, we implement the same estimation techniques and treatments in the sample period, as in our previous analysis between securitization and loan portfolio size. We expect that securitization should be positively related to Consumer Loans/Total Loans (i.e. $\alpha_1 > 0$).

From our set of results in Panel 2 of Table 3, we find a confirmation of our above expectation. *Securitizatio*n is positively related to Consumer Loans/Total Loans, with this effect being statistically and economically significant. At the same time, from our results in Panel 2 of Table 4, we observe that the positive relationship between *Securitization* and Consumer Loans/Total Loans holds in both periods when securitization was highly practiced and when it was not. Going through our control variables, the robust and economically significant relationships to Consumer Loans/Total Loans that we find are those on Capitalization and Core Deposits/Assets. We have in the results of both Panel 2 of Table 3 and Panel 2 of Table 4 that Capitalization is positively related to Consumer Loans/Total Loans. This result reiterates the importance of capital adequacy in bearing loan exposures, especially risky loans such as Consumer Loans. Meanwhile, Core Deposits/Assets is negatively related to Consumer Loans/Total Loans in all our estimations. This implies that banks relying much on traditional funding may not grant and hold much Consumer Loans. This can be explained by the banks creating a mismatch on their assets and liabilities to manage cash flows, since both Core Deposits and Consumer Loans are retail in nature[26].

With our findings above, we have managed to prove the first two points of our hypothesis. These points are that banks have taken advantage of the credit risk management property of securitization to be able to increase their loan portfolios, and that this increase is geared towards Consumer Loans. In the following analyses, we seek to confirm the remaining part of our hypothesis.

[26] Consumer Loans and Core Deposits are retail banking activities in the sense that banks transact such activities with individual clients. In a period when there is a high demand for cash among consumers, a surge in applications for Consumer Loans might happen alongside deposit withdrawals, creating a cash flow problem. Thus banks, may want to avoid engaging in both retail lending and borrowing activities simultaneously, or in other words, create a mismatch in their assets and liabilities.

This is that as the banks make the said changes in their loan portfolios using securitization, they expose themselves to higher risk and that this exposure to greater risk has been done to enjoy high returns (that an increase in risk-taking with intense monitoring promises).

*B. Securitization, Loan Portfolio Risk and Bank Returns*

*i. Loan Portfolio Risk*

To check if banks may have exposed themselves to more risk through securitization, we look at the relationship between securitization and the overall risk of the bank's loan portfolio. We take four indicators of loan portfolio risk namely; a. the Non-Performing Loans[27] to Total Loans Ratio (NPLs/Total Loans); b. the standard deviation of NPLs/Total Loans[28] (SD NPLs); c. the Loan Charge-Offs[29] to Total Loans Ratio (Charge-Offs/Total Loans); and d. the standard deviation of Charge-Offs/Total Loans[30] (SD Charge-Offs).

Given our measures for loan portfolio risk, we do panel estimations of the following equation:

$$Y_{it} = \alpha_o + \alpha_1 Securitization_{it-1} + \beta X_{it-1} + \phi Z_{it-1} + \varepsilon_{it} \quad (2)$$

Where: $Y_{it}$ = Loan Portfolio Risk Indicator of bank *i* at the end of quarter *t*; $Securitization_{it-1}$ = securitization activity of bank *i* at the beginning of quarter *t*; $X_{it-1}$ = vector of bank-specific control variables of bank *i* at the beginning of quarter *t*; and $Z_{it-1}$ = vector of shares of each loans class in the loan portfolio of bank *i* at the beginning of quarter *t*.

For the bank-specific control variables, we include the same control variables for Bank Size and Capitalization plus a control variable for Loan Portfolio Size, measured by Total Loans normalized to Total Assets (Total Loans/Assets). We control for Loan Portfolio Size as this variable may have an influence on the incidence of loan defaults (which we use as indicators for loan portfolio risk). Like in our previous estimations we also take into account the geographical confinement of the bank's operations (Local Bank Dummy) and its affiliation to a foreign bank holding company (Foreign Bank Dummy).

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[27] Non-Performing Loans are defined as loans that have been past due for 90s days plus loans that have been in non-accrual status.

[28] In calculating SD NPLs, we use NPLs of the four quarters of each year. As a result we experience a reduction in the number of observations when using this as indicator for loan portfolio risk. The same case applies to SD Charge-Offs.

[29] Loan charge-offs are defined as loans that have been delinquent for at least 120 days.

[30] See Note 28.

At the same time, we also include variables controlling for the shares of each loans class in the banks' respective loan portfolios (vector-*Z*). We include this set of control variables, considering that each loan class have varying risk and may therefore have different impacts on the incidence of loan defaults. To avoid perfect collinearity, we exclude the portfolio share of Other Loans (i.e. Other Loans/Total Loans).

Going back to Table 1, we see in our summary statistics that our indicators of loan portfolio risk are generally higher for banks that securitize more (i.e. those in the Mid and High-Securitizers Group), than those that securitize less (i.e. those in the Low-Securitizers Group). This gives us the impression that overall loan portfolio risk may increase with securitization. In Table 5, we get a verification of this notion where we find a positive relationship between *Securitization* and all our measures of loan portfolio risk. As reported in Table 5, securitization is statistically and economically significant in most of our estimations except that of SD Charge-Offs. These results affirm our point that banks have used securitization not necessarily to totally isolate themselves from risk, but rather to be able to bear greater risk.

On the control variables, Banks Size, Capitalization and Loan Portfolio Size are chiefly positively related to loan portfolio risk. Bigger and more capitalized banks as well as banks with larger portfolios do tend to take on more risk. Hence, such variables are bound to be positively related with loan portfolio risk. Meanwhile, the respective portfolio shares of the different loans classes are also mostly positively related to all the measures of loan portfolio risk. This result is immediate, as every loans class must pose some risk to the loan portfolio of the bank.

*ii. Bank Returns*

Finding that banks may have securitized towards increasing their loan portfolio risk, we go to our other point, where this move may have been stirred by the banks wanting to realize the high potential returns of such risky loan exposures (with more intense monitoring). Should this be the case, then securitization activity must be associated with high returns for the banks. We measure bank returns in two dimensions namely the actual returns of the bank and the stability of these returns. Our measures for the actual bank returns are the ROA and the ROE, while for the stability of bank returns, our indicators are the respective

standard deviations of the ROA and ROE (SD ROA and SD ROE)[31]. The higher the SD ROA or the SD ROE, the less stable are the bank returns.

Looking at the summary statistics of our variables for bank returns in Table 1, we find some evidence that the increase in risk taking through securitization may be accompanied by high bank returns. We observe that the ROA and the ROE for High-Securitizers are markedly higher than that of Mid-Securitizers and Low-Securitizers. However, it also seems that these high returns may not necessarily be complemented with more stable bank returns, as the SD ROA and the SD ROE appear higher for the groups of banks that securitize more.

To verify our observations, we estimate our variables for bank returns against the same independent variables we used in the estimations for loan portfolio risk (i.e. Equation 2). The results are presented in Table 6. In Panels 1 & 2 of Table 6, we find that *Securitization* is positively related to both the ROA and ROE and is also statistically and economically significant in both estimations. These findings along with the earlier ones on loan portfolio risk, confirm our point that banks may have used securitization to take on higher risk and enjoy high returns. This is emphasized with the portfolio share of risky Consumer Loans being also positively related to the ROA, while the portfolio shares of the other loans classes have coefficients with negative signs. On the other control variables, we have that bank size and capitalization are negatively related to bank returns, pointing out that big and more capitalized banks are not necessarily the most profitable. This may be once again due to the tendency of most of these banks to go into other activities where these activities may not be very high-yielding (e.g. fee-based services). Loan portfolio size, on the other hand, is positively related to both ROA and ROE. These results are driven by the large interest income that is derived from a big loan portfolio.

Meanwhile, Panels 3 & 4 show that securitization is positively related to the SD ROA and the SD ROE, or that securitization can lead to unstable bank returns. These results may be due to the risky source of the high returns provided by securitization, which is that of increasing the portfolio share of risky loans. The implication of these findings is that, although the banks' increase in risk exposures through securitization may yield high gains, these gains may be unstable (owing to the high risk exposures itself). Given such, the reward of high

[31] Like in the case of SD NPLs and SD Charge-Offs, the SD ROA and the SD ROE are calculated using the ROA and the ROE of the four quarters of each year. As a result we experience a reduction in the number of observations for these particular estimations.

returns for higher risk may not be enough to convince the banks to sustain their engagement in securitization. Thus, some form of windfall might be necessary to persuade banks to continue to securitize and carry on with the strategy above. We find such windfall in the complementary diversification effect of securitization, which we discuss in the following section.

## V. Further Analyses

*A. Securitization and Loan Portfolio Diversification*

Our earlier finding which shows that securitization shuffles the composition of the bank's loan portfolio towards more Consumer Loans, brings the possibility that securitization may also have an impact on the diversification of the bank's loan portfolio. Given that diversification has implications on the risk of the bank's loan portfolio, as well as its returns, we look into this issue. The classical hypothesis of diversification posits that by spreading a portfolio into different assets (or, in our case, loans) with uncorrelated risks, the risks may cancel each other out. As such, diversification may reduce the overall risk of the loan portfolio and that the risk-reduction could also lead to more stable returns. In Acharya, Hasan & Saunders (2002), this hypothesis has been partly verified by results that among Italian banks, the banks that diversify their loans on different sectors have lower NPLs.

If we look back at our summary statistics in Table 1, we may observe that securitization, to some degree, could lead to a more diversified loan portfolio. As we move from the Low-Securitizers Group to the High-Securitizers Group, we see a relatively more even distribution in the portfolio shares of each loans class. For example, Low-Securitizers, on average, hold a large chunk of their loans in Real Estate Loans at 62%, followed by C&I Loans at 24% and only a small portion of Consumer Loans at 8%. In contrast, High-Securitizers, have a relatively more balanced loan portfolio, where on average, the portfolio share of Real Estate Loans is at 45%, while that of the C&I Loans is at 17% and that of Consumer Loans is at 26%.

To further investigate this point, we take an indicator for loan portfolio diversification given by the inverse of the Herfindahl-Hirschman Index $(1 - HHI)$[32]. The intuition of this index is that the higher it is, the more diverse is the loan portfolio. The average $1 - HHI$ of our different bank groups are reported in Table 1. Both Mid-Securitizers and High-Securitizers have fairly higher

[32] Please see the Appendix for a discussion on the computation of the Herfindahl-Hirschman Index.

average diversification indicators than the Low-Securitizers. Given such, we move to confirm this observed case of securitization leading to loan portfolio diversification. To do so, we implement a panel estimation on $1-HHI_{it}$ against securitization. In this estimation, we include the same control variables used in Equation (1). At the same time, we add a one-period lagged value of the same indicator for loan portfolio diversification ($1-HHI_{it-1}$). The purpose of adding $1-HHI_{it-1}$ is to control for the likelihood that the bank may have already been diversifying previously (perhaps as a way to manage risk).

Our estimation results reported in the first row of Table 7[33] shows that securitization may actually lead to loan portfolio diversification, with *Securitization* being positively related to $1-HHI$. We note that *Securitization* is statistically and economically significant in relation to the loan portfolio diversification indicator, even while considering for the strong reinforcing effect of the previous extent of loan portfolio diversification ($1-HHI_{t-1}$).

*B. Securitization, Loan Portfolio Diversification, Risk and Returns*

Given the result above, we next examine if the bank reaps the known benefits of diversification, namely lower overall loan portfolio risk and more stable returns. In doing this, we estimate our measures of loan portfolio risk and our measures for bank returns volatility against our diversification indicator ($1-HHI_{it-1}$)[34], while controlling for securitization activity. We also include the control variables we have used in the estimation of Equation (2), except for the portfolio shares of the different loans classes, as these shares may already be accounted for by the diversification indicator[35].

Looking at our results on the second to the seventh rows of Table 7[36], we find that the banks do enjoy the beneficial effects of diversification. In Panel 1, we can see that $1-HHI_{t-1}$ is negatively related to our measures of loan portfolio risk, indicating that diversification lowers overall loan portfolio risk. At the same time, we can observe that the diversification indicator is negatively related to the SD ROA and the SD ROE, which means that diversification may stabilize bank

[33] For purposes of brevity, we report in Table 7 only the coefficients of our variables of interest namely *Securitization* and the one-period lag of the diversification index (*1-HHI$_{t-1}$*).

[34] The loan portfolio diversification indicator for this set of estimations takes a one-period lag, since we use beginning of quarter values for our independent variables, as in the earlier estimations.

[35] This is because the calculation of the diversification index is based on the portfolio share of each loans class in the bank's loan portfolio.

[36] See Note 33.

returns. Meanwhile, in Panel 2 we see the same relationship we have found earlier between securitization and our variables for loan portfolio risk and bank returns stability. In the case of NPLs and SD NPLs, we see that the negative impact of $1-HHI_{t-1}$ is more economically significant than the positive impact of *Securitization*. These suggest that the diversification benefit of reduced overall loan portfolio risk, may effectively temper the increased risk brought about by securitization that results from the greater portfolio share of risky loans. Likewise, the negative effect of $1-HHI_{t-1}$ on SD ROE is more economically significant than the positive effect of *Securitization*. This points out that the instability of returns from securitization may also be mitigated by the diversification benefit of stable returns. Given these, we can consider that the diversification benefits could offset the undesirable effects of securitization. As such, banks receive the needed windfall to continue to engage in securitization with the interest of taking on higher risk, in pursuit of high returns.

## VI. Concluding Remarks

Securitization provides banks with a means to isolate themselves from risky loans. A number of studies have shown that banks may take advantage of this credit risk management property of securitization, where banks with riskier assets tend to securitize more. We expound on this point by looking at what happens to the banks' risk exposures as they securitize.

We have observed that when securitizing, banks have larger loan portfolios and that this increase in loan portfolio size is geared towards having more risky assets. At the same time, we have found that these changes in the banks' loan portfolios, through securitization, entail an increase in the overall risk of the bank's loan portfolios as well as high returns. Given these, we construe that as banks securitize and use the credit risk management property of securitization, what occurs is not necessarily a total isolation from risk (as what theory may predict). Instead, what happens is a taking on of greater risk among the securitizing banks, to achieve high returns.

A concern on the high returns from securitization, however, is that we have also found these to be unstable. This may due to the fact that the said returns are derived from the high exposure to risky loans. Nevertheless, this concern, as well as, the implications of having more risky assets is tempered through the benefits of having a more diversified loan portfolio, which comes as a side-effect of the engagement in securitization. As banks use securitization to increase their

exposure to risky assets, they also end up diversifying their loan portfolios that provide them the diversification benefits of reduced overall loan portfolio risk and more stable returns. With these diversification benefits offsetting the above issues, banks find the motivation to keep on securitizing to increase their risk exposures, and enjoy the accompanying high rewards for taking on risky assets.

From our findings, we conclude that the credit risk management property of securitization goes beyond the mere offloading of credit risk, by taking loans out of the bank balance sheet. Rather, the credit risk management role of securitization goes all the way to the structure of the bank's loan portfolio or the bank's choice of assets, where this choice of assets is geared towards more risk-taking, to achieve better returns.

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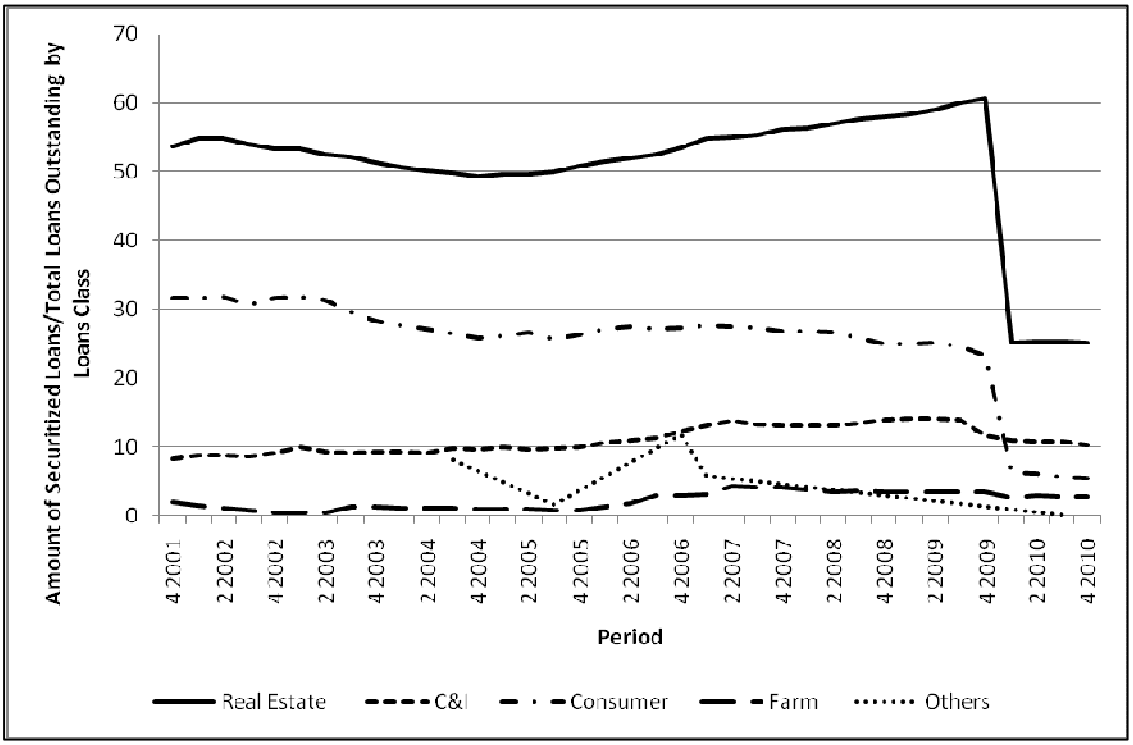
**Table 1. Summary Statistics**

| | Volume of Bank Assets Sold & Securitized/Assets (Securitization) | | |
|---|---|---|---|
| Sampling Period: 2001:4-2010:4, No. Of Banks: 129, No. of Banks in Each Group: 43 | Low-Securitizers (Sec ≤ 33rd Percentile) | Mid-Securitizers (33rd Percentile<Sec≤ 67th Percentile) | High-Securitizers (67th Percentile< Sec) |
| | 1 | 2 | 3 |
| Total Loans/Assets | 59.929 | 64.019 | 64.126 |
| Real Estate Loans/Total Loans | 62.434 | 57.585 | 45.991 |
| C&I Loans/Total Loans | 23.668 | 20.940 | 17.047 |
| Consumer Loans/Total Loans | 8.230 | 9.637 | 26.774 |
| Farm Loans/Total Loans | 0.554 | 0.425 | 0.588 |
| Other Loans/Total Loans | 5.185 | 11.441 | 9.633 |
| Log of Assets | 16.338 | 16.674 | 17.522 |
| CAR | 10.266 | 11.401 | 12.374 |
| Core Deposits/Assets | 58.062 | 51.734 | 43.220 |
| 1-HHI | 0.433 | 0.454 | 0.453 |
| NPLs/Total Loans | 1.310 | 2.106 | 2.025 |
| SD NPLs | 0.290 | 0.523 | 0.369 |
| Charge-Offs/Total Loans | 0.563 | 0.920 | 1.667 |
| SD Charge-Offs | 0.168 | 0.218 | 0.205 |
| ROA | 0.880 | 0.769 | 1.180 |
| SD ROA | 0.200 | 0.425 | 0.394 |
| ROE | 9.809 | 7.613 | 10.576 |
| SD ROE | 2.039 | 3.830 | 3.692 |

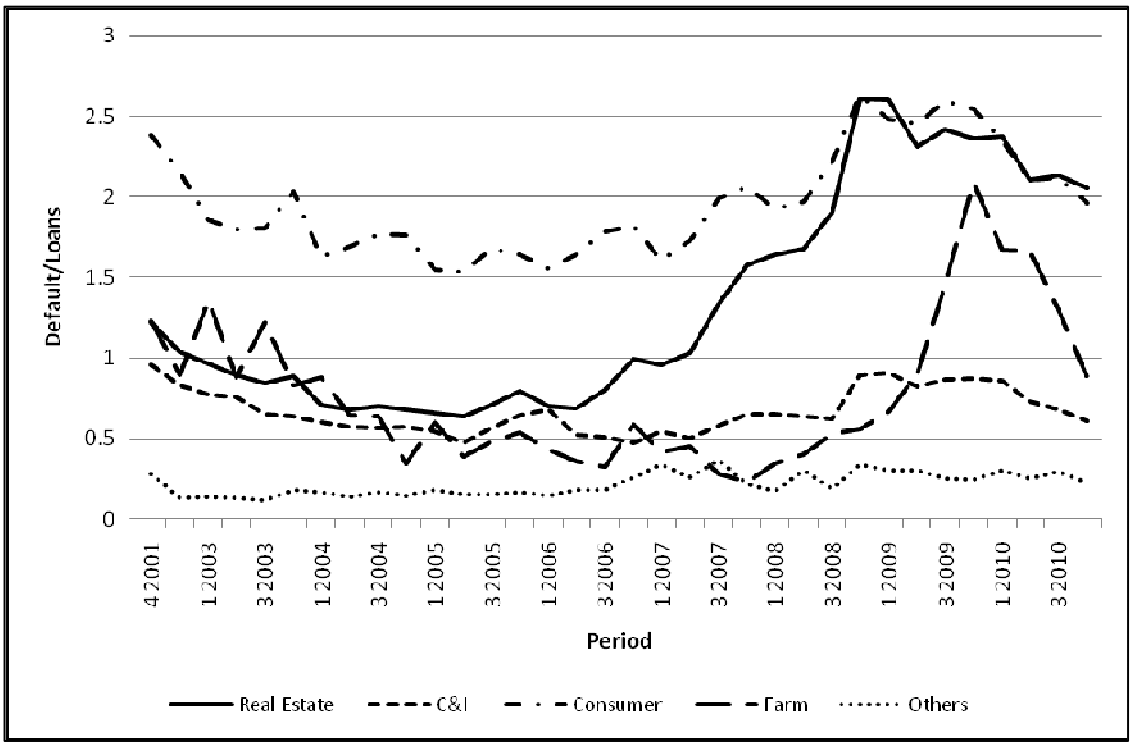
Balance sheet data are taken from the FDIC Quarterly Call Reports. 1-HHI is the inverse of the Herfindahl-Hirschman Index, serving as indicator for loan portfolio diversification. The standard deviations (SDs) are calculated for each year using quarterly values.

**Figure 1. Share of Securitized Loans to Total Loans Outstanding by Loans Class (2001-2010)**




The share of Securitized Loans to Total Loans Outstanding of each Loans Class is calculated as the ratio of the Amount of Securitized Loans of each Loans Class to the Total Amount of Loans of each Loans Class (e.g. Share of Securitized Real Estate Loans = Amount of Real Estate Loans Securitized/Total Real Estate Loans Outstanding). Data used for the calculation of figures plotted above are taken from the Flow of Funds Account of the United States, Federal Reserve Board.

**Figure 2. Default Rates by Loans Class (2001-2010)**




The default rate of each Loans Class is calculated as the ratio of the Amount of Loans of each Loans Class that is in Default to the Total Amount of Loans of Each Loan Class (e.g. Default Rate of the Real Estate Loans=Real Estate Loans in Default/Total Amount of Real Estate Loans). The default rates are calculated based on the aggregate values for the entire Commercial and Thrift Banking System under the FDIC. Data on aggregate values for the Commercial and Thrift Banking System are accessible through the Statistics on Depository Institutions available at the FDIC website.

**Table 2. Covariance Matrix of Defaults among Different Loans Classes (2001-2010)**

| | Farm | C&I | Consumer | Others |
|---|---|---|---|---|
| Real Estate | 0.1436186 | 0.0604956 | 0.1908590 | 0.0314621 |
| Farm | | 0.0389255 | 0.0779504 | 0.0036428 |
| C&I | | | 0.0361855 | 0.0029371 |
| Consumer | | | | 0.0127283 |

The covariances are calculated using the default rates in Figure 2. The range for the calculation of the covariances is based in the sample period of 2001:4-2010:4.

## Table 3. Securitization and the Bank Loan Portfolio (Entire Period)

| | Dependent Variable | | | |
|---|---|---|---|---|
| | Total Loans/Assets$_t$ | | Consumer Loans/Loans$_t$ | |
| | 1 | | 2 | |
| Sampling Period: 2001:4-2010:4 | FE | IV | FE | IV |
| Independent Variables | | | | |
| Securitization$_{t-1}$ | 0.081*** | 0.086*** | 0.428*** | 0.475*** |
| | (8.706) | (6.950) | (32.356) | (36.663) |
| Log of Assets$_{t-1}$ | -0.047*** | -0.038*** | -0.001 | 0.001 |
| | (-20.243) | (-6.696) | (-0.523) | (0.015) |
| CAR$_{t-1}$ | 0.476*** | 0.628*** | 0.354*** | 0.805*** |
| | (13.961) | (11.481) | (12.870) | (14.003) |
| Core Deposits/Assets$_{t-1}$ | -0.001 | 0.019 | -0.058*** | -0.091*** |
| | (-0.071) | (1.259) | (-11.312) | (-5.742) |
| Local Bank Dummy | Yes | Yes | Yes | Yes |
| Foreign Bank Dummy | Yes | Yes | Yes | Yes |
| No. of Observations | 3982 | 3982 | 3982 | 3982 |
| No. of Banks | 129 | 129 | 129 | 129 |
| R-Squared | 0.378 | 0.167 | 0.435 | 0.426 |

The main independent variable for these estimations is Securitization measured as the Total Bank Assets Sold and Securitized normalized to Total Assets. The dependent variable in Panel 1 is Loan Portfolio Size measured as the ratio of Total Loans to Total Assets. The dependent variable in Panel 2 is the ratio of Consumer Loans to Total Loans. FE refers to the Bank Fixed Effects estimation results, while IV refers to the Panel Instrumental Variables estimation results. In the IV estimations, the instruments used are the previous period's (i.e. two-period lag) Securitization, Log of Assets, CAR, Core Deposits/Assets, Total Amount of Subordinated Securitization Retained by the Bank/Total Bank Assets Sold and Securitized, Lines of Credit on Securitized Loans/Total Bank Assets Sold and Securitized, and Total Amount of Securitized Loans in Default/Total Bank Assets Sold and Securitized. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

**Table 4. Securitization and the Bank Loan Portfolio (Differentiated Periods)**

| | Dependent Variable | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total Loans/Assets$_t$ | | | | Consumer Loans/Loans$_t$ | | | |
| | 1 | | | | 2 | | | |
| | 2001:4-2009:2 | | 2009:3-2010:4 | | 2001:4-2009:2 | | 2009:3-2010:4 | |
| | FE | IV | FE | IV | FE | IV | FE | IV |
| Independent Variables | | | | | | | | |
| Securitization$_{t-1}$ | 0.071*** | 0.069*** | 0.139*** | 0.288*** | 0.489*** | 0.489*** | 0.282*** | 0.467*** |
| | (7.635) | (5.399) | (13.526) | (4.075) | (48.121) | (38.118) | (5.176) | (5.294) |
| Log of Assets$_{t-1}$ | -0.043*** | -0.031*** | -0.058*** | -0.058*** | -0.007*** | -0.004 | 0.019*** | 0.012 |
| | (-16.912) | (-5.001) | (-18.606) | (-3.357) | (-3.498) | (0.642) | (5.194) | (0.583) |
| CAR$_{t-1}$ | 0.497*** | 0.660*** | 0.518*** | 0.531** | 0.384*** | 0.715*** | 0.598*** | 1.057*** |
| | (14.662) | (11.128) | (7.066) | (2.614) | (12.854) | (12.100) | (9.949) | (4.174) |
| Core Deposits/Assets$_{t-1}$ | -0.002 | 0.010 | 0.014 | 0.024 | -0.062*** | -0.073*** | -0.242*** | -0.262*** |
| | (-0.185) | (0.620) | (0.891) | (0.529) | (-12.075) | (-4.383) | (-17.946) | (-4.700) |
| Local Bank Dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Foreign Bank Dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| No. of Observations | 3275 | 3275 | 707 | 707 | 3275 | 3275 | 707 | 707 |
| No. of Banks | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 |
| R-Squared | 0.558 | 0.181 | 0.724 | 0.100 | 0.558 | 0.478 | 0.865 | 0.245 |

Table 4 (Previous Page) Notes: The main independent variable is Securitization measured as the Total Bank Assets Sold and Securitized normalized to Total Assets. The dependent variable in Panel 1 is Loan Portfolio Size measured as the ratio of Total Loans to Total Assets. The dependent variable in Panel 2 is the ratio of Consumer Loans to Total Loans. Estimations for the dependent variables are differentiated into two periods, namely 2001:4-2009:2 and 2009:3-2010:4. The period of 2001:4-2009:2 pertain to the period when securitization has been highly practiced by banks. On the other hand, the period 2009:3-2010:4 refers to the period when banks have engaged less in securitization, as the activity has fallen out of favour due to its involvement with the subprime crisis. FE refers to the Bank Fixed Effects estimation results, while IV refers to the Panel Instrumental Variables estimation results. In the IV estimations, the instruments used are the previous period's (i.e. two-period lag) Securitization, Log of Assets, CAR, Core Deposits/Assets, Total Amount of Subordinated Securitization Retained by the Bank/Total Bank Assets Sold and Securitized, Lines of Credit on Securitized Loans/Total Bank Assets Sold and Securitized, and Total Amount of Securitized Loans in Default/Total Bank Assets Sold and Securitized. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

## Table 5. Securitization and Loan Portfolio Risk

| | Dependent Variable | | | |
|---|---|---|---|---|
| | $NPLs_t$ | Charge-$Offs_t$ | SD $NPLs_t$ | SD Charge-$Offs_t$ |
| Sampling Period: 2001:4-2010:4 | 1 | 2 | 3 | 4 |
| Independent Variables | | | | |
| $Securitization_{t-1}$ | 0.786*** | 0.917*** | 0.141*** | 0.023 |
| | (10.624) | (8.240) | (4.003) | (0.887) |
| Log of $Assets_{t-1}$ | 0.917*** | 0.326*** | 0.100*** | 0.021*** |
| | (22.872) | (17.296) | (5.400) | (2.709) |
| $CAR_{t-1}$ | 1.670*** | 0.366 | 0.723*** | 0.092 |
| | (5.409) | (1.503) | (4.746) | (0.907) |
| $Loans/Assets_{t-1}$ | 1.045*** | 0.882*** | 0.108* | 0.046 |
| | (9.145) | (12.561) | (1.698) | (1.503) |
| Real Estate $Loans/Loans_{t-1}$ | 1.276*** | 0.224*** | 0.145* | 0.047 |
| | (9.181) | (3.025) | (1.913) | (1.293) |
| C&I $Loans/Loans_{t-1}$ | 1.099*** | 0.745*** | 0.156* | 0.154*** |
| | (7.304) | (7.165) | (1.681) | (3.428) |
| Consumer $Loans/Loans_{t-1}$ | 0.369** | 2.579*** | -0.135* | 0.218*** |
| | (2.445) | (20.083) | (-1.648) | (4.964) |
| Farm $Loans/Loans_{t-1}$ | 4.463*** | -0.236 | 0.841 | 0.296 |
| | (4.678) | (-0.279) | (1.609) | (0.819) |
| Local Bank Dummy | Yes | Yes | Yes | Yes |
| Foreign Bank Dummy | Yes | Yes | Yes | Yes |
| No. of Observations | 3982 | 3982 | 971 | 971 |
| No. of Banks | 129 | 129 | 129 | 129 |
| R-Squared | 0.230 | 0.317 | 0.092 | 0.071 |

The dependent variable in Panel 1 is Non-Performing Loans normalized to Total Loans. Non-Performing Loans are defined as loans that have been past due for 90 days plus loans that have been in non-accrual status. In Panel 2, the dependent variable is Charge-Offs normalized to Total Loans. Loans are Charged-Off if they are delinquent for the past 120 days. The dependent variable in Panel 3 is the standard deviation (SD) of Non-Performing Loans/Total Loans, while in Panel 4, the dependent variable is the SD of Charge-Offs/Total Loans. The respective SDs are calculated for each year using quarterly values. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

## Table 6. Securitization and Bank Returns

| | Dependent Variable | | | |
|---|---|---|---|---|
| | $ROA_t$ | $ROE_t$ | SD $ROA_t$ | SD $ROE_t$ |
| Sampling Period: 2001:4-2010:4 | 1 | 2 | 3 | 4 |
| Independent Variables | | | | |
| $Securitization_{t-1}$ | 0.858*** | 4.935*** | 0.251*** | 1.672*** |
| | (9.264) | (6.208) | (4.640) | (4.371) |
| Log of $Assets_{t-1}$ | -0.285*** | -2.875*** | -0.008 | -0.031 |
| | (-16.017) | (-15.165) | (-0.737) | (-0.265) |
| $CAR_{t-1}$ | -1.177*** | -67.438*** | 0.098 | -9.307*** |
| | (-4.581) | (-30.092) | (0.572) | (-7.489) |
| $Loans/Assets_{t-1}$ | 0.346*** | 5.053*** | 0.236*** | 0.649 |
| | (4.514) | (6.207) | (4.843) | (1.413) |
| Real Estate $Loans/Loans_{t-1}$ | -0.817*** | -11.627*** | -0.357*** | -2.589*** |
| | (-8.100) | (-11.518) | (-4.445) | (-3.817) |
| C&I $Loans/Loans_{t-1}$ | -0.148 | -7.164*** | -0.239** | -3.570*** |
| | (-1.123) | (-5.213) | (-2.340) | (-4.014) |
| Consumer $Loans/Loans_{t-1}$ | 0.371*** | -0.901 | -0.222** | -1.381** |
| | (3.102) | (-0.818) | (-2.461) | (-1.992) |
| Farm $Loans/Loans_{t-1}$ | -2.211*** | -18.823*** | -0.792 | -1.222 |
| | (-3.316) | (-2.877) | (-1.533) | (-0.444) |
| Local Bank Dummy | Yes | Yes | Yes | Yes |
| Foreign Bank Dummy | Yes | Yes | Yes | Yes |
| No. of Observations | 3982 | 3982 | 971 | 971 |
| No. of Banks | 129 | 129 | 129 | 129 |
| R-Squared | 0.178 | 0.301 | 0.098 | 0.096 |

The dependent variable in Panel 1 is the ROA, while in Panel 2, the dependent variable is the ROE. The standard deviations of the ROA and the ROE stand as dependent variables and measures of bank returns stability in Panels 3 and 4, respectively. The respective SDs are calculated for each year using quarterly values. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

**Table 7. Securitization, Loan Portfolio Diversification, Risk and Returns**

| | Independent Variables | | No. of Obs. | No. of Banks | R-Squared |
|---|---|---|---|---|---|
| | $1\text{-}HHI_{t-1}$ | $Securitization_{t-1}$ | | | |
| Sampling Period: 2001:4-2010:4 | 1 | 2 | | | |
| Dependent Variables | | | | | |
| $1\text{-}HHI_t$ | 0.855*** | 0.019*** | 3982 | 129 | 0.976 |
| | (107.307) | (3.832) | | | |
| $NPLs_t$ | -0.782*** | 0.286*** | 3982 | 129 | 0.263 |
| | (-4.098) | (4.576) | | | |
| $Charge\text{-}Offs_t$ | -0.125** | 1.730*** | 3982 | 129 | 0.219 |
| | (-2.465) | (13.965) | | | |
| SD $NPLs_t$ | -0.094* | -0.017 | 971 | 129 | 0.042 |
| | (-2.428) | (-0.502) | | | |
| SD $Charge\text{-}Offs_t$ | -0.051* | 0.080*** | 971 | 129 | 0.043 |
| | (-1.787) | (2.978) | | | |
| SD $ROA_t$ | -0.160*** | 0.278*** | 971 | 129 | 0.111 |
| | (-4.786) | (5.558) | | | |
| SD $ROE_t$ | -2.129*** | 1.981*** | 971 | 129 | 0.137 |
| | (-5.254) | (5.401) | | | |

The dependent variables are on the first column (leftmost panel) of the Table. 1-HHI is the indicator of loan portfolio diversification, measured as the inverse of the Herfindahl-Hirshcman Index (HHI). For brevity, only the main independent variables, $1\text{-}HHI_{t-1}$ (in Panel 1) and $Securitization_{t-1}$ (in Panel 2) are reported. Items in parenthesis report the t-statistics. * denotes significance at the 10% level, ** at the 5% level and, ***at the 1% level. All regressions include an intercept.

**Appendix: The Herfindahl-Hirschman Index (HHI)**

The HHI is originally a measure of market dispersion (or concentration), calculated using the market shares of a set competing firms. However, the concept of the HHI has been also applied to create an indicator for loan portfolio diversification. Studies that have used the HHI as an indicator for loan portfolio diversification include Acharya, et. al. (2002), Stiroh (2004), Kamp, Pfingsten & Porath (2006) and Kamp, Pfingsten, Memmel & Behr (2007). The HHI (as a loan portfolio diversification measure) is calculated as:

$$HHI_B = \sum_{i=1}^{n} q_i^2 \qquad (1A)$$

Where: $HHI_B$ is the HHI or loan portfolio diversification indicator of bank B, $i$ denotes a particular loan segment in bank B's portfolio, $n$ is the number of segments in bank B's loan portfolio, and $q_i = \frac{Q_i}{\sum_{i=1}^{n} Q_i}$ or the share of a certain loan segment *i*, in bank B's loan portfolio.

In our study, we have five loan segments, which are the five loans classes we consider, namely Real Estate Loans, C&I Loans, Consumer Loans, Farm Loans and Other Loans. The HHI takes a value between $1/n$ and 1, where a value equal to 1 means that the bank's loans are of only one segment or that there is full concentration (i.e. no diversification). On the other hand, an HHI equal to $1/n$, implies equal shares among the different loan segments in bank B's portfolio or full diversification. For our analysis, it is more convenient to take and use the inverse of the HHI that is, $1 - HHI$. In this way, we have that a higher (lower) $1 - HHI$ indicates a more diverse (concentrated) loan portfolio for the bank.