On the Interaction between Competition and Securitization: Is it good for Bank Capital Structure?

Antonio BAYEH*

*Corresponding Author, PhD in finance, Lecturer at Grenoble IAE
University of Grenoble Alpes, CERAG Laboratory
150, rue de la chimie
38040 Saint-Martin-d'Hères
antonio.bayeh@univ-grenoble-alpes.fr

Abstract

This paper investigates new determinants of US bank capital structure over 2000-2013 using instrumental variable regression, fixed-effects models and quantile regression. We find that higher competition and securitization separately reduce bank capital ratios. Additionally, we exploit possible channels underlying these results. More importantly, we show that competition, when interacted with securitization, has a significant implication for the ongoing debate on bank capital. Interestingly, deeper investigations emphasize a positive interaction effect on less-capitalized banks compared to highly-capitalized banks. Overall, our findings introduce previously undiscovered empirical evidence to the general theoretical models about capital structure, and implement some important policy implications.

Keywords:

Competition, Securitization, Capital Structure, Banking Regulation, Financial Crisis, Instrumental Variable Regression, Fixed-Effects Model, Quantile Regression.

"*The first and, to my mind, still the most important element of regulatory strengthening was to increase the amount of capital held by banks to ensure they remained viable financial intermediaries that could finance economic activity."*

Governor Daniel K. Tarullo, Departing Thoughts Speech
Board of Governors of the Federal Reserve System - April 5, 2017

1. Introduction

Maintaining a viable bank capital structure remains a concern for financial regulators (Federal Reserve System, European Central Bank, Bank for International Settlements, International Monetary Fund, World Bank), given that this condition is fundamental for bank survival. Generally, retaining a high level of capital translates into a decrease in bank profits; therefore bank managers tend to realize some regulatory arbitrage opportunities to mitigate the negative effect of capital on their bank performance. In this paper, we find another channel determining bank capital structure and explaining the incentives behind regulatory arbitrage. In particular, banks benefit from competitive pressures and securitization possibilities to reduce their leverage. Interestingly, we find that the interaction between competition and securitization could also explain the positive changes in capital structure for less-capitalized banks. Nevertheless, such an interaction is detrimental for highly capitalized banks' structure. These results suggest that policies limiting bank competition and securitization appear to have beneficial effects for

financial stability because both of them are analyzed separately and not jointly. Hence, any other future policy should take into account that the securitization – capital assessment differs in terms of market structure and bank-level capitalization volumes.

Bank capital structure received increasing attention over the last recent years (Berger and Bouwman, 2013; Almazan et al. 2015; Chen, 2016; Allen et al., 2011; Schaeck and Cihak, 2010; Acharya et al., forthcoming; Berger and Bouwman, 2016, Berger and Bouwman, 2005). Also, securitization reached very high volumes prior to the financial crisis, and was thus subject to many interesting studies (Loutskina, 2011; Han, 2015; Almazan et al., 2015; Uhde and Michalak, 2010; Casu et al., 2014; Acharya et al., 2013; Marques-Ibanez et al., 2014; Keys et al., 2010; Mian and Sufi, 2010; Purnanandam, 2011; Panetta and Pozzolo, 2010; Cerrato et al., 2012). We focus on the link between securitization and capital through previously undiscovered channel: ***Banking Competition***.

This paper provides many empirical contributions to the existing literature. Exploring new determinants of bank capital structure, we are the first to study the impact of a joint interaction between competition and securitization, over 2000-2013, on bank capital ratios. More precisely, we revisit the rare literature related to the competition-capital nexus by providing important evidence suggesting that competition decreases bank capital ratios. Then, we study the effect of securitization on bank capital; motivated by the fact that securitization is indeed a source of funding for banks providing liquidity to a large extent. Finally, we show that competition could be a significant channel that explains the impact of securitization on bank capital.

The literature shows very rare empirical studies that generate contradictory results regarding the determinants of bank capital structure through competition (Berger et al., 2009; Schaeck and Cihak, 2010; Berger et al., 2017; Mehran and Thakor, 2011) and securitization (Scopelliti, 2016; Affinito and Tagliaferri, 2010; Jiangli and Pritsker, 2008). In addition, the majority of these papers take into account an international data to gauge the effect in different countries. To be more specific, we fill this gap in the literature by focusing on US commercial banking specificities.

Firstly, we test possible channels that explain the relation between competition and capital.[1] Secondly, our paper is the first to study the impact of securitization on US bank capital structure by considering the recent financial crisis effect[2].

Additionally, we measure securitization by employing an innovative indicator developed by Loutskina (2011) that merges economy-wide data from the Flow of Funds Accounts of the United States, reflecting the outstanding volume of securitized and conventional loans, with bank-level data reflecting the weight of bank-level loan portfolio. To our best knowledge, no prior studies have analyzed the impact of this indicator on bank capital. From our point of view, it is interesting to show how the level of securitization affects bank capital structure.

In a similar vein, no empirical studies have intended to test whether banking competition could be a channel through which securitization possibly affects bank capital structure. Some theoretical models (Ahn and Breton, 2014; Frankel and Jin, 2015; Li and Sun, 2011) emphasize the relationship between competition and securitization, but do not link such an interaction with bank capital. Through our study, we show that generally when competition is interacted with securitization, the bank capital structure will slightly improve, although the individual separated effect of both variables is negatively influencing competition. This is a very interesting contribution, in the sense that securitization does not improve capital structure unless it is realized in a competitive banking market.

Further, deeper investigations lead us to extend these findings by analyzing the consequences of securitization and competition for various levels of capitalized banks. Surprisingly, highly-capitalized banks benefit from an increase in their conventional and regulatory capital ratios when they highly securitize loans in a less competitive banking market. In contrast, less-capitalized banks suffer from a reduction in their equity and regulatory capital ratios if they

[1] Berger et al. (2017) develop possible channels through which deregulation affects bank capital structure. We adopt a similar approach but to explain competition, as measured by the Lerner index, and not by deregulation indices as in Berger et al. (2017).

[2] Jiangli and Pritsker (2008) use data from bank holding companies to analyze the securitization-capital nexus for the pre-crisis period.

securitize loans in such banking market. We thus provide new determinants for various levels of US capital structure.

Another concern in the literature emphasizes the possible endogeneity bias between banking competition and capital. We take into account this problem by conducting an instrumental variable regression with the lagged Lerner index by one period and the corporate income tax rate as possible instruments. Endogeneity tests, over-identification tests, and first stage tests show that our instruments are valid and may effectively be employed in the instrumental variable regression. We also address possible endogeneity between securitization and capital by running a fixed-effect model that includes bank-, year-, and state-fixed effects.

Most importantly, we better understand our main findings by implementing a quantile regression, introduced by Koenker and Bassett (1978), that focuses on the extreme levels of dependent variables rather than the means as proposed by the ordinary-least-square regressions. Specifically, this technique more effectively takes into account the influence of outliers compared to the latter. To our best knowledge, our paper is the first to use such estimation method when assessing securitization's effect on capital. Accordingly, we contribute to the literature by proposing this key methodological contribution.

According to Berger et al. (2017), there is also a gap in the literature regarding how competition impacts capital structure. Following their approach, our paper is the first to apply some of the channels proposed by these authors to provide explanations for the competition-capital nexus. More precisely, the channels that reflect bank-level characteristics are contradictory: On the one hand, we propose three channels (lower cost of capital, lower risk, lower size) explaining the positive impact of competition on bank capital which is the first hypothesis. On the other hand, the totally opposite sign of each of these three channels explain the negative impact of competition on bank capital, which is the second hypothesis.

Lastly, several policy implications for regulators emerge from this paper. Importantly, the impact of competition and securitization should not be seen separately on bank capital. To be more specific, regulations limiting bank competition are exclusively beneficial for highly-capitalized banks that securitize more of their loans. For instance, following our results, less-capitalized

banks that securitize loans in a competitive market are more likely to increase their capital holdings and hence their probability of enduring stability after a crisis. Hence, restricting competition by regulators is expected to mitigate this positive link between securitization and capital.

Our paper is organized as follows. Section 2 presents the literature review for competition-capital, securitization-capital, and takes into account the very few theoretical models relating competition to securitization. Section 3 presents the data, the variables and the three models used. Section 4 reports the empirical results of the various methodologies. Section 5 concludes.

2. Literature Review and Hypotheses Development

2.1. LITERATURE ON COMPETITION - CAPITAL STRUCTURE

Our paper is closely related to the theoretical models as well as the previous empirical studies that aim at analyzing the relationship between banking competition and capital.

Chen (2016) develops a theoretical model linking bank competition to capital structure. In this model, banks operating under competitive markets tend to hold less capital than their peers in concentrated markets. This is explained by the fact that competition makes it hard for banks to gain a bargaining power in front of their borrowers, which leads to a decrease in profits from capital. Beside market power, they show that deposit insurance also increases bank capital ratio. As a policy implication, Chen (2016) encourages regulators to establish less capital requirements when banks operate in a competitive market.

Keeley (1990) explains the reasons behind the fall of bank capital ratios by showing how a decrease in bank market power as measured by the market-to-book ratio has driven banks to decrease their capital ratios. More precisely, his theoretical model posits that any variation in bank capital ratio would be significantly influenced by variations in the level of market power.

Hanson et al. (2011) study the impact of US bank deregulation on leverage ratio and show a positive sign of intrastate branching and interstate banking, thus confirming the *compression*

effect which predicts that bank capital falls when deregulation occurs. To be specific, banks performing in a competitive environment are more likely to hold more capital.

Mehran and Thakor (2011) empirically show that bank capital and bank value increase when competition decreases and provide empirical evidence to their theoretical model predicting a positive correlation between total bank value and capital ratios.

Allen et al. (2011) focus on the importance of asset side when analyzing market discipline by developing a theoretical model where banks face the moral hazard because of screening and monitoring costs. In addition, they show that banks increase their capital in a response to the competitive pressure, especially when deposit insurance exists in the market. They also argue that capitalization is more pronounced for banks which are more engaged in lending based on monitoring borrowers.

Analyzing the impact of competition on stability for 8,235 banks in 23 countries, Berger et al. (2009) empirically argue that higher market power increases bank equity capital ratio, hence suggesting a significant and negative relationship between competition and capital. In other words, bank capital ratio is higher for all banks enjoying a higher concentration level in their markets.

Schaeck and Cihak (2010) analyze the impact of banking competition on capital ratio for a sample of 2600 banks in 10 European countries and show that higher competition implies higher capital holding by these banks as a buffer to avoid default. More broadly, they provide evidence to the competition-stability nexus in the sense that competition increases bank capital, an important aspect of bank soundness. According to these findings, competition restrictions are thus ineffective since any decrease in competition could reduce bank capital holding and hence mitigate the positive effect of competition on bank stability.

Berger et al. (2017) test how changes in competition influence bank capital ratio for a sample of US banks over the period 1986-2014. As a result, they find that competition, as measured by deregulation, increases bank capital ratios. More precisely, after the introduction of the Riegle-Neal Act of 1994, the analysis shows how capital ratios have increased by around 3.2% in the less restricted states compared to the most restricted states.

The channels through which banking competition may affect capital ratios must be included in our analysis. For instance, Berger et al. (2017) have shown the existence of four channels justifying a positive link between competition and capital ratio such as lower cost of capital from external and internal sources, higher charter value, expanded growth opportunities, and higher shareholder-creditor agency problem. On the other hand, competition could also reduce capital ratio through higher cost of capital, lower charter value, too-big-to-fail channel, and shareholder-manager agency problem.

To summarize, we follow Berger et al. (2017) and build two contradictory hypotheses.

H1. Positive impact of competition on bank capital:

For this hypothesis, one could argue that three channels exist to explain the positive sign between competition and capital structure: a high degree of profitability, a low degree of risk, and a small bank size. More precisely, we explain each of these channels through some theoretical assumptions and previous empirical studies.

H1.a Lower cost of capital channel: Many studies have emphasized the importance of competition and its impact on bank specific characteristics. More specifically, Chong (1991) studies the effect of interstate deregulation on bank profitability and shows a positive impact between these two concepts. We expect that higher competition combined with higher profitability would increase bank capital. This assumption is empirically confirmed by Hortlund (2005) who provides an evidence of a positive "long-term" relationship between leverage and profitability for the Swedish commercial banks over the period 1870-2001, by Berger (1995) who analyzes the evolution of US banking industry from 1979 to 1994; and by the pecking order theory of Myers and Majluf (1984) arguing that there is an inverse relation between profitability and debt, in the sense that firms prefer internal funds (equity) compared to external funds (debt). Moreover, Berger and Mester (1997) analyze the efficiency of 6000 US commercial banks over the period 1990-1995 and find that greater efficient scales are positively related to bank profitability. To conclude with this channel, we posit that higher profitability facilitates bank access to internal funding and thus increases their capital ratios.

This channel is confirmed by a positive (negative) sign of the interaction between competition (concentration) and profitability on capital: Highly profitable banks performing under competitive pressure are more likely to increase their capital.

H1.b **Lower Risk Channel:** Berger et al. (2017) argue that higher competition could lead to a higher charter value. As a result, banks usually protect this value from higher risk by increasing their equity capital. The charter value may thus be considered as a channel through which banks increase their capital. In addition, the importance of this charter value stems from the fact that there is a significant probability of increased efficiency, leading banks to increase their profits and reduce their risk in order to be safer in the market.
This channel is supported by a negative (positive) sign of the interaction between competition (concentration) and size on capital: Less risky banks in competitive markets register an increase in their capital.

H1.c **Lower Size:** According to Berger and Mester (1997), large banks are more cost efficient, but they face some difficulties in terms of providing revenue efficiencies. Their empirical results are consistent with the theory pointing to common wisdom that small banks are usually more profitable as measured by profitability ratios. Hence, one would expect that smaller banks are more likely to rely on internal funding such as capital to provide funding for their activities.

This channel is confirmed if we find a negative (positive) sign of the interaction term between competition (concentration) and size: Smaller banks performing in more competitive markets are more likely to increase their capital.

H2 **Negative impact of competition on bank capital:**

For this hypothesis, one could argue that at least three channels exist to explain the negative sign between competition and capital structure: a low degree of profitability, a high degree of risk, and a higher bank size. More precisely, we explain each of these channels through some theoretical assumptions and previous empirical studies.

H2.a **Higher cost of capital channel:** Following this channel, competition may paradoxically reduce the capital ratios. More precisely, the "*Structure Conduct Performance*" hypothesis posits

that banks performing in a competitive market are more eager to make efforts so that they can increase their profits. To do so, they propose products and services in the market at a low price (Bain, 1959), and hence they will face a more important cost of capital. Therefore, one would expect that their incentives to increase capital will be reduced when competition is high enough to let them neglect the higher cost of capital.

This channel is confirmed if we find a negative (positive) sign of the interaction between competition (concentration) and profitability on bank capital: Less profitable banks in competitive markets face a reduction in their capital. In other words, less profitable banks in concentrated markets experience an increase in their capital.

H2.b **Higher risk channel:** On the other hand, higher competition may increase bank risk, as the "competition-fragility" hypothesis shows through many empirical studies. A high level of risk makes it difficult for banks to increase their capital in the sense that it may mitigate the investors' willingness to invest in banks facing such a reduction in soundness.

This channel is confirmed if we find a positive (negative) sign of the interaction between competition (concentration) and profitability on bank capital: The riskiest banks in competitive markets face a reduction in their capital. In other words, the riskiest banks in concentrated markets are more likely to experience an increase in their capital.

H2.c **Higher Size:** Kaufman (2013) defines the Too-Big-To-Fail firms as entities benefiting from government support when they face bankruptcies. Hence, we may posit that larger banks find it more costly to raise capital especially when they need an additional government support. In other words, competition helps banks to expand their market shares, in the sense that they are able to grow and become TBTF. Hence, according to moral hazard hypothesis, they have higher incentives to engage in riskier activities, including a motivation to reduce their capital.

This channel is confirmed if we find a negative (positive) impact of the interaction between size and competition (concentration) on bank capital: Larger banks in competitive markets are less likely to increase their capital. In other words, higher size combined with higher concentration increases capital ratio.

To summarize this large literature review, panel A of table 3.1 provides a detailed literature review including the studies showing support for H1 or H2.

[INSERT TABLE 1 AROUND HERE]

2.2. LITERATURE ON SECURITIZATION-CAPITAL STRUCTURE

This paper is also closely related to the literature on securitization-capital. Although ours is the first to study this nexus in US banks for a period including the post-crisis[3], we try to link our results with those of previous studies in other countries than US.

Scopelliti (2016) tests how changes in securitization help European banks to manage their capital holdings between 1999 and 2010, hence considering the pre-crisis and the crisis period. More globally, the relevant theory suggests that banks securitize their assets before the crises in order to remove credit risk off their balance sheets, and then to increase their profits from selling such assets during the crisis in the sense that they increase their liquidity. Scopelliti (2016) shows that securitization increases risk-weighted capital ratios and does not affect significantly the leverage ratio. Also, the theoretical assumptions would suggest that banks improve their risk-based capital ratio once they transfer credit risk from their balance sheets to the special purpose vehicle. However, banks retaining risk are less likely to experience a change in their solvency level.

During the crisis, the period where banks usually retain their asset-backed securities, Scopelliti (2016) empirically shows that a higher incentive to securitize loans by the European banks leads to a larger increase in their risk-weighted capital ratio. This is also applied for the banks having less exposure to liquidity funding. In other words, banks that are securitizing their assets and having a lower liquidity are more likely to benefit from regulatory arbitrage advantages by regulators compared to the most liquid banks.

Scopelliti (2016) focuses on the collateral framework of the Euro system in an attempt to analyze the retention of asset-backed securities in Europe during the crisis period (2007-2010). Moreover, liquidity needs could justify this fact, since banks that are interested in receiving

[3] Jiangli and Pritsker (2008) analyze the impact of securitization on several US bank holding companies characteristics including leverage and show that securitization is positively related to leverage ratio.

liquidity from central banks are more eager to retain a higher portion of asset-backed securities in their balance sheets compared to the most liquid banks. In a similar vein, Loutskina (2011) and Almazan et al. (2015) emphasize the importance of liquidity as a determinant factor behind securitization activities. To be more specific, banks that are facing difficulties in terms of liquidity funding have a significant probability of securitizing their loans in order to provide more funding for their activities. The report on asset securitization incentives by the BIS (2011), as well as the International Monetary Fund (2009) show that securitization is considered to a large extent as an alternative funding source for banks. For instance, during the pre-crisis period, the asset-backed securities and covered bonds funded between 20 and 60 per cent of the residential mortgage loans in the United States. In addition, in the end of 2009, almost 19% of real estate and consumer credit loans were funded by mortgage- backed securities. Cerrato et al. (2012) analyze the incentives behind securitization in UK banks and argue that liquidity is a major concern driving banks to securitize. Leland (2007) focuses on banks' strategies to securitize loans as an incentive to provide additional funding. More precisely, the liquid capital of banks will increase as a result of selling the loan portfolio to the special purpose vehicle. Loutskina (2011) shows that securitization is positively related to bank lending capacity and negatively related to bank dependence on traditional sources of funding, as the payments received due to securitization may be used to finance new projects. Almazan et al. (2013) analyze the relationship between securitization and capital structure for the Spanish banks between 1988 and 2016. According to this study, Spanish banks depend on securitization as a central source of funding, thus altering the liabilities structure. These statistics and findings show that securitization is indeed a new and important source of funding for banks.

We focus on this literature because it is essential to find a channel through which securitization influences capital ratio. For example, Scopelliti (2016) emphasizes the importance of liquidity constraints through the classification of securitization by asset type and by credit rating in European banks and shows that these issuances lead to an increase in bank risk-based capital ratio. In other words, banks are more likely to experience an increase in their capital ratio while securitizing their assets and this is particularly motivated by the liquidity funding motivation.

This paper is also related to the literature studying the relation between guarantees to the special purpose vehicle and capital ratio. In this context, Uhde and Michalak (2010) argue that the leverage ratio increases after banks' engagement in securitization, as they use liquid capital to improve their capital structure. Almazan et al. (2013) do not find a significant impact of securitization on banks' incentives to increase their capital ratio. In other words, they neglect the theory predicting an important role of securitization as a risk management tool. In a similar perspective, Casu et al. (2011) show, on a sample of US bank holding companies from 2001 to 2007, that securitization is more to be considered as a financing technique rather than a risk transfer tool. Acharya et al. (2013) argue that banks securitized their assets and used the special purpose vehicles, known as conduits, to reduce regulatory capital arbitrage and not to transfer their credit risk. More specifically, before the crisis, banks provided high guarantees to the special purpose vehicles, and hence suffered from the crisis as they were obliged to pay off the maturity of guarantees to the special purpose vehicles. Moreover, banks enjoying a low level of economic capital were more frequently issuing guarantees compared to other banks, as shown by the negative relation between the guarantees and the Tier-1 regulatory capital to risk-weighted assets.

Following these theoretical and empirical models, we build the two following hypotheses which are eventually contradictory:

H3. Positive impact of securitization on bank capital

H4. Negative impact of securitization on bank capital

More precisely, panel B of table 3.1 provides a detailed literature review regarding each hypothesis.

2.3. LITERATURE ON "Competition & Securitization" – Capital

After presenting the literature in details, we intend to see if competition may be considered as a channel through which securitization affects bank capital. To our best knowledge, our paper is the first to empirically evaluate such a channel. The rationale behind this assumption is linked to some previous empirical studies which analyze the impact of competition on risk through the

channel of capital. For instance, Marques-Ibanez et al. (2014) show that the effect of capitalization is important while analyzing the impact of competition on bank risk. In a similar perspective, if competition decreases bank risk, banks respond to such a reduction by increasing their leverage in order to take on new risks and hence to increase their profits.

We thus develop two contradictory channels that may explain the impact of securitization on bank capital.

H5. **Higher competition channel:** Banks performing in competitive markets and securitizing their loans to a large extent are more likely to enjoy a reduction in risk-taking and hence suffer from a decrease in their profits. Therefore, given that banks are indeed searching for profits, they will eventually increase their capital[4].

We thus expect that higher competition combined with higher securitization will increase leverage. In other words, higher concentration with higher securitization will decrease leverage.

This explains why we assign "higher competition" title to this hypothesis, in the sense that higher competition will improve the impact of securitization on bank capital.

H6. **Lower competition channel:** Another strand of literature shows a contradictory assumption. More specifically, Ahn and Breton (2014) argue that, under competitive conditions, banks that are securitizing their loans register an increase in their profits, since they allegedly have riskier loan portfolios in the sense that they have fewer incentives to screen and monitor their borrowers.

As a result, we expect that higher competition combined with higher securitization will decrease leverage. Put differently, higher concentration combined with higher securitization will increase leverage.

Thus, this hypothesis labeled "lower competition" points to a softening effect of competition on the securitization-capital nexus.

[4] See, for instance, Marques-Ibanez et al. (2014), Keys et al. (2010), Njiskens and Wagner, 2011)

3. Data, Variables, and Methodology

3.1. Data Sources and Sample

We collect individual bank year-end data from the Call Reports of Conditions and Income of the Federal Reserve System from 2000 to 2013. We drop missing and negative values on gross total loans, total assets, input and output variables that are necessary to compute our variables of interest. All variables are truncated at the top and bottom percentiles to control for outliers. As for the securitization variables, we collect data from the Flow of Funds Accounts of the United States. Also, the macroeconomic variables are collected from the US census bureau and the US bureau of labor statistics. Our final sample consists of 92,180 bank year-end observations from 9,660 US commercial banks.

3.2. Variables

3.2.1. Banking Competition variables: Conventional and Adjusted Lerner index

To measure bank competition, we follow recent literature [Beck et al. (2013), Turk-Ariss (2010), Berger et al.(2009), Anginer et al. (2014), Koetter et al. (2012), Kick et al. (2015), Delis et al. (2016), Delis (2012), Beck et al. (2006), Casu and Girardone (2009), Duygun et al. (2013), Schaeck and Cihak (2014)] by employing the Lerner index which captures the market power of the banking industry.

More precisely, we use two types of Lerner index: the conventional and the efficiency-adjusted Lerner index. To do so, we estimate marginal costs using two distinct approaches[5]. The marginal costs are estimated through two econometric models: OLS regression and Stochastic Frontier Approach technique.

The conventional Lerner index is computed by including the marginal costs computed through OLS model, while those generated through SFA analysis are used to compute efficiency-adjusted Lerner index.

$$Conventional\ Lerner = \frac{p - MC_{OLS}}{p}$$

$$Adjusted\ Lerner = \frac{p - MC_{SFA}}{p}$$

Where

p is the ratio of the total operating income to total assets,

MC_{OLS} reflects the marginal costs computed through OLS regression,

MC_{SFA} denotes the marginal costs computed through SFA technic,

Adjusted Lerner is the Efficiency-adjusted Lerner index,

Conventional Lerner is the Conventional Lerner index.

Particularly, the adjusted Lerner index is different from the conventional Lerner index in terms of computation techniques. In fact, marginal costs take into account the relationship between competition and efficiency to compute the former, while the latter is obtained through an ordinary-least square regression that neglects the inter-relatedness between competition and efficiency.

3.2.2. Securitization Variables

We compute securitization variable as the index of a bank's potential to securitize its loans following Loutskina (2011). More specifically, we divide loans into six categories: home mortgages, multi-family residential mortgages, commercial mortgages, consumer credit, commercial and industrial loans, and farm mortgages. The sum of all these loans generates the securitization ratio. Further, we have two origins for this index: Market-level data from the Flow of Funds Account of the United States, reflecting time variation since the economy-wide data varies over time; and bank level-data from the Call Reports of Conditions and Incomes reflecting variation across every bank, since the individual bank data varies from one bank to another. To summarize, this index reflects the incentives of bank i to securitize its loans[6].

$$Securitization\ of\ loan_i = \frac{Economy-wide\ securitized\ loans\ of\ type\ i}{Economy-wide\ total\ outstanding\ loans\ of\ type\ \ i} \times \frac{Bank-level\ conventional\ loans\ of\ type\ i}{Bank-level\ Total\ loans}$$

As we can see from this equation, the ratio includes two components: On the one hand, the first one is labeled Economy-wide component which is the ratio of economy-wide securitized loans over economy-wide total outstanding loans. On the other hand, the second one reflects bank-level component which is the ratio of total conventional loans of a given type divided by total overall loans of bank j at time t.

A higher level of securitization ratio reflects a higher potential of bank i to securitize its loans. Hence, H3 hypothesis - *positive impact of securitization on bank capital* – is confirmed if this ratio has a positive coefficient, whereas H4 hypothesis – *negative impact of securitization on bank capital* – finds its way when the coefficient of securitization ratio is negative.

Now figure 1 shows the evolution of the denominator of the first component of securitization ratio: The economy-wide total outstanding loans over 2000-2013 collected from the Flow of Funds Accounts of the United States.

[INSERT FIGURE 1 AROUND HERE]

From figure 1, we can see that home mortgages are largely dominating in the US. For instance, these mortgages were hugely increasing before sharply falling from 2007. This is closely in line with the statistics of Justiniano et al. (2015). Precisely, these authors also use the Flow of Funds Accounts of the United States to analyze the home-mortgages debt in the US. Consequently, they show that this kind of mortgages "*skyrocketed"* between 2000 and 2007 before falling. Additionally, Justiniano et al. (2015) argue that home-mortgages debt counts for around 70% of total household liabilities. Hence, this explains why home mortgages in our statistics are significantly higher than other types of outstanding loans. For instance, home mortgages outstanding were around $5,220 billion by the end of 2000, and increased to attend $11,100

billion by the end 2008 when the crisis was extremely hitting the United States and the rest of the world.

Further, we now focus on the numerator of the first component of securitization ratio: The total economy-wide securitized mortgages collected from the Flow of Funds Accounts of the United States between 2000 and 2013. This is reported in figure 2.

[INSERT FIGURE 2 AROUND HERE]

From figure 2, we find that home mortgages securitized, consumer mortgages, commercial mortgages, multi-family residential mortgages securitized, commercial and industrial loans securitized and farm mortgages securitized are characterized by an increased volume, respectively, from 2000 to 2009. This is hugely in line with the descriptive statistics of Loutskina (2011) that show the exact same order of securitization volume for each type of loan. Precisely, a huge expansion of securitization has characterized the US overall economy. For example, home mortgages securitized were $2,810 billion by the end of 2000 and reached $6,850 billion by the end of the recent financial crisis of 2009, hence registering a 144% increase in nine years. During 2009 also, the total securitized volume reached $54,389 billion of commercial and industrial loans, $4 billion of farm mortgages, $572 billion of consumer credit mortgages, $570 billion of commercial mortgages, and $217 billion of multifamily residential mortgages. After 2009, all these mortgages declined, especially following the introduction of Dodd-Frank Act of 2010 that limited the expansion of securitization activities.

3.2.3. Bank Capital Structure Variables

Our main capital measures include the commonly known Equity Ratio, equity capital divided by total assets. This measure has been widely used in the literature (Schaeck and Cihak, 2010; Berger et al., 2009; Berger et al., 2017). It reflects banks' incentives to generate funds through raising equity.

$$Equity\ ratio_{jt} = \frac{Total\ Equity\ of\ bank\ j\ at\ time\ t}{Total\ Assets\ of\ bank\ j\ at\ time\ t}$$

Additionally, we use the leverage ratio, computed as the Tier-1 Capital ratio divided by total assets to gauge the importance of Tier-1 as a numerator. Also, this ratio finds itself through some empirical papers (Berger et al., 2017; Baker et al, 2015; Casu et al., 2014).

$$Leverage_{jt} = \frac{Tier-1\ Capital\ of\ bank\ j\ at\ time\ t}{Total\ Assets\ of\ bank\ j\ at\ time\ t}$$

Finally, Basel III and Dodd-Franck Act of 2010 emphasize the importance of risk-weighted assets when analyzing the capital structure of banks. To this end, we employ the critical Tier-1 Capital ratio divided by the risk-weighted assets. We refer to Berger and Bouwman (2013) who use this ratio as a measure of bank capital in an attempt to analyze the impact of the latter on bank performance during the crisis, and to Baker et al. (2015) who study the relationship between the cost of capital and capital ratios of US banks in the context of the "low risk anomaly hypothesis".

$$Tier-1\ risk-based\ Capital_{jt} = \frac{Tier-1\ Capital\ of\ bank\ j\ at\ time\ t}{Risk-weighted\ Assets\ of\ bank\ j\ at\ time\ t}$$

Figure 3 shows the evolution of each of these three ratios over time.

[INSERT FIGURE 3AROUND HERE]

As we can see from figure 3, the equity ratio and the leverage ratio are relatively following a constant slope between 2000 and 2013, with a slight increase after 2008. Further, the Tier-1 risk-based capital ratio sharply increased during this period, consistently with the findings of Lambertini and Mukherjee (2016). Accordingly, this could be explained by the introduction of the Capital Purchase Program (CPP) providing banks with more capital after the crisis so that they generate new loans and hence improve the overall economy that was hugely impacted by the crisis. Specifically, the US Treasury Office of Financial Stability founded this program as a part of the Troubled Assets Relief Program (TARP) which was created in the context of the Emergency Economic Stabilization Act of 2008 that aims at limiting US bank risk. Hence, under this new regulation, banks had more incentives to increase their capital in order to repay the equity injections offered to them by the US treasury. The latter also restricted banks from

offering dividends and compensations and limited the accumulation of dividends toward 5% for five years that follow investment activities.

3.2.4. Control Variables

We include a set of variables that control for bank-specific characteristics as well as overall macro-economic conditions to test the competition-securitization-capital nexus.

We first describe the six bank-level control variables that we use in this paper. Firstly, following, Berger et al. (2017) and Schaeck and Cihak (2010), we control for ***Bank Size***. Precisely, we expect that larger banks are less likely to hold higher capital (Ayuso et al., 2004) because they are more diversified so they benefit from diversification (Demsetz and Strahan, 1997), and hence they are more able to acquire funds through short-term equity funding (Berger et al., 2017). Secondly, we control for bank profitability through the return-on-assets ***ROA*** (Scopelliti, 2016). We expect that more profitable banks are less likely to hold more capital because higher profitability is in line with a reduction of funding costs (Berger et al., 2017). Thirdly, we control for bank risk, as included by Berger et al. (2017), Shaeck and Cihak (2010), Koetter et al. (2012) and Scopelliti (2016). We measure bank risk by the non-performing loans ratio ***NPL***, by expecting that riskier banks are more likely to be characterized by low capital buffers. Fourthly, we control for bank ***Non-Interest Income*** to control for bank profits generated through non-lending activities (Scopelliti, 2016). Fifthly, we take into account another measure of income, which is the interest income from federal funds under repurchase agreements (***REPO***). Sixthly, we control for the ***Liquidity*** as it might affect the competition-capital nexus.

Additionally, we take into account possible macro-economic control variables. So we include the ***GDP change*** to account for the macro-economic evolutions that might induce an increase in capital (Schaeck and Cihak, 2010, Laeven and Majoni, 2003). We also include the ***Gini*** coefficient for income inequality to control for the growth of income (Beck et al., 2010), the ***unemployment rate*** to mitigate the effect of unemployment on the competition-capital nexus, and the ***house price index*** which has been shown by Pan and Wang (2017) as a significant determinant of bank instability.

3.3. Empirical Methodology

3.3.1. Competition – Capital Structure Model

We model bank capital ratios as a function of bank competition and several bank-level and macro-economic control variables.

$$Capital\ it = \alpha_j + \beta_1\ Competition_{it} + \beta_2\ Bank - Control_{it} + \beta_3 Macro - economic_{it} + \varepsilon_{it} \quad (1)$$

Where

Capital $_{it}$ is either the equity ratio, the leverage ratio, or the Tier 1 Capital ratio,

Competition $_{it}$ is the Efficiency-adjusted Lerner index, or the conventional Lerner index,

Bank-Control $_{it}$ is a vector of bank-specific control variables including: Bank size (log of total assets), non-performing loans ratio, interest income on repurchase agreements (REPO), liquidity ratio, return on assets,

Macro-Economic $_{it}$ is a vector of macro-economic control variables including: GDP change, Gini coefficient of income inequality, house price index, and unemployment rate, and

ε_{it} is the error term.

Dealing with the relationship between capital ratio and competition requires taking into account possible endogeneity bias between Lerner index and different capital measures. For instance, Schaeck and Cihak (2010) argue that endogeneity could exist between bank market share and capital, in the sense that the most capitalized banks may have an incentive to increase their market share by expanding their branches or by merging with other banks. Nevertheless, a negative association could also exist between concentration and capital, as pointed by Demsetz and Strahan (1997) and Flannery and Rangan (2004) who show that bank size is negatively associated with capital levels, since huge banks are able to access different sources of funding, so they are less likely to rely on capital as a source of funding.

To address all these concerns, we adopt a two-stage SLS instrumental variable technique, with lagged Lerner index by one period and corporate tax rate as possible instruments that are not endogenous with capital ratio. We expect that these instruments are valid enough to address the

endogeneity problems between capital and competition, and to provide robust evidence in this nexus.

To further analyze the competition-capital, we focus more on the channels that affect this relationship, which we model through the following equation:

$$Capital\ it = \alpha_j + \beta_1\ Competition_{it-1} + \beta_2\, Competition_{it-1}\ \times Risk_{it} + \beta_3\, Competition_{it-1}\ \times Profitability_{it} + \beta_4\, Competition_{it-1}\ \times Size_{it} + \beta_5\, Bank - Control_{it} + \beta_6 Macro - economic_{it} + STATE_{it} + TIME_{it} + \varepsilon_{it} \quad (2)$$

Where

Capital $_{it}$ is either the equity ratio, the leverage ratio, or the Tier 1 Capital ratio,

Competition $_{it-1}$ is the Efficiency-adjusted Lerner index, or the conventional Lerner index, both are lagged by one period,

$Competition_{it-1}\ \times Risk_{it}$ is the interaction term between the lagged Lerner and the NPL ratio,

$Competition_{it-1}\ \times Profitability_{it}$ is the interaction term between lagged Lerner and ROA,

$Competition_{it-1}\ \times Size_{it}$ is the interaction term between the lagged Lerner and the logarithm of total assets,

Bank-Control $_{it}$ and *Macro-Economic* $_{it}$ include same variables as in equation 1,

$STATE_{it}$ represents a vector of state dummies, and

$TIME_{it}$ is a vector of year dummies.

This second equation involves running a fixed-effect model where we include interaction terms between Lerner and bank characteristics, as shown in the previous hypotheses, which may provide further explanation to the impact of competition on bank capital. Our model includes state, bank, and time fixed effects.

3.3.2. Securitization – Capital Structure Model

As we already mentioned, we are interested in assessing whether higher securitization potentials increase bank capital ratio. To this end, we follow Scopelliti (2016) and adopt a similar approach:

$$Capital\ it = \alpha_j + \beta_1\ SECURITIZATION_{it-1} + \beta_2\ SECURITIZATION_{it-1} \times CRISIS_{it} + \beta_3\ Bank - Control_{it} + \beta_4\ Macro - economic_{it} + STATE_{it} + TIME_{it} + \varepsilon_{it} \quad (3)$$

Where

Capital $_{it}$ is either the equity ratio, the leverage ratio, or the Tier-1 risk-based capital ratio,

SECURITIZATION $_{it-1}$ is the lagged securitization index as Loutskina (2011) which equals the sum of all types of securitized loans,

$CRISIS_{it}$ is a dummy variable equal to one if the sample is between 2007 and 2009 and 0 otherwise,

Bank-Control $_{it}$ is a vector of bank-specific control variables including: Bank size (log of total assets), non-performing loans ratio, non-interest income share, return on assets,

Macro-Economic $_{it}$ is a vector of macro-economic control variables including: GDP change, Gini coefficient of income inequality, house price index, and unemployment rate,

$STATE_{it}$ represents a vector of state dummies, and

$TIME_{it}$ is a vector of year dummies.

The equation 3 consists of a fixed-effect model where we include some fixed effects. Importantly, following Berger et al. (2017), we include bank fixed effects to control for time-invariant differences that might not be captured between banks and year fixed effects to take into account possible time-changes in terms of macro-economic and regulatory environment evolution. Further, we follow Casu et al. (2014) by including state fixed effects to control for state specific characteristics that might influence banks.

Addionally, we focus on each type of securitized loans when analyzing the impact of their issuance on bank capital and comparing the classification between each type of securitized loan. To be specific, we follow a similar approach by Scopelliti (2006) and run the following regression.

$$Capital\ it = \alpha_j + \beta_1\ Home_{it-1} + \beta_2\ Home_{it-1} \times CRISIS_{it} + \beta_3\ Multi - family_{it-1} + \beta_4\ Multi_{it-1} \times CRISIS_{it} + \beta_5\ CandI_{it-1} + \beta_6\ CandI_{it-1} \times CRISIS_{it} + \beta_7\ Farm_{it-1} + \beta_8\ Farm_{it-1} \times CRISIS_{it} + \beta_9\ Consumer_{it-1} + \beta_{10}\ Consumer_{it-1} \times CRISIS_{it} + \beta_{11} Commercial_{it-1} +$$

$$\beta_{12}\ Commercial_{it-1} \times CRISIS_{it} + \beta_{13} BANK - CONTROL_{it} + \beta_{14} Macro - economic_{it} + STATE_{it} + TIME_{it} + \varepsilon_{it} \quad (4)$$

Where

Capital $_{it}$ *is* either the equity ratio, the leverage ratio, or the Tier 1 Capital ratio,

$CRISIS_{it}$ is a dummy variable equal to one if the sample is between 2007 and 2009 and 0 otherwise,

Home $_{it-1}$ is the lagged ratio of home mortgages securitized,

Multi-family $_{it-1}$ is the lagged ratio of multi-family mortgages securitized,

Commercial-and-industrial $_{it-1}$ is the lagged ratio of commercial and industrial loans securitized,

Farm $_{it-1}$ is the lagged ratio of farm mortgages securitized,

Consumer $_{it-1}$ is the lagged ratio of consumer mortgages securitized,

Commercial $_{it-1}$ is the lagged ratio of commercial mortgages securitized,

Bank-Control $_{it}$ and *Macro-Economic* $_{it}$ include same variables as in equation 3, and

$STATE_{it}$ and $TIME_{it}$ control for state and year fixed effects.

3.3.3. Securitization & Competition – Capital Structure Model

Can we consider bank competition as a channel through which securitization affect capital ratio? To answer this question, we run the following regression:

$$Capital\ it = \alpha_j + \beta_1\ Competition_{it-1} + \beta_2\, Competition_{it-1} \times SECURITIZATION_{it} + \beta_3\, Bank - Control_{it} + \beta_4 Macro - economic_{it} + STATE_{it} + TIME_{it} + \varepsilon_{it} \quad (3.5)$$

Where

Capital $_{it}$ is either the equity ratio, the leverage ratio, or the Tier 1 risk-based capital ratio,

Competition $_{it-1}$ is the lagged Lerner index,

$Competition_{it-1} \times SECURITIZATION_{it}$ is the interaction term between the lagged Lerner index and the securitization ratio,

Bank-Control $_{it}$ and *Macro-Economic* $_{it}$ include same variables as in equation 3,
$STATE_{it}$ and $TIME_{it}$ control for state and year fixed effects.

We follow the methodology of Koetter et al. (2012) who study the impact of a joint interaction between deregulation and competition on bank efficiency. More precisely, the main motivation behind this fixed-effects model is to see how changes in competition level, combined with the volume of securitized loans, could affect bank capital ratio.

4. Empirical Results

4.1. RESULTS OF Competition – Capital STRUCTURE

4.1.1. Competition – Capital Structure Baseline Model: Main Results

Table 3.2 reports estimated results for equation 3.1 and for testing the hypotheses H1 (Positive impact of competition on capital) and H2 (Negative impact of competition on capital).

[INSERT TABLE 2 AROUND HERE]

Columns 1 and 2 present results using Equity Ratio as dependent variable. The coefficients of the efficiency-adjusted Lerner index (0.109), as well as the conventional Lerner index (0.204), show a positive and statistically significant sign at the 1%. More precisely, a higher conventional or adjusted Lerner index increases bank equity ratio, which means that the higher is the competition level, the lower is bank equity ratio. Columns 3 and 4 report results using Leverage ratio as dependent variable and show positive and significant coefficients at the 1% of both conventional Lerner index (0.131) and adjusted Lerner index (0.130). Columns 5 and 6 include the regressions of Tier 1 Capital ratio as dependent variable. Also, we see positive and significant coefficient at the 1% level of conventional Lerner index (0.215) and adjusted Lerner index (0.205).

Overall, these results confirm the **H2 hypothesis**. More precisely, a higher concentration level (lower competition) increases bank capital ratios, consistently with Berger et al. (2009) who provide similar results for a sample of 8,235 banks in 23 countries. Moreover, our results are the first to provide empirical evidence for the theoretical model of Chen et al. (2016) by arguing that

competition effectively lowers bank bargaining power and thus leads to a reduction in their capital ratios. In a similar vein, according to our results, if market power decreases, bank capital ratio will also decrease, as shown by Keeley (1990). In his theoretical model, he also shows a significant variation between bank market power and capital ratio, which is clearly shown in our results, since all the coefficients of both Lerner index types show a significant impact on equity ratio, leverage ratio, and Tier 1 Capital ratio.

4.1.2. Competition – Capital Structure: Possible Channels

Table 3 shows the results for equation 3.2 in which we combine the competition measures with bank-characteristics determinants of capital ratio to provide further evidence regarding some explanations of the negative sign between competition and capital. These characteristics include: Bank risk measured by the non-performing loans ratio, bank profitability measured by the return-on-assets, and bank size measured by the logarithm of total assets.

[INSERT TABLE 3 AROUND HERE]

Columns 1 and 2 report results for the ER, columns 3 and 4 for Leverage ratio and columns 5 and 6 for Tier-1 risk-based capital ratio as dependent variables. Adjusted Lerner index is included for the regressions in columns 1, 3, and 5, while conventional Lerner index is included in the regressions reported on the columns 2, 4 and 6.

Given that H2 was already confirmed, we would like to check if the three channels (H2.a, H2.b, and H2.c.) of this hypothesis may significantly help explaining the negative relationship between competition and capital. We would thus expect a negative sign of the interaction between Lerner index and ROA (**higher cost of capital channel**), a positive sign between Lerner index and NPL (**higher risk channel**), as well as Lerner index and bank size (**higher size channel**).

Firstly, the coefficients of the interaction between Lerner index and ROA are negative and statistically significant at the 1% level across the entire regressions. Hence, we conclude that the **H2.a hypothesis (higher cost of capital channel)** is confirmed for the US commercial banks. In other words, the most profitable banks in the most concentrated markets (less competitive markets) are less likely to hold higher capital. All else equal, banks that are exposed to higher

competition and that are less profitable cannot get easier access to capital, and face difficulties in getting funding at low costs. As a result, the higher cost of capital channel could explain to a large extent why competition reduces bank capital. These results are consistent with the SCP hypothesis predicting that banks facing higher competition are more likely to experience a higher cost of capital.

Secondly, the interaction term between Lerner index and the NPL is positive and statistically significant at the 1% level in column 2 (0.624), column 4 (0.395), and column 6 (0.336). In addition, the coefficient is positive but not significant in column 3 (0.025), and negative and statistically significant in column 1 (-0.151) and 5 (-0.182). Hence, we provide some support for the hypothesis **H2.b (higher risk channel)** when using the conventional Lerner index as an indicator of bank competition. That is, the riskiest banks that are faced by higher market power register an increase in their capital ratios. This is also related to the "*competition-fragility*" hypothesis, suggesting that higher competition increases bank risk. And to the extent that investors have less incentive to invest in risky banks, we suggest that these banks may be facing difficulties in increasing their capital.

Thirdly, when combining Lerner index with bank size, we find a positive and significant impact in column 1 (0.018), column 3 (0.003) and column 5 (0.002). However, we also find a negative sign in column 2 (-0.019) and column 6 (-0.006). The positive sign is slightly dominant across all the regressions, we can thus argue that the hypothesis **H2.c (higher size channel)** is partially confirmed, especially when competition is measured by the efficiency-adjusted Lerner index. More precisely, larger banks performing in concentrated markets have a more important access to funding than other banks performing in competitive markets. Our results provide some evidence to the moral hazard hypothesis, given that competition does not encourage large banks to increase their capital. These banks have higher incentives to engage in risky activities that are reflected in a certain way by a reduction in capital.

4.2. RESULTS OF Securitization – Capital STRUCTURE

4.2.1. Securitization – Capital Structure Baseline Model: Main Results

Table 3.4 reports the results of equation 3 with the main objective of analyzing the impact of securitization on bank capital.

[INSERT TABLE 4 AROUND HERE]

Column 1 reports results concerning the impact of securitization lagged by one period on equity ratio, column 2 reports the impact of securitization lagged by one period and column 3 shows how securitization affects the regulatory Tier-1 risk-based capital ratio.

The coefficient of securitization on the three independent variables is negative, that is, -0.011 on equity ratio, -0.004 on leverage ratio, and -0.003 on Tier-1 risk-based Capital ratio. Accordingly, banks that are more engaged in securitization activities tend to reduce their capital. Our results thus confirm the **H4 (higher securitization reduces bank capital**). Although the nexus between securitization and capital is rarely treated in the literature, our results are consistent with those of Scopelliti (2016) who shows that the higher is the securitization among European banks, the lower is their leverage ratio (with a decrease in 0.15 points). That is, European banks (as shown by Scopelliti, 2016) and US commercial banks (as shown in our identification strategy) were in fact issuing securitized loans to increase their leverage through reducing their Tier-1 risk-based capital ratio. In addition, our results are closely in line with the findings of Acharya et al. (2013) who provide empirical evidence to the "regulatory arbitrage hypothesis" predicting that banks securitize their assets with a main objective of reducing their regulatory capital instead of transferring risk to outside investors. This is very important in the sense that banks apparently had some incentives in using the special purpose vehicles for regulatory arbitrage, which explains why they retained risks on their balance sheets and hence hugely suffered from the negative effect of the crisis.

In an attempt to provide further evidence for these results, we combine the securitization ratio with the crisis dummy. Results are shown from columns 5 to 7. Specifically, we find that the effect is more negatively pronounced when securitization is interacted with the crisis dummy,

which suggests that the crisis actually had a huge negative effect on the securitization-equity ratio (-0.066 in column 5, on the securitization-leverage ratio (-0.027 in column 6), and on the securitization-tier-1 risk-based capital ratio (-0.049 in column 7). These findings serve as additional support for our *H4. Hypothesis*. That is, generally, securitization induces banks to reduce their capital holdings.

4.2.2. Securitization – Capital Structure: Results of Loan Classifications

To look more deeply into the classification of securitized loans, we run a similar regression but this time we include each type of securitized loans instead of focusing on the securitization ratio as a whole. The rationale behind this specification follows the empirical model of Scopelliti (2016) in the sense that we would like to analyze the changes in capital following the issuance of different types of securitized loans. Table 5 thus reports results of equation 4.

[INSERT TABLE 5 AROUND HERE]

Column 1 reports results concerning the impact of each type of securitized loans on equity ratio, column 2 shows the impact on leverage ratio, while column 3 reports results on Tier 1 Capital ratio.

From table 3.5, we observe that the home mortgages securitized have a negative and statistically significant impact (-0.039) on equity ratio, suggesting that higher securitization of these mortgages is accompanied by a decrease in bank capital. This impact remains negative (-0.022), but also statistically significant at the 1% level, on leverage ratio. Further, home mortgages have a negative impact on capital when the latter is measured as the tier 1 capital over risk-weighted assets (-0.021). As for the multifamily mortgages, the relationship with equity ratio (0.034) and Tier 1 Capital ratio (0.067) is positive and non-significant, whereas it is positive but slightly significant with the leverage ratio (0.059). The commercial and industrial securitized loans have a positive and statistically significant impact on bank capital, with a coefficient of 0.003 on leverage ratio, 0.007 on tier-1 risk-based capital ratio. In a similar vein, the consumer mortgages significantly decrease equity ratio (-0.036), leverage ratio (-0.039) and tier-1 risk-based capital ratio (-0.070. Similarly, farm mortgages have a negative and significant impact on equity ratio, (-

0.856). In contrast, commercial mortgages have a positive and significant impact on leverage ratio (0.065), but a less positive significant impact on Tier-1 risk-based capital (0.044).

Overall, our results suggest that, on the hand, banks issuing commercial and industrial loans, multifamily mortgages and commercial mortgages register an improvement in their leverage capital and their regulatory capital. On the other hand, banks issuing home mortgages, farm mortgages and consumer mortgages experience a reduction in their overall capital ratios. One possible explanation for these results could be related to credit risk transfer versus regulatory capital arbitrage motivations. More precisely, the first package of loans (commercial and industrial mortgages and commercial mortgages) was securitized by the US commercial banks in order to remove credit risk from their balance sheet. In other words, these banks transferred credit risk from the first package of loans, in the sense that the rise in capital ratios is directly proportional to the rise in the volume of the first package loans securitization.

Nevertheless, the US commercial banks seem to securitize the second package of loans (home mortgages, farm mortgages and consumer mortgages) as a result of implicit recourse provided by them to the special purpose vehicles. This specific package of loans yields similar results to the credit card receivables issued by European banks as shown by Scopelliti (2016). In a similar vein, our results are in line with Acharya et al. (2013) regarding the regulatory capital arbitrage hypothesis. To be more specific, banks issuing the second package of loans were intending to retain credit risk on their balance sheets to realize regulatory capital arbitrage.

Further, we interact each of securitized loans with the crisis dummy to see how these different types of securitized loans react to the crisis period. Interestingly, we find a negative and significant impact for the majority of securitized loans. For instance, from column 4, we find that higher securitization of home mortgages, multifamily mortgages, commercial and industrial loans, farm mortgages, consumer mortgages and commercial mortgages significantly reduce equity ratio (-0.072, -0.116, -0.074, -0.780, -0.236, and -0.220, respectively). Additionally, all these packages reduce leverage ratio, except for the multifamily mortgages (0.069 in column 5), and Tier-1 risk-based capital ratio except for the multifamily mortgages (0.124 in column 6).

All in all, our findings are highly supportive for the **H4 (higher securitization reduces bank capital**), especially during the crisis period. That is, securitization seems to be following regulatory capital arbitrage incentives by US commercial banks, in the sense that they realize some gains in terms of reducing capital holdings which are allegedly costly for banks. Our results thus introduce a first step toward showing another feature of securitization that adds to its other characteristics: Bank capital reduction.

4.3. RESULTS OF "Competition & Securitization" – CAPITAL

Could banking competition be considered as a possible channel to explain the impact of securitization on capital? This question is answered in this section. In fact, one of the main contributions of this paper is to show if banking competition could serve as a channel through which securitization affects bank capital. To this end, we run a model in which we include an interaction term between the lagged Lerner index and the securitization ratio. Table 6 reports results for equation 5.

[INSERT TABLE 6 AROUND HERE]

Columns 1 and 4 report the interaction between both types of Lerner index and securitization on equity ratio, columns 2 and 5 report results including the leverage ratio as dependent variable, and columns 3 and 6 include Tier-1 risk-based capital ratio as main dependent variable.

We are interested in assessing the sign of the interaction term between competition and securitization. As we can see, the joint interaction between the lagged conventional Lerner index is positive and statistically significant on the equity ratio (0.089), negative on leverage ratio (-0.025), and negative and statistically significant on Tier-1 risk-based capital ratio (-0.086). As for the interaction between the Lagged adjusted Lerner index and the securitization ratio, we report a negative impact on the three equity ratios (-0.087, -0.013 and -0.011).

By way of interpretation, higher concentrated banks (higher Lerner index) performing higher securitization activities experience a reduction in their capital ratios. All else equal, we may propose that higher competition with higher securitization increase bank capital structure, since competition should be interpreted as the opposite of concentration.

Overall, these results provide empirical support for the H5 hypothesis (higher competition channel), that is, the higher are the concentration and the securitization level by the US commercial banks, the lower is their leverage ratio. More specifically, we have shown through this specification that our results are slightly related to Mian and Sufi (2009), Keys et al. (2010), Nijskens and Wagner (2011), and Marques-Ibanez (2014). In other words, as market power increases, banks engaged in more securitization activities have fewer incentives to increase their capital and leverage ratio.

Although the effect is somehow weakly significant, it is interesting to see that the interaction has changed the positive sign of Lerner index on capital ratio, in the sense that securitization under competition increases capital ratios. The regulatory capital arbitrage seems to be relevant when competition is high but also when competition is accompanied by a significant increase in securitization activities by US commercial banks.

4.4. Results of the Simultaneous Quantile Regression

To test whether heterogeneous responses across capitalized banks to the interaction between banking competition and securitization exist, we run a simultaneous quantile regression with bootstrapping technique. Precisely, Koenker and Basset (1978) develop a theoretical model introducing the quantile regression as an efficient solution replacing the least square regressions. Accordingly, this regression takes into account analyzing the changes in the responses of dependent variable (bank capital) following the changes in one unit of independent variables (competition and securitization). Further, Koenker and Hallock (2001) introduce the objectives of quantile regression which aims at minimizing the optimization problem.

Empirically, the quantile model is described as:

$$Q\left(CAP_{it} \mid Comp_{it-1} \times SEC_{it}\right) = f\left(Competition, Securitization, Competition \,\&\, Securitization, Control\ variables\right)$$

Precisely, we run the following model:

$$Q\left(CAP_{it} \mid Comp_{it-1} \times SEC_{it}\right) = \alpha_j + \beta_1\, Competition_{it-1} + \beta_2\, Competition_{it-1} \times SECURITIZATION_{it} + \beta_3\, Bank - Control_{it} + \beta_4 Macro - economic_{it} + STATE_{it} + TIME_{it} + \varepsilon_{it} \quad \textbf{(6)}$$

Results for this specification are provided in table 7. In this table, four panels take into account various measurements of bank capital.

[INSERT TABLE 7 AROUND HERE]

Let us consider that the highly-capitalized banks are those represented at the 75th quantile, the medium-capitalized banks are represented at the 50th quantile, and the less-capitalized banks are analyzed at the 25th quantile. By way of reminder, we would like to test the influences of competition and securitization on these banks' capital ratio. In other words, securitization combined with competition could possibly have a different impact on less-capitalized bank compared to highly-capitalized bank.

In panel A, we show the results when using the equity ratio as main dependent variable. First, the conventional Lerner index is reported in columns 1 to 3, while the adjusted Lerner index is reported in columns 4 to 6. As we can see, both types have a positive and significant impact at the 1% level on equity ratio, thus providing additional support to the main findings (competition reduces bank capital). Interestingly, securitization ratio is shown to have a negative impact on medium and highly-capitalized banks' equity ratio (-0.024, -0.126, -0.037 and -0.086 in columns 2, 3, 5 and 6, respectively). Apparently, the H4. hypothesis - *Securitization - Lower capital* - is thus more pronounced for medium and largely capitalized banks. Now turning to the interaction between competition and securitization, a positive impact between lagged conventional Lerner index and securitization ratio is reported at the 50th and the 75th quartile (0.044 and 0.203 in columns 2 and 3). Similarly, higher lagged adjusted Lerner index combined with higher securitization ratio increases equity ratio (0.057 and 0.127 in columns 5 and 6, respectively). However, higher lagged conventional Lerner index with higher securitization significantly reduces equity ratio for less-capitalized banks, as shown in column 1 (-0.018).

All in all, these findings show that the H5 hypothesis – *higher competition channel* – is only confirmed for less-capitalized banks. However, we should note that the impact is not statistically significant for the interaction between lagged adjusted Lerner index and securitization ratio (-0.004 in column 4). So the H5 hypothesis appears to be weakly supported for less-capitalized banks. Surprisingly and most importantly, the H6 hypothesis – *lower competition channel* – finds its way through medium-capitalized and highly-capitalized US commercial banks, suggesting the following: When these banks securitize their loans in a more competitive banking market, they are more likely to experience a decrease in their equity ratio.

In panel B, we report the results of leverage ratio as dependent variable. Particularly, similar results are reported for the separated effects of competition (positive) and securitization (negative) on bank capital (leverage ratio). More importantly, the interaction between lagged Lerner index and securitization ratio appears to be positively influencing the leverage ratio across all quantiles. To be more specific, the lagged conventional Lerner index interacted with securitization ratio has a positive and statistically significant impact on leverage ratio for the less-capitalized banks (0.186 in column 7), for medium-capitalized banks (0.090 in column 8), and for highly-capitalized banks (0.222 in column 9). Additionally, higher values of lagged adjusted Lerner index combined with higher values of securitization ratios significantly increase the leverage of less-capitalized banks (0.019 in column 10), medium-capitalized banks (0.085 in column 11), and highly-capitalized banks (0.158 in column 12).

Overall, the H6 hypothesis – *lower competition channel* – is validated for all types of banks when bank capital is measured by the leverage ratio. These results do not significantly differ from our previous findings in the sense that this hypothesis is also confirmed when bank capital is measured by equity ratio.

We now move to analyze the impact of competition and securitization on the two regulatory capital ratios: Tier-1 risk-based capital ratio and total regulatory capital ratio.

Panel C shows the regressions of Tier-1 risk-based capital ratio. From columns 1 and 2, we find that the interaction between lagged conventional Lerner index and securitization ratio is statistically negative for less-capitalized and medium-capitalized banks (-0.179 and -0.143).

More specifically, a bank that is not retaining a huge portion of Tier-1 risk-based capital will be more likely to experience a reduction in this capital if it sells its loans in a concentrated market. From column 4, we find similar findings for less-capitalized banks when we use the adjusted Lerner index as an indicator for bank competition (-0.037). More importantly, highly-capitalized banks that securitize their loans in a less competitive market benefit from an increase in their Tier-1 risk-based capital ratio, as shown in column 6 (0.141).

Overall, the H5 hypothesis – *higher competition channel* – is relevant for less-capitalized and medium-capitalized banks that are characterized by a low Tier-1 risk-based capital. In fact, these banks appear to face a reduction in this ratio if they securitize loans to a large extent when they are enjoying market power. That is, if less- and medium-capitalized banks are located in a less competitive market, their Tier-1 risk based capital ratio inquired by regulatory authorities will be declining, especially if their loans are highly sold to external investors. Our findings for less-capitalized and medium-capitalized banks are consistent with the theories predicting that banks securitizing their loans in a competitive banking market are searching for profits. As a result they will eventually decrease their capital since the latter is costly for banks. Interestingly, the H6 hypothesis – *lower competition channel* – is significantly relevant for highly-capitalized banks that retain a high Tier-1 risk-based capital. In other words, competition combined with securitization mitigates banks' ability to satisfy regulatory authorities in terms of risk-based capital ratios. Therefore, only highly-capitalized banks that are located in a concentrated (less competitive) banking market are likely to increase their Tier-1 risk-based capital ratio. These findings could be explained by the theoretical model of Ahn and Breton (2014) which shows that competitive pressure pushes banks securitizing their loans to increase their profits.

Additionally, we want to make sure that these findings are also robust when using another measure of regulatory capital ratio: The total regulatory capital ratio that includes the Tier-2 capital and that is computed as follows.

$$Total\ Regulatory\ Capital_{jt} = \frac{Tier-1 + Tier-2\ Capital\ of\ bank\ j\ at\ time\ t}{Risk-weighted\ Assets\ of\ bank\ j\ at\ time\ t}$$

Berger and Minnis (forthcoming), Berger et al. (2017), Baker and Wurgler (2015) and Berger and Bouwman (2013) use this ratio in their empirical studies that analyze bank capital. Now we have to see if the previous findings remain unchanged after including this ratio.

Results are shown in panel D of table 3.7. In particular, the H5 hypothesis – *higher competition channel* – holds for less-capitalized banks when using the two Lerner indices (-0.170 and -0.036, respectively). Precisely, the interaction's coefficients are significant at the 1% level, therefore leaving no doubt about supporting the H5 hypothesis for banks that are characterized by a low regulatory capital. Now moving to the other side of banks, we see that higher concentration with higher securitization increases bank regulatory capital. Specifically, from columns 9 and 12, we find that highly-capitalized banks, securitizing their loans in less competitive markets, experience an increase in their total regulatory capital (0.023 and 0.143). Consequently, the H6 hypothesis – *lower competition channel* – finds it way again through highly-capitalized banks but this time using an alternative measure of regulatory capital.

5. Conclusion

Our paper provides several implications for academics, practitioners and regulators. We analyze possible new determinants of capital structure for US commercial banks over 2000-2013, a period that clearly takes into account the recent financial crisis effect. More particularly, we show that competition and securitization should not be treated separately when analyzing capital structure.

We employ a battery of econometric models specified in addressing potential endogeneity between our dependent variables (bank capital ratios), our variables of interest (competition, securitization, interaction between competition and securitization), our bank-level control and our macro-economic control variables. To this end, we use an instrumental variable regression with lagged Lerner index and corporate tax rate as instruments. We also conduct a fixed-effects model with bank-, year-, and state-fixed effects to take into account possible endogeneity problems that may arise while performing tests at the bank-level. Most importantly, we perform a quantile regression to assess the impact of the abovementioned independent variables on different levels of capitalized banks.

Many contributions to the literature are established. Firstly, we revisit the rare literature on competition and capital, to which we add a very important contribution: possible channels explaining this nexus. More specifically, we show that competition (higher Lerner index) reduces (increases) bank capital as measured by three ratios: the total equity to total assets ratio, the Tier-1 Capital to total assets ratio, and the Tier-1 Capital to risk-weight assets ratio. Following Berger et al. (2017), we explain this negative relation by three channels: higher cost of capital, higher size, and higher risk.

Secondly, we test the impact of securitization, as measured by an innovative indicator reflecting both economy-wide and bank-level potential weights of securitization, on bank capital structure. To our best knowledge, our paper is the first to study this impact, especially during and after the crisis, in the context of US commercial banks. We find that securitization generally reduces capital, thus providing empirical evidence to the regulatory capital arbitrage hypothesis, in contrast to the credit-risk transfer hypothesis. In other words, US commercial banks seem to perform securitization activities in an attempt to benefit from arbitrage opportunities.

Thirdly, we study, for the first time, the impact of a joint interaction between competition and securitization on bank capital. This is motivated by the need to explore possible channels providing robust explanations. We show that competition may be considered as a possible channel through which securitization improves capital structure. That is, a new channel is added to the literature to explain the relationship between securitization and capital. In other words, our paper reports that banks performing securitization activities in competitive markets are more likely to improve their capital structure.

Fourthly, and most importantly, deeper investigations offer surprising results. On the one hand, if highly-capitalized US commercial banks are located in a competitive banking market, their equity ratio, leverage ratio and both regulatory capital ratios will experience a decline following an increase in their potential to securitize loans. On the other hand, less-capitalized banks benefit from competitive pressures to increase their capital, especially when they highly securitize their loans. Although no prior studies investigate all these relations, we try to relate our findings to some theoretical models that assess a link between competition, securitization and overall bank profitability.

All in all, our findings yield some important policy implications, in the sense that securitization is beneficial for bank capital and thus for bank survival but only under competitive banking markets and for less-capitalized banks. Thus, regulators are encouraged to take into account the interaction between competition and securitization, in the sense that restricting securitization in competitive states is detrimental for less-capitalized banks' capital structure. Further, given that higher securitization with higher concentration (i.e. less competition) increases highly capitalized banks' capital, regulatory pressure is recommended to move toward encouraging competition for this type of banks. Precisely, we suggest that any modification of the Dodd-Frank Act or any implementation of a future policy accounts for two main factors when assessing securitization's effect on overall economy: The market structure level and the bank capitalization level.

References

Acharya, V., Mehran, H., and Thakor, A.V., forthcoming, Caught between Scylla and Charybdis? Regulating bank leverage when there is rent seeking and risk shifting, *Review of Corporate Finance Studies.*

Acharya, V., Schnabl, P., and Suarez, G., (2013) Securitization without risk transfer, *Journal of Financial Economics* **107**, 515-536.

Affinito, M., and Tagliaferri, E. (2010) Why do banks securitize their loans? Evidence from Italy. *Journal of Financial Stability* **6**, 189-202.

Ahn, J-H., and Breton, D. (2014) Securitization, competition and monitoring, *Journal of Banking & Finance* **40**, 195-210.

Allen, F., Carletti, E., and Marquez, R.S. (2011) Competition and capital regulation, *Review of Financial Studies* **24**, 983-1018.

Almazan, A., Martin-Oliver, A., and Saurina, J. (2015) Securitization and banks' capital structure, *Review of Corporate Finance Studies* **4**, 206-238.

Anginer, D., and Demirguc-Kunt, A. (2014), How does competition affect bank systemic risk? *Journal of Financial Intermediation* **23**, 1-26.

Ayuso, J., Perez, D., and Saurina, J. (2004) Are capital buffers procyclical? Evidence from Spanish panel data, *Journal of Financial Intermediation* **13**, 249-264.

Bain, J.S. (1959) Barriers to new competition, Industrial Organization.

Baker, M., and Wurgler, M. (2015) Do strict capital requirements raise the cost of capital? Bank regulation, capital structure, and the low-risk anomaly, *American Economic Review* **105**, 315-20.

Bank for International Settlement Report on asset securitization incentives, July 2011.

Beck, T., De Jonghe, O., and Schepens, G. (2013) Bank competition and stability: Cross-country heterogeneity, *Journal of Financial Intermediation* **23**, 218-244.

Beck, T., Demirguc-Kunt, A., and Levine, R. (2006) Bank concentration, competition, and crises: First results, *Journal of Banking & Finance* **30**, 1581-1603.

Bedendo, M., and Bruno, B. (2012) Credit risk transfer in U.S. commercial banks: What changed during the 2007-2009 crisis? *Journal of Banking & Finance* **36**, 3620-3273.

Berger, A., Ozterkin, O., and Roman, R. (2017) How does competition affect bank capital structure? Evidence from a natural experiment. Working paper.

Berger, A., and Bouwman, C. (2016) Bank liquidity creation, monetary policy, and financial crises, *Journal of Financial Stability* **30**, 139-155.

Berger, A., and Bouwman, C. (2013) How does capital affect bank performance during financial crises? *Journal of Financial Economics* **109**, 146-176.

Berger, A., and Bouwman, C. (2005) Bank liquidity creation and bank capital, "*The Art of the Loan in the 21st Century", Proceedings of the 41st annual conference on bank structure and competition*, Federal Reserve Bank of Chicago, 223-228.

Berger, A., Kashyap, A.K., and Scalise, J.M. (1995) The transformation of the US banking industry: what a long, strange trip it's been. Brookings papers on economic activity 1995, 55-218.

Berger, A., Klapper, L., and Turk-Ariss, R. (2009) Bank competition and financial stability, *Journal of Financial Services Research* **21**, 849-870.

Berger, A., and Mester, L.J. (1997) Inside the Black Box: What explains differences in the efficiencies of financial institutions? *Journal of Banking & Finance* **21**, 895-947.

Berger, P., Minnis, M., and Sutherland, A. (forthcoming) Commercial lending concentration and bank expertise: Evidence from borrower financial statements, *Journal of Accounting and Economics*.

Blundell, R., and Bond, S. (1998) Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* **87**, 115-143.

Casu, B., Clare, A., Sarkisyan, A., and Thomas, S. (2014) Securitization and bank performance, *Journal of Money, Credit and Banking* **45**, 1617-1658.

Casu, B., Clare, A., Sarkisyan, A., and Thomas, S. (2011) Does securitization reduce credit risk taking? Empirical evidence from US bank holding companies, *The European Journal of Finance* **17**, 769-788.

Casu, B., and Girardone, C. (2009) Testing the relationship between competition and efficiency in banking: A panel data analysis, *Economics Letters* **105**, 134-137.

Cebenoyan, A., and Strahan, P. (2004) Risk management, capital structure, and lending at banks, *Journal of Banking & Finance* **28**, 19-43.

Cerrato, M., Choudhry, M., Crosby, J., and Olukuru, J. (2012) Why do UK banks securitize? Working paper.

Chen, Y. (2016) Bank capital and credit market competition: Will competitive pressure lead higher capital levels? *Journal of International Money and Finance* **69**, 247-263.

Chong, B.S. (1991) The effects of interstate banking on commercial banks' risk and profitability, *The Review of Economics and Statistics* 78-84.

Delis, M., Kokas, S., and Ongena, S. (2016) Bank market power and firm performance, *Review of Finance* **21**, 1-28.

Delis, M. (2012) Bank competition, financial reform, and institutions: The importance of being developed, *Journal of Development Economics* **97**, 450-465.

Demsetz, R., and Strahan, P. (1997) Diversification, Size, and Risk at Bank Holding Companies, *Journal of Money, Credit and Banking* **29**, 300-313.

Dionne, G., and Harchaoui, T. (2008) Bank Capital, Securitization, and Credit Risk: An Empirical Evidence, *Insurance and Risk Management* **75**, 459-485.

Duygun, M., Sena, V., and Shaban, M. (2013) Schumpeterian competition and efficiency among commercial banks, *Journal of Banking & Finance* **37**, 5176-5185.

Flannery, M.J., and Rangan, K.P. (2006) Partial adjustmend toward target capital structures, *Journal of Financial Economics* **79**, 469-506.

Frankel, D., and Jin, Y. (2015) Securitization and lending competition, *The Review of Economic Studies* **82**, 1383-1408.

Gorton, G., and Metrick, A. (2012) Securitized banking and the run on repo, *Journal of Financial Economics* **104**, 425-451.

Gorton, G., and Ordonez, G. (2016) Good booms, bad booms. *NBER working paper 2200*.

Han, J., Kwangwoo, P., and Pennacchi, G. (2015) Corporate taxes and securitization, *Journal of Finance* **70**, 1287-1321.

Hanson, S., Kashyap, A., and Stein, J. (2011) A macro prudential approach to financial regulation, *Journal of Economic Perspectives* **25**, 3-28.

Hellmann, T., Mudock, K., and Stiglitz, J.E. (2000) Liberalization, moral hazard in banking and prudential regulation: Are capital controls enough? *American Economic Review* **90**, 147-165.

Hortlund, P. (2005) The long-term relationship between capital and earnings in banking. SSE/EFI Working Paper Series in Economics and Finance No. 611.

Houston, J.F., Lin, C., Lin, P., and Ma, Y. (2010) Creditor rights, information sharing, and bank risk taking, *Journal of Financial Economics* **96**, 485-512.

Jiangli, W., and Pritsker, M. (2008) The impacts of securitization on US bank holding companies. FDIC working paper.

Justiniano, A., Primiceri, G., and Tambalotti, A. (2015) Credit Supply and the Housing Boom. Federal Reserve Bank of New York Staff Reports, no. 709.

Kaufman, G.G. (2014) Too big to fail in banking: What does it mean? *Journal of Financial Stability* **13**, 214-223.

Keeley, M. (1990) Depost insurance, risk, and market power in banking, *American Economic Review* **80**, 1183-1200.

Kick, T., and Prieto, E. (2015) Bank risk and competition: Evidence from regional banking markets, *Review of Finance* **19**, 1185-1222.

Koenker, R., and Hallock, K. (2001) Quantile Regression, *Journal of Economic Perspectives* **15**, 143-156.

Koenker, R. and Bassett, G. (1978) Regression Quantiles, *Econometrica* **46**, 33-50.

Laeven, L., and Majnoni, G. (2003) Loan Loss Provisioning and Economic Slowdowns: Too Much, Too late? World Bank Policy Research Working Paper, no. 2749.

Lambertini, L., and Mukherjee, A. (2016) Is Bank Capital Regulation Costly for Firms? – Evidence from Syndicated Loans. Working Paper.

Leland, H. (2007) Financial Synergies and the Optimal Scope of the Firm: Implications for Mergers, Spinoffs, and Structured Finance, *The Journal of Finance* **62**, 765-807.

Li, Z., and Sun, J. (2011) Bank competition, securitization, and risky investment. Working paper.

Loutskina, E. (2011) The role of securitization in bank liquidity and funding management, *Journal of Financial Economics* **100**, 663-684.

Marques-Ibanes, D., Altunbas, Y., and Leuvensteijn, M. (2014) Competition and Bank Risk: The effect of securitization and bank capital. ECB Working Paper 1678.

Mehran, H., and Thakor, A. (2011) Bank capital and value in the cross-section, *Review of Financial Studies* **24**, 1019-67.

Mian, A., and Sufi, A. (2009) The consequences of mortgage credit expansion: Evidence from the US Mortgage Default Crisis, *The Quarterly Journal of Economics* **124**, 1449-1496.

Mian, A., and Sufi, A. (2010) Household leverage and the recession of 2007 to 2009. Working Paper, Chicago Booth.

Myers, S.C., and Majluf, N.S. (1984) Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* **13**, 187-221.

Nijskens, R., and Wagner, W. (2011) Credit risk transfer activities and systemic risk: How banks became less risky individually but posed greater risks to the financial system at the same time, *Journal of Banking & Finance* **35**, 1391-1398.

Pan, H., and Wang, C. (2017) House prices, bank instability, and economic growth: Evidence from the threshold model, *Journal of Banking & Finance* **37**, 1720-1732.

Panetta, F., and Pozzolo, A. (2010) Why do banks securitize their assets? Bank-level evidence from over one hundred countries. Working paper.

Purnanandam, A. (2011) Originate-To-Distribute Model and The Subprime Mortgage Crisis, *Review Of Financial Studies* **24**, 1881-1915.

Keys, B., Mukherjee, T., Seru, A., and Vig, V. (2010) Did securitization lead to lax screening? Evidence from subprime loans, *The Quarterly Journal of Economics* **125**, 307-362.

Keeley, M. (1990) Deposit insurance, risk, and market power in banking, *American Economic Review* **80**, 1183-1200.

Koenker, R., and Bassett, G. (1978) Regression Quantiles, *Econometrica* **46**, 33-50.

Koetter, M., Kolari, J., and Spierdijk, L. (2012) Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for US banks, *The Review of Economics and Statistics* **94**, 462-480.

Schaeck, K., and Cihák, M. (2014) Competition, efficiency, and stability in banking, *Financial Management* **43**, 215-241.

Schaeck, K., and Cihák, M. (2010) Banking competition and capital ratios, *European Financial Management* **18**, 836-866.

Schaeck, K., Cihák, M., and Wolfe, S. (2009) Are competitive banks more stable? *Journal of Money, Credit and Banking* **41**, 711-734.

Scopelliti, A. (2016) Securitization, Bank Capital, and Financial Regulation: Evidence from European Banks, Working paper.

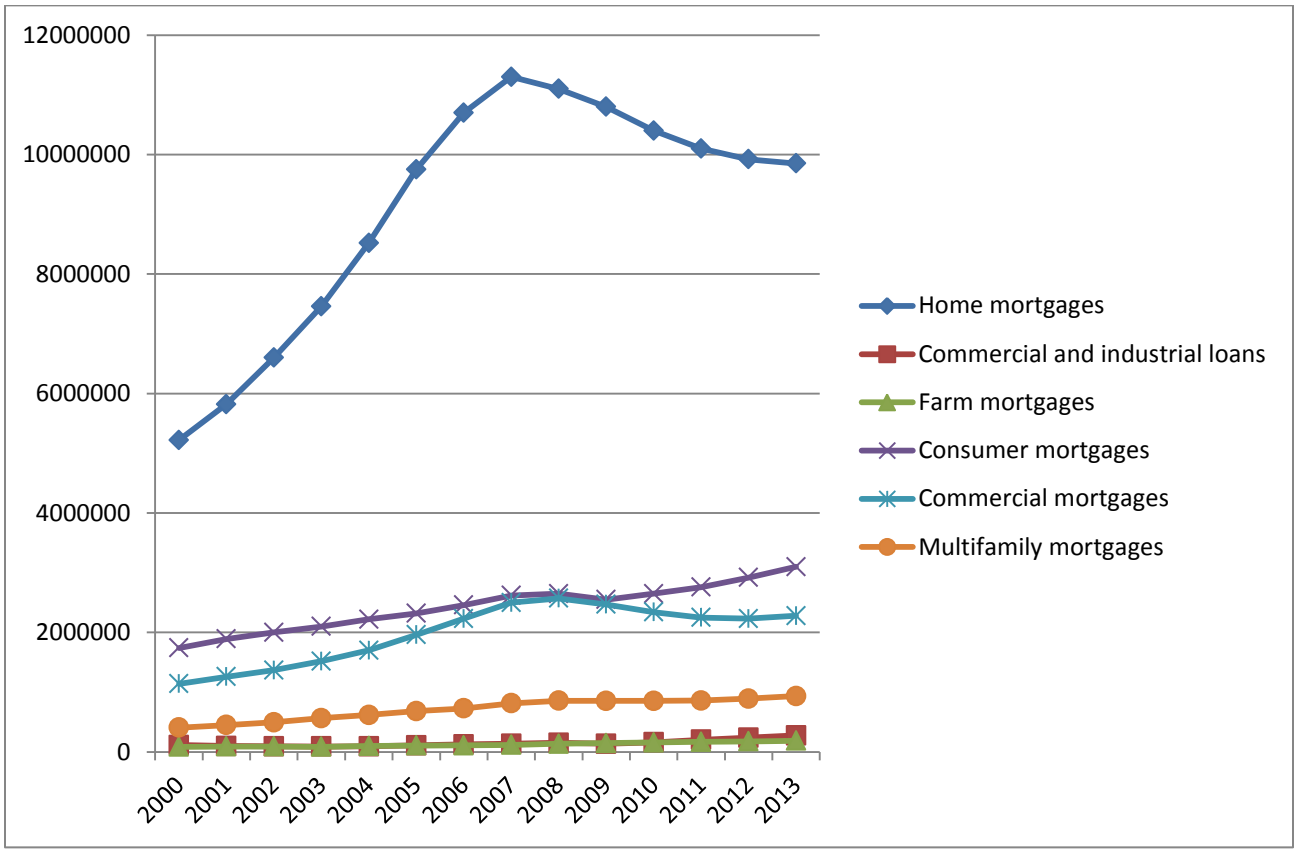
Turk-Ariss, R. (2010) On the implications of market power in banking: Evidence from developing countries, *Journal of Banking & Finance* **34**, 765-775.

Uhde, A., and Michalak, T. (2010) Securitization and systematic risk in European banking: Empirical evidence, *Journal of Banking & Finance* **34**, 3061-3077.

Zarutskie, R. (2013) Competition, financial innovation and commercial bank loan portfolios, *Journal of Financial Intermediation* **22**, 373-396.

Figures

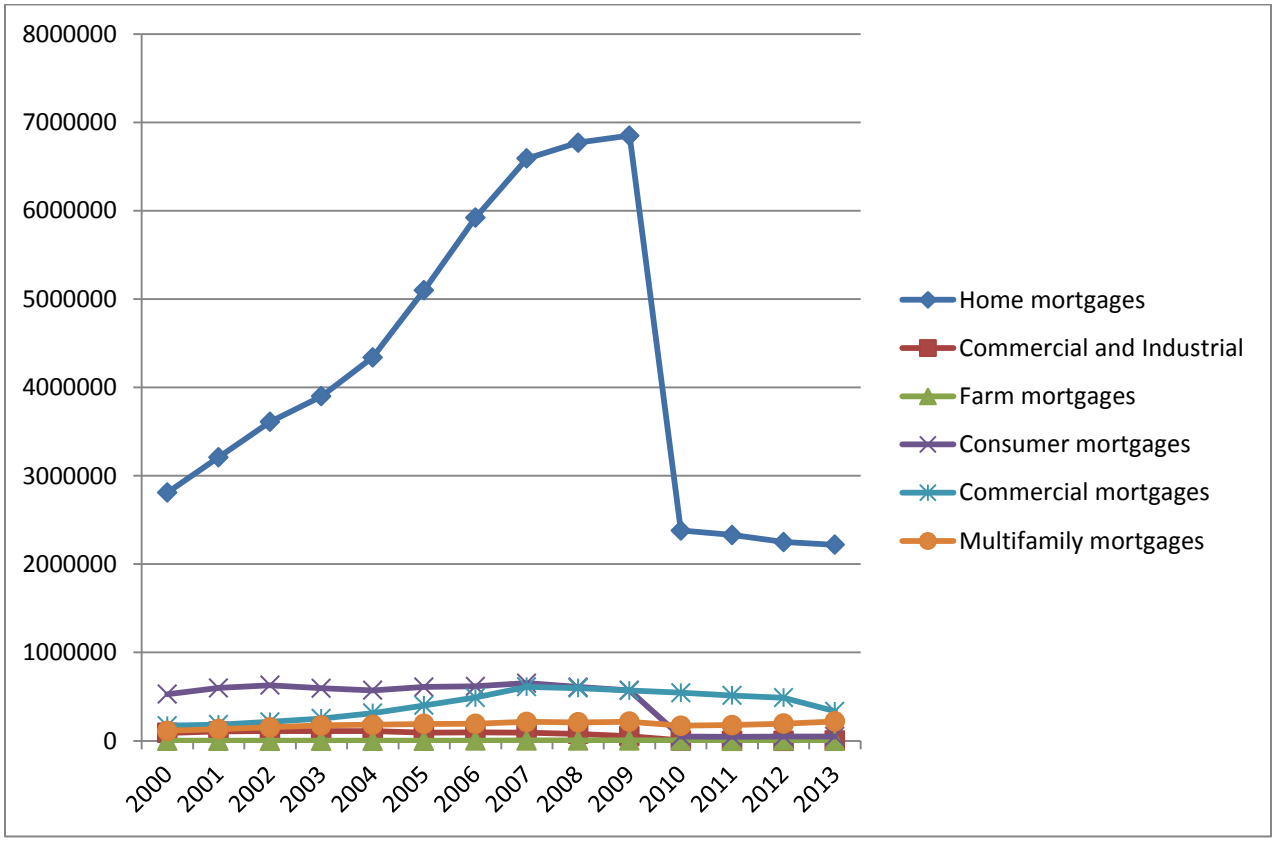
Figure 1. Total Outstanding Loans



Note:

The figure 1. above shows the evolution of total economy-wide outstanding loans between 2000 and 2013. Data are from the Flow of Funds Accounts of the United States.
See Appendix 3.A. for variables description.

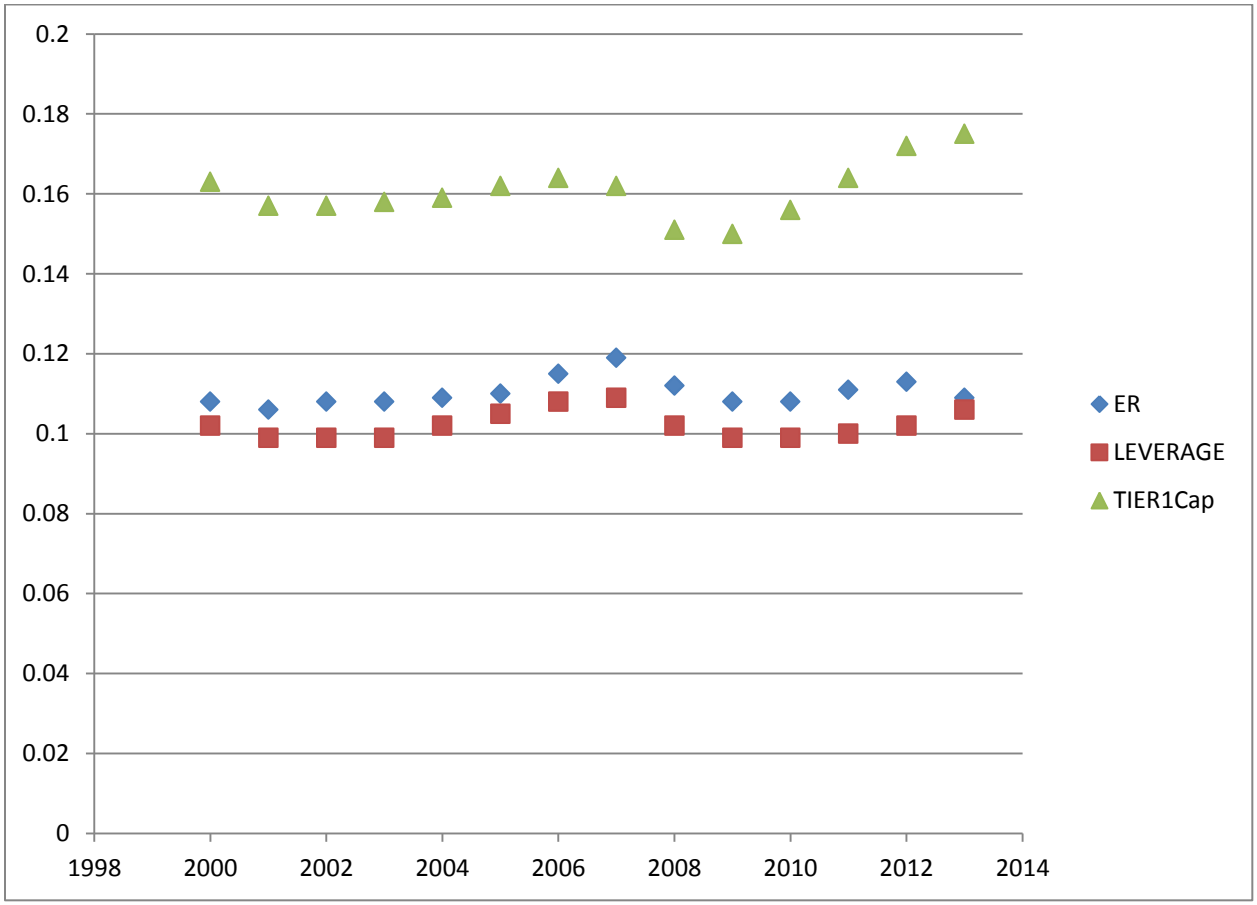
Figure 2. Total Securitized Loans



Note:

Figure 3.2. above shows the evolution of different economy-wide securitized mortgages between 2000 and 2013. Data are from the Flow of Funds Accounts of the United States.
See Appendix 3.A. for variables description.

Figure 3. Evolution of Bank Capital



Note:

Figure 3 above shows the evolution of different capital mortgages over 2000 and 2013. Data are from the Call Report of Condition and Income, Federal Reserve System.
See Appendix 3.A. for variables description.

Table 1. Literature Review

Authors	Period of study	Countries	Methodology	Main empirical results
PANEL A. Competition – Capital				
Berger et al. (2009)	1999-2005	8235 banks in 23 countries	GMM estimation	Higher market power implies higher equity ratio
Schaeck and Cihak (2010)	1999-2004	2600 European banks	Random-effects model	Positive impact of competition on capital ratio
Hanson et al. (2011)	1976-1994	US banks	Reduced-form regressions	Positive impact of deregulation on capital ratio
Berger et al. (2017)	1986-2014	US banks	Partial adjustment model	Positive relationship between competition and capital ratio
Mehran and Thakor (2011)	1989-2007	US banks	Multivariate regressions	Positive relation between bank value and capital ratio
PANEL B. Securitization – Capital				
Dionne and Harchaoui (2008)	1988-1998	Canadian banks	OLS regression	Negative relation between securitization and capital ratio
Acharya et al. (2013)	2001-2009	US banks and SPV	Panel regressions	Support for the Regulatory capital arbitrage hypothesis
Panetta and Pozzolo (2010)	1991-2007	12,830 banks from 140 countries	Difference-in-difference model	Positive relation between securitization and capital ratio
Scopelliti (2016)	1999-2010	European banks	Fixed-effects model	Positive impact of securitization on risk-weighted capital ratio
Almazan et al. (2015)	1988-2006	Spanish banks	Probit model	Securitization has changed bank capital structure
Cebenoyan and Strahan (2004)	1987-1993	US banks	Cross-sectional regressions	Banks securitizing their loans hold a lower level of capital
Affinito and Tagliaferri (2010)	2000-2006	Italian banks	Probit and logit models	Less-capitalized banks increase their securitization activities
Jiangli and Pritsker (2008)	2001-2007	US bank holding companies	Instrumental variable regression	Securitization increases leverage

Table 2. Competition – Capital Structure: IV 2SLS Regression

Dependent	*(1)* ***ER***	*(2)* ***ER***	*(3)* ***Leverage***	*(4)* ***Leverage***	*(5)* ***Tier 1***	*(6)* ***Tier 1***
Conventional Lerner	**0.109*** **		**0.131*** **		**0.215*** **	
	(0.006)		**(0.005)**		**(0.009)**	
Adjusted Lerner		**0.204*** **		**0.130*** **		**0.205*** **
		(0.007)		**(0.003)**		**(0.007)**
Size	0.007***	0.006***	-0.005***	-0.007***	-0.008***	-0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Non-performing loans	-0.273***	-0.141***	-0.131***	-0.033***	-0.186***	-0.029
	(0.015)	(0.013)	(0.011)	(0.010)	(0.025)	(0.024)
REPO	0.481***	0.517***	0.445***	0.443***	0.965***	0.958***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.033)	(0.033)
Liquidity	0.034***	0.012***	0.027***	0.019***	0.248***	0.237***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)
ROA	-0.739***	-1.128***	-0.604***	-0.624***	-1.026***	-1.023***
	(0.061)	(0.069)	(0.056)	(0.055)	(0.100)	(0.096)
GDP	-0.000***	-0.000***	-0.000***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gini	-0.145***	-0.201***	-0.069***	-0.051***	0.018	0.054***
	(0.017)	(0.016)	(0.008)	(0.007)	(0.015)	(0.014)
House price index	0.001	-0.015***	0.007***	-0.001**	0.152***	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Unemployment	0.001***	0.000***	0.001***	0.000***	0.003***	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.013	0.050***	0.048***	0.105***	-0.074***	0.017**
	(0.009)	(0.009)	(0.003)	(0.003)	(0.007)	(0.007)
R-squared	0.0536	0.0582	0.2321	0.231	0.3742	0.3673
Observations	91,073	91,073	91,073	91,073	91,073	91,073
Over-identification test						
Chi-square	0.038	3.910	5.830	30.598	2.3642	16.103
p-value	0.8448	0.048	0.015	0.000	0.1241	0.0001
Endogeneity test						
Chi-square	91.102	369.351	176.626	401.462	104.123	217.123
p-value	0.000	0.000	0.000	0.000	0.000	0.000
First-stage tests						
F-statistic	6545.09	4631.69	6545.09	4631.69	6545.09	4631.69
p-value	0.000	0.000	0.000	0.000	0.000	0.000

Table 2 Description

Table 3.2 analyzes the impact of banking competition on capital holdings using an instrumental variable regression, as described in **equation 3.1,** from 2000 till 2013.

Columns 1 and 2 include equity ratio as dependent variable, columns 3 and 4 include leverage ratio as dependent ariable, while columns 5 and 6 report results using Tier-1 risk-based capital as dependent variable.

Conventional Lerner index is reported in columns 1, 3 and 5, while adjusted Lerner index is reported in the other columns.

The instruments used in the IV model: Lagged Lerner index by one year and state-level corporate income tax rate.

The null-hypothesis of the over-identification tests: Instruments are valid.

The null-hypothesis of the endogeneity tests: Variables are exogenous.

The null-hypothesis of the first-stage test: Instruments are weak.

This table also includes a set of control variables: Bank size, Non-performing loans ratio (NPL), interest income on federal funds sold under repurchase agreement (REPO), Liquidity ratio, Return-On-Assets (ROA), GDP change, Gini coefficient of income inequality, house price index and unemployment rate.

Standard errors in parentheses are robust for time-series correlation and heteroskedasticity.

***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

See Appendix A for variable description.

Table 3. Competition – Capital Structure: Possible Channels

	Dependent	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
		ER	***ER***	***Leverage***	***Leverage***	***Tier 1***	***Tier 1***
Expected Sign	*ADJUSTED LERNER*	***YES***	***NO***	***YES***	***NO***	***YES***	***NO***
	Lerner Index $_{t-1}$	-0.171***	0.257***	-0.002	0.052***	0.024	0.158***
		(0.031)	(0.061)	(0.011)	(0.018)	(0.020)	(0.033)
+	**Lerner $_{t-1}$ x NPL**	-0.151**	0.624***	0.025	0.395***	-0.182*	0.336*
		(0.062)	(0.107)	(0.051)	(0.097)	(0.101)	(0.181)
-	**Lerner $_{t-1}$ x ROA**	**-1.198*** **	**-2.139*** **	**-0.920*** **	**-2.031*** **	**-2.499*** **	**-4.266*** **
		(0.216)	**(0.297)**	**(0.209)**	**(0.289)**	**(0.402)**	**(0.607)**
+	**Lerner $_{t-1}$ x Size**	**0.018*** **	**-0.019*** **	**0.003*** **	**-0.000**	**0.002**	**-0.006** **
		(0.002)	**(0.005)**	**(0.000)**	**(0.001)**	**(0.001)**	**(0.002)**
	Size	-0.042***	-0.012**	-0.031***	-0.027***	-0.035***	-0.034***
		(0.003)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)
	Non-performing loans	-0.080*	-0.618***	-0.175***	-0.419***	-0.035	-0.422***
		(0.047)	(0.075)	(0.041)	(0.066)	(0.077)	(0.120)
	REPO	0.381***	0.372***	0.363***	0.352***	0.740***	0.796***
		(0.015)	(0.016)	(0.015)	(0.015)	(0.033)	(0.035)
	Liquidity	0.001	0.000	0.006**	0.006**	0.195***	0.174***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.008)
	ROA	0.606***	1.158***	-0.402**	1.080***	1.193***	2.319***
		(0.167)	(0.196)	(0.162)	(0.190)	(0.297)	(0.395)
	GDP	-0.000***	-0.000***	-0.000***	-0.000***	0.001***	-0.000**
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Gini	-0.005	0.014	-0.018	-0.017	0.519***	0.064*
		(0.029)	(0.029)	(0.018)	(0.018)	(0.032)	(0.035)
	House price index	0.011***	0.016***	0.011***	0.013***	0.035***	0.015***
		(0.003)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)
	Unemployment	0.001***	0.001***	0.000***	0.001***	0.001***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Constant	0.322***	0.061	0.346***	0.363***	0.026	0.397***
		(0.040)	(0.046)	(0.022)	(0.022)	(0.024)	(0.041)
	BANK-FIXED	YES	YES	YES	YES	YES	YES
	STATE-FIXED	YES	YES	YES	YES	YES	YES
	YEAR-FIXED	YES	YES	YES	YES	YES	YES
	R-squared	0.2364	0.2341	0.3565	0.3590	0.3424	0.3637
	Observations	91,073	91,073	91,073	91,073	91,073	91,073

Table 3 Description

Table 3.3 analyzes the impact of banking competition on bank capital holdings using a fixed-effects model, as described in **equation 3.2,** from 2000 till 2013.

The FE model includes bank-, year-, and state-fixed effects.

Columns 1 and 2 include equity ratio as dependent variable, columns 3 and 4 include leverage ratio as dependent variable, while columns 5 and 6 report results using Tier-1 risk-based capital as dependent variable.

Conventional Lerner index is reported in columns 1, 3 and 5, while adjusted Lerner index is reported in the other columns.

We interact the lagged Lerner index with bank risk (NPL), profitability (ROA), and size (logarithm of total assets) to provide evidence for the proposed channels explaining the competition-capital nexus as in Berger et al. (2017). Precisely, given that the previous table shows a negative impact of competition on capital, we expect that the interaction between Lagged Lerner index is positive (**H2.a hypothesis**), the interaction with ROA is negative (**H2.b hypothesis**), and the interaction with size is positive (**H2.c hypothesis**).

This table also includes a set of control variables: Bank size, Non-performing loans ratio (NPL), interest income on federal funds sold under repurchase agreement (REPO), Liquidity ratio, Return-On-Assets (ROA), GDP change, Gini coefficient of income inequality, house price index and unemployment rate.

Standard errors in parentheses are robust for time-series correlation and heteroskedasticity.

***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

See Appendix A for variable description.

Table 4. The impact of securitization on bank capital: Interaction with crisis dummy

Dependent	*(1)* *ER*	*(2)* *Leverage*	*(3)* *TIER 1*	*(4)* *ER*	*(5)* *Leverage*	*(6)* *TIER 1*
Securitization $_{t-1}$	**-0.011*** **	**-0.004** **	**-0.003**	**-0.003**	**-0.001**	**0.002**
	(0.004)	**(0.002)**	**(0.004)**	**(0.003)**	**(0.002)**	**(0.004)**
Securitization $_{t-1}$ x CRISIS				**-0.066*** **	**-0.027*** **	**-0.049*** **
				(0.009)	**(0.003)**	**(0.007)**
Size	-0.036***	-0.037***	-0.062***	-0.037***	-0.037***	-0.063***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Non-performing loans	-0.275***	-0.234***	-0.356***	-0.282***	-0.237***	-0.362***
	(0.015)	(0.012)	(0.024)	(0.014)	(0.012)	(0.024)
Non-interest income	-0.016***	-0.016***	-0.015*	-0.014***	-0.015***	-0.138
	(0.004)	(0.003)	(0.008)	(0.004)	(0.003)	(0.008)
ROA	-0.588***	-0.543***	-1.254***	-0.536***	-0.534***	-1.238***
	(0.054)	(0.051)	(0.105)	(0.054)	(0.051)	(0.104)
GDP	-0.000***	-0.000**	-0.000**	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gini	0.048	0.022	0.034	0.046	0.021	0.033
	(0.030)	(0.020)	(0.040)	(0.030)	(0.020)	(0.004)
House price index	0.022***	0.021***	0.032***	0.023***	0.021***	0.032***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)
Unemployment	0.001***	0.000	-0.000	0.001***	0.000**	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.312***	0.457***	0.721***	0.342***	0.469***	0.743***
	(0.026)	(0.020)	(0.043)	(0.027)	(0.020)	(0.044)
STATE-FIXED	YES	YES	YES	YES	YES	YES
TIME-FIXED	YES	YES	YES	YES	YES	YES
BANK-FIXED	YES	YES	YES	YES	YES	YES
R-squared	0.1606	0.2167	0.1582	0.1647	0.2181	0.1593
Observations	91,066	91,066	91,066	91,066	91,066	91,066

Table 4 Description

Table 3.4 analyzes the impact of securitization on bank capital holdings using a fixed-effects model, as described in **equation 3.3,** from 2000 till 2013.

The FE model includes bank-, year-, and state-fixed effects.

Columns 1 and 4 include equity ratio as dependent variable, columns 2 and 5 include leverage ratio as dependent variable, while columns 3 and 6 report results using Tier-1 risk-based capital as dependent variable.

Conventional Lerner index is reported in columns 1, 3 and 5, while adjusted Lerner index is reported in the other columns.

The main independent variable is the securitization ratio as proposed by Loutskina (2011).

In columns 4, 5 and 6, we interact this ratio with the crisis dummy to gauge the crisis effect.

Crisis is a dummy that takes 1 if the sample is between 2007 and 2009, and 0 otherwise.

This table also includes a set of control variables: Bank size, Non-performing loans ratio (NPL), non-interest income, Return-On-Assets (ROA), GDP change, Gini coefficient of income inequality, house price index and unemployment rate.

Standard errors in parentheses are robust for time-series correlation and heteroskedasticity.

***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

See Appendix A for variable description.

Table 5. The impact of securitization on bank capital: Classification by loan types

Dependent	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	ER	***Leverage***	***TIER 1***	***ER***	***Leverage***	***TIER1***
Home mortgages $_{t-1}$	**-0.039*** **	**-0.022*** **	**-0.021*** **	-0.024***	-0.017***	-0.009
	(0.005)	**(0.003)**	**(0.007)**	(0.004)	(0.003)	(0.007)
Home mortgages $_{t-1}$ X CRISIS				**-0.072*** **	**-0.019*** **	**-0.046*** **
				(0.012)	**(0.003)**	**(0.008)**
Multifamily mortgages $_{t-1}$	**0.034**	**0.059***	**0.067**	0.051	0.056*	0.062
	(0.036)	**(0.034)**	**(0.074)**	(0.033)	(0.031)	(0.067)
Multifamily mortgages $_{t-1}$ X CRISIS				**-0.116***	**0.069**	**0.124**
				(0.070)	**(0.059)**	**(0.117)**
Commercial and industrial loans $_{t-1}$	**0.000**	**0.003***	**0.007** **	0.005	0.005***	0.011***
	(0.003)	**(0.002)**	**(0.004)**	(0.003)	(0.002)	(0.004)
Commercial and industrial loans $_{t-1}$ X CRISIS				**-0.074*** **	**-0.026*** **	**-0.039*** **
				(0.012)	**(0.004)**	**(0.008)**
Farm mortgages $_{t-1}$	**-0.856*** **	**-0.112**	**0.295**	-0.475**	0.226*	0.803***
	(0.192)	**(0.089)**	**(0.190)**	(0.220)	(0.117)	(0.253)
Farm mortgages $_{t-1}$ X CRISIS				**-0.780*** **	**-0.340*** **	**-0.656*** **
				(0.199)	**(0.106)**	**(0.213)**
Consumer mortgages $_{t-1}$	**-0.036*** **	**-0.039*** **	**-0.070*** **	-0.014	-0.292***	-0.053***
	(0.012)	**(0.008)**	**(0.018)**	(0.013)	(0.008)	(0.018)
Consumer mortgages $_{t-1}$ X CRISIS				**-0.236*** **	**-0.094*** **	**-0.159*** **
				(0.040)	**(0.016)**	**(0.036)**
Commercial mortgages $_{t-1}$	**-0.017**	**0.065*** **	**0.044***	0.026	0.074***	0.061*
	(0.020)	**(0.011)**	**(0.024)**	(0.016)	(0.011)	(0.024)
Commercial mortgages $_{t-1}$ X CRISIS				**-0.220*** **	**-0.041*** **	**-0.078***
				(0.046)	**(0.015)**	**(0.030)**
Size	-0.036***	-0.037***	-0.062***	-0.037***	-0.037***	-0.063
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Non-performing loans	-0.282***	-0.241***	-0.360***	-0.291***	-0.243***	-0.365***
	(0.014)	(0.012)	(0.024)	(0.014)	(0.012)	(0.024)
Non-interest income	-0.015***	-0.015***	-0.014	-0.013***	-0.014***	-0.012
	(0.004)	(0.003)	(0.008)	(0.004)	(0.003)	(0.008)
ROA	-0.542***	-0.532***	-1.247***	-0.522***	-0.521***	-1.228***
	(0.054)	(0.051)	(0.104)	(0.054)	(0.051)	(0.104)
GDP	-0.000***	-0.000**	-0.000**	-0.000**	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gini	0.060**	0.026	0.042	0.046	0.026	0.043
	(0.030)	(0.020)	(0.040)	(0.030)	(0.020)	(0.040)
House price index	0.023***	0.022***	0.032***	0.023***	0.022***	0.033***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)
Unemployment	0.001***	0.000*	-0.000***	0.000**	0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5. The impact of securitization on bank capital: Classification by loan types (continued)

Dependent	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
	ER	***Leverage***	***TIER 1***	***ER***	***Leverage***	***TIER1***
Constant	0.311***	0.453***	0.713***	0.357***	0.468***	0.735***
	(0.026)	(0.020)	(0.043)	(0.028)	(0.020)	(0.044)
STATE-FIXED	YES	YES	YES	YES	YES	YES
YEAR-FIXED	YES	YES	YES	YES	YES	YES
BANK-FIXED	YES	YES	YES	YES	YES	YES
R-squared	0.1629	0.2217	0.1595	0.1680	0.2235	0.1609
Observations	91,066	91,066	91,066	91,066	91,066	91,066

Table 5 Description

Table 3.5 analyzes the impact of various securitized loans on bank capital holdings using a fixed-effects model, as described in **equation 3.4,** from 2000 till 2013.

The FE model includes bank-, year-, and state-fixed effects.

Columns 1 and 4 include equity ratio as dependent variable, columns 2 and 5 include leverage ratio as dependent variable, while columns 3 and 6 report results using Tier-1 risk-based capital as dependent variable.

The main independent variables include home mortgages securitized, multifamily mortgages securitized, commercial and industrial loans securitized, farm mortgages securitized, consumer mortgages securitized and commercial mortgages securitized.

In columns 4, 5 and 6, we interact all these ratios with the crisis dummy to gauge the crisis effect.

Crisis is a dummy that takes 1 if the sample is between 2007 and 2009, and 0 otherwise.

This table also includes a set of control variables: Bank size, Non-performing loans ratio (NPL), non-interest income, Return-On-Assets (ROA), GDP change, Gini coefficient of income inequality, house price index and unemployment rate.

Standard errors in parentheses are robust for time-series correlation and heteroskedasticity.

***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

See Appendix A for variable description.

Table 6. Competition & Securitization – Capital: Possible channel?

Dependent	*(1)* *ER*	*(2)* *Leverage*	*(3)* *TIER 1*	*(4)* *ER*	*(5)* *Leverage*	*(6)* *TIER 1*
Conventional Lerner $_{t-1}$	0.026**	0.070***	0.150***			
	(0.013)	(0.006)	(0.014)			
Adjusted Lerner $_{t-1}$				0.061***	0.040***	0.073***
				(0.005)	(0.003)	(0.007)
Securitization ratio	-0.041*	0.031***	0.101***	0.090***	0.020**	0.041**
	(0.024)	(0.011)	(0.026)	(0.016)	(0.009)	(0.017)
Conventional Lerner $_{t-1}$ x Securitization	**0.089****	**-0.025**	**-0.086****			
	(0.036)	**(0.017)**	**(0.038)**			
Adjusted Lerner $_{t-1}$ x Securitization				**-0.087*****	**-0.013**	**-0.011**
				(0.018)	**(0.011)**	**(0.021)**
Size	-0.035***	-0.036***	-0.061***	-0.037***	-0.037***	-0.064***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Non-performing loans	-0.285***	-0.225***	-0.341***	-0.263***	-0.218***	-0.331***
	(0.015)	(0.012)	(0.024)	(0.014)	(0.012)	(0.024)
Non-interest income	-0.015***	-0.015***	-0.012	-0.011***	-0.012***	-0.007
	(0.004)	(0.003)	(0.008)	(0.004)	(0.003)	(0.008)
ROA	-0.603***	-0.590***	-1.348***	-0.612***	-0.589***	-1.341***
	(0.055)	(0.052)	(0.107)	(0.055)	(0.052)	(0.107)
GDP	-0.000***	-0.000***	-0.000**	-0.000***	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gini	0.051*	0.027	0.042	0.046	0.024	0.036
	(0.030)	(0.020)	(0.040)	(0.030)	(0.020)	(0.040)
House price index	0.023***	0.019***	0.027***	0.020***	0.019***	0.028***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)
Unemployment	0.001***	0.000**	-0.000**	0.000**	0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.189***	0.351***	0.695***	0.280***	0.434***	0.686***
	(0.028)	(0.021)	(0.043)	(0.026)	(0.020)	(0.041)
STATE-FIXED	YES	YES	YES	YES	YES	YES
YEAR-FIXED	YES	YES	YES	YES	YES	YES
BANK-FIXED	YES	YES	YES	YES	YES	YES
R-squared	0.1662	0.2345	0.1767	0.1709	0.2329	0.1733
Observations	91,073	91,073	91,073	91,073	91,073	91,073

Table 6 Description

Table 3.6 analyzes the impact of a joint interaction between Lerner index lagged by one period and securitization ratio on bank capital holdings using a fixed-effects model, as described in **equation 3.5,** from 2000 till 2013.

The FE model includes bank-, year-, and state-fixed effects.

Columns 1 and 4 include equity ratio as dependent variable, columns 2 and 5 include leverage ratio as dependent variable, while columns 3 and 6 report results using Tier-1 risk-based capital as dependent variable.

Columns 1 to 3 include show results using Conventional Lerner index lagged by one year as a main variable of competition, while columns 4 to 6 show results using adjusted Lerner index lagged by one year.

The main independent variables also include the securitization ratio, as well as the interaction between this ratio and Lerner index lagged by one year.

This table also includes a set of control variables: Bank size, Non-performing loans ratio (NPL), non-interest income, Return-On-Assets (ROA), GDP change, Gini coefficient of income inequality, house price index and unemployment rate.

Standard errors in parentheses are robust for time-series correlation and heteroskedasticity.

***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

See Appendix A for variable description.

	PANEL A						PANEL B					
Dependent variable	EQUITY RATIO						LEVERAGE RATIO					
Quantile	*(1)* *25th*	*(2)* *50th*	*(3)* *75th*	*(4)* *25th*	*(5)* *50th*	*(6)* *75th*	*(7)* *25th*	*(8)* *50th*	*(9)* *75th*	*(10)* *25th*	*(11)* *50th*	*(12)* *75th*
Conventional Lerner $_{t-1}$	0.034***	0.040***	0.033***				0.023***	0.027***	0.027***			
	(0.002)	(0.003)	(0.005)				(0.002)	(0.003)	(0.004)			
Adjusted Lerner $_{t-1}$				0.036***	0.035***	0.038***				0.026***	0.023***	0.024***
				(0.001)	(0.001)	(0.002)				(0.002)	(0.001)	(0.002)
SECURITIZATION	0.011**	-0.024***	-0.126***	0.002	-0.037***	-0.086***	-0.017***	-0.057***	-0.134***	-0.017***	-0.061***	-0.108***
	(0.005)	(0.008)	(0.005)	(0.003)	(0.004)	(0.006)	(0.005)	(0.010)	(0.011)	(0.005)	(0.004)	(0.007)
Lerner $_{t-1}$ **× SEC**	**-0.018****	**0.044*****	**0.203*****	**-0.004**	**0.057*****	**0.127*****	**0.186*****	**0.090*****	**0.222*****	**0.019*****	**0.085*****	**0.158*****
	(0.007)	**(0.011)**	**(0.019)**	**(0.004)**	**(0.005)**	**(0.008)**	**(0.008)**	**(0.014)**	**(0.016)**	**(0.006)**	**(0.005)**	**(0.008)**
Constant	0.069***	0.072***	0.091***	0.073***	0.085***	0.105***	0.067***	0.073***	0.093***	0.069***	-0.004	0.117***
	(0.002)	(0.003)	(0.007)	(0.003)	(0.003)	(0.006)	(0.001)	(0.003)	(0.003)	(0.002)	(0.008)	(0.005)
Bank- and Macro-Control	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.0290	0.0302	0.0374	0.0434	0.0461	0.0521	0.0509	0.0668	0.0946	0.0648	0.0821	0.1080
Observations	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073
	PANEL C						**PANEL D**					
Dependent variable	TIER-1 RISK-BASED CAPITAL RATIO						TOTAL REGULATORY CAPITAL RATIO					
Quantile	*(1)* *25th*	*(2)* *50th*	*(3)* *75th*	*(4)* *25th*	*(5)* *50th*	*(6)* *75th*	*(7)* *25th*	*(8)* *50th*	*(9)* *75th*	*(10)* *25th*	*(11)* *50th*	*(12)* *75th*
Conventional Lerner $_{t-1}$	0.129***	0.171***	0.214***				0.128***	0.168***	0.212***			
	(0.004)	(0.005)	(0.009)				(0.003)	(0.005)	(0.006)			
Adjusted Lerner $_{t-1}$				0.071***	0.086***	0.102***				0.070***	0.087***	0.101***
				(0.003)	(0.002)	(0.004)				(0.002)	(0.003)	(0.005)
SECURITIZATION	0.165***	0.168***	0.102***	0.065***	0.045***	-0.013	0.159***	0.156***	0.096***	0.065***	0.044***	-0.016
	(0.011)	(0.013)	(0.027)	(0.009)	(0.008)	(0.015)	(0.012)	(0.012)	(0.022)	(0.006)	(0.010)	(0.015)
Lerner $_{t-1}$ **× SEC**	**-0.179****	**-0.143*****	**0.015**	**-0.037*****	**0.018**	**0.141*****	**-0.170*****	**-0.127*****	**0.023**	**-0.036*****	**0.016**	**0.143*****
	(0.016)	**(0.020)**	**(0.038)**	**(0.011)**	**(0.011)**	**(0.019)**	**(0.016)**	**(0.018)**	**(0.032)**	**(0.008)**	**(0.014)**	**(0.019)**
Constant	-0.014***	-0.050***	-0.074***	0.026***	0.005	0.024**	-0.001	-0.037***	-0.061***	0.036***	0.015***	0.037***
	(0.004)	(0.007)	(0.011)	(0.004)	(0.005)	(0.010)	(0.004)	(0.004)	(0.007)	(0.004)	(0.005)	(0.007)
Bank- and Macro-Control	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.0693	0.0954	0.1115	0.0756	0.1013	0.1192	0.0651	0.0915	0.1084	0.0708	0.0971	0.1160
Observations	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073	91,073

Table 7. Simultaneous Quantile Regression with bootstrapping technique

Table 7 Description

Table 3.7 analyzes the impact of a joint interaction between Lerner index lagged by one period and securitization ratio on bank capital holdings using quantile regression at the 25^{th}, 50^{th}, and 75^{th} quantile, as described in **equation 3.6**, from 2000 till 2013.

The 25^{th} quantile represents banks having a level of 25^{th} percentile of the dependent variable, the 50^{th} quantile represents banks retaining a level of 50^{th} percentile of the dependent variable, while the 75^{th} quantile assesses banks characterized by a high level of the dependent variable.

Various dependent variables are used: Equity ratio in panel A, Leverage ratio in panel B, Tier-1 risk-based capital ratio in panel C, and Total regulatory capital ratio in panel D.

The independent variables include: Conventional Lerner index lagged by one year in columns 1 to 3 of panels A and C and in columns 7 to 9 of panels B and D. Adjusted Lerner index lagged by one year in columns 4 to 6 of panels A and C and in columns 10 to 12 of panels B and D. We also include securitization ratio, and its interaction with the lagged Lerner index.

This table includes but does not report (because of limited space) a set of control variables: Bank size, Non-performing loans ratio (NPL), non-interest income, Return-On-Assets (ROA), GDP change, Gini coefficient of income inequality, house price index and unemployment rate.

Bootstrap standard errors are reported in parentheses.

***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

See Appendix A for variable description.

Appendix A. Variables Description

Name	Description	Source
Instruments		
Lagged Lerner	Lerner indices derived from OLS (Conventional) and SFA estimates of marginal cost (Adjusted) lagged by one period	Own calculations
Corporate Tax rate	Corporate income tax rate at the state level	US census bureau
Macro-economic variables		
Unemployment rate	Total unemployed as percentage of the civilian labor force	Bureau of Labor Statistics
GDP change	GDP change rate	US census bureau
Gini	Gini coefficient of income inequality	US census bureau
Unemployment rate	Total unemployed as percentage of the civilian labor force	
Bank-specific control variables		
REPO	Interest income on federal funds sold and securities purchased under REPO (riad4020) / total interest income (riad4107)	
Liquidity ratio	(Cash+securities) (rcfd0081+rcfd0071+rcfd1754+rcfd1773) / total assets (rcfd2170)	
Non-interest income ratio	Non-interest income (riad4079) / net operating revenue (riad4074+riad4079)	Call Report of Condition and Income, Wharton database
Size	Logarithm of total assets (rcfd2170)	
Non-performing loans	Ratio of non-performing loans (rcfd1407+rcfd1403) to total loans (y_2)	
Return on assets	Ratio of net income (riad4340) to total assets (rcfd2170)	

Securitization variables		
Home mortgages	Mortgages secured by family (1-4) residential mortgages	
Multifamily residential mortgages	Mortgages secured by family (>5) residential mortgages	Flow of funds accounts of the United States
Commercial mortgages	Mortgages secured by nonfarm nonresidential properties	
Farm mortgages	Real Estate Loans secured by farmland	
Consumer mortgages	Consumer mortgages securitized	
Commercial and Industrial Loans	Commercial and industrial loans securitized	
Securitization ratio	Share of securitized loans over total outstanding loans from Flow of Funds multiplied by the share of loan portfolio in a given bank from Call Reports	Own calculations
Dependent variables		
Capital to asset ratio (ER)	Equity ratio defined as gross total equity (rcfd 3210) divided by gross total assets (rcfd 2170)	Call Report of Condition and Income, Wharton database
Leverage Ratio (LEVERAGE)	Ratio of Tier 1 Capital (rcfd8274) over total assets (rcfd2170)	
Tier 1 Capital Ratio (TIER1Cap)	Ratio of Tier 1 Capital (rcfd8274) over risk-weighted assets (rcfda223)	
Total Regulatory Capital	The sum of Tier 1 Capital (rcfd8274) and Tier 2 Capital (rcfd8275) divided by risk-weighted assets (rcfda223)	

Appendix B. General Descriptive Statistics

Variables	Mean	Standard Deviation	Percentiles		Number of observations
			5^{th}	95^{th}	
CAPITAL STRUCTURE					
Equity ratio	0.1102	0.0792	0.0694	0.1750	92,180
Leverage ratio	0.1021	0.0412	0.0670	0.1660	92,180
Tier-1 Capital ratio	0.1601	0.0939	0.0921	0.3038	92,180
COMPETITION					
Adjusted Lerner $_{t-1}$	0.7893	0.1354	0.5421	0.9589	92,180
Conventional Lerner $_{t-1}$	0.7060	0.0908	0.5665	0.8521	92,180
SECURITIZATION					
SECURITIZATION ratio	0.2589	0.1240	0.0816	0.4737	92,166
Home mortgages	0.1361	0.0981	0.0200	0.3276	92,166
Multifamily mortgages	0.0050	0.008	0.000	0.0194	92,166
Commercial and Industrial	0.0527	0.1107	0.000	0.2944	92,166
Consumer mortgages	0.0200	0.0255	0.000	0.0679	92,166
Farm mortgages	0.0012	0.0020	0.000	0.0054	92,166
Commercial mortgages	0.0436	0.0316	0.0037	0.1029	92,166
BANK-LEVEL CONTROL					
Size	11.7944	1.2079	10.0198	13.9223	92,180
Non-Performing Loans	0.0147	0.0221	0.000	0.0533	92,166
REPO	0.0160	0.0351	0.000	0.0621	92,180
Liquidity ratio	0.2884	0.1482	0.0849	0.5668	92,180
Return on Assets	0.0078	0.0102	-0.009	0.0196	92,180
Non-interest income	0.1569	0.0950	0.0368	0.3230	92,180
MACRO-ECONOMIC CONTROL					
GDP change	2.1028	2.7894	-2.5	7.4	91,088
Gini	0.4516	0.0192	0.4174	0.48	91,088
House price index	5.6550	0.2774	5.3	6.2	91,088
Unemployment	6.0956	1.8686	3.7	9.8	91,088

Appendix C. Correlation Matrix

Dependent		*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*
Conventional Lerner	**(1)**	1.000													
Adjusted Lerner	**(2)**	0.5876	1.000												
Equity ratio	**(3)**	-0.0002	0.1406	1.000											
Leverage ratio	**(4)**	0.0689	0.1497	0.4754	1.000										
Tier-1 risk-based	**(5)**	0.1268	0.1528	0.4033	0.8353	1.000									
Securitization	**(6)**	-0.2366	-0.1726	-0.0605	0.0621	0.1120	1.000								
Size	**(7)**	-0.0799	0.0832	0.0352	-0.2855	-0.2731	-0.3059	1.000							
NPL	**(8)**	-0.1164	-0.1694	-0.0645	-0.0738	-0.0582	-0.1031	0.0394	1.000						
NII	**(9)**	0.0448	-0.1204	0.0082	-0.1458	-0.1130	-0.0646	0.2494	-0.0130	1.000					
ROA	**(10)**	0.4436	0.3152	-0.0494	-0.1041	-0.0790	0.0975	0.0767	-0.3818	0.1588	1.000				
GDP	**(11)**	0.2700	0.0452	-0.0208	-0.0237	0.0178	-0.0302	-0.0737	-0.0828	0.0436	0.1015	1.000			
Gini	**(12)**	0.0885	0.1314	0.0329	0.0180	0.0772	-0.3043	0.2396	0.1267	0.0402	-0.1455	-0.0234	1.000		
House price index	**(13)**	-0.0316	0.1570	0.0323	0.0143	-0.0188	-0.0811	0.2573	0.0068	-0.0800	-0.1276	-0.1378	0.2342	1.000	
Unemloyment rate	**(14)**	-0.2023	-0.0109	0.0233	-0.0053	-0.0054	-0.1228	0.1816	0.2771	-0.0028	-0.2684	-0.4369	0.4176	0.1011	1.000

Appendix C shows the correlation matrix between all variables in our model: Conventional Lerner index (1), Adjusted Lerner index (2), Equity ratio (3), Leverage ratio (4), Tier-1 risk-based capital ratio (5), overall securitization ratio (6), bank size (7), non-performing loans ratio (8), Non-Interest income NII (9), return-on-assets ROA (10), GDP change (11), Gini coefficient of income inequality (12), house price index (13) and unemployment rate (14)