

The risk-and-return effects of US banking competition and securitization

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Antonio BAYEH^{a*} Radu BURLACU^b

Abstract

Using a sample of 104,771 bank-year end data of the US commercial banks, we investigate the impact of the joint interaction between bank competition and securitization on risk and profitability. Our main findings show that Lerner index has a negative impact on bank risk and a positive impact on bank profitability. We also find that securitization has a positive impact on bank profitability prior to the recent financial crisis. The interaction between competition and securitization is found to have a negative impact on bank profitability and a positive impact on bank risk prior, during and after the crisis. Our paper emphasizes empirically the importance of the regulations restricting the recent expansion of bank competition, and provides new insights into the effects of competition and securitization on banks' risk and return.

Keywords: Securitization, competition, bank risk, stability, difference-in-difference.

^a Corresponding Author, PhD candidate in Banking and Finance at the CERAG, University of Grenoble Alpes, Grenoble, France; and Visiting Researcher at the David O'Brien Centre for Sustainable Enterprise, John Molson School of Business, Concordia University, Montreal, Quebec. *antonio.bayeh@univ-grenoble-alpes.fr*

^b Professor of Finance, Director of the CERAG, University of Grenoble Alpes, Grenoble, France.

1. INTRODUCTION

Since the last Great Depression of 2008, securitization has been an interesting topic over the last years. The Lehman Brother collapse has emphasized an increasing strand of research related to the impact of securitization on financial stability, which is found to be negative. In parallel, a tremendous evolution of the US banking competition has emerged in the US. More precisely, the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 has permitted US banks to expand their branches into new states. Hence, a high level of deregulation and competition characterized the US banking system prior to 2008. However, the last financial crisis has pushed bank regulators to put in place new laws that aim at limiting bank competition and securitization that have been showing a negative impact on financial stability. For instance, the Dodd-Frank Act of 2010 obliged banks to retain 5% of their credit risk exposure while securitizing their loans.

Despite the growing interest in bank competition and securitization; none of the previous studies, to our best knowledge, have considered the environment in which the commercial banks perform. To be more precise, the market structure's effect may be of a particular interest when analyzing the securitization issues. Some few studies have theoretically analyzed the relation between securitization and competition without any empirical evidence. For instance, the models provided by Hakenes and Schnabel (2010) and Huang et al. (2013) posit that banks are characterized by a low profitability as well as low capital buffers. Hence, they securitize the risky loans to increase their underlying loan pools' quality. For instance, banks lend more risky loans under competitive markets so that they are able to achieve higher returns (Faruggio et al., 2015).

In this paper, we contribute to this literature by analyzing empirically how an interaction between bank competition and securitization affect bank risk and return in the US. Specifically, using data from the Call Reports of Condition and Income during the period of 1999 to 2013, we document that the bank concentration level, as measured by the Lerner index, is positively related to bank stability. In the second analysis, we show that, on the one hand, home and farm mortgages are negatively related to banks' non-performing loans ratio. On the other hand, the commercial and multifamily mortgages have a positive impact on the non-performing loans. We then document a negative and significant impact of the joint interaction between the Lerner index and securitization ratio on bank risk, suggesting that banks that securitize their mortgage loans and perform in a competitive market are more profitable than their peers in a concentrated market. Finally, we show

that a higher Lerner index combined with a higher securitization ratio decreases the return-on-assets and the return-on-equity ratios prior to the recent financial crisis. During the latter, the impact remains negative but not statistically significant. After the crisis, we show that banks performing in a concentrated market and securitizing their home mortgages are more likely to experience a reduction in their profits.

Our paper is related to many theoretical and empirical studies exploiting the relationship between bank competition and stability. To be more precise, two contradictory theories emerge: “Competition-stability” versus “competition-fragility”.

H1.a. “Competition-fragility” hypothesis: A higher competition increases bank risk

First of all, this hypothesis posits that bank’ managers in concentrated markets benefit from a high degree of monopoly rents that needs to be maintained by investing in safe assets. The intuition behind this theory puts forward a direct relationship between competition and bank risk-taking. Marcus (1984) developed a theoretical model in which he showed that the deregulation has a potential of increasing the bank insolvency risk. More precisely, banks are eager to take on more risks as their charter value falls. Marcus thus emphasizes the importance of the insolvency effect when analyzing banks’ charter value. Matutes and Vives (1995) develop a theoretical framework showing that, when banks perform under a local monopoly system, the deposit insurance scheme seems to increase the volume of deposits since the deposit rate is low. As a result, the banks’ market share will increase, so that implies a tendency from a concentrated towards a competitive banking system. In a similar vein, Keeley (1990) theoretically rejects the Markowitz two-parameter portfolio model that posits a positive relationship between stringent capital regulation and the bank failure. In other words, he puts forward a theory proposing a negative impact of competition on bank stability, the so-called “competition-fragility”. In an attempt to analyze the relationship between financial liberalization and regulation, Hellmann et al. (2000) work on a theoretical model showing that the capital requirements are costly, in the sense that the banks are obliged to hold excessive and costly capital. They also suggest that some regulations, in the form of activity restrictions, may solve the moral-hazard problem and thus reduce the positive impact of competition on banks’ incentive to gambling. Boot and Thakor (2003) develop a theoretical model analyzing the asset portfolio as well as the regulator’s characteristics and emphasize the importance of transparency in generating a social optimum. They also argue that

banks performing in a competitive market earn a lower volume of rents which reduces their monitoring incentives and hence the financial stability as a whole. The latter has been considered by Allen and Gale (2004) who, when reviewing the latest competition-stability models, come to a conclusion that this issue must include a variety of required factors for a well-established policy implication at this point. We follow their intuition by emphasizing the importance of securitization procedure, a financial procedure that is accused of causing the recent financial crisis of 2008-2009. In a complementary setting, Wagner (2010) considers a model that includes a bank and an entrepreneur and concludes that when competition increases, the bank tends to finance a higher-risk profile's project than under concentration. He adds that it also finances projects inducing a higher level of risk. Banking competition, therefore, destroys financial stability, in the sense that the risk-appetite in a competitive system is relatively important.

H1.b. "Competition-stability" hypothesis: A higher concentration increases bank risk

On the other hand, lack of competition may have a detrimental effect on financial stability. In this context, Boyd and De Nicolo (2005) focus on the loan market competition. In a theoretical model, they show the existence of a risk-incentive mechanism in a concentrated banking market. In other words, the loan rates increase when competition decreases. Therefore, the bankruptcy risk of banks borrowers leads to a moral hazard problem, in the sense that the interest costs increase, which automatically implies a risk of failure. A banking crisis is less likely to occur in concentrated banking systems, but also more competition leads to a reduction in bank risk (Beck et al., 2006). Studying the impact of concentration on bank systemic risk, Boyd et al. (2007) find that more competitive banking system is more likely to induce a low systemic fragility as measured by the Z-score. In a similar vein, the probability of bank systemic risk is positively related to banks' concentration level (Schaeck et al., 2009).

More recently, the implementation of the Basel II accord allowed the large banks to adopt an internal rating based approach and thus reduce their capital holdings. These banks had a competitive advantage over small banks, so in a competitive market, the small banks' market share decline, leading to an increase in risk-taking. In other words, bank concentration, encouraged by the implementation of such bank regulation, tends to reduce the financial stability (Hakenes and Schnabel, 2011). This stability increases with the existence of competition in European countries (Schaeck and Cihak, 2014). The monetary policy shocks are also taken into consideration in the

analysis of competition, as they induce an effect on the financial stability. More precisely, concentrated banks are more likely to engage in riskier investments in the light of a less fragile shock induced by a low interest rate (Dell'ariccia et al., 2014).

H1.c. U-shaped relationship: No direct impact of competition on bank risk

Competition seems to have a U-shaped relationship with bank risk-taking. More specifically, when confronted to concentration, the banking markets are more likely to be financially stable, but at the same time a higher level of competition reduces bank risk (Beck et al., 2006). Berger et al. (2009) empirically argue that the loan market competition has a detrimental impact on credit risk, but at the same time may increase bank risk and decrease capital ratios. Under specific circumstances, competition increases bank risk-taking incentives by banks, and then reduces it (Martinez-Miera and Repullo, 2010). In a similar vein, the choice of the competition measures may affect the competition-stability results. For instance, Kick and Prieto (2015) analyze this nexus on a sample of German regional markets and find that competition reduces bank risk when it is measured at the level of the bank market by the Lerner index or the local market share. However, they also find that the market power measures, such as the Lerner index, tend to indicate a negative impact of competition on bank risk.

A more detailed literature review about competition-stability is illustrated in the table 1.

[INSERT TABLE 1 AROUND HERE]

Our paper is also related to the literature analyzing the relationship between securitization and bank risk. More precisely, we study the following hypotheses.

H2.a. Securitization – systemic risk: A higher level of securitization increases bank risk

Before analyzing the impact of securitization on bank risk, we briefly present the academic literature explaining securitization. Why do banks securitize their assets and what is the impact of securitization on banks? One cannot emphasize the motivations without mentioning the regulatory capital arbitrage hypothesis. More precisely, bank capital requirements inherently increase bank owners' cost of capital. Hence, banks tend to borrow on a short-term and lend on a longer period, they would thus increase their leverage in an attempt to reduce the capital constraints (Acharya et al., 2013). For instance, banks securitize their highest-quality loans in order to develop a better reputation in the market and benefit from reductions in regulatory capital retention. Therefore, a

higher level of securitization leads to a higher risk at the balance sheet level of banks. More recently, van Oordt (2014) develops the theoretical framework of Wagner (2010) by showing that loan “tranching” is not motivated by information asymmetry but rather by risk management incentives. Investors’ choice between risky and safe tradable assets is mainly based on the combination of assets that they already held in their portfolios. Diversification allowed by securitization may lead to a systemic event failure triggered by the defaults costs of banks engaged in securitization activities.

H2.b. Securitization – stability: A higher level of securitization reduces bank risk

On the other hand, the credit risk transfer technique may lead to promote financial stability. DeMarzo (2005) develop a theoretical model where a lender is supposed to pool senior tranches which are known by their low degree of risk. Banks originating and selling loans to the special purpose vehicle are more likely to securitize the lowest-risky loans as a way to encourage investors to buy them. This operation is also characterized by the fact that these investors hold private information regarding the type of loans they are about to buy. Duffie (2007) argues that securitization leads to a diversification of risks among the investors who buy the tradable assets. Banks have an incentive to retain the riskiest tranches in their balance sheets, but they also decrease their leverage and increase their diversification, and the financial stability would thus be guaranteed and improved. This mechanism is motivated by the regulatory capital requirements, although it should be accompanied by additional adjustments to provide further improvements. Pennacchi (1998) theoretically demonstrates that banks facing an important level of competition as well as regulatory capital constraints need to screen and monitor their loans. The costs of these activities may be reduced by loan sales. In other words, securitization reduces the risk given that loan sales increase bank profits.

We are aware of the market structure effect in which banks perform and securitize their loans. More precisely, one cannot simply test the impact of securitization on bank risk without emphasizing the degree of competition in the banking market, for the latter is crucial for bank stability. We thus develop a third model in an attempt to analyze whether the competition has a significant impact on the securitization-stability nexus. Specifically, we test the following hypothesis.

H3. Competition – securitization – risk: A higher level of competition with a higher level of securitization increases bank risk

During the pre-crisis period, banks that securitize their loans more broadly have a higher profitability (Cebenoyan and Strahan, 2004). In other words, the deregulation that preceded the crisis¹ has offered banks that securitize their loans a higher return on their activities. In a similar vein, Breton et al. (2014) theoretically posit that banks that securitized their loans have benefited from the competition level to decrease their screening and monitoring costs as an effective way in increasing their profits. Therefore, these banks were not aware of their borrowers' probability of default in the second market, which has led them to become systemically risky and more fragile to future shocks, especially the recent financial crisis. Gorton and Ordonez (2014) develop a theoretical model arguing that the securitized loans are complex and opaque; they are thus more likely to cause a financial fragility, in the sense that the social cost of information is relatively important.

2. Data and methodology

2.1. Data

We collect individual bank-level data from the Call Reports of Condition and Income of the Federal Reserve System. More precisely, we are interested in the December call reports since bank year-end data is more robust. To compute the securitization variables, we collect market-level data on securitized loans from the Flow of Funds Accounts of the United States. As for the macro-economic control variables, we use data from the US census bureau and the US bureau of labor statistics.

We start with a bank year-end data covering the period starting from December 1999 to December 2013. We then drop missing and negative observations on gross total loans, input factor prices, output variables, and costs. To reduce the influence of outliers, all the variables are winsorized at the 1st and 99th percentile. Our final sample consists of an unbalanced panel data including 104,771 bank year-end observations.

¹ Vives (2001) argues that the banking sector was characterized by a high degree of deregulation in the three decades preceding the last financial crisis of 2008. We thus expect a higher degree of competition during that period.

2.2. Variables

2.2.1. Competition

Our main variable of competition at the bank level is the Lerner index, which is widely used in the literature.² This index measures the market power of the banking industry by subtracting the price of total assets from marginal costs.

In our study, we follow the methodology of Koetter et al. (2012) and use two types of Lerner index: The conventional and the inefficiency-adjusted Lerner index. To do so, we start with a regression of two types (OLS and stochastic frontier analysis; SFA) to estimate marginal costs. Those generated through OLS are used to compute conventional Lerner index, while those generated through SFA analysis are used to compute efficiency-adjusted Lerner index.

Marginal costs are calculated through the intermediation approach (Sealey and Lindely, 1977), which specifies labor and physical capital as inputs to generate deposits that are used to fund loans and other earning assets. We follow previous studies estimating Lerner index in banking (Carbo et al., 2009; Turk-Ariss, 2010) by specifying three inputs (borrowed funds, labor, and capital) and two outputs (securities and loans). We then compute a translog total cost function for bank j at time t as follows:

$$\begin{aligned} \ln TOC_{jt} = & \alpha + \sum_{i=1}^3 \beta_i \log w_{ijt} + \sum_{p=1}^2 \gamma_p \log y_{jt} + \delta \log(Z_{jt}) + \sum_{i=1}^3 \varphi_i / 2 \log(w_{ijt}^2) + \\ & \sum_{i < k} \sum \eta_{ik} \log w_{ijt} \log w_{kjt} + \\ & \sum_{p=1}^2 \theta_p / \\ & 2(\log y_{pjt})^2 + \left(\frac{\kappa_{12}}{2}\right) \log y_{1jt} \log y_{2jt} + \sum_{i=1}^3 \sum_{p=1}^2 \lambda_{pi} \log w_{ijt} \log y_{pjt} + \sum_{k=1}^2 v_k trend^k + \\ & \sum_{i=1}^3 \xi_i \log w_{ijt} trend + \sum_{p=1}^2 \omega_p \log y_{pjt} trend + \varepsilon_{jt} \end{aligned}$$

Where TOC_{jt} denotes total operating costs, w_{ijt} represents bank j input factor prices at time t ($i=1,2,3$); y_{1jt} denotes the total securities of bank j at time t ; y_{2jt} denotes the total loans of bank j at time t ; and $trend$ is a time trend used as a tool to take into consideration technical change.

The linear homogeneity restriction requires that the factor prices (w_1 and w_2) must be divided by the cost of borrowed funds (w_3). The input factor prices are clustered at 1 and 99% to reduce the influence of outliers.

² See, for instance, 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).

Then, the marginal costs can be obtained using the coefficient estimates of the equation (1) as follows:

$$MC_{jt} = TOC_{jt}/y_{1jt} [\gamma_1 + \theta_1 \log y_{1jt} + \left(\frac{\kappa_{12}}{2}\right) \log y_{2jt} + \sum_{i=1}^3 \lambda_{1i} \log w_{ijt} + \omega_1 trend] + TOC_{jt}/y_{2jt} [\gamma_2 + \theta_2 \log y_{2jt} + \left(\frac{\kappa_{12}}{2}\right) \log y_{1jt} + \sum_{i=1}^3 \lambda_{2i} \log w_{ijt} + \omega_2 trend]$$

The estimated cost frontier coefficients and OLS coefficients are shown in Appendix A.

To approximate revenues, we follow Beck et al. (2013) and define p as the ratio of the total operating income to total assets. The Lerner index is then computed as $(p-mc)/p$.

The conventional Lerner index is estimated from OLS estimates of MC, as follows:

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

In contrast, the efficiency-adjusted Lerner index is estimated from frontier (SFA) estimates of MC, as follows:

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

The difference between the two Lerner types is that the efficiency-adjusted Lerner takes into account the inter-relatedness of competition and efficiency. Hence, we can rely on this modified index to better examine the implications of the degree of competition on efficiency. Furthermore, the Efficient Structure Hypothesis postulates that market structure is driven by efficiency and reverse causality is likely to prevail between the variables of interest. Conventional Lerner indices implicitly assume full bank efficiency and fail to consider the possibility that banks may not exploit pricing opportunities resulting from market power.

2.2.2. Securitization

To construct our variables measuring securitization, we follow Loutskina (2011) who proposes a new index of liquidity reflecting the degree of securitization in the US banking market. For instance, one cannot compute an index of securitization without including the individual bank loan portfolio structure as well as the economy-wide securitized assets. To summarize, we compute the following index

$$\text{Securitization of loan } i = \frac{\text{Economy – wide securitized loan } i}{\text{Economy – wide total loans } i} \times \text{bank loan } i \text{ portfolio}$$

Where economy-wide securitized loan i represents the amount of securitized loans, economy-wide total outstanding loans i denotes the annual amount of total loans of type i in each year, and bank loan i portfolio is the share of loans i in bank j .

The index measures the bank's incentives to securitize its loans.³ A higher bank j loan portfolio of type i with a lower securitized loan of the same type i means that bank i depends more on retaining the loan i in its balance sheet rather than securitizing it. In other words, the index weights bank j 's potential to securitize loans of type j , based on the composition of bank j 's loan portfolio. In fact, we divide the index into four categories depending on the type of loans: Home mortgages, multifamily mortgages, farm mortgages and commercial mortgages.

2.2.3. Bank risk

We are particularly interested in analyzing the impact of competition and securitization on bank credit risk, given that loan quality is essential for the survival of banks. To do so, we compute the ratio of non-performing loans (henceforth NPL) to total loans. The intuition behind this measure is to show whether competition increases the deficiency of bank loans as measured by the NPL ratio. On the one hand, Boyd and De Nicolo (2005) emphasize the positive impact of loan market competition on financial stability since banks reduce their lending rate to face their competitors. Therefore, lenders would pay more easily their debts, as the interest rates are relatively low, which leads to a reduction in bank loan default probability. On the other hand, a higher level of competition causes a reduction in rents earned by banks, which increases their financial fragility. We may thus suppose that a higher concentration implies a higher degree of stability, in line with the theory of competition-fragility (Keeley, 1990; Boot and Thakor, 2003; Allen and Gale, 2004).

$$\text{NPL ratio of bank } i = \frac{\text{Non – performing loans of bank } i}{\text{Total loans of bank } i}$$

³ This index is also used in some previous studies, for instance, Loutskina (2011), Zarutskie (2013), and Chen et al. (2016).

The NPL ratio captures the degree to which a borrower is able to pay his debts. More precisely, a higher NPL ratio implies a higher level of bank risk, in the sense that banks could not receive payment from their risky borrowers. This ratio is widely used in the literature on bank risk. For instance, Almarzoqi et al. (2015) study the impact of competition on bank credit risk as measured by the NPL ratio in the MENA region. Banks facing a higher NPL ratio are more likely to experience failure (Demirguc-Kunt, 1989), have a moral-hazard behavior which cause losses in the future (Zhang et al., 2016), are considered as financially “polluted” (Barseghyan, 2010), and retain an important risk regarding their liquidity and profitability (Ghosh, 2016). Hence, NPLs may also serve as an indicator of potential moral-hazard problem inside the banks. Studying the determinants of NPLs in the US commercial banks from 1984 to 2013, Ghosh (2016) empirically shows that higher capital and credit standards as well as an efficient risk management tend to reduce the NPLs.

2.2.4. Bank profitability

Banks operating in a more competitive market are characterized by a low profitability and a low capital buffer (Hakenes and Schanbl, 2010; Huang et al., 2013). We are therefore interested in analyzing the impact of competition and securitization on bank profitability, in an attempt to assess whether higher competition with a higher securitization implies a higher level of profitability. On the one hand, since concentration is expected to increase bank managers’ rents, we use the return on assets as a main indicator of profitability.

$$ROA \text{ of bank } it = \frac{\text{Net income of bank } i \text{ at time } t}{\text{Total assets of bank } i \text{ at time } t}$$

sources of liquidity to the originator banks. We thus expect that the interaction between competition and securitization has a significant impact on banks’ return on equity.

$$ROE \text{ of bank } it = \frac{\text{Net income of bank } i \text{ at time } t}{\text{Total equity capital of bank } i \text{ at time } t}$$

2.3. Methodology

2.3.1. Competition - risk

In the baseline specification, we first test whether competition has a significant impact on bank risk by using the following panel regression that includes bank-fixed effects.

$$\begin{aligned} Risk_{jt} = & \alpha_j + \beta_1 Competition_{jt} + \beta_2 Bank - Control_{jt} + \beta_3 Macro - economic_{jt} \\ & + \varepsilon_{jt} \end{aligned}$$

Where j indicates each bank in the sample, and t denotes the year t . $Risk_{jt}$ is the dependent variable representing bank risk, which is the NPL ratio. $Competition_{jt}$ represents an indicator of competition at the bank level, the Lerner index, measuring the market power. $Bank - Control_{jt}$ is a vector of bank-specific control variables, and $Macro - economic_{jt}$ denotes a vector of macro-economic variables evaluating the US economy and its impact on the competition-stability nexus.

However, the OLS regression could be biased because of possible endogeneity concerns arising between competition and bank risk. To address this issue, we follow the dynamic panel literature (Bond and Blundell, 1998) by using an instrumental-variable regression. To do so, we use the lagged Lerner index by one year as an instrument.⁴

To the extent that the Lerner index inversely measures competition, we posit the following hypotheses

H1. (a) Competition-fragility: A high Lerner index value (less competition) leads to a decrease in the NPL ratio.

H1. (b) Competition-stability: A high Lerner index value (high competition) leads to an increase in the NPL ratio.

2.3.2. Securitization - risk

In a second step, we analyze the impact of securitization on bank risk. To do so, we perform an OLS regression within a bank fixed-effect model in a way to provide a comprehensive

⁴ Many previous studies use an IV approach to address the endogeneity problems by using the lagged value of independent variable. See for instance Schaeck et al. (2014), Koetter et al. (2012), and Jones (2012).

analysis of the securitization-stability nexus. More specifically, the model takes the following equation

$$\begin{aligned} Risk_{jt} = & \alpha_j + \beta_1 Securitization_{jt} + \beta_2 Bank - Control_{jt} \\ & + \beta_3 Macro - economic_{jt} + \varepsilon_{jt} \end{aligned}$$

Where $Securitization_{jt}$ represents the securitization ratio of each type of loans. More precisely, we compute four ratios reflecting the home mortgages securitized, the multifamily mortgages securitized, the farm mortgages securitized, and the commercial mortgages securitized. We are interested in analyzing whether banks that securitize their loans to a large extent are more likely to experience a high probability of default in terms of their loan quality. We thus test which of the following hypotheses is relevant

H2. (a) Securitization-risk: A higher securitization ratio has a positive impact on the NPL ratio.

H2. (b) Securitization-stability: A higher securitization ratio has a negative impact on the NPL ratio.

2.3.3. Competition – securitization – risk

Since we emphasize the importance of the market structure in which banks perform, we are also interested in analyzing the impact of the joint interaction between competition and securitization on bank risk. In other words, the securitization's impact on bank risk might be distorted by the level of competition in the US banking market. For instance, Hakenes and Schnabl (2010) argue that banks performing in a competitive market are more eager to securitize their loans so they could thus increase their lending capacity and therefore their profitability. More recently, Breton et al. (2014) develop a theoretical model emphasizing the interaction between competition and securitization. They come to a conclusion of a negative relationship between securitization and competition, thus affecting banks' screening and monitoring incentives. Marques-Ibanez et al. (2014) empirically study the impact of competition and securitization on bank risk in nine European countries and US. However, we run a difference-in-difference approach to gauge the impact of the joint interaction between the Lerner index and the securitization ratio on the NPL ratio as follow

$$\begin{aligned}
\mathbf{Risk\ }jt &= \alpha_j + \beta_1 \mathbf{Competition}_{jt-1} + \beta_2 \mathbf{Securitization}_{jt} \\
&+ \beta_3 \mathbf{Securitization}_{jt} \times \mathbf{Competition}_{jt-1} + \beta_4 \mathbf{Bank - Control}_{jt} \\
&+ \beta_5 \mathbf{Macro - economic}_{jt} + \varepsilon_{jt}
\end{aligned}$$

Where $\mathbf{Securitization}_{jt} \times \mathbf{Competition}_{jt-1}$ represents the interaction term between the Lerner index and the securitization ratio. This model aims at emphasizing whether there is any significant effect of competition on the securitization-stability nexus. We thus posit the following hypotheses.

H3. (a) Competition-securitization-risk: A lower Lerner index (higher competition) combined with a higher securitization ratio lead to an increase in the NPL ratio.

H3. (b) Competition-securitization-stability: A lower Lerner index (higher competition) combined with a higher securitization ratio lead to a decrease in the NPL ratio.

2.3.4. *Competition – securitization – profitability*

One of the main motivations driving banks to securitize their loans is the need to increase their performance (Faruggio et al., 2015). Hence, we look forward to studying whether this objective is attained through securitization. Moreover, a higher concentration is expected to increase bank monopoly rents, thus leading bank managers to benefit from this situation to increase their profits.⁵ As a result, we expect that a higher Lerner index increases bank profitability. In an attempt to empirically test this relation, we develop the following difference-in-difference regression with bank fixed-effects.

$$\begin{aligned}
\mathbf{Return\ }jt &= \alpha_j + \beta_1 \mathbf{Competition}_{jt-1} + \beta_2 \mathbf{Securitization}_{jt} \\
&+ \beta_3 \mathbf{Securitization}_{jt} \times \mathbf{Competition}_{jt-1} + \beta_4 \mathbf{Bank - Control}_{jt} \\
&+ \beta_5 \mathbf{Macro - economic}_{jt} + \varepsilon_{jt}
\end{aligned}$$

Where $\mathbf{Return\ }jt$ denotes the Return on Assets ratio and the Return on Equity ratio. The main objective behind this model consists of studying whether securitized banks in a concentrated market are more likely to generate higher profits. The following hypotheses are tested.

⁵ Boot and Thakor (2003) theoretically posit that banks in a more competitive market earn lower rents.

H4. (a) Competition-securitization-profitability: A lower Lerner index (higher competition) combined with a higher securitization ratio lead to an increase in ROA and ROE.

H4. (b) Competition-securitization-negative profitability: A lower Lerner index (higher competition) combined with a higher securitization ratio lead to a decrease in ROA and ROE.

To gauge the recent financial crisis's effect, we split the sample into three periods: the pre-crisis period covering the data from 1999 to 2007, the crisis period which ranges between 2007 and 2009, and the post-crisis period that succeeds 2009.

3. Empirical results

3.1. Competition – bank risk

The results on the impact of competition on bank risk are reported in table (3). Columns (1) to (4) report the OLS regression results, while columns (5) to (8) report the IV regression which includes the Lerner index lagged by one period as an instrument. As for the decomposition of the independent variables, we use the two types of Lerner index, for instance, the conventional and the adjusted Lerner, on which we regress the NPL ratio. We also include bank-specific control variables such as the security share of each bank, the income share, and the size. Macro-economic variables are also included in our model, such as the unemployment rate, the GDP change rate, as well as the Gini coefficient of income inequality.

[INSERT TABLE 3 AROUND HERE]

As we observe from the first two columns, we find that the adjusted Lerner index has a negative and significant impact on the NPL ratio (-0.026 and -0.025 respectively). In other words, a higher level of concentration reduces bank risk; we thus conclude that competition has a detrimental effect on bank stability. Our results are in line with those of the previous empirical studies supporting the “competition-fragility” hypothesis. The OLS regression results of the NPL ratio on the conventional Lerner index also imply a negative and significant relationship between the two variables (-0.022 and -0.015 respectively). As for the macro-economic variables, their impact is globally positive on the NPL ratio. Banks performing in an environment where the GDP change is high, the unemployment rate is high, and the coefficient of inequality is also high, are more likely to retain a lower loan quality portfolio.

Since we are aware of possible endogeneity bias between the Lerner index and the NPL ratio, we perform an instrumental-variable regression with two steps (IV 2SLS). We refer to the dynamic panel literature as a main motivation for using the Lagged value of Lerner index as an instrument in the IV regression (Blundell and Bond, 1998).

We find that the negative impact of the adjusted Lerner index remains negative and statistically significant, although it has slightly increased compared to the OLS regression (-0.030). The conventional Lerner index also reduces significantly the NPL ratio, with a stronger effect (-0.055 and -0.021 respectively). While controlling for bank-specific and macro-economic variables, the significant relevance of our model remains strong and significant.

More broadly, our results are in line with those of Kick and Prieto (2015) who study the German regional banks and empirically show that a higher market power is related to a higher stability. This is also consistent with the results of Tabak et al. (2011) for a sample of Brazilian commercial banks, showing that bank loan portfolio concentration has a negative impact on Brazilian banks' risk-taking. Beck et al. (2006) also show that countries, in which a concentrated banking system exists, are less likely to experience a banking crisis. Diallo (2015) shows that competition reduces bank stability on a sample of 145 countries. We thus provide an additional empirical support to the "competition-fragility" hypothesis, in the sense that bank managers benefit from monopoly rents to improve their loan quality and hence decrease their risk of failure.

3.2. Securitization– bank risk

Results of our model explaining the impact of securitization on banks' NPL ratio are reported in table (4).

[INSERT TABLE 4 AROUND HERE]

We test the impact of securitization on bank risk as measured by the non-performing-loans ratio. We report the results of the home mortgages securitized in columns (1) and (2), commercial mortgages in columns (3) and (4), multifamily mortgages in columns (5) and (6), and farm mortgages in columns (7) and (8). We find that the higher the US commercial banks securitize their home mortgages; the lower is their non-performing loans rate. The impact is statistically significant (-0.021), and gets stronger after including the control variables (-0.024). Our results are

consistent with those of Ambrose et al. (2005) who argue that the riskier loans, which are those having the highest probability of default, are more likely to be sold as mortgage backed securities. In other words, the regulatory capital arbitrage theory, which posits that the originators tend to securitize low-risk loans and retain high-risk loans in their portfolio, is valid for the home and farm mortgages. In contrast, the commercial and multifamily mortgages have a positive impact on the non-performing loans, as shown in columns 3 (0.138) and 5 (0.114). These results show that the US commercial banks are using internal information to select and securitize the loans with lower profitability (higher NPL). Consistently with the reputation hypothesis as noted by Ambrose et al. (2005), we assume that US banks benefit from asymmetric information with the commercial and multifamily mortgages' investors in the sense that they securitize the less profitable loans. In a similar vein with Krahenen and Wilde (2006), the US commercial banks seem to retain the riskiest tranches of the commercial and farm mortgages, thus reducing their regulatory capital requirements.

3.3. Competition – securitization – bank risk

Results of the impact of the joint interaction between competition and securitization are reported in tables (5) and (6).

[INSERT TABLES 5 AND 6 AROUND HERE]

The model is closely related to the difference-in-difference approach by Koetter et al. (2012) who study the impact of competition on bank efficiency. The main motivation behind their study is to show whether deregulation may have an effect on the competition-efficiency nexus. We follow a similar approach in an attempt to figure out whether the market structure effect is important to be considered when analyzing the competition-stability nexus. We slightly consider that the change in competition might affect the impact of securitization on bank risk.

As we can see, the Lerner index has a negative and significant impact on NPL all over the sample, before, during and after the crisis. To be more specific, the higher the concentration is in the US banking market, the lower is the ratio of non-performing loans ratio. During the pre-crisis period, the impact of the adjusted and unadjusted Lerner index on the NPL ratio is negative and statistically significant (-0.005 and -0.007 respectively). During the crisis, these two coefficients negatively increased (-0.038 and -0.035 respectively), suggesting that the competition had a

detrimental effect on the financial stability. Our results are in line with those of Kick and Prieto (2015) for the German regional banks, as well as those of Marques-Ibanez et al. (2014) for the largest banks in Europe and US, as well as the theoretical models supporting the competition-fragility hypothesis (Keeley, 1990; Hellmann et al., 2000; Boot and Thakor, 2003; Allen and Gale, 2004; Wagner, 2010). In other words, our findings argue that more concentrated banks are more eager to adjust their risk-taking following a monetary policy shock. We can thus conclude that a higher market power is associated with a lower risk-taking, in the sense that the price-setting power is able to reduce the negative effect of restrictive monetary policies on the US banks' stability.

The impact of securitization on the credit risk is negative across all the period except during the crisis (0.108), suggesting that when banks securitize their home mortgages between 2007 and 2009, their non-performing loans ratio significantly increases. Our findings confirm the hypothesis that securitization endangers banks' stability, hence confirming the claims that securitization was one of the main reasons of the recent financial crisis. Turning to the impact of the joint interaction between competition and securitization on bank risk, we find a positive and significant impact before, during and after the crisis (0.013, 0.150, and 0.098 respectively). Interestingly, the impact was stronger during the crisis. To be more specific, a higher Lerner index with a higher level of securitized home mortgages for a given US commercial banks lead to a higher non-performing loans ratio. This effect is strong and statistically significant. Therefore, in more concentrated markets, banks that securitize their home mortgages are more likely to experience a higher probability of default.

3.4. Competition – securitization – bank profitability

We next move to the competition-securitization-profitability nexus in an attempt to see whether more competitive banking markets securitizing their loans to a large extent have a high or a low profitability ratio on their assets and their equity. We report the results of the joint interaction between competition and securitization on bank profitability before the recent financial crisis (columns 1 to 4), during the crisis (columns 5 to 8), and after the crisis (columns 9 to 12), in table (7).

[INSERT TABLE 7 AROUND HERE]

Before the recent financial crisis, we observe that the adjusted Lerner index has a positive and significant impact on ROA and ROE (0.037 and 0.002 respectively). Concerning the impact of securitization on bank profitability, we find that banks securitizing their home mortgages generate a positive and significant return over their assets (0.106) and their equity (0.006). Our results are in line with those of Cebenoyan and Strahan (2004) who argue that banks securitizing their loans in the pre-crisis period are more profitable. Regarding the interaction term between competition and securitization, we find that a higher adjusted and conventional Lerner index combined with a higher securitization ratio have a negative and significant impact on ROA (-0.100 and -0.147 respectively). Therefore, in a concentrated banking market, banks that securitize an important volume of home mortgages are less likely to earn higher profits. We can thus argue that securitization in competitive markets is more profitable for banks. These findings provide empirical evidence to the theoretical model of Breton et al. (2014) which posits that banks that securitize their loans benefit from competition to reduce the costs of screening and monitoring their borrowers and hence increase their profits. As for the bank-specific variables, we interestingly find that more capitalized banks are less likely to generate return on assets (-0.114 and -0.112) and return on equity (-0.018). This finding is in line with Hellmann et al. (2000) who theoretically show that capital requirements are costly for banks.

The crisis period induces different results compared to the pre-crisis period. For instance, as shown in the columns (5) and (6), the impact of concentration as measured by the adjusted Lerner index is positive and significantly stronger on ROA (0.200) and ROE (0.191). Moreover, the ratio of securitization seems to move from a positive and significant impact on profitability during the pre-crisis period, to a negative and non-significant during the crisis. This implies that banks no longer benefit from selling their home mortgages to increase their profitability. These findings are in line with the theoretical predictions of Gorton and Ordonez (2016) which are based on the social costs of the information. More precisely, the crisis period pushes banks to increase their screening and monitoring incentives, in the sense that bank managers may evaluate borrowers' probability of default. This significant increase in the social costs implies a decrease in banks' profitability. Concerning the interaction between competition and securitization, the impact is also negative but not significant, except on the ROE where the effect is statistically significant (-0.062).

The post-crisis period reveals that bank market power does not significantly affect the return on assets and equity. However, as shown in the last column, the impact of the conventional Lerner index on ROE is significantly positive (0.012), which means that more concentrated banks generate a high proportion of profits over their equity. As shown in column 10, the coefficient of securitization on ROA is the strongest among the entire sample (0.768). In other words, banks that securitize their home mortgages after the crisis increase to a large extent their profits. The coefficient of the interaction term between competition and securitization is negatively significant (-0.997), which means that banks performing in a concentrated market and securitizing their home mortgages are more likely to experience a reduction in their profits.

4. Conclusion

In this paper, we analyze the impact of competition and securitization on bank risk and return. The literature presents contradictory theories and empirical results on whether competition increases or decreases stability. Similarly, securitization has been considered as an important topic in the recent years. Moreover, while some theoretical predictions emphasize the positive impact of securitization on bank profitability, other models negatively link these two concepts by arguing that securitizing banks in a competitive market increase risk and return at the same time.

In an effort to better understand the joint relation between competition and securitization and how it may affect bank risk and return, we collect bank-level data from the Call Reports of Condition and income and market-level data from the Flow of Funds Accounts of the United States, as well as macro-economic variables from the US census bureau from 1999 to 2013. Our tests reveal that firstly competition tends to have a negative impact on stability, since higher Lerner index reduces bank risk as measured by the NPL ratio. We employ two methodological approaches, the OLS and the IV regression, that yield similar results regarding this relationship. Secondly, we split the securitization ratio into four categories, in a way to show how each type of securitized loans differently affect the NPL ratio. Our findings reveal that home and farm mortgages have a detrimental effect on bank loan quality, while multifamily and commercial mortgages seem to increase the US loans' quality. Thirdly, and after we've contributed to the literature by presenting a clear and significant results at the first two steps, we interact the Lerner index with securitization ratio to test whether the market structure effect on the securitization-stability nexus. We strongly believe that one cannot emphasize this nexus without considering the market structure in which the

US commercial banks perform. We document a strong and positive impact of the interaction between the Lerner index and securitization ratio on the NPL ratio, suggesting that securitizing banks in a more competitive state are less risky than their peers in a more concentrated banking system. Fourthly, we extend the previous analysis by studying the bank profitability effects. The main intuition is to show whether concentration is beneficial for bank managers, since the concentrated banks earn monopoly rents, thus increasing banks' value. Our main findings show a negative and significant impact on bank ROA and ROE before and after the recent financial crisis.

Our research contributes to the literature by assessing the effects of competition and securitization on bank risk and return. Overall, the results support the view that competition endangers financial stability, and therefore raise important questions about the efficiency of the future policies encouraging the deregulation. For instance, the Dodd-Frank Act incentivizes the US commercial banks to better screen their borrowers, and puts forward some restrictions regarding the extent to which a bank can securitize its loans. In other words, since this Act increases the concentration level and restricts securitization, the financial stability will be increasing. That is what we have shown through our paper, in the sense that a higher securitization with a higher concentration increases the NPL ratio of US commercial banks. We thus expect that the restrictions on securitization in a concentrated market could improve the US loan quality.

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Table 1. Literature review (Competition-risk)

Authors	Period of study	Countries	Methodology and variables	Main empirical results
Grop et al. (2014)	2003	Banks from 30 OECD countries	Cross-sectional OLS and IV regressions MS of competitor banks Support ratings	Market share of insured competitor banks increase banks' risk-taking
Berger et al. (2009)	1999-2005	Banks in 23 industrial countries	GMM NPL, ER, Z-score Lerner and HHI	Support for "competition-stability" and "competition-fragility"
De Nicolo and Turk Ariss (2010)	1992-2006	European banks	Fixed-effect model Z-score and ER Deposit risk premium and loan rent	No trade-off between competition and stability
Diallo (2015)	1997-2010	145 countries	Logit model Boone and Lerner Probability of crisis	Bank competition reduces stability
Beck and De Jonghe (2014)	2002-2011	77 countries	Year and bank fixed effects model Sectorial HHI MES	Higher specialization leads to a higher systemic risk and a higher volatility
Kick and Prieto (2015)	1994 – 2010	German banks	Logit and IV Lerner and Boone Bank distress, Bank default, Z-score	Market power increases the financial stability
Tabak et al. (2011)	2003-2009	96 Brazilian commercial banks	Arellano and Bond estimation model HHI NPL	Loan portfolio concentration lowers bank risk-taking
Beck et al. (2006)	1980-1997	69 countries	Logit model CR3 Crisis dummy	Concentrated systems are less likely to experience a crisis Competition lowers bank risk
Schaeck et al. (2009)	1980-2003	38 countries	Duration analysis and logit model H-statistic and CR3 Crisis dummy	Support for "competition-stability"

Authors	Period of study	Countries	Methodology and variables	Main empirical results
Boyd et al. (2007)	2003 and 1993-2004	2500 US banks and 2600 banks in 134 countries	Cross-sectional regression HHI Z-score	Competitive banking systems are more prone to be less systemically risky
Jimenez et al. (2007)	1988-2003	Spanish banks	GMM Lerner index NPL	Support for “competition-fragility”
Schaeck and Cihak (2012)	1999-2004	The EU 15 countries	2SLS IV regression H-statistic, CR3, HHI and MS	Support for “competition-stability” if considering that better capitalized banks are less risky
Schaeck and Cihak (2014)	1993 – 2002	European and US banks	2SLS and quantile Lerner index and Boone Z-score	Negative impact of competition on bank risk
Anginer et al. (2014)	1997 - 2009	63 countries	OLS Lerner index, H-statistic Distance to default, CoVar	Competitive banking encourages more diversified risks, and thus decreases systemic fragility
Beck et al. (2013)	1994 - 2009	79 countries	Cross-country regression Lerner index Z-score	U-shaped relationship between market power and stability

Table 2. Summary statistics

Variables	Mean	Standard Deviation	Percentiles		Number of observations
			5 th	95 th	
<u>Stochastic Frontier Analysis</u>					
W ₁	33.94	32.39	9.90	93.95	104,492
W ₂	53.05	15.58	32.96	83.34	104,492
W ₃	2.17	1.12	0.53	4.10	104,492
Y ₁	73284.28	196978.5	1986	258143	104,492
Y ₂	441567.7	4247339	11022	779009	104,492
Z	70945.74	729770.9	2341	112901	104,492
<u>Control variables</u>					
Unemployment rate	5.91	1.91	3.4	9.6	103,379
Financial freedom	80.64	8.93	70	90	103,379
GDP change	2.25	2.88	-2.6	7.8	103,379
Gini coefficient	0.45	0.02	0.415	0.48	103,379
SEC	0.11	0.08	0.06	0.17	104,492
INC	0.70	0.13	0.44	0.89	104,492
ER	0.11	0.08	0.06	0.17	104,492
Size	11.78	1.22	9.99	13.95	104,492
<u>Risk measurements</u>					
LLR	0.005	0.009	0	0.018	104,472
NPL	0.014	0.021	0	0.051	104,472
LLP	0.014	0.009	0.006	0.03	104,472
<u>Competition measures</u>					
Conventional Lerner	0.70	0.08	0.566	0.84	104,492
Adjusted Lerner	0.78	0.13	0.54	0.95	104,492
HHI loans	0.57	2.12	0.30	0.89	104,472
<u>Securitization variables</u>					
Home mortgages ratio	0.13	0.10	0.01	0.33	104,472
Commercial mortgages ratio	0.04	0.03	0.003	0.10	104,472
Multifamily mortgages ratio	0.004	0.008	0	0.02	104,472
Farm mortgages ratio	0.001	0.001	0	0.005	104,472

Table 3. The impact of competition on bank risk for the entire sample

	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>IV</i>	<i>IV</i>	<i>IV</i>	<i>IV</i>
<i>Dependent</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>
<i>Instruments</i>	-	-	-	-	<i>Lagged</i>	<i>Lagged</i>	<i>Lagged</i>	<i>Lagged</i>
					<i>Lerner</i>	<i>Lerner</i>	<i>Lerner</i>	<i>Lerner</i>
Adjusted Lerner index	-0.026*** (0.000)	-0.025*** (0.000)			-0.030*** (0.000)	-0.030*** (0.000)		
Conventional Lerner index			-0.022*** (0.001)	-0.015*** (0.001)			-0.055*** (0.001)	-0.021*** (0.001)
GDP change		0.000*** (0.000)		0.000*** (0.000)		0.000*** (0.000)		0.000*** (0.000)
Unemployment rate		0.003*** (0.000)		0.003*** (0.000)		0.003*** (0.000)		0.003*** (0.000)
Gini		0.029*** (0.003)		0.016*** (0.003)		0.033*** (0.000)		0.019*** (0.004)
Security share		-0.008*** (0.000)		-0.013*** (0.000)		-0.007*** (0.000)		-0.013*** (0.000)
Income share		0.011*** (0.000)		0.011*** (0.000)		0.011*** (0.000)		0.010*** (0.000)
Size		-0.000** (0.000)		-0.000*** (0.000)		-0.000 (0.000)		-0.000*** (0.000)
Constant	0.035*** (0.000)	-0.005*** (0.001)	0.030*** (0.000)	-0.005*** (0.001)	0.042*** (0.001)	-0.003 (0.001)	0.052*** (0.001)	-0.001 (0.001)
Number of observations	104,472	103,359	104,472	103,359	104,471	103,358	104,471	103,358
R-squared	2.63	11.61	0.89	9.60	2.30	11.53	n.a.	9.54

Table 4. The impact of securitization on bank risk

<i>Dependent</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>
Home mortgages	-0.021*** (0.001)	-0.024*** (0.001)						
Commercial mortgages			0.138*** (0.002)	0.072*** (0.003)				
Multifamily mortgages					0.114*** (0.009)	0.039*** (0.009)		
Farm mortgages							-0.039*** (0.028)	-0.499*** (0.029)
GDP change		0.000** (0.000)		0.000*** (0.000)		0.000*** (0.000)		0.000*** (0.000)
Unemployment rate		0.003*** (0.000)		0.003*** (0.000)		0.003*** (0.000)		0.003*** (0.000)
Security share		-0.015*** (0.000)		-0.011*** (0.000)		-0.013*** (0.000)		-0.013*** (0.000)
Income share		0.010*** (0.000)		0.009*** (0.000)		0.011*** (0.000)		0.012*** (0.000)
Size		-0.000*** (0.000)		-0.000*** (0.000)		-0.000*** (0.000)		-0.000*** (0.000)
Constant	0.017*** (0.000)	-0.004*** (0.000)	0.008*** (0.000)	-0.003*** (0.000)	0.013*** (0.000)	-0.009*** (0.000)	0.014*** (0.000)	-0.007*** (0.000)
Number of observations	104,472	103,359	104,472	103,359	104,472	103,359	104,472	103,359
R-squared	1.02	10.43	3.99	10.08	0.22	9.28	1.2	9.43

Table 5. The impact of competition and securitization on bank risk for the entire sample

<i>Sample</i>	ALL			
<i>Adjusted Lerner</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
<i>Dependent</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>
	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>
Lagged Lerner	-0.027*** (0.001)	-0.029*** (0.001)	-0.046*** (0.002)	-0.035*** (0.002)
SECURITIZATION	-0.133*** (0.008)	-0.098*** (0.008)	-0.100*** (0.007)	-0.116*** (0.007)
Lagged Lerner	0.094*** (0.009)	0.085*** (0.008)	0.044*** (0.011)	0.122*** (0.011)
*SECURITIZATION		0.003*** (0.000)		0.002*** (0.000)
Size		-0.021*** (0.003)		-0.024*** (0.003)
Equity Ratio		0.010*** (0.001)		0.009*** (0.001)
Income share		0.000*** (0.000)		0.000*** (0.000)
GDP change		0.255*** (0.013)		0.25*** (0.013)
Gini		0.003*** (0.000)		0.003*** (0.000)
Unemployment rate		-0.008*** (0.000)		-0.008*** (0.000)
House price index				
Constant	0.044*** (0.001)	-0.087*** (0.006)	0.056*** (0.001)	-0.082*** (0.005)
Bank fixed-effects	YES	YES	YES	YES
R-squared	2.19	7.86	2.92	7.59
Number of observations	104,771	103,358	104,771	103,558

Table 6. The impact of competition and securitization on bank risk before, during and after the crisis

<i>Sample</i>	PRE-CRISIS				CRISIS				POST- CRISIS			
<i>Adjusted Lerner</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
<i>Dependent</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>	<i>(6)</i>	<i>(7)</i>	<i>(8)</i>	<i>(9)</i>	<i>(10)</i>	<i>(11)</i>	<i>(12)</i>
	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>	<i>NPL</i>
Lagged Lerner	-0.007*** (0.001)	-0.005*** (0.000)	-0.009*** (0.001)	-0.007*** (0.001)	-0.052*** (0.009)	-0.038*** (0.008)	-0.065*** (0.008)	-0.035*** (0.008)	-0.027*** (0.004)	-0.016*** (0.004)	-0.057*** (0.004)	-0.026*** (0.006)
SECURITIZATION	-0.008 (0.004)	-0.012*** (0.003)	-0.011** (0.004)	-0.015*** (0.004)	0.108*** (0.039)	-0.009 (0.036)	0.155*** (0.030)	0.018 (0.027)	-0.136*** (0.045)	-0.116*** (0.043)	-0.210*** (0.046)	-0.188*** (0.046)
Lagged Lerner	0.010** (0.004)	0.013** (0.004)	0.013*** (0.005)	0.019*** (0.005)	0.189*** (0.047)	0.150*** (0.042)	0.140*** (0.042)	0.143*** (0.039)	0.172*** (0.047)	0.098* (0.046)	0.254*** (0.000)	0.206*** (0.050)
*SECURITIZATION		0.000 (0.000)		0.000 (0.000)		-0.010*** (0.002)		-0.011*** (0.002)		0.005* (0.002)		0.005** (0.002)
Size												
Equity Ratio		-0.003*** (0.010)		-0.003*** (0.001)		-0.066*** (0.019)		-0.068*** (0.019)		-0.046* (0.022)		-0.049** (0.022)
Income share		-0.023*** (0.001)		0.02** (0.001)		-0.017*** (0.005)		-0.018*** (0.005)		0.007 (0.004)		0.008 (0.004)
GDP change		0.000*** (0.000)		0.000*** (0.000)		0.001*** (0.000)		0.001*** (0.000)		-0.000*** (0.000)		-0.000*** (0.000)
Gini		-0.005 (0.007)		-0.006 (0.007)		0.170*** (0.047)		0.162*** (0.047)		-0.026 (0.028)		0.018 (0.029)
Unemployment rate		0.000*** (0.000)		0.000*** (0.000)		0.003*** (0.000)		0.003*** (0.000)		0.002*** (0.000)		0.001*** (0.000)
House price index		-0.000* (0.000)		-0.000 (0.000)		-0.082*** (0.005)		-0.084*** (0.005)		-0.025*** (0.003)		-0.023*** (0.003)

Table 6 (continued). The impact of competition and securitization on bank risk before, during and after the crisis

Constant	0.014*** (0.000)	0.009** (0.003)	0.016*** (0.000)	0.009*** (0.003)	0.019** (0.007)	0.540*** (0.050)	0.021*** (0.006)	0.564*** (0.051)	0.045*** (0.004)	0.119*** (0.031)	0.067*** (0.004)	0.087*** (0.031)
Bank fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.68	0.20	0.38	n/a	n/a	n/a	n/a	n/a	13.13	5.02	11.99	4.29
Number of observations	61,104	59,901	61,104	59,901	20,372	20,372	20,372	20,372	22,295	22,295	22,295	22,295

Table 6. The impact of competition and securitization on bank profitability before, during and after the crisis

<i>Sample</i>	PRE-CRISIS				CRISIS				POST- CRISIS			
<i>Adjusted Lerner</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>
<i>Dependent</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>	<i>(6)</i>	<i>(7)</i>	<i>(8)</i>	<i>(9)</i>	<i>(10)</i>	<i>(11)</i>	<i>(12)</i>
	<i>ROA</i>	<i>ROA</i>	<i>ROE</i>	<i>ROE</i>	<i>ROA</i>	<i>ROA</i>	<i>ROE</i>	<i>ROE</i>	<i>ROA</i>	<i>ROA</i>	<i>ROE</i>	<i>ROE</i>
Lagged Lerner	0.037*** (0.005)	0.057*** (0.008)	0.002*** (0.000)	0.000 (0.001)	0.200*** (0.069)	0.191*** (0.072)	0.003 (0.003)	-0.001 (0.003)	0.025 (0.039)	0.063 (0.056)	0.003 (0.001)	0.012*** (0.003)
SECURITIZATION	0.106*** (0.026)	0.135*** (0.030)	0.006** (0.002)	0.004 (0.003)	-0.579 (0.341)	-0.389 (0.266)	-0.031 (0.016)	-0.017 (0.014)	0.301 (0.402)	0.768** (0.326)	0.004** (0.018)	0.092*** (0.022)
Lagged Lerner *SECURITIZATION	-0.100** (0.025)	-0.147*** (0.034)	-0.005 (0.003)	-0.003 (0.003)	-0.300 (0.393)	-0.708 (0.365)	-0.031 (0.019)	-0.062*** (0.020)	-0.321 (0.394)	-0.997*** (0.360)	-0.020 (0.018)	-0.092*** (0.025)
Size	0.041*** (0.002)	0.041*** (0.002)	0.006*** (0.000)	0.006*** (0.000)	0.201*** (0.025)	0.211*** (0.026)	0.016*** (0.001)	0.016*** (0.001)	0.059** (0.023)	0.057** (0.025)	0.001 (0.000)	0.001 (0.000)
Equity Ratio	-0.114*** (0.025)	-0.112*** (0.026)	-0.018*** (0.004)	-0.018*** (0.004)	0.646*** (0.185)	0.677*** (0.194)	0.011* (0.005)	0.013* (0.005)	1.662*** (0.529)	1.668*** (0.535)	0.076*** (0.020)	0.076 (0.020)
Income share	0.031*** (0.009)	0.033*** (0.009)	0.011*** (0.001)	0.011*** (0.001)	-0.099* (0.044)	-0.094* (0.043)	0.001 (0.002)	0.000 (0.002)	-0.470*** (0.048)	-0.471*** (0.047)	-0.031*** (0.002)	-0.031*** (0.002)
GDP change	-0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000** (0.000)	-0.005*** (0.000)	-0.005*** (0.000)	-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	-0.34*** (0.041)	-0.357 (0.041)	-0.037*** (0.004)	-0.033*** (0.004)	-1.425*** (0.275)	-1.384*** (0.284)	-0.160*** (0.018)	-0.164*** (0.018)	-0.626** (0.283)	-0.640** (0.258)	0.009 (0.011)	-0.008 (0.011)
Unemployment rate	-0.005*** (0.000)	-0.006*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.020*** (0.001)	-0.019*** (0.001)	-0.001*** (0.000)	-0.001*** (0.000)	-0.004*** (0.001)	-0.005*** (0.001)	-0.000*** (0.000)	-0.000*** (0.000)
House price index	-0.017*** (0.002)	-0.018*** (0.002)	-0.002*** (0.000)	-0.002*** (0.000)	0.520*** (0.000)	0.536*** (0.048)	0.034*** (0.002)	0.036*** (0.002)	0.103*** (0.024)	0.095*** (0.024)	0.006*** (0.001)	0.005*** (0.001)
Constant	-0.149*** (0.024)	-0.143*** (0.024)	-0.037*** (0.002)	-0.037*** (0.002)	-4.542*** (0.479)	-4.747*** (0.499)	-0.295*** (0.021)	-0.294*** (0.021)	-0.806*** (0.299)	-0.763** (0.323)	-0.040*** (0.014)	-0.027 (0.014)
Bank fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	7.09	7.63	4.77	4.63	0.10	n/a	n/a	n/a	0.90	0.92	5.75	6.67
Number of observations	59,901	59,901	59,901	59,901	20,372	20,372	20,372	20,372	22,295	22,295	22,295	22,295

APPENDIX: VARIABLES DESCRIPTION

Name	Description	Source
<u>Stochastic Frontier Analysis</u>		
Cost of fixed assets(w_1)	Fixed assets (riad4217) divided by premises and fixed assets (rcfd 2145)	Call Report of Condition and Income, Federal Reserve Bank of Chicago
Cost of borrowed funds (w_2)	Personnel expenses (riad4135) divided by number of employees (riad4150)	
Cost of labor (w_3)	Interest expenses on deposits (riad417) divided by sum of total deposits (rcfd2200)	
Total securities (y_1)	Sum of securities held to maturity (rcfd1754) and securities held for sale (rcfd1773)	
Total loans (y_2)	Total loans and leases (rcfd1400)	
Equity (Z)	Gross total equity (rcfd3210)	
Operating costs (TOC)	Sum of interest expenses on deposits (riad4170), on fed funds (riad4180), loan-loss provisions (riad4230), expenditures on fixed assets (riad4217) and salaries (riad4135)	
Profits before tax (PBT)	Operating income (riad4000) less TOC	
<u>IV regression</u>		
<u>Instruments</u>		
Lagged Lerner	Lerner indices derived from OLS (Conventional) and SFA estimates of marginal cost (Adjusted) lagged by one period	Own calculations
<u>Macro-economic variables</u>		
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	
<u>Bank-specific control variables</u>		
Security share (SEC)	Share of securities (y_1) of total assets	Call Report of Condition and
Loan income share (INC)	Interest and fee income from loans (riad4230) divided by operating income (riad4000)	Income, Federal Reserve Bank of Chicago
Size	Logarithm of total assets (rcfd2170)	
Capital to asset ratio (ER)	Equity ratio defined as gross total equity (rcfd 3210) divided by gross total assets (rcfd 2170)	

Securitization variables

Home mortgages	Mortgages secured by family (<4) residential mortgages	Flow of funds accounts of the United States
Multifamily residential mortgages	Mortgages secured by family (>5) residential mortgages	
Commercial mortgages	Mortgages secured by nonfarm nonresidential properties	
Farm mortgages	Real Estate Loans secured by farmland	
Securitization ratio	Share of securitized loans over total outstanding loans multiplied by the share of loan portfolio in a given bank	Own calculations

Dependent variables

Non-performing loans	The ratio of non-performing loans (rcfd1407+rcfd1403) to total loans (y ₂)	Call Report of Condition and Income, Federal Reserve Bank of Chicago
Return on assets	The ratio of net income (riad4340) to total assets (rcfd2170)	
Return on equity	The ratio of net income (riad4340) to total equity (rcfd3210)	
