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Short-term safety or long-term failure? Empirical evidence of the impact of securitization on bank risk

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Abstract

Based on a sample of U.S. commercial banks from 2002 to 2012, this paper shows that bank loan securitization has a significant and positive impact on both Z-scores and the likelihood of bank failure, indicating a short-term risk reduction and a long-term risk increase effect. We also find disparate impacts between mortgage and non-mortgage securitization. Loan sale activities are found to have a similar impact to securitization.

JEL Classification: G10, G20, G21

Keywords: Securitization; Bank Risk; Bank Failure; Heckman Self-selection; Survival Analysis

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1. Introduction

Loan securitization (securitization hereafter) is arguably one of the main triggers of the 2007-09 global financial crisis. A commonly held view argues that securitization leads to a lower credit standard and less incentive for banks to monitor loans (Keys et al., 2010). Securitizers may also have incentives to securitize better-quality loans in the portfolio to pursue higher reputations or ratings and receive reductions in regulatory capital retention (Acharya, Schnabl, and Suarez, 2013), thus increasing bank risk on the balance sheet. However, the impact of securitization on bank risk is still inconclusive in the literature. Early studies suggest that securitization allows originators to transfer potential risk to security investors, along with the underlying assets (Pennacchi, 1988), and achieve increased portfolio and geographic diversification (Hughes et al., 1999; Deng, Elyasiani, and Mao, 2007; Berger and DeYoung, 2001). Despite the strong prior, there is limited studies, to the best of the authors' knowledge, that directly studies the impact of bank securitization and risk. In this paper we fill this gap and reconcile previous conflicting theories on the impact of bank securitization on risk. We find that the involvement of securitization leads to reduced bank risk in the short-term, while increase the likelihood of bank failure in the long run.

Specifically, using data from commercial banks in the U.S. during the period of 2002 to 2012, we document that the involvement of securitizations by commercial banks (measured as the ratio of securitized assets over total assets) is positively associated with Z-score. We report an average of 10.99% of a standard deviation increase of Z-score due to a one-standard-deviation increase of total securitization ratio. In the second analysis, we employ a survival

analysis to estimate the long-term impact of securitization on bank risk. We find that the involvement of securitizations by commercial banks is positively associated with the likelihood of bank failure. We find 1% increase of total securitization ratio increases the possibility of bank failure by an average of 0.57%. Overall, these results suggest that securitization reduces bank risk in the short run but increases bank risk (likelihood of failure) over the long term.

The explanations are as follows. Securitization creates a more efficient risk sharing through diversification. The pooling and traching of securitization create low-risk and highly liquid securities to attract investors (DeMarzo, 2005). Securitizers thus may easily shift their credit-risk exposures to the counter parties through true sales (Humphreys and Kreistman 1995; Kramer 2003). In practice, some risk can also be transferred out of the banking system through securitization, for example to hedge funds and equity investors, creating an even larger amount of investors to share the potential risk. Thus, securitization could reduce bank risk by substituting large potential exposures to direct borrowers with smaller and more diversified exposures and smoothing out the risks among many investors (Duffie, 2007).

In the long run, however, securitizers may decrease their efforts on screening borrowers, lower borrowing standards, and grant more poor quality loans considering the potential risk can be easily transferred to the investors (Hakenes and Schnabel, 2010). The reckless behaviour links securitizers with aggressive risk taking and greater retentions of risky assets (Acharya and Johnson, 2007). The increased risk on the balance sheet may also increase their cost of financing. In response, securitizers may choose to securitize better assets rather than risky assets (Acharya, Schnabl, and Suarez, 2013), and left with insufficient capital buffer to survive

a severe event (Berger and Bouwman, 2013). The development of complex structured credit products makes it more difficult for most investors and rating agencies to analyse the potential risks and fair values of securitized assets (Griffin and Tang, 2009). Thus, the potential risk increase is not likely to be recognized within a short period. When the diversification mechanism of securitization is not able to cover the losses, a majority of bank failure could breakout (Wagner, 2010).

We concern of the relationship identified by the baseline framework could be endogenous. On the one hand, small banks may not prefer securitizing loans due to substantial large amount of upfront fixed costs. On the other hand, banks with higher reputation are more likely to be frequent securitizers because of a lower lemon discounts (Campbell and Kracaw, 1980; Diamond, 1984; Boyd and Prescott, 1986). We conduct three methods to address this issue. First, we use the Heckman self-selection model to estimate the causal effect of securitization on Z-scores, where we adopt three exogenous instruments. The first instrument is the state-level corporate tax rate. On the one hand, the corporate-tax-exempt benefit of securitization may increase banks' incentive to securitize assets (Han, Park, and Pennacchi, 2015), and on the other hand, state-level corporate tax itself is not directly related to bank risk. Second, we construct a peer liquidity index based on Loutskina's (2011) liquidity index, which captures banks' incentive to securitize. It is also unlikely that a bank's industry peers' securitizing behavior can directly affect its own risk (other than through the channel of securitization). The third instrument is the interaction of the two above mentioned instruments; it captures both instruments' characteristics. Second, we use instrumental variable method with

the same set of instruments and control variables.

We finally use a propensity score matching based weighted-least-squares estimation method, where the weights are inversely proportional to the probability of a bank being a securitizer. We assign propensity scores (represented by \hat{p}) estimated by a probit regression using the following control variables: *bank size*, *diversification ratio*, *liquidity ratio*, *non-interest expense ratio*, *non-performing loans ratio*, *local market power index*, *bank holding company (BHC) dummy*, and *metropolitan statistical area (MSA) dummy*. A securitizer receives a weight of $1/\hat{p}$, while a non-securitizer receives a weight of $1/(1-\hat{p})$. We also use a matched subsample including unique pairs of securitizer and non-securitizer with a difference of propensity score within 1%. All the results are consistent with the main results.

The breakout of the 2007-09 financial crisis suddenly dried out the liquidity in the market. Securitization activities significantly rely on the liquidity in the market, so the withdrawal of repurchase agreements may trigger a securitized-banking run (Gorton and Metrick, 2012). Thus, we expect the impact of securitization to decrease because of a significant shrink in the scale of securitization market. We divide the sample period into pre- and post-crisis subsamples in all estimations above. We define pre-crisis period to cover years from 2002 to 2007, while post-crisis period from 2007 to 2012. We find the impacts of securitization on bank's Z-scores and the likelihood of bank failure are positive and statistically significant in both periods, but the economic significance decreases after the breakout of the financial crisis. Overall, the sub-sample results still support our main results.

Main transmission mechanisms from securitization to bank riskiness are through capital

relief, favourable liquidity and risk transfer. To shed some more light on risk transfer, this paper focuses on mortgage securitization vs non-mortgage securitization. The collaterals (i.e., real estates) of mortgage loan are not easily depreciated (Campbell and Cocco, 2015). Mortgage loans are widely considered to be safer than non-mortgage loans. Mortgage securitization is in turn not significantly related to risk transferring (Martín-Oliver and Saurina, 2007). Securitizing risky assets (e.g., non-mortgage loans), however, is found to be a more efficient risk transferring to decrease expected losses (Minton et al., 2004; Bannier and Hansel, 2008). We thus expect the non-mortgage securitization ratios to be more significantly related to the increase of bank's Z-scores. Mortgage loans are also easier to be securitized thanks to the higher quality and stronger degree of commoditisation (Altunbas, Gambacorta, and Marques-Ibanez, 2009). Mortgage securitizers are expected to more aggressive to take on more risk and lower their lending standards considering their potential risk can be easily shifted to the third parties. Thus, mortgage securitization is criticized more severely for deteriorating loan qualities and leading to potential problems (Hakenes and Schnabel, 2010). We expect mortgage securitization to be more strongly related to the likelihood of bank failure than non-mortgage securitization. To test the hypothesis, we break down securitization into mortgage and non-mortgage groups. We find that while the increase of non-mortgage securitization ratios respond to higher Z-scores, mortgage securitization ratios are not significantly related to changes in Z-scores. In the long run, mortgage securitization ratios are found to be more significantly related to the likelihood of bank failure.

In practice, banks may choose loan sales rather than securitization because of a lower

level of fixed upfront costs (Carlstrom and Samolyk, 1995). Our final test focuses on loan sales. Loan sales involve the totality of an originated loan (Gorton and Haubrich, 1987) and are affected without recourse (Greenbaum and Thakor, 1987). Loan sellers can also reduce their risk by separating the ownership of riskier assets from their balance sheet (Berger and Udell, 1993). We thus expect loan sale ratios are positively related to bank's Z-scores. Similar to securitization, loan sales without recourse also increase sellers' incentives to apply weaker managerial standards (Cebenoyan and Strahan, 2004). We expect loan sale ratios are significantly related to the likelihood of bank failure. Following Bedendo and Bruno (2012), we define loan sales by the difference between 1) the outstanding principal balance of assets owned by others, with servicing retained by the bank, and 2) the outstanding principal balance of assets sold and securitized by the bank. Using similar estimating methods, we find loan sales also reduce bank risk in the short run, but increase the likelihood of bank failure in the long run.

Our paper provides direct empirical evidence on the impact of securitization on bank risk. Previous studies on securitization and bank risk pay more attentions on the theoretical basis, providing both risk reduction (Benveniste and Berger, 1987; Pennacchi, 1988) and risk increase theories (Kobayashi and Osano, 2012; van Oordt, 2014). Empirical examinations of securitization provide evidence with the impact on bank performance (Guner, 2006; Casu et al., 2012), or specific on the impact of CMBS (Titman and Tsyplakov, 2010; An, Deng, and Gabriel, 2011), CLOs (Benmelech, Dlugosz, and Ivashina, 2012), subprime mortgage loans (Keys, Seru, and Vig, 2012), and asset-backed commercial papers (Acharya, Schnabl, and

Suarez, 2013) on bank performance and managerial efforts. To authors' best knowledge, there is no direct empirical evidence to test the impact of the involvement of securitization on bank risk. We thus reconcile the conflicts of theories and find a short-term risk reduction and long-term bank failure increase effect of securitization. Part of our bank failure increase arguments is related to the rapid development of complex structured credit products. Higher complexity of securitization makes investors and rating agencies more difficult to analyse the potential risks and fair values (Griffin and Tang, 2009). Securitizers can in turn take advantage of the private information to take on more risk and decrease their monitoring efforts. Recent literature show higher complexity in securitization transactions can significantly decrease loan performance (Furfine, 2015) and increase default rates (Ghent, Torous, and Valkanov, 2014). Our study adds more evidence to this group of studies by providing a positive association between a higher complexity of securitization and the likelihood of failure.

Our research also extends the understanding of the impact of securitization on bank behaviour. Previous literature finds that securitization leads to a decreased cost of capital (Berger, Herring, and Szego, 1995; Carlstrom and Samolyk, 1995; Duffee and Zhou, 2001; Nicolo and Pelizzon, 2008; Nadauld and Weisbach, 2012), a higher level of diversification (Allen and Carletti, 2006; Rossi, Schwaiger, and Winkler, 2009), and a higher level of liquidity (Loutskina, 2011; Casu et al., 2013). Thus, securitization is beneficial to securitizers because it relieves underinvestment problems (Lockwood, Rutherford, and Herrera, 1996) and increases profitability (Schliephake and Kirstein, 2013). However, securitization may also encourage banks to take advantage of the asymmetric information and decrease managerial efforts

(Parlour and Plantin, 2008; Maddaloni and Peydro, 2011; Ahn and Breton, 2014; Wang and Xia, 2014). Thus, securitization can also undermine the loan quality in the market (Jones, 2000; Berndt and Gupta, 2009; Mian and Sufi, 2009; Purnanandam, 2011; Rosch and Scheule, 2012; Carbo-Valverde, Marques-Ibanez, Rodriguez-Fernandez, 2012). Our research provides a link between the disparate behaviours.

Finally, our results in this paper may shed some light on the ongoing discussion of the role of securitization in changing the banking models and contributing to the 2007-09 global financial crisis. The implication of the results on the different impact of securitization on bank risk in the short and long term may suggest that the examination of bank risk should not only be focused on balance sheet ratios but also on the managerial system.

In Section 2 we describe our dataset and empirical strategy. Section 3 shows the main results. Section 4 presents additional analysis and Section 5 concludes.

2. Data and methodology

2.1. Data

We collect securitization and bank-specific data from the Reports of Income and Condition for commercial banks (the Call Report). Because U.S. banks are only required to provide detailed information on their securitization activities from June 2001, our annual data covers the period from 2002 to 2012. Our final sample is an unbalanced panel including 342 banks with securitized loans and 8,483 banks without, accounting for 77,598 total bank-year observations.

2.2. Variables

The key independent variable is the *securitization ratio*, which is defined as the ratio of the outstanding principal balance of assets securitized over total assets for a given type (i.e., mortgage or non-mortgage loans).

We measure bank insolvency risk using the *Z-score*, which is equal to the return on assets plus the capital asset ratio divided by the standard deviation of asset returns¹:

$$Zscore = \frac{ROA+E/A}{sdROA} \quad (1)$$

A higher *Z-score* indicates a lower probability of insolvency risk. Because the *Z-score* is highly skewed, we use the natural logarithm of the *Z-score*. For brevity, we use the label “*Z-score*” in referring to the natural logarithm of the *Z-score* in the remainder of the paper. Following Anginer, Demirguc-Kunt, and Zhu (2013), we also compute *Z-score* scaled by the standard deviation of return on assets over a five-year rolling window.²

We also define bank failure dummy as one if a bank failed or is acquired by another bank under government assistance, and zero otherwise.

We control for a set of bank-specific variable in the regression analysis. *Retained interest ratio* is defined as the total amount of retained interest divided by the total amount of securitization assets of a given type, including the aggregate retained interests into credit enhancements, liquidity provisions, and seller’s interest. The incentive of securitizers to carefully monitor loans could increase by providing enhancements which may decrease bank

¹ *Z-score* is extensively used in bank risk literature, e.g., Demirguc-Kunt et al., 2008; Graham et al., 2008; Houston et al., 2010; Laeven and Levine, 2009; Santos and Winton, 2008.

² Our results are robust with different rolling windows, from four to six years, when calculating the standard deviation of ROA.

risk (Downing, Jaffee, and Wallace, 2009).

Bank size is defined as the natural logarithm of an individual bank's total assets. The impact on risk and failure are not conclusive.³ We use *diversification ratio* to control for a bank's diversification situation, which is defined as non-interest income divided by total operating income. Previous research suggests that diversification into non-interest income can reduce bank risk, as it improves banks' ability to absorb volatilities in the interest income (Demsetz and Strahan, 1999). *Liquidity ratio* is calculated as liquid assets divided by total assets. Liquidity improves a bank's lending ability, but high liquidity can also be associated with agency problems. *Non-interest expense ratio* is an indicator of banks' efficiency, defined as non-interest expenses divided by total assets. Non-interest expenses are usually not associated with targeting customers to deposit funds; therefore, they are more likely to increase risk level and likelihood of failure (Lepetit et al., 2008). *Non-performing loans ratio*, computed as the amount of loans past due 90 days divided by total assets, reflects the risk management situation. Because non-performing loans are either in default or close to being in default, bank risk level and failure possibility can be positively related to the proportion of non-performing loans.

Following Berger and Bouwman (2013), we control for banks' local market power as the deposit concentration for the local markets in which the bank operates. The larger the local

³ For example, Hakenes and Schnabel (2011), Haan and Poghosyan (2012), and DeMiguel et al. (2013) suggest a negative relationship between bank size and bank risk, while Gennotte and Pyle (1991) support a positive relationship. The literature also offers arguments suggesting that bank size may increase (Uhde and Michalak, 2010) and decrease (Berger and Bouwman, 2013) the likelihood of bank failure.

market power, the greater a bank's market power and concentration in its surroundings. We use a bank holding company (BHC) dummy to control for whether it belongs to a bank holding company. BHC dummy equals one if the bank belongs to a bank holding company, and zero otherwise. A bank belonging to a bank holding company is expected to be more likely to survive, because the holding company is required to act as a source of strength to all the banks it owns (Houston and James, 1998; Paligorova and Xu, 2012). However, within a short time window, banks belonging to a BHC are more likely to take more risk, as they have this "backup" (Jiang, Lee, and Yue, 2010). We finally use a metropolitan statistical area (MSA) dummy, which equals one if the bank is located in a metropolitan area, and zero otherwise, to identify individual banks' locations. Competition may be fiercer in metropolitan areas, and banks in suburban areas are more likely to have a more stable environment.

2.3 Empirical strategy

In order to test whether bank loan securitization impacts differently on short- and long-term risk, we start to estimate the relationship between loan securitization and bank Z-score. We first use the following OLS model:

$$Zscore_{i,t} = \beta_0 + \beta_1 Securitization\ Ratio_{i,t-1} + \beta_2 X_{i,t-1} + \alpha_i + \delta_t + \mu_{i,t} \quad (2)$$

where $Zscore_{i,t}$ is the dependent variable, $Securitization\ Ratio_{i,t-1}$ is the vector of total securitization ratio, $X_{i,t-1}$ is the vector of bank-specific control variables, α_i is the individual difference, δ_t is the time variation that not related to individual characteristics, and $\mu_{i,t}$ is the disturbance term.

The relationship identified by the OLS model could be biased since self-selection

problem exists in the decision of securitizing loans. First, securitization involves substantial upfront fixed costs including consultancy and organizational costs, payments to rating agencies, underwriting fees, and legal expenses. Small banks thus may not prefer securitizing loans. Second, the lemon discount required on the underlying assets suggests that securitized assets are likely to be underpriced (Campbell and Kracaw, 1980; Diamond, 1984; Boyd and Prescott, 1986). Thus, banks with higher reputation are more likely to enjoy a lower discount during securitization process. The existence of self-selection problem in securitization is, therefore, a rational conjecture.

We use three methods to address this endogeneity issue. First, we use a Heckman self-selection model, where we introduce three instrument variables. The first instrument is the state-level corporate tax rate⁴, because higher corporate tax rates may increase a bank's incentive to securitize assets due to the corporate tax exemption of securitized assets (Han, Park, and Pennacchi, 2015). The second instrument is peer liquidity index. Liquidity index is proposed by Loutskina (2011) to effectively capture banks' ability to sell loans. Following Loutskina (2011), we break down a bank's loan portfolio into six groups: 1) home mortgages, 2) multi-family residential mortgages, 3) commercial mortgages, 4) agricultural loans, 5) commercial and industrial (C&I) loans, and 6) consumer credit.⁵ Liquidity index is defined as:

$$Liquidity\ Index_{it} = \sum_{j=1}^6 \left(\frac{Economy\ Wide\ Securitization_{jt}}{Economy\ Wide\ Total\ Loans_{jt}} \right) \times (Loan\ Share_{j,it}) \quad (3)$$

In this equation, *Economy Wide Securitization_{jt}* is the total securitized loans of

⁴ The data are available from the U.S. Tax Foundation website at: <http://www.taxfoundation.org/taxdata/show/230.html>.

⁵ The data used to construct liquidity index comes from the "Financial Accounts of the United States" (Z.1) data release.

type j at time t in the whole economy, $Economy\ Wide\ Total\ Loans_{jt}$ is the total loans outstanding of type j at time t in the whole economy, and $Loan\ Share_{j,it}$ is the share of type j loans in bank i at time t in the whole economy.

Finally, we construct bank i 's peer liquidity index by calculating the average liquidity index of bank i 's peers.⁶ The herd effect (Chari and Kehoe, 2004) implies that an individual bank's incentive to securitize loans can be stimulated by its industry peers, but it is unlikely that a bank's industry peers' securitizing behaviour can directly affect this bank's risk.

State-level corporate tax rate only provides information on the impact of securitization incentives of a state's "average" bank, while peer liquidity index captures no state-level difference. We construct the third instrument by interacting the above two instruments. After using the instruments to determine the incentives to securitize loans in the first-step regression, we add the self-selection control variable, inverse Mills ratio, into the following main regression:

$$Zscore_{i,t} = \beta_0 + \beta_1 Securitization\ Ratio_{i,t-1} + \beta_2 X_{i,t-1} + \beta_3 inverse\ Mills\ ratio + \alpha_i + \delta_t + \mu_{i,t} \quad (4)$$

Second, we use instrumental variable approach, where we employ the same set of instruments and control variables as the Heckman model.

Finally, we concern the potential biases caused by the unbalanced samples with the sample of securitizer (342) being significantly smaller than that of non-securitizers (8,483). Following Bortolotti, Fotak, and Megginson (2015), we use the propensity score matching

⁶ Bank i itself is excluded.

based weighted square regression. We first assign propensity scores (represented by \hat{p}) to banks using the following bank-specific characteristics: *bank size*, *diversification ratio*, *liquidity ratio*, *non-interest expense ratio*, *non-performing loans ratio*, *local market power index*, *bank holding company (BHC) dummy*, and *metropolitan statistical area (MSA) dummy*. A securitizer receives a weight of $1/\hat{p}$, while a non-securitizer receives a weight of $1/(1-\hat{p})$. We then refine our sample by constructing a subsample consists of securitizers and their most similar non-securitizer counterparties. We use a 1:1 matching by imposing a 1% tolerance on the difference of propensity scores of each securitizer and matched non-securitizer. We also divide the sample period into pre- and post-crisis to check the difference. Our results are also robust when we use simple propensity score matching method.

We use the survival analysis to estimate the relationship between securitization ratio and the likelihood of bank failure. Survival analysis is concerned with studying the time between a treatment's initial application and a subsequent event (such as bank failure), so it is possible to test the long-term impact of securitization. The survival analysis technique has been widely applied in banking research. Cole and Gunther (1995) employ survival analysis to study the determinants of bank failure. Recently, Berger and Bouwman (2013) used survival analysis to estimate the relationship between a bank's capital and its likelihood of survival. The Cox proportional hazards model is specified as follows:

$$\log \left(\frac{\lambda_i(t_i|Securitization)}{\lambda_0(t)} \right) = \beta_0 + \beta_1 Securitization Ratio_{i,t} + \beta_2 X_{i,t} + \mu_i + \varepsilon_{i,t} \quad (5)$$

where $\lambda_i(t_i|Securitization)$ is the hazard function for securitizers under the event of bank failure, $\lambda_0(t)$ is the average survival time of the entire sample, $Securitization Ratio_{it}$

is the vector of total securitization ratio, X_{it} is the vector of bank-specific control variables, μ_i is the individual differences that not related to time variables, and $\varepsilon_{i,t}$ is the disturbance term. We also use the logit model to check the robustness of the results of survival analysis.

The breakout of the 2007-09 financial crisis significantly changes the macroeconomic environment, e.g., it suddenly dried out the liquidity in the market. Securitization activities rely heavily on the liquidity in the market, so the withdrawal of repurchase agreements may trigger a securitized-banking run (Gorton and Metrick, 2012). The significant dive of the securitization market scale may in turn decrease the impact of securitization. Thus, we expect the impact of securitization on bank's risk may be decreased after the breakout of the 2007-09 financial crisis. We divide our sample into pre- and post-crisis periods. Pre-crisis period covers years from 2002 to 2006, while post-crisis period covers years from 2007 to 2012. We then rerun all regressions using the before and after 2007 subsamples.

3. Empirical results

3.1. Preliminary analysis

Table 1 shows the summary statistics on all variables used in this study for both securitizers and non-securitizers. We report the number and proportion of failed banks on securitizers and non-securitizers in Panel A, Table 1. Within each group, we also divide the sample into pre- and post-crisis periods. We show that 331 banks securitized their assets and 3 (0.91%) of them went failure before the breakout of the 2007-09 financial crisis. After the breakout of the crisis, there were 17 (5.74%) securitizers failed. A similar picture can be seen for non-securitizers. Before 2007, we find 70 (0.87%) of 8,059 non-securitizers failed while

this proportion surges to 7.08% (505 failed banks out of a sample of 7,137 non-securitizers) after 2007.

<Insert Table 1 Panel A Here>

Panel B, Table A shows the descriptive statistics of securitizers and non-securitizers on the rest of variables.⁷ We also divide the sample into pre- and post-crisis periods. Statistics of mean, median, and standard deviation (SD) are reported under each subgroup. The average value of Z-scores decreased from 1.05 before 2007 to 0.63 from 2007, and the standard deviations of Z-scores for both securitizers and non-securitizers also increased significantly after 2007. These results reflect the severe impact of crisis on bank risk. Since values of securitization related variables for non-securitizers are all zero, we only report the statistics for securitizers on variables of *total securitization ratio%* and *total retained interest ratio%*. We also show a significant dive of the securitization market scale after the breakout of crisis (average securitization of 13.24% before 2007 vs. 7.08% from 2007), which could be caused by a sudden erosion of liquidity in the capital market (Gorton and Metrick, 2012). The average credit enhancements level increases from 4.28% to 5.26%, suggesting investors become more cautious after realizing the crisis. Small banks are rare securitizers due to a large amount of upfront costs, and we show that the average size of securitizers (nearly \$596 million) in our sample is over four times than non-securitizers (nearly \$134 million). Literature show that securitization allows banks to achieve more diversified portfolios (DeMarzo, 2005), and a lower liquidity level (Lourtskina, 2011). The costs of deposits are lower for bank holding

⁷ We report percentage values of ratio variables in Table 1.

companies that located in a metropolitan area with higher market power, so they are more likely to be able to maintain the “originate-to-distribute” funding model (Loutskina and Strahan, 2009). Our results support all theories above.

<Insert Table 1 Panel B Here>

We also show the differences between securitizers and non-securitizers and changes for the before and after the 2007-09 financial crisis sub-periods in Panel C, Table 1, where we also report Student's t-test and Wilcoxon rank-sum test for the means and medians of the differences, respectively. The breakout of the 2007-09 financial crisis witnessed a more significant increase in proportions of failed non-securitizers (6.21%) than securitizers (4.84%), and the proportion of failed non-securitizers exceeds that of securitizers (by 1.33%). The Student's t-test shows that the difference between proportions of failed securitizers and non-securitizers is statistically significant at 1% level. This result links securitization with a higher likelihood of bank failure before 2007. This finding confirms that banks with high involvement in the OTD market during the pre-crisis period contribute more significantly to the loan quality deterioration (Purnanandam, 2011). The 2007-09 financial crisis also significantly decreases bank risk, where we find the average Z-scores of securitizers and non-securitizers decreases by 0.42 and 0.43, respectively. However, Z-scores of securitizers are higher than non-securitizers in both periods (i.e., before and after 2007), suggesting securitization could decrease bank risk. We also find significant differences between securitizers and non-securitizers regarding to the rest of control variables, which are all in the line with our previous findings.

<Insert Table 1 Panel C Here>

3.2. *The impact of bank securitization on Z-score*

Results on our baseline model of the impact of loan securitization on bank's Z-scores are reported in Table 2. We report results of OLS in column (1), Heckman model in columns (2) to (4), and instrumental variable approach in columns (5) to (7), respectively. We report the second-step results of Heckman self-selection and IV models using instruments of: i) state-level corporate tax rate; ii) peer liquidity index, and iii) state-level corporate tax rate \times peer liquidity index, from columns (2) to (7). The first-step results are all reported in Appendix C. All regressions include bank and year fixed effects.

<Insert Table 2 Here>

Across all specifications, the key variable, total securitization ratio, has positive and significant coefficients, indicating that the involvement of securitization activities is associated with a decrease in bank risk. In column (1), we show a one-standard-deviation increase in total securitization ratio is associated with an increase of 10.99% of a standard deviation in bank's Z-scores. We find similar economic impacts using Heckman and instrumental variable estimations, where a one-standard-deviation increase in total securitization ratio is associated with an average increase of 6.49% (from column (2) to (4)) and 6.91%⁸ (from column (5) to (7)) of a standard deviation in bank's Z-scores, respectively. These results are in line with our

⁸ The standardized economic significances estimated by Heckman models using instrument: i) state-level corporate tax rate, ii) peer liquidity index, and iii) state-level corporate tax rate \times peer liquidity index, are 6.26% (column (2)), 6.11% (column (3)), and 7.09% (column (4)), respectively. Those significances estimated by instrumental variable models are 6.69% (column (5)), 8.24% (column (6)), and 5.80% (column (7)), respectively. We use the same averaging methods based on these three instruments to conduct the average economic significances for the rest of the paper, which we will not specify each number hereafter.

hypothesis that securitization could help banks to reduce their risk in the short run by substituting large potential exposures to direct borrowers with smaller and more diversified exposures and smoothing out the risks among many investors (Duffie, 2007).

Results on the control variables are largely in the line with our expectations and previous literature. Literature suggests that providing credit enhancements could decrease bank risk by forcing securitizers to retain long-term economic exposure. Our findings support this argument by presenting a positive relationship between total retained interest ratio and Z-score. The negative correlation between bank size and Z-score can be explained by the *too-big-to-fail* theory that larger banks are more likely to take on more risk. As expected, a higher level of diversification and liquidity decreases bank risk, while less efficient banks are likely to be riskier.

Analysis so far ignores the presence of the 2007-09 financial crisis, we therefore divide our sample into pre- and post-crisis periods to examine whether securitization activities impact differently on bank risk. We rerun the OLS, Heckman, and instrumental variable regressions using the subsamples and report the results in Table 3.

<Insert Table 3 Here>

Consistent with the results on full sample, we find the coefficients of total securitization ratio are all significant and positive in all specifications. We also find a decreased economic impact of securitization ratio on Z-score after the breakout of the financial crisis. For example, in column (1), a one-standard-deviation increase in total securitization ratio is associated with an increase of 13.48% of a standard deviation in bank's Z-scores before 2007 when estimated

by OLS, while this economic impact significantly decreases to 8.06% (column (2)) after 2007. Similar declines of economic significance are also found in Heckman and instrumental variable estimations. After June 2007, the securitization market suffered significant dive in total scale since insufficient information to price and quality of securities (Pagano and Volpin, 2012), which increased the overhang of illiquid assets on banks' balance sheets (Brunnermeier and Pedersen, 2009). Bank risk in turn cannot be sufficiently transferred through securitization process. Another explanation could be the motivation change after 2007. Bedendo and Bruno (2012) argue that the principal incentive behind credit risk transferring activities is to raise financial resources rather than transferring risk during severe times.

We also concern of the unbalanced observations for securitizers (3,132) and non-securitizers (74,466), and employ a propensity score matching based weighted-least-squares estimation to address this problem using a full sample and 1:1 matched sample. Results on full sample, 1:1 matched sample are reported in column (1) to (2), Table 4. Results again show a positive and significant association between securitization ratio and bank's Z-scores. After dividing our sample into pre- and post-crisis periods, we report consistent results in column (3) and (4). Taken together results in Table 2 to 4, our first analysis suggests the involvement of securitization decreases bank's risk measured by Z-score.

<Insert Table 4 >

3.3. The impact of bank securitization on the likelihood of failure

The results so far demonstrate that the involvement of securitization has a positive

impact on bank risk measured by Z-score. However, this relationship tends to be short term because Z-score is calculated by year-end balance sheet ratios and may only capture a snapshot of bank risk. The sub-sample analysis of the 2007-09 financial crisis on Z-score also presents the relationship is strongly related to short-term economic situations. Following Chava, Livdan, and Purnanandam (2009), we use the Cox proportional hazards model along with a logistic model to estimate the impact of securitization on the likelihood of bank failure. The Cox model is likely to capture long-term effect and statistically superior for bankruptcy prediction since it takes the time at risk into consideration (see Shumway, 2001; Chava and Jarrow, 2004). Results on Cox models are reported in columns (1) to (3), Table 5, while results using logit models are reported in columns (4) to (6). We also divided the sample into pre- and post-2007 periods. We control for bank fixed effects in both regressions and report coefficients in the Cox models and marginal effects (rounded to four decimals) in logit regressions.

<Insert Table 5 Here>

Total securitization ratio is found to have a positive and significant impact on the likelihood of bank failure, and the results are consistent among all regressions. We find a 1% increase of total securitization ratio leads to a 0.75% ($\exp(0.561) - 1$) (column (1)) and 0.39% (column (4)) increase of possibility of bank failure, estimated by Cox and logit models, respectively. This finding is consistent with our hypothesis that the involvement of securitization could lead to long-term risk. Securitization encourages banks to take on more risk, decrease their efforts on screening borrowers, lower borrowing standards, and grant more poor quality loans (Hakenes and Schnabel, 2010). The possibility of bank failure in turn

increases because the diversification mechanism of securitization may not enough to cover the potential losses in the long run (Wagner, 2010).

After dividing the sample into pre- and post-2007 periods, we find securitization ratio is still positively related to the likelihood of bank failure for both sub-sample periods. We report an average 1.21% (column (2) and (5)) increase of possibility of bank failure caused by 1% increase in population means of total securitization ratio before 2007, while this marginal effect decreases to an average of 0.28% (column (3) and (6)) after 2007. The decreased impact of securitization on the likelihood of bank failure may also due to the significant decrease in the scale of securitization market caused by the liquidity shortage in the secondary market after the breakout of financial crisis.

Similar to the analysis on Z-scores, we also employ a propensity score matching based weighted-least-squares estimation for bank failure to address the endogeneity problem. Marginal effects of each variable on the likelihood of bank failure are reported in Table 6. We find consistent positive and significant impact of securitization ratios on the likelihood of bank failure, which confirms our main findings on bank failure in Table 5. Taken together the results on Z-scores and bank failure, we find evidence to support the hypothesis that securitization leads to a short-term risk reduction, and long-term failure increase effect.

<Insert Table 6 >

4. Additional analysis

4.1. The impact of mortgage and non-mortgage securitization on bank Z-score and the likelihood of bank failure

Main transmission mechanisms from securitization to bank riskiness are through capital relief, favourable liquidity and risk transfer. To shed some more light on risk transfer, this paper focuses on mortgage securitization vs non-mortgage securitization. Mortgage loans are widely considered to be higher quality due to the underlying real estates are not easily depreciated (Campbell and Cocco, 2015). Mortgage securitization is in turn not significantly related to risk transferring (Martín-Oliver and Saurina, 2007). Non-mortgage securitization, however, allows banks to remove riskier asset out of their balance sheet and share potential risk with a large number of investors, decreasing the expected losses (Minton et al., 2004; Bannier and Hansel, 2008). We thus expect a more significant impact of non-mortgage securitization ratios on the increase of Z-scores. Meanwhile, mortgage loans can be easily securitized due to the higher quality and stronger degree of commoditisation (e.g., mortgage loans enjoy a higher standardisation of credit assessment techniques) (Altunbas, Gambacorta, and Marques-Ibanez, 2009). The rapid development of the secondary market makes it even more convenient to banks to securitize mortgage loans (Frame and White, 2005). Mortgage securitizers are in turn encouraged to take on more risk and reduce their incentives to carefully monitoring loans (Hakenes and Schnabel, 2010). Non-mortgage securitization requires securitizers to provide higher retention of risk exposures⁹ during the process in order to signal the quality of the underlying assets (Guo and Wu, 2014), which forces non-mortgage securitizers to keep monitoring loans (Kiff and Kissler, 2010) and be more cautious when granting loans (Hattori

⁹ It is found in International Monetary Fund (2009) that a minimum retention requirement of 5% could be binding for almost all types of asset-backed securities (ABS), but this retention ratio for mortgage-backed securities (MBS) is below 1%.

and Ohashi, 2011). We thus expect the impact of mortgage securitization on the likelihood of bank failure is more significant than non-mortgage securitization.

To test our hypothesis, we break down securitization activities into mortgage and non-mortgage securitizations. Mortgage loans include 1-4 home mortgages, while non-mortgage loans contain all other types of loans, including home equity lines, credit card receivables, auto loans, commercial and industrial loans, other consumer loans, and all other loans. We replace total securitization ratios in all specifications with mortgage and non-mortgage securitization ratios, respectively. The OLS and Cox survival analysis results are reported in Table 7. We report the Heckman self-selection model results on Z-scores in Appendix D.

<Insert Table 7 Here>

We find mortgage securitization ratio is not significantly related to Z-score, while non-mortgage securitization is found to have a significant and positive impact on Z-score. A one-standard-deviation increase in non-mortgage securitization ratio is associated with an increase of 6.73% of a standard deviation in bank's Z-scores, and this economic impact is 11.93% and 2.88% before and after 2007, respectively. This finding is in the line with the evidence of no risk transfer in mortgage securitization (Acharya, Schnabl, and Suarez, 2013). Regards to the likelihood of bank failure, we find mortgage and non-mortgage securitizations both lead to a higher likelihood of bank failure. The marginal impact of mortgage securitization is significantly higher than non-mortgage securitization. A 1% increase of securitized mortgage loans ratio leads to a 1.04% increase in the possibility of bank failure, compare with that of non-mortgage securitization ratio is 0.20%. Mortgage securitization is more likely to encourage

banks to take on more risk and lower the lending standards, which may contribute more significantly to the deterioration of loan qualities in the market and the likelihood of bank failure.

4.2. The impact of loan sales on bank Z-score and the likelihood of bank failure

Our final test focuses on loan sales. Similar to securitizations, loan sales also allow sellers to transfer potential risk to the buyers. However, loan sales involve the totality of an originated loan (Gorton and Haubrich, 1987) and are affected without recourse and bank serves as a pure broker (Greenbaum and Thakor, 1987). In practice, banks may choose to use total loan sale rather than securitization as their funding strategy (Carlstrom and Samolyk, 1995). Loan sellers can also reduce potential risk by separating the ownership of riskier assets from their balance sheet (Berger and Udell, 1993), which in turn transfers the potential risk to the loan buyers. Meanwhile, loan sales without recourse increase sellers' incentives to apply weaker managerial standards, leading to the deterioration of loan quality (Cebenoyan and Strahan, 2004). We thus expect a similar impact of loans sales on bank's Z-scores and the likelihood of failure. Following Bedendo and Bruno (2012), we define loan sales by the difference between 1) the outstanding principal balance of assets owned by others, with servicing retained by the bank, and 2) the outstanding principal balance of assets sold and securitized by the bank. Loan sales data are collected from the Call Report, and the regression results are reported in Table 8.

<Insert Table 8 Here>

We find a similar positive impact of loan sale on bank's Z-score. The coefficients of

loan sale ratio are all positive and statistically significant at 1% level across all specifications. We find a one-standard-deviation increase in loan sale ratio is associated with an increase of 7.51% and an average increase of 7.47% of a standard deviation in bank's Z-scores when estimated by OLS and Heckman models, respectively. This finding holds after we divide the sample into pre- and post-2007 periods, where the economic impact is around 8% before 2007, and 6% after 2007. Results on bank failure are also consistent with securitization regressions, where a 1% increase of loan sale ratios leads to a 2.6% increase in the possibility of bank failure. Thus, results show loan sale activities have a similar risk reduction effect during a short term, and a bank failure possibility increase effect in the long run.

6. Conclusion

We study how securitization affects bank risk on the short and long term. To address the endogeneity problem in securitization, we employ both a Heckman self-selection model and an instrumental variable approach. We also introduce three instruments, i) state-level corporate tax rate; ii) peer liquidity index; iii) state-level corporate tax rate \times peer liquidity index; in both analyses. We find consistent and robust results in all specifications. We document that the involvement of securitization decreases bank's short-term risk measured by Z-score, but increases the likelihood of bank failure in the long run.

Concerning the severe economic environmental change before and after the 2007-09 financial crisis, we also divide the sample period into pre- and post-crisis periods. We find consistent results, but spot a significant economic significance change after the breakout of the

2007-09 crisis. Specifically, the risk reduction benefit of securitization is significantly decreased after 2007, while the marginal effects of securitization on the likelihood of bank failure are rather stable with a small increase.

In addition, we find disparate impacts between mortgage and non-mortgage securitizations. Mortgage securitization is not likely to help banks to reduce their short-term risk, while non-mortgage securitization could provide efficient risk transferring. However, both mortgage and non-mortgage securitizations significantly increase bank's possibility of failure, between which the economic impact of mortgage securitization is more significant. We also find that loan sale activities respond to a similar positive impact on bank risk. Overall, we present a short-term risk reduction and a long-term risk increase effect of securitization.

Our research may shed some light on the debate on the impact of securitization on bank risk. While securitization may be a good risk management tool to help securitizers reduce temporary risk, it can also increase banks' incentives to take excessive risk. This suggests that, rather than restricting banks' securitization activities, regulators should focus more on investigating the changes in lending standards and other risk-taking behaviour as a result of securitization.

References

- Acharya, V.V., Johnson, T.C., 2007. Insider trading in credit derivatives. *Journal of Financial Economics* 84, 110-141.
- Acharya, V.V., Schnabl, P., Suarez, G., 2013. Securitization without risk transfer. *Journal of Financial Economics* 107, 515-536.
- Ahn, J.H., Breton, R., 2014. Securitization, competition and monitoring. *Journal of Banking and Finance* 40, 195-210.
- Altunbas, Y., Gambacorta, L., Marques-Ibanez, D., 2009. Securitisation and the bank lending channel. *European Economic Review* 53, 996-1009.
- Allen, F., Carletti, E., 2006. Credit risk transfer and contagion. *Journal of Monetary Economics* 53, 89-111.
- An, X., Deng, Y., Gabriel, S.A., 2011. Asymmetric information, adverse selection, and the pricing of CMBS. *Journal of Financial Economics* 100, 304-325.
- Anginer, D., Demirguc-Kunt, A., Zhu, M., 2013. How does deposit insurance affect bank risk? Evidence from the recent crisis. *Journal of Banking and Finance* 48, 312-321.
- Bedendo, M., Bruno, B., 2012. Credit risk transfer in U.S. commercial banks: What changed during the 2007-2009 crisis? *Journal of Banking and Finance* 36, 3260-3273.
- Benmelech, E., Dlugosz, J., Ivashina, V., 2012. Securitization without adverse selection: The case of CLOs. *Journal of Financial Economics* 106, 91-113.
- Benveniste, L.M., Berger, A.N., 1987. Securitization with recourse. *Journal of Banking and Finance* 11, 403-424.
- Berger, A.N., Bouwman, C.H.S., 2013. How does capital affect bank performance during financial crises? *Journal of Financial Economics* 109, 146-176.
- Berger, A.N., DeYoung, R., 2001. The Effects of Geographic Expansion on Bank Efficiency. *Journal of Financial Services Research* 19, 163-84.
- Berger, A.N., Herring, R.J., Szego, G.P., 1995. The role of capital in financial institutions. *Journal of Banking and Finance* 19, 393-430.
- Berger, A.N., Udell, G.F., 1993. Securitization, risk and the liquidity problem in banking. Board of Governors of the Federal Reserve System (US).
- Berndt, A., Gupta, A., 2009. Moral hazard and adverse selection in the originate-to-distribute model of bank credit. *Journal of Monetary Economics* 56, 725-743.
- Bortolotti, B., Fotak, V., Megginson, W.L., 2015. The Sovereign Wealth Fund Discount: Evidence from Public Equity Investments. *Review of Financial Studies* 28, 2993-3035.

- Boyd, J.H., Prescott, E.C., 1986. Financial Intermediary-Coalitions. *Journal of Economic Theory* 38, 211-232,
- Brunnermeier, M.K., Pedersen, L., 2009. Market Liquidity and Funding Liquidity. *Review of Financial Studies* 22, 2201-2238.
- Campbell, J.Y., Cocco, J.F., 2015. A Model of Mortgage Default. *The Journal of Finance* 70, 1495-1554.
- Campbell, T.S., Kracaw, W.A., 1980, Information Production, Market Signalling, and the Theory of Financial Intermediation. *The Journal of Finance* 35, 863- 882.
- Carbo-Valverde, S., Marques-Ibanez, D., Rodriguez-Fernandez, F., 2012. Securitization, risk-transferring and financial instability: The case of Spain. *Journal of International Money and Finance* 31, 80-101.
- Carlstrom, C. T., Samolyk, K. A., 1995. Loan sales as a response to market-based capital constraints. *Journal of Banking and Finance* 19, 627-646.
- Casu, B., Clare, A., Sarkisyan, A., Thomas, S., 2013. Securitization and bank performance. *Journal of Money, Credit and Banking* 45, 1617-1658.
- Cebenoyan, S., Strahan, P., 2004. Risk Management, Capital Structure and Lending at Banks. *Journal of Banking and Finance* 28, 19-43.
- Chari, V.V., Kehoe, P.J., 2004. Financial Crises as Herds: Overturning the Critiques. *Journal of Economic Theory* 119, 128-150.
- Chava, S., Jarrow, R., 2004. Bankruptcy Prediction with Industry Effects. *Review of Finance* 8, 537-569.
- Chava, S., Livdan, D., Purnanandam, A., 2009. Do shareholder rights affect the cost of bank loans? *The Review of Financial Studies* 22, 2973-3004.
- Cole, R.A., Gunther, J.W., 1995. Separating the likelihood and timing of bank failure. *Journal of Banking and Finance* 19, 1073-1089.
- DeMarzo, P.M., 2005. The pooling and tranching of securities: A model of informed intermediation. *The Review of Financial Studies* 18, 1-35.
- DeMiguel, V., Martin-Utrera, A., Nogales, F.J., 2013. Size matters: Optimal calibration of shrinkage estimators for portfolio selection. *Journal of Banking and Finance* 37, 3018-3034.
- Demirguc-Kunt, A., Detragiache, E., Tressel, T., 2008. Banking on the principles: Compliance with Basel core principles and bank soundness. *Journal of Financial Intermediation* 17, 511-542.
- Demsetz, R.S., Strahan, P.E., 1999. Diversification, size, and risk at bank holding companies. *Journal of Money, Credit, and Banking* 29, 300-313.

- Deng, S., Elyasiani, E., Mao, C.X., 2007. Diversification and the cost of debt of bank holding companies. *Journal of Banking and Finance* 31, 2453-2473.
- Diamond, D.W., 1984. Financial Intermediation and Delegated Monitoring. *Review of Economic Studies* 51, 393-414.
- Downing, C., Jaffee, D., Wallace, N., 2009. Is the market for mortgage-backed securities a market for lemons? *Review of Financial Studies* 22, 2457-2494.
- Duffee, G.R., Zhou, C., 2001. Credit derivatives in banking: Useful tools for managing risk? *Journal of Monetary Economics* 48, 25-54.
- Duffie, D., 2007. Innovations in Credit Risk Transfer: Implications for Financial Stability 1–47.
- Frame, W.S., White, L.J., 2005. Fussing and fuming about Fannie and Freddie: How much smoke, how much fire? *Journal of Economic Perspectives* 19, 159-184.
- Furfine, C. 2014. Complexity and loan performance: Evidence from the securitization of commercial mortgages. *Review of Corporate Finance Studies* 2, 154-87.
- Ghent, A.C., Torous, W.N., Valkanov, R.I., 2014. Complexity in Structured Finance: Financial Wizardry or Smoke and Mirrors? Available at SSRN 2325835, 2014.
- Gorton, G., Haubrich, J.G., 1987. Loan sales, recourse and reputation: An analysis of secondary loan participations. Working paper, University of Pennsylvania, Philadelphia.
- Gorton, G., Metrick, A., 2012. Securitized banking and the run on repo. *Journal of Financial Economics* 104, 425–451.
- Graham, J.R., Li, S., Qiu, J., 2008. Corporate misreporting and bank loan contracting. *Journal of Financial Economics* 89, 44-61.
- Greenbaum, S., Thakor, A., 1987. Bank funding model: Securitization versus deposits. *Journal of Banking and Finance* 11, 379-401.
- Griffin, John, and Dragon Tang, 2012, Did subjectivity play a role in CDO credit ratings? *Journal of Finance* 67, 1293-1328.
- Guo, G., Wu, H.M., 2014. A study on risk retention regulation in asset securitization process. *Journal of Banking and Finance* 45, 61-71.
- Haan, J., Poghosyan, T., 2012. Size and earning volatility of US bank holding companies. *Journal of Banking and Finance* 36, 3008-3016.
- Hakenes, H., Schnabel, I., 2010. Credit risk transfer and bank competition. *Journal of Financial Intermediation* 19, 308-332.
- Hakenes, H., Schnabel, I., 2011. Bank size and risk-taking under Basel II. *Journal of Banking and Finance* 35, 1436-1449.

- Han, J., Park, K., Pennacchi, G., 2015. Corporate taxes and securitization. *The Journal of Finance* 70, 1287-1321.
- Hattori, M., Ohashi, K., 2011. Detrimental Effects of Retention Regulation: Incentives for Loan Screening in Securitization under Asymmetric Information. IMES Discussion Paper Series 2011-E-17
- Houston, J.F., James, C., 1998. Do bank internal capital markets promote lending? *Journal of Banking and Finance* 22, 899-918.
- Houston, J.F., Lin, C., Lin, P., Ma, Y., 2010. Creditor rights, information sharing, and bank risk taking. *Journal of Financial Economics* 96, 485-512.
- Hughes, J.P., Lang, W., Mester, L.J., Moon, C.G., 1999. The dollars and sense of bank consolidation. *Journal of Banking and Finance* 23, 291-324.
- Humphreys, T., Kreistman, R.M., 1995. *Mortgage-Backed Securities Including REMICS and Other Investment Vehicles*. New York: Little, Brown.
- Jiang, G., Lee, C.M.C., Yue, H., 2010. Tunneling through intercorporate loans: The China experience. *Journal of Financial Economics* 96, 1-20.
- Jones, D., 2000. Emerging problems with the Basel capital accord: regulatory capital arbitrage and related issues. *Journal of Banking and Finance* 24, 35-58.
- Keys, B., Mukherjee, T., Seru, A., Vig, V., 2009. Financial regulation and securitization: evidence from subprime loans. *Journal of Monetary Economics* 56, 700-720.
- Keys, B.J., Mukherjee, T., Seru, A., Vig, V., 2010. Did securitization lead to lax screening? Evidence from subprime loans. *Quarterly Journal of Economics* 125, 307-362.
- Keys, B. J., Seru, A., and Vig, V., 2012. Lender screening and the role of securitization: Evidence from prime and subprime mortgage markets. *Review of Financial Studies* 25, 2071-2108.
- Kiff, J., Kissler, M., 2010. *Asset Securitization and Optimal Retention*. IMF Working Paper No. 10/74.
- Kobayashi, M., Osano, H., 2012. Nonrecourse financing and securitization. *Journal of Financial Intermediation* 21, 659-693.
- Kramer, A., 2003. *Financial Products: Taxation, Regulation and Design*. New York: Aspen Publishers.
- Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. *Journal of Financial Economics* 93, 259-275.
- Lepetit, L., Nys, E., Rous, P., Tarazi, A., 2008. Bank income structure and risk: An empirical analysis of European banks. *Journal of Banking and Finance* 32, 1452-1467.

- Lockwood, L.J., Rutherford, R.C., Herrera, M.J., 1996. Wealth effects of asset securitization. *Journal of Banking and Finance* 20, 151-164.
- Loutskina, E., 2011. The role of securitization in bank liquidity and funding management. *Journal of Financial Economics* 100, 663-684.
- Loutskina, E., Strahan, P.E., 2009. Securitization and the declining impact of bank finance on loan supply: evidence from mortgage originations. *The Journal of Finance* 64, 861-889.
- Maddaloni, A., Peydro, J.L., 2011. Bank risk-taking, securitization, supervision, and low interest rates: Evidence from the Euro-area and the U.S. lending standards. *Review of Financial Studies* 24, 2121-2165.
- Martín-Oliver, A., Saurina, J., 2007. Why Do Banks Securitise Assets? Bank of Spain.
- Mian, A., Sufi, A., 2009. The consequences of mortgage credit expansion: evidence from the 2007 mortgage default crisis. *Quarterly Journal of Economics* 124, 1449-1496.
- Minton, B.A., Stulz, R.M., Williamson, R., 2009. How much do banks use credit derivatives to reduce risk? *Journal of Financial Services Research* 35, 1-31.
- Nadauld, T.D., Weisbach, M.S., 2012. Did securitization affect the cost of corporate debt? *Journal of Financial Economics* 105, 332-352.
- Nicolo, A., Pelizzon, L., 2008. Credit derivatives, capital requirements and opaque OTC markets. *Journal of Financial Intermediation* 17, 444-463.
- Pagano, M., Volpin, P., 2012. Securitization, transparency, and liquidity. *Review of Financial Studies* 25, 2417-2453.
- Paligorova, T., Xu, Z., 2012. Complex ownership and capital structure. *Journal of Corporate Finance* 18, 701-716.
- Parlour, C.A., Plantin, G., 2008. Loan sales and relationship banking. *Journal of Finance* 63, 1291-1314.
- Pennacchi, G.G., 1988. Loan sales and the cost of bank capital. *The Journal of Finance* 2, 375-396.
- Purnanandam, A.K., 2011. Originate-to-distribute model and the sub-prime mortgage crisis. *Review of Financial Studies* 24, 1881-1915.
- Rosch, D., Scheule, H., 2012. Capital incentives and adequacy for securitizations. *Journal of Banking and Finance* 36, 733-748.
- Rossi, S.P.S., Schwaiger, M.S., Winkler, G., 2009. How loan portfolio diversification affects risk, efficiency and capitalization: A managerial behavior model for Austrian banks. *Journal of Banking and Finance* 33, 2218-2226.
- Santos, J.A.C., Winton, A., 2008. Bank loans, bonds, and information monopolies across the

- business cycle. *The Journal of Finance* 63, 1315-1359.
- Schliephake, E., Kirstein, R., 2013. Strategic effects of regulatory capital requirements in imperfect banking competition. *Journal of Money, Credit and Banking* 45, 675-700.
- Shumway, T., 2001. Forecasting Bankruptcy More Accurately: A Simple Hazard Model. *The Journal of Business* 74, 101-124.
- Titman, S., Tsyplakov, S., 2010. Originator performance, CMBS structures, and the risk of commercial mortgages. *Review of Financial Studies* 23, 3558-3594.
- Uhde, A., Michalak, T.C., 2010. Securitization and systematic risk in European banking: Empirical evidence. *Journal of Banking and Finance* 34, 3061-3077.
- van Oordt, M.R.C., 2014. Securitization and the dark side of diversification. *Journal of Financial Intermediation* 23, 214-231.
- Wagner, W., 2010. Diversification at financial institutions and systemic crises. *Journal of Financial Intermediation* 19, 373–386.
- Wang, Y., Xia, H., 2014. Do lenders still monitor when they can securitize loans? *Review of Financial Studies* 27, 2354-2391.

Table 1: Summary Statistics

Panel A: Statistics for bank failure

Table 1 shows the descriptive statistics of the dependent and independent variables used in this paper. The statistics are based on our panel data including 342 securitizers and 8,483 non-securitizers during the period of 2002 to 2012, accounting for total bank-year observations of 3,983. Previous periods are not included because U.S. banks are only required to provide detailed information on their securitization activities from June 2001. Variable definitions are provided in Appendix A. Concerning the impact of the 2007-2009 financial crisis, we divide the time period into before- and after-2007 to check the difference. Panel A reports the statistics of bank failures in terms of number of failed banks (failed #) and the proportion of failed banks (failed %) in the total number of banks (bank #). Panel B reports the statistics of securitizers and non-securitizers, respectively. We show statistics of mean, median, and standard deviation. Panel C shows the comparative statistics of: 1.the difference between the pre- and post-crisis periods; and, 2.the difference between securitizers and non-securitizers. Differences in the number and proportion of failed banks are showed with regards to variable of bank failure, while differences in means and medians are showed for the rest of variables. Information on Student's t-test on means and Wilcoxon rank-sum test on medians are also showed in Panel C.

	Securitizers								Non-securitizers							
	before 2007				after 2007				before 2007				after 2007			
	bank #	failed #	failed %	Obs.	bank #	failed #	failed %	Obs.	bank #	failed #	failed %	Obs.	bank #	failed #	failed %	Obs.
<i>Bank failure</i>	331	3	0.91%	1,534	296	17	5.74%	1,598	8,059	70	0.87%	36,221	7,137	505	7.08%	38,245

Table 1: Summary Statistics (continued)

Panel B: Statistics for securitizers and non-securitizers

	Securitizers								Non-securitizers							
	before 2007				after 2007				before 2007				after 2007			
Dependent variable	mean	median	SD	Obs.	mean	median	SD	Obs.	mean	median	SD	Obs.	mean	median	SD	Obs.
<i>Z-score</i>	1.05	0.96	0.45	1,534	0.64	1.04	1.01	1,598	1.05	1.02	0.34	36,221	0.61	0.96	0.98	38,245
Securitization regressor																
<i>Total securitization ratio%</i>	13.24	4.00	56.54	1,534	7.08	1.46	30.78	1,598	-	-	-	-	-	-	-	-
Bank-specific control variables																
<i>Total retained interest ratio%</i>	4.28	1.75	14.33	1,534	5.26	0.00	20.00	1,598	-	-	-	-	-	-	-	-
<i>Bank size</i>	13.23	12.68	2.01	1,534	13.36	12.97	1.86	1,598	11.65	11.54	1.19	36,221	11.94	11.84	1.19	38,245
<i>Diversification ratio%</i>	25.55	14.24	25.56	1,534	24.44	14.04	25.28	1,598	12.55	10.56	10.10	36,221	11.97	9.99	10.78	38,245
<i>Bank liquidity ratio%</i>	22.60	21.01	12.84	1,534	20.65	18.77	12.15	1,598	23.33	21.06	14.63	36,221	22.15	19.46	14.92	38,245
<i>Non-interest expense ratio%</i>	3.38	2.86	1.96	1,534	3.34	2.93	1.69	1,598	3.07	2.88	1.20	36,221	3.13	2.93	1.23	38,245
<i>Non-performing loans ratio%</i>	1.89	0.48	3.58	1,534	2.55	0.36	4.63	1,598	1.53	0.23	3.02	36,221	1.54	0.09	3.30	38,245
<i>Local-market power</i>	2.29	0.02	5.42	1,534	2.47	0.03	5.82	1,598	0.46	0.01	2.40	36,221	0.51	0.01	2.50	38,245
<i>Bank holding company dummy</i>	0.86	1.00	0.34	1,534	0.90	1.00	0.30	1,598	0.82	1.00	0.39	36,221	0.83	1.00	0.38	38,245
<i>Metropolitan statistical area dummy</i>	0.79	1.00	0.41	1,534	0.78	1.00	0.41	1,598	0.61	1.00	0.49	36,221	0.61	1.00	0.49	38,245

Table 1: Summary Statistics (continued)

Panel C: Difference between securitizers and non-securitizers

Dependent variable	Difference with the reference of 2007/2008 financial crisis difference = value after 2007 - value before 2007						Difference between securitizers and non-securitizers difference = value of securitizer - value of non-securitizer					
	Securitizers			Non-securitizers			Before 2007			After 2007		
	statistic	Dif %	t-test on means	Dif %	t-test on means		Dif %	t-test on means	Dif %	t-test on means		
<i>Bank failure</i>	4.84%		a*	6.21%		a	0.04%		a	-1.33%		a
<i>Z-score</i>	-0.42	0.08	a	-0.43	-0.05	a, b	0.01	-0.06	a, b	0.03	0.07	a
Securitization regressor												
<i>Total securitization ratio%</i>	-6.16	-2.54	a, b	-	-	-	-	-	-	-	-	-
Bank-specific control variables												
<i>Total retained interest ratio%</i>	0.98	-1.75	b	-	-	-	-	-	-	-	-	-
<i>Bank size</i>	0.14	0.29	a, b	0.29	0.29	a, b	1.58	1.14	a, b	1.42	1.13	a, b
<i>Diversification ratio%</i>	-1.10	-0.20	-	-0.58	-0.57	a, b	13.00	3.68	a, b	12.47	4.05	a, b
<i>Bank liquidity ratio%</i>	-1.95	-2.25	a, b	-1.18	-1.60	a, b	-0.73	-0.05	a	-1.49	-0.69	a, b
<i>Non-interest expense ratio%</i>	-0.04	0.07	b	0.06	0.05	a, b	0.31	-0.01	a	0.21	0.01	a
<i>Non-performing loans ratio%</i>	0.66	-0.12	a, b	0.01	-0.14	b	0.36	0.25	a, b	1.01	0.27	a, b
<i>Local-market power</i>	0.19	0.01	b	0.04	0.00	a, b	1.82	0.02	a, b	1.97	0.03	a, b
<i>Bank holding company dummy</i>	0.04	0.00	a	0.01	0.00	a	0.05	0.00	a	0.08	0.00	a
<i>Metropolitan statistical area dummy</i>	-0.01	0.00	-	0.00	0.00	-	0.17	0.00	a	0.17	0.00	a

NOTE: * Letters "a" and "b" indicate a significant difference of means and medians at 1% level, respectively.

Table 2: The impact of loan securitization on Z-score

Table 2 shows our baseline results on the impact of total loan securitization ratio on bank's Z-scores. The sample period is 2002-2012. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All variable definitions are provided in Appendix A. The baseline OLS results are reported in column (1). Concerning the endogeneity problem, we use Heckman self-selection model and 2SLS as two identifications. We introduce three instruments in the Heckman and 2SLS models: 1) state-level corporate tax rate; 2) peer liquidity index; and 3) state-level corporate tax rate \times peer liquidity index. We only report the second-step results in columns (2) to (7), respectively. The first-step results are reported in Appendix C. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	Z-score						
	OLS	Heckman			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Instrument	(none)	(Corporate tax rate)	(Peer liquidity index)	(Interaction term)	(Corporate tax rate)	(Peer liquidity index)	(Interaction term)
<i>Total securitization ratio</i> _{t-1}	0.383*** (0.13)	0.218*** (0.03)	0.213*** (0.03)	0.247** (0.09)	0.233*** (0.08)	0.202*** (0.27)	0.287*** (0.10)
<i>Total retained interest ratio</i> _{t-1}	0.004 (0.04)	0.280*** (0.04)	0.280*** (0.04)	0.322* (0.14)	1.674** (0.71)	1.927*** (0.72)	3.047*** (4.08)
<i>Bank size</i> _{t-1}	-0.079*** (0.01)	-0.055** (0.02)	-0.129*** (0.04)	-0.356*** (0.26)	-0.054*** (0.01)	-0.058*** (0.01)	-0.074*** (0.05)
<i>Diversification ratio</i> _{t-1}	0.145*** (0.05)	0.131 (0.08)	0.142*** (0.09)	0.502*** (0.29)	0.090*** (0.03)	0.096*** (0.14)	0.142*** (0.04)
<i>Bank liquidity ratio</i> _{t-1}	-0.472** (0.20)	-14.734 (10.76)	-1.335** (1.25)	-0.351*** (0.31)	-0.344 (0.30)	-0.318 (0.31)	-0.212 (0.54)
<i>Non-interest expense ratio</i> _{t-1}	0.020 (0.08)	0.221 (0.31)	0.052 (0.29)	-4.421*** (2.52)	-1.273 (0.86)	-1.020** (1.89)	-1.513** (0.97)
<i>Non-performing loans ratio</i> _{t-1}	-0.131*** (0.03)	-0.006 (0.05)	-0.026** (0.07)	-0.484*** (0.86)	-0.304 (0.32)	-0.367** (0.34)	-0.606** (1.10)
<i>Local-market power</i> _{t-1}	0.027 (0.02)	0.484*** (0.12)	-0.446*** (0.12)	-0.226** (0.11)	0.041 (0.08)	0.037 (0.09)	-0.126 (0.30)
<i>Bank holding company dummy</i> _{t-1}	-0.038*** (0.01)	-0.067* (0.04)	-0.075* (0.04)	-3.238*** (2.86)	-0.056*** (0.01)	-0.024 (0.08)	-0.050*** (0.01)
<i>Metropolitan statistical area dummy</i> _{t-1}	-0.013 (0.02)	-0.099*** (0.03)	-0.091*** (0.03)	-16.79* (8.69)	-0.017** (0.01)	-0.015* (0.01)	-0.007 (0.03)
Constant	1.311*** (0.09)	1.616*** (0.48)	3.204*** (0.80)	1.671*** (1.34)	1.074*** (0.09)	1.284** (0.63)	1.119*** (0.08)
<i>Inverse Mills Ratio</i>		-0.235*** (0.07)	-0.243*** (0.08)	-0.488*** (0.13)			
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	69,258	69,258	69,258	69,258
Adjusted-R ²	0.2534	0.4346	0.3446	0.3418	0.4579	0.4928	0.4579

Table 3: The impact of loan securitization on Z-score, before- and after-2007

Table 3 shows our baseline results using split samples referring to the 2007-2009 financial crisis. We divide our sample into before- and after-2007 periods. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All variable definitions are provided in Appendix A. Results on before and after 2007 subsamples using OLS estimators are reported in columns (1) and (2), respectively. We use Heckman self-selection model and 2SLS as two additional identifications to address the endogeneity problem. We introduce three instruments in the Heckman and 2SLS models: 1) state-level corporate tax rate; 2) peer liquidity index; and 3) state-level corporate tax rate \times peer liquidity index. We report second-step results of Heckman model in columns (3) to (8), while results using 2SLS estimations in columns (9) to (14), respectively. The first-step results are reported in Appendix C. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	OLS		Heckman					Z-score						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Instrument	(none)	(none)	(Corporate tax rate)	(Peer liquidity index)	(Interaction term)	(Corporate tax rate)	(Peer liquidity index)	(Interaction term)	(Corporate tax rate)	(Peer liquidity index)	(Interaction term)	(Corporate tax rate)	(Peer liquidity index)	(Interaction term)
Time period	before	after												
	2007	2007	before 2007					after 2007						
<i>Total securitization ratio_{t-1}</i>	0.347** (0.33)	0.442* (0.33)	0.182*** (0.04)	0.179*** (0.04)	0.194*** (0.04)	0.212*** (0.05)	0.208*** (0.05)	0.209*** (0.05)	0.080** (0.08)	0.078** (0.04)	0.118** (0.12)	0.265** (0.11)	0.228** (0.10)	0.285** (0.14)
<i>Total retained interest ratio_{t-1}</i>	0.034 (0.04)	0.000 (0.05)	0.269*** (0.08)	0.275*** (0.07)	0.264*** (0.08)	0.278*** (0.05)	0.272*** (0.05)	0.276*** (0.05)	4.137** (1.82)	3.497 (11.56)	3.532** (1.71)	0.465 (0.32)	-10.883 (11.70)	0.045** (0.35)
<i>Bank size_{t-1}</i>	-0.007** (0.01)	-0.11*** (0.01)	-0.149*** (0.04)	-0.188*** (0.05)	-0.118*** (0.04)	-0.005 (0.03)	-0.045 (0.03)	-0.023 (0.03)	-0.092*** (0.02)	-0.083*** (0.02)	-0.059** (0.34)	-0.025*** (0.00)	-0.128*** (0.10)	-0.030*** (0.00)
<i>Diversification ratio_{t-1}</i>	0.066 (0.06)	0.110* (0.07)	0.268** (0.13)	0.254* (0.13)	0.287** (0.12)	0.011 (0.11)	0.026 (0.11)	-0.017 (0.11)	0.177** (0.07)	0.164** (0.06)	-0.053 (0.56)	-0.022 (0.03)	0.428 (0.46)	-0.009 (0.03)
<i>Bank liquidity ratio_{t-1}</i>	-0.446*** (0.10)	-1.025* (0.61)	-4.143 (57.67)	-39.553 (51.49)	-18.738* (60.52)	-14.110 (10.70)	-12.982 (11.16)	-13.476* (10.85)	0.039 (1.50)	-0.123 (1.39)	-2.727* (6.63)	-0.399* (0.22)	-0.942* (1.53)	-0.341** (0.21)
<i>Non-interest expense ratio_{t-1}</i>	0.012 (0.11)	-0.073 (0.08)	0.362 (0.35)	0.283 (0.31)	0.366 (0.36)	0.160 (0.50)	0.113 (0.50)	0.116 (0.50)	2.651* (1.59)	-2.223 (1.36)	2.922 (8.65)	1.071*** (0.40)	0.434 (0.44)	-4.945 (5.39)
<i>Non-performing loans ratio_{t-1}</i>	0.762** (0.49)	0.13*** (0.04)	0.005 (0.79)	-0.187 (0.91)	0.078 (0.71)	-0.030 (0.05)	-0.061 (0.06)	-0.042 (0.05)	-1.228 (0.94)	-1.035 (0.84)	2.180 (8.03)	2.588 (1.89)	-36.289 (46.85)	-0.673 (1.60)
<i>Local-market power_{t-1}</i>	0.026 (0.02)	0.035 (0.03)	0.598*** (0.19)	0.383* (0.20)	0.596*** (0.19)	0.443*** (0.15)	0.462*** (0.16)	0.445*** (0.15)	-0.020 (0.17)	0.204*** (0.73)	-0.012 (0.15)	0.121*** (0.04)	0.115*** (0.04)	0.723*** (1.10)
<i>Bank holding company dummy_{t-1}</i>	-0.003** (0.01)	-0.035* (0.02)	0.066 (0.06)	0.054 (0.06)	0.051 (0.06)	-0.145*** (0.05)	-0.159*** (0.05)	-0.150*** (0.05)	-0.001*** (0.03)	-0.213*** (0.48)	-0.011 (0.03)	-0.107*** (0.01)	-0.100*** (0.20)	-0.098*** (0.01)
<i>Metropolitan statistical area dummy_{t-1}</i>	-0.012 (0.02)	-0.009 (0.03)	-0.017 (0.05)	-0.024 (0.05)	-0.030 (0.05)	-0.119*** (0.03)	-0.116*** (0.03)	-0.117*** (0.03)	-0.004 (0.02)	-0.077 (0.17)	-0.008 (0.02)	-0.024*** (0.01)	0.023 (0.05)	-0.021*** (0.01)
<i>Constant</i>	0.404*** (0.12)	1.71*** (0.15)	3.182*** (0.80)	3.997*** (1.03)	2.591*** (0.72)	0.669 (0.64)	1.592** (0.71)	1.080* (0.58)	1.505*** (0.17)	1.398*** (0.19)	1.228*** (3.84)	0.678*** (0.05)	1.856* (1.12)	0.745*** (0.06)
<i>Inverse Mills Ratio</i>			-0.430*** (0.11)	-0.084** (0.11)	-0.348*** (0.10)	-0.541*** (0.14)	-0.246** (0.12)	-0.155** (0.10)						
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,638	39,620	29,638	29,638	29,638	39,620	39,620	39,620	29,638	29,638	29,638	39,620	39,620	39,620
Adjusted-R ²	0.2185	0.2781	0.4374	0.3029	0.4444	0.3294	0.3712	0.3544	0.2719	0.3932	0.4754	0.4648	0.3022	0.4819

Table 4: The Impact of Securitization on Bank Z-scores, WLS with Propensity-Score Weighting

Table 4 reports the results of the impact of securitization ratios on bank's Z-scores using a propensity score matching based weighted-least-squares estimator. We use a full sample and a 1:1 matched subsample including securitizers and non-securitizers with a propensity score distance within 1%. Within each sample, we use the propensity scores as the weights to conduct a least squares estimation. The sample period is from 2002 to 2012. We also divide the sample period into pre- and post-crisis subsamples. All variable definitions are presented in Appendix A. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	Z-score			
	(1) Full sample	(2) 1:1 matched sample	(3) before 2007	(4) after 2007
<i>Total securitization ratio</i> $\%_t$	0.209*** (0.01)	0.196*** (0.02)	0.172*** (0.01)	0.220*** (0.03)
<i>Total retained interest ratio</i> $\%_t$	0.238*** (0.03)	0.126*** (0.04)	0.307*** (0.06)	0.163*** (0.04)
<i>Bank size</i> $_t$	-0.033*** (0.00)	-0.016*** (0.00)	-0.046*** (0.00)	-0.030*** (0.00)
<i>Diversification ratio</i> $\%_t$	0.036*** (0.01)	0.112* (0.06)	-0.014 (0.01)	0.085*** (0.02)
<i>Bank liquidity ratio</i> $\%_t$	-0.400 (0.54)	8.398 (8.73)	-0.651 (0.61)	0.969 (1.38)
<i>Non-interest expense ratio</i> $\%_t$	-0.600*** (0.02)	-0.394*** (0.06)	-0.675*** (0.03)	-0.562*** (0.03)
<i>Non-performing loans ratio</i> $\%_t$	-0.150*** (0.02)	-0.047*** (0.01)	6.109*** (0.87)	0.111*** (0.01)
<i>Local-market power</i> $_t$	0.073*** (0.01)	0.292*** (0.08)	0.103*** (0.02)	0.024 (0.02)
<i>Bank holding company dummy</i> $_t$	-0.116*** (0.00)	-0.159*** (0.03)	-0.125*** (0.00)	-0.105*** (0.00)
<i>Metropolitan statistical area dummy</i> $_t$	-0.020*** (0.00)	-0.070*** (0.02)	-0.006* (0.00)	-0.027*** (0.00)
<i>Constant</i>	0.766*** (0.01)	0.225*** (0.06)	0.913*** (0.02)	0.725*** (0.02)
Observations	77,598	6,264	37,755	39,843
Pseudo R-squared	0.2658	0.1726	0.2046	0.2429

Table 5: The Impact of Securitization on the Likelihood of Bank Failure

Table 5 shows the results on the impact of bank loan securitization on the likelihood of bank failure. We employ both survival analysis (column (1) to (3)) and logit model (column (4) to (6)). The sample period is from 2002 to 2012. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All variable definitions are presented in Appendix A. We also divide the sample period into before- and after-2007 to explore the difference referring to the 2007-09 financial crisis. We control for bank fixed effects in both regressions. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	<i>Bank Failure</i>					
	Cox model			Logit model		
	(1) full sample	(2) before 2007	(3) after 2007	(4) full sample	(5) before 2007	(6) after 2007
<i>Total securitization ratio</i> _{<i>t</i>}	0.561*** (0.23)	1.019*** (0.15)	0.335** (0.32)	0.0039*** (0.001)	0.0064*** (0.000)	0.0016** (0.003)
<i>Total retained interest ratio</i> _{<i>t</i>}	-0.370 (0.93)	-48.354*** (13.43)	-0.161 (0.86)	-0.1270 (0.076)	-0.0740*** (0.027)	-0.1162 (0.075)
<i>Bank size</i> _{<i>t</i>}	0.108*** (0.04)	-0.038 (0.13)	0.148*** (0.04)	0.0015*** (0.000)	0.0005 (0.000)	0.0020*** (0.000)
<i>Diversification ratio</i> _{<i>t</i>}	-0.806** (0.40)	-1.363 (1.23)	-0.885** (0.42)	-0.0077*** (0.003)	-0.0022 (0.002)	-0.0101** (0.005)
<i>Bank liquidity ratio</i> _{<i>t</i>}	8.273** (3.81)	16.555*** (5.02)	9.020 (9.65)	0.1078* (0.060)	0.0579** (0.026)	0.1304 (0.118)
<i>Non-interest expense ratio</i> _{<i>t</i>}	1.185*** (0.27)	1.367*** (0.21)	0.951*** (0.30)	0.0075*** (0.002)	0.0018*** (0.001)	0.0108** (0.004)
<i>Non-performing loans ratio</i> _{<i>t</i>}	-29.130** (14.25)	1.935 (4.21)	-35.379** (17.46)	-0.1815 (0.110)	-0.2605 (0.589)	-0.3410* (0.184)
<i>Local-market power</i> _{<i>t</i>}	0.823* (0.46)	1.076 (1.19)	0.974** (0.46)	0.0081** (0.003)	-0.0009 (0.002)	0.0124** (0.005)
<i>Bank holding company dummy</i> _{<i>t</i>}	-0.146 (0.11)	-0.910*** (0.25)	-0.024 (0.12)	-0.0014* (0.001)	-0.0020*** (0.001)	-0.0004 (0.001)
<i>Metropolitan statistical area dummy</i> _{<i>t</i>}	0.826*** (0.11)	0.661** (0.29)	0.835*** (0.11)	0.0049*** (0.001)	0.0009** (0.000)	0.0082*** (0.001)
<i>Constant</i>				-7.722*** (0.41)	-6.039*** (1.70)	-7.090*** (0.46)
Observations	77,598	37,755	39,843	77,598	37,755	39,843
Pseudo Likelihood	-3226	-3875	-2683	-5734	-5148	-5122

Table 6: The Impact of Securitization on the Likelihood of Failure, WLS with Propensity-Score Weighting

Table 6 reports the results of the impact of securitization ratios on the likelihood of bank failure using a propensity score matching based weighted-least-squares estimator. We use a full sample and a 1:1 matched subsample including securitizers and non-securitizers with a propensity score distance within 1%. Within each sample, we use the propensity scores as the weights to conduct a least squares estimation. The sample period is from 2002 to 2012. We also divide the sample period into pre- and post-crisis subsamples. All variable definitions are presented in Appendix A. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. We report marginal effects instead of coefficients. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	<i>Bank failure</i>			
	(1) Full sample	(2) 1:1 matched sample	(3) before 2007	(4) after 2007
<i>Total securitization ratio</i> $\%_t$	0.0019*** (0.004)	0.0068*** (0.003)	0.0015** (0.002)	0.0049** (0.009)
<i>Total retained interest ratio</i> $\%_t$	-0.0070 (0.010)	-0.0000 (0.006)	-0.0086 (0.010)	-0.0060 (0.014)
<i>Bank size</i> $_t$	0.0019*** (0.000)	0.0003 (0.001)	0.0000 (0.000)	0.0025*** (0.001)
<i>Diversification ratio</i> $\%_t$	-0.0107*** (0.003)	-0.0036 (0.006)	-0.0018 (0.002)	-0.0140*** (0.005)
<i>Bank liquidity ratio</i> $\%_t$	0.0867 (0.275)	0.0601 (0.961)	0.0487 (0.199)	0.0968 (0.463)
<i>Non-interest expense ratio</i> $\%_t$	0.0530*** (0.006)	0.0012 (0.007)	0.0464*** (0.004)	0.0581*** (0.011)
<i>Non-performing loans ratio</i> $\%_t$	-0.0449 (0.038)	-0.0129 (0.020)	-0.0421 (0.093)	-0.0553 (0.048)
<i>Local-market power</i> $_t$	0.0128*** (0.004)	0.0045 (0.009)	-0.0022 (0.003)	0.0194*** (0.007)
<i>Bank holding company dummy</i> $_t$	-0.0015 (0.001)	0.0001 (0.003)	-0.0023*** (0.001)	-0.0005 (0.002)
<i>Metropolitan statistical area dummy</i> $_t$	0.0048*** (0.001)	0.0020 (0.002)	0.0011* (0.001)	0.0082*** (0.001)
<i>Constant</i>	-0.0178*** (0.004)	-0.0022 (0.007)	0.0018 (0.003)	-0.0236*** (0.006)
Observations	77,598	6,264	37,755	39,843
Pseudo R-squared	0.2031	0.1121	0.2071	0.2032

Table 7: The Impact of Mortgage and Non-Mortgage Securitization on Z-score and the Likelihood of Bank Failure

Table 7 presents regression results on the impact of mortgage and non-mortgage securitization on bank Z-scores and the likelihood of failure. We use OLS in Z-score regressions (results on Heckman models are reported in Appendix D), and the Cox model in survival analysis. The sample period is 2002-2012. We also divide sample into before- and after-2007 periods to explore the differences referring to the 2007-2009 financial crisis. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All independent variables are lagged in OLS regressions. We control for bank and year fixed effects in OLS regression, and only bank fixed effects in Cox model. All variable definitions are presented in Appendix A. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	Z-score						Bank failure						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	Full	Before	After	Full	Before	After	Full	Before	After	Full	Before	After	
	Sample	2007	2007	Sample	2007	2007	Sample	2007	2007	Sample	2007	2007	
	OLS						Cox model						
<i>Mortgage securitization ratio</i> $\%_{t-1}$	0.109	-0.045	-0.206				<i>Mortgage securitization ratio</i> $\%_t$	0.711***	0.974***	0.570*			
	(0.04)	(0.11)	(0.20)					(0.21)	(0.15)	(0.32)			
<i>Mortgage retained interest ratio</i> $\%_{t-1}$	0.008	0.034	0.243***				<i>Mortgage retained interest ratio</i> $\%_t$	0.286	30.616	0.379			
	(0.04)	(0.04)	(0.08)					(1.14)	(10.345)	(1.13)			
<i>Non-mortgage securitization ratio</i> $\%_{t-1}$				0.247***	0.310***	0.198***	<i>Non-mortgage securitization ratio</i> $\%_t$				0.185**	0.223**	0.119**
				(0.15)	(0.91)	(0.04)					(0.52)	(0.50)	(0.45)
<i>Non-mortgage retained interest ratio</i> $\%_{t-1}$				0.007	0.007	-0.008	<i>Non-mortgage retained interest ratio</i> $\%_t$				-1.503	-43.99***	-0.981
				(0.01)	(0.01)	(0.03)					(1.77)	(12.27)	(1.18)
<i>Bank size</i> $_{t-1}$	-0.08***	-0.007	-0.20***	-0.08***	-0.007	-0.15***	<i>Bank size</i> $_t$	0.109***	-0.035	0.148***	0.108***	-0.039	0.148***
	(0.01)	(0.01)	(0.05)	(0.01)	(0.01)	(0.04)		(0.04)	(0.13)	(0.04)	(0.04)	(0.13)	(0.04)
<i>Diversification ratio</i> $\%_{t-1}$	0.163***	0.180**	0.107	0.145***	0.066	0.284**	<i>Diversification ratio</i> $\%_t$	-0.813**	-1.428	-0.887**	-0.806**	-1.371	-0.886**
	(0.05)	(0.06)	(0.14)	(0.05)	(0.06)	(0.13)		(0.40)	(1.21)	(0.42)	(0.40)	(1.23)	(0.42)
<i>Bank liquidity ratio</i> $\%_{t-1}$	-0.469**	-0.45***	8.222	-0.472**	-0.44***	5.414	<i>Bank liquidity ratio</i> $\%_t$	8.155**	6.437**	8.974	8.321**	15.687***	8.886
	(0.20)	(0.10)	(53.37)	(0.20)	(0.10)	(58.03)		(3.85)	(2.92)	(9.64)	(4.01)	(4.73)	(9.61)
<i>Non-interest expense ratio</i> $\%_{t-1}$	0.037	0.013	1.634***	0.024	0.011	0.273	<i>Non-interest expense ratio</i> $\%_t$	1.191***	1.377***	0.953***	1.181***	1.367***	0.949***
	(0.08)	(0.11)	(0.25)	(0.08)	(0.11)	(0.35)		(0.27)	(0.21)	(0.30)	(0.27)	(0.21)	(0.30)
<i>Non-performing loans ratio</i> $\%_{t-1}$	0.131***	0.757	0.263	0.128***	0.725	0.251	<i>Non-performing loans ratio</i> $\%_t$	-28.59**	3.942	-35.25**	-27.89**	3.620	-34.66**
	(0.03)	(0.48)	(0.96)	(0.03)	(0.47)	(0.80)		(14.02)	(8.49)	(17.36)	(13.92)	(3.95)	(17.17)
<i>Local-market power</i> $_{t-1}$	0.027	0.026	0.543**	0.027	0.026	0.624***	<i>Local-market power</i> $_t$	0.818*	1.246	0.973**	0.821*	1.090	0.975**
	(0.02)	(0.02)	(0.22)	(0.02)	(0.02)	(0.19)		(0.46)	(1.07)	(0.46)	(0.46)	(1.18)	(0.46)
<i>Bank holding company dummy</i> $_{t-1}$	-0.04***	0.003	0.014	-0.04***	0.003	0.062	<i>Bank holding company dummy</i> $_t$	-0.152	-0.93***	-0.025	-0.143	-0.909***	-0.023
	(0.01)	(0.01)	(0.06)	(0.01)	(0.01)	(0.06)		(0.11)	(0.25)	(0.12)	(0.11)	(0.25)	(0.12)
<i>Metropolitan statistical area dummy</i> $_{t-1}$	-0.013	-0.012	-0.008	-0.013	-0.012	-0.024	<i>Metropolitan statistical area dummy</i> $_t$	0.827***	0.667**	0.834***	0.828***	0.661**	0.835***
	(0.02)	(0.02)	(0.05)	(0.02)	(0.02)	(0.05)		(0.11)	(0.29)	(0.11)	(0.11)	(0.29)	(0.11)
Constant	1.317***	0.404***	4.144***	1.312***	0.403***	3.189***							
	(0.09)	(0.12)	(0.87)	(0.09)	(0.12)	(0.82)							
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Time Fixed Effect	No	No	No	No	No	No
Observations	69,258	29,638	39,620	69,258	29,638	39,620	Observations	77,598	37,755	39,843	77,598	37,755	39,843
Adjusted-R ²	0.4533	0.4781	0.4308	0.4120	0.4253	0.4187	Pseudo-R ²	0.2116	0.2347	0.2112	0.2120	0.2367	0.2113

Table 8: The Impact of Loan Sales on Z-score and the Likelihood of Bank Failure

Table 8 presents regression results of the impact of loan sales on bank Z-scores and the likelihood of failure. We use OLS and Heckman self-selection models in Z-score regressions, and the Cox model in survival analysis. The sample period is 2002-2012. We also divide sample into before- and after-2007 periods to explore the differences referring to the 2007-2009 financial crisis. Control variables include bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All independent variables are lagged in OLS and Heckman models. We control for bank and year fixed effects in OLS and Heckman models, and only control for bank fixed effects in Cox models. All variable definitions are presented in Appendix A. In Heckman regressions, we report only second-step results in Table 8 and the first-step results in Appendix C. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	Z-score												Bank failure		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Full Sample				Before 2007				After 2007				Full Sample	Before 2007	After 2007
	OLS		Heckman		OLS		Heckman		OLS		Heckman		Cox model		
<i>Loan sale ratio%</i>	0.240*** (0.06)	0.171*** (0.02)	0.273*** (0.02)	0.272*** (0.02)	0.192*** (0.04)	0.179*** (0.02)	0.218*** (0.02)	0.217*** (0.02)	0.201** (0.61)	0.209*** (0.02)	0.276*** (0.02)	0.278*** (0.02)	0.373** (0.48)	0.913** (1.36)	0.226** (0.20)
<i>Bank size</i>	-0.079*** (0.01)	-0.022*** (0.01)	-0.016 (0.01)	-0.015** (0.01)	-0.120*** (0.04)	-0.022*** (0.01)	-0.050*** (0.01)	-0.038*** (0.01)	-0.007 (0.01)	-0.059*** (0.01)	-0.037*** (0.01)	-0.020** (0.01)	0.109*** (0.04)	-0.056 (0.13)	0.149*** (0.04)
<i>Diversification ratio%</i>	0.146*** (0.05)	0.032 (0.03)	0.026 (0.03)	0.026 (0.03)	0.299** (0.13)	0.084** (0.04)	-0.049 (0.04)	-0.055 (0.04)	0.066 (0.06)	-0.043 (0.05)	0.086** (0.04)	0.081** (0.04)	-0.810** (0.40)	-1.400 (1.23)	-0.891** (0.42)
<i>Bank liquidity ratio%</i>	-0.469** (0.20)	-0.344 (0.60)	-0.371** (0.60)	-0.359 (0.60)	-8.018 (60.77)	-5.379 (6.64)	-0.289 (0.54)	-0.252 (0.54)	-0.439*** (0.10)	-0.199 (0.53)	-5.334 (6.76)	-5.508 (6.62)	8.164** (3.83)	6.524** (2.89)	8.696 (9.55)
<i>Non-interest expense ratio%</i>	0.011 (0.08)	-0.215** (0.15)	-0.214** (0.15)	-0.205 (0.15)	0.431 (0.36)	-0.710*** (0.22)	0.379* (0.21)	0.454** (0.21)	0.016 (0.11)	0.434** (0.22)	-0.687*** (0.22)	-0.699*** (0.22)	1.190*** (0.27)	1.360*** (0.21)	0.957*** (0.30)
<i>Non-performing loans ratio%</i>	0.132*** (0.03)	0.058 (0.04)	0.055** (0.04)	0.055** (0.04)	0.119 (0.73)	0.046 (0.04)	0.877* (0.46)	0.936** (0.43)	0.744 (0.48)	0.825* (0.48)	0.044 (0.04)	0.046 (0.04)	-28.781** (14.06)	-1.652 (8.66)	-33.887** (17.09)
<i>Local-market power</i>	0.027 (0.02)	0.096** (0.05)	0.090** (0.05)	0.088* (0.05)	0.647*** (0.19)	0.066 (0.06)	0.139** (0.07)	0.149** (0.07)	0.026 (0.02)	0.157** (0.07)	0.087 (0.06)	0.062 (0.06)	0.820* (0.46)	1.178 (1.09)	0.961** (0.46)
<i>Bank holding company dummy</i>	-0.038*** (0.01)	-0.120*** (0.02)	-0.113*** (0.02)	-0.110*** (0.02)	0.046 (0.06)	-0.141*** (0.02)	-0.114*** (0.02)	-0.106*** (0.02)	0.003 (0.01)	-0.118*** (0.02)	-0.173*** (0.03)	-0.136*** (0.02)	-0.152 (0.11)	-0.900*** (0.25)	-0.020 (0.12)
<i>Metropolitan statistical area dummy</i>	-0.013 (0.02)	-0.019** (0.01)	-0.020*** (0.01)	-0.021*** (0.01)	-0.033 (0.05)	-0.024** (0.01)	-0.000 (0.01)	-0.003 (0.01)	-0.012 (0.02)	0.003 (0.01)	-0.019* (0.01)	-0.024** (0.01)	0.827*** (0.11)	0.669** (0.29)	0.835*** (0.11)
<i>Constant</i>	1.309*** (0.09)	0.780*** (0.13)	0.659*** (0.21)	0.623*** (0.13)	2.687*** (0.74)	0.819*** (0.17)	1.277*** (0.26)	1.044*** (0.18)	0.405*** (0.12)	1.463*** (0.20)	1.147*** (0.24)	0.762*** (0.17)			
<i>Inverse Mills Ratio</i>		-0.086*** (0.03)	-0.060*** (0.04)	-0.053** (0.03)		-0.088** (0.04)	-0.182*** (0.05)	-0.139*** (0.03)		-0.221*** (0.04)	-0.164*** (0.06)	-0.076** (0.04)			
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Observations	69,258	69,258	69,258	69,258	29,638	29,638	29,638	29,638	39,620	39,620	39,620	39,620	77,598	37,755	39,843
Adjusted-R ²	0.4650	0.4506	0.4302	0.3968	0.4898	0.3548	0.3433	0.3295	0.5425	0.3606	0.3488	0.3344			
Pseudo-R ²													0.3233	0.3464	0.3229

Appendix A: Variable Definition

Variable	Definition
Dependent variable	
<i>Z-score</i>	Z-score is banks' distance to insolvency, which equals to the return on assets plus the capital asset ratio divided by the standard deviation of asset returns.
<i>Bank Failure</i>	Bank failure dummy, which equals to one if the bank failed or is acquired by another bank under the government assistance in the sample and zero otherwise.
Independent variables	
<i>Total Securitization Ratio</i>	The outstanding principal balance of total amount of assets securitized over total assets.
<i>Mortgage Securitization Ratio</i>	The outstanding principal balance of total amount of mortgage assets securitized over total assets.
<i>Non-Mortgage Securitization Ratio</i>	The outstanding principal balance of total amount of non-mortgage assets securitized over total assets.
<i>Total Retained Interests Ratio</i>	The total dollar amount of credit exposure from all retained interest only strips, all other credit enhancements, unused commitments to provide liquidity to asset securitized, and ownership (or sellers) interests carried as securities or loans on related assets, divided by the total of all securitized assets.
<i>Mortgage Retained Interests Ratio</i>	The total dollar amount of credit exposure from all retained interest only strips, all other credit enhancements, unused commitments to provide liquidity to asset securitized, and ownership (or sellers) interests carried as securities or loans on related assets, divided by the total of all securitized mortgage assets.
<i>Non-Mortgage Retained Interests Ratio</i>	The total dollar amount of credit exposure from all retained interest only strips, all other credit enhancements, unused commitments to provide liquidity to asset securitized, and ownership (or sellers) interests carried as securities or loans on related assets, divided by the total of all securitized non-mortgage assets.
<i>Bank Size</i>	The natural logarithm of total assets.
<i>Diversification Ratio</i>	Noninterest income divided by total operation income.
<i>Liquidity Ratio</i>	Liquid assets divided by total assets.
<i>Non-Interests Expenses Ratio</i>	Noninterest expense divided by total assets.
<i>Non-Performing Loans Ratio</i>	Loans past due 90 days divided by total assets.
<i>Local-Market Power</i>	The sum of the squares of each portfolio in every bank.
<i>Bank Holding Company Dummy</i>	Bank holding company dummy equals to one if the bank belongs to a bank holding company, and zero otherwise.
<i>Metropolitan Statistical Area Dummy</i>	Metropolitan statistical area dummy equals to one if the bank locates in metropolitan area, and zero otherwise.
Instruments	
<i>Peer Liquidity Index</i>	Peer liquidity index is the average of liquidity indexes of a bank's peers. Liquidity index is proposed by Loutskina (2011) to effectively capture banks' potential ability to securitize loans.
<i>state-level corporate tax rate</i>	State level corporate tax rate
<i>Peer Liquidity Index × State-level Corporate Tax Rate</i>	The cross product of peer liquidity index and state-level corporate tax rate.

Appendix B: Correlation Matrix

Panel A: Z-score and controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	1.0000										
(2)	0.0205***	1.0000									
(3)	0.0116***	0.1838***	1.0000								
(4)	-0.0661***	0.0736***	0.0954***	1.0000							
(5)	0.0768***	0.2032***	0.1332***	0.2721***	1						
(6)	0.0617***	-0.0068	-0.0043	-0.0538***	0.0741***	1					
(7)	0.0101**	0.1629***	0.0583***	-0.1337***	0.5157***	-0.0929***	1				
(8)	-0.031**	0.0649***	0.0410***	-0.0486***	0.0242***	-0.0573***	0.0702***	1			
(9)	-0.0011***	0.0472***	0.0641***	0.2172***	0.1844***	0.0737***	-0.0169***	0.0328***	1		
(10)	-0.0638***	-0.0408***	-0.0041	0.1920***	0.0584***	0.0131***	-0.1042***	-0.0180***	0.0257***	1	
(11)	-0.0246***	0.0235***	0.0302***	0.2723***	0.0982***	-0.1124***	0.0807***	-0.0383***	-0.0268***	-0.0337***	1

Note: Variables are numbered as follows: (1) Z-score, (2) Total securitization ratio; (3) Total retained interest ratio; (4) Bank size; (5) Diversification ratio; (6) Liquidity ratio; (7) Non-interests expense ratio; (8) Non-performing loans ratio; (9) Local-market power index; (10) BHC dummy; (11) MSA dummy.

Appendix B: Correlation Matrix (continued)

Panel B: Failure and controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	1.0000										
(2)	0.0068*	1.0000									
(3)	0.0002	0.1838***	1.0000								
(4)	0.0249***	0.0736***	0.0954***	1.0000							
(5)	-0.0208***	0.2032***	0.1332***	0.2721***	1						
(6)	-0.0427***	-0.0068	-0.0043	-0.0538***	0.0741***	1					
(7)	0.0687***	0.1629***	0.0583***	-0.1337***	0.5157***	-0.0929***	1				
(8)	0.0386***	0.0649***	0.0410***	-0.0486***	0.0242***	-0.0573***	0.0702***	1			
(9)	-0.0024	0.0472***	0.0641***	0.2172***	0.1844***	0.0737***	-0.0169***	0.0328***	1		
(10)	-0.0077**	-0.0408***	-0.0041	0.1920***	0.0584***	0.0131***	-0.1042***	-0.0180***	0.0257***	1	
(11)	0.0326***	0.0235***	0.0302***	0.2723***	0.0982***	-0.1124***	0.0807***	-0.0383***	-0.0268***	-0.0337***	1

Note: Variables are numbered as follows: (1) *Failure dummy*, (2) *Total securitization ratio*; (3) *Total retained interest ratio*; (4) *Bank size*; (5) *Diversification ratio*; (6) *Liquidity ratio*; (7) *Non-interests expense ratio*; (8) *Non-performing loans ratio*; (9) *Local-market power index*; (10) *BHC dummy*; (11) *MSA dummy*.

Appendix C: Additional Results

Panel A: First-step results of Heckman self-selection model on securitization

Appendix C shows the first-step results of Heckman and 2SLS regressions. Results on securitization activities using Heckman and 2SLS regressions are reported in Panel A and B, respectively. First-step results of Heckman regression on loan sales, mortgage, and non-mortgage securitizations are reported in Panel C, D, and E, respectively. Instrumental variables include: 1) state-level corporate tax rate; 2) peer liquidity index; and, 3) state-level corporate tax rate \times peer liquidity index. Bank characteristics include bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All variable definitions are provided in Appendix A.

Dependent Variable	Securitization Dummy								
	full sample			before 2007			after 2007		
<i>Bank size</i>	0.352*** (0.01)	0.331*** (0.01)	0.346*** (0.01)	0.428*** (0.02)	0.410*** (0.02)	0.418*** (0.02)	0.275*** (0.01)	0.254*** (0.01)	0.696*** (0.21)
<i>Diversification ratio</i>	0.082 (0.10)	0.196* (0.10)	0.152* (0.10)	0.172* (0.17)	-0.039 (0.17)	-0.025 (0.17)	0.279** (0.13)	0.404*** (0.13)	0.011* (0.01)
<i>Bank liquidity ratio</i>	-3.839 (9.70)	-3.399 (9.33)	-3.621 (9.68)	-3.431 (13.18)	-2.802 (12.77)	-2.863 (13.30)	-4.275 (14.41)	-4.023 (13.53)	-0.073 (0.05)
<i>Non-interest expense ratio</i>	1.005*** (0.13)	0.786*** (0.10)	1.003*** (0.13)	1.136*** (0.17)	0.918*** (0.13)	1.137*** (0.17)	0.907*** (0.19)	0.668*** (0.17)	0.874** (0.50)
<i>Non-performing loans ratio</i>	3.325*** (0.71)	3.533*** (0.71)	3.299*** (0.71)	22.301*** (5.06)	26.834*** (5.15)	23.695*** (5.13)	3.528*** (0.74)	3.702*** (0.73)	2.579** (1.32)
<i>Local-market power</i>	0.004 (0.16)	0.186 (0.16)	0.119 (0.16)	0.176 (0.28)	0.501* (0.26)	0.326 (0.27)	-0.229 (0.21)	-0.124 (0.21)	0.019 (0.02)
<i>Bank holding company dummy</i>	-0.038 (0.04)	-0.025 (0.04)	-0.038 (0.04)	-0.135* (0.07)	-0.147** (0.07)	-0.136* (0.07)	0.043 (0.06)	0.066 (0.05)	-0.012*** (0.01)
<i>Metropolitan statistical area dummy</i>	-0.014 (0.03)	-0.060* (0.03)	-0.021 (0.03)	-0.079 (0.06)	-0.120** (0.06)	-0.091 (0.06)	0.023 (0.04)	-0.013 (0.04)	-0.003* (0.00)
<i>State-level corporate tax rate</i>	0.206*** (0.10)			0.009*** (0.00)			0.004*** (0.00)		
<i>Peer liquidity index</i>		0.023*** (0.01)			0.023** (0.01)			0.022*** (0.01)	
<i>State-level corporate tax rate \times Peer liquidity index</i>			0.001*** (0.00)			0.001*** (0.00)			0.001*** (0.00)
<i>Constant</i>	-6.832*** (0.13)	-6.521*** (0.12)	-6.748*** (0.13)	-7.883*** (0.23)	-5.816*** (0.17)	-7.705*** (0.22)	-7.513*** (0.21)	-5.576*** (0.16)	-5.799*** (0.17)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Pseudo-R ²	0.3587	0.3227	0.4487	0.4514	0.3959	0.2434	0.3436	0.3902	0.2632

Appendix C: Additional Results (continued)

Panel B: First-step results of 2SLS model on securitization

Dependent Variable	Securitization Ratio								
	full sample			before 2007			after 2007		
<i>Bank size</i>	0.462*** (0.12)	0.484*** (0.13)	0.462*** (0.12)	0.693*** (0.21)	0.770*** (0.24)	0.696*** (0.21)	0.331*** (0.10)	0.336*** (0.10)	0.332*** (0.10)
<i>Diversification ratio</i>	0.013** (0.01)	0.015** (0.01)	0.008* (0.01)	0.019** (0.01)	0.010*** (0.08)	0.011* (0.01)	0.005*** (0.00)	0.005*** (0.01)	0.010 (0.01)
<i>Bank liquidity ratio</i>	-0.042 (0.03)	-0.049* (0.03)	-0.043 (0.03)	-0.067 (0.05)	-0.029* (0.01)	-0.073 (0.05)	-0.008 (0.01)	-0.007 (0.01)	-0.086 (0.08)
<i>Non-interest expense ratio</i>	0.449 (0.32)	0.241** (0.14)	0.447 (0.31)	0.869* (0.50)	0.387** (0.22)	0.874** (0.50)	-0.086 (0.08)	-0.084 (0.08)	0.238 (0.19)
<i>Non-performing loans ratio</i>	0.112** (0.06)	0.117* (0.06)	0.113** (0.06)	2.520** (1.31)	2.646** (1.36)	2.579** (1.32)	0.238 (0.19)	0.126 (0.08)	0.105** (0.05)
<i>Local-market power</i>	0.010 (0.02)	0.029 (0.02)	0.013 (0.02)	0.013 (0.02)	0.059 (0.04)	0.019 (0.02)	0.104* (0.05)	0.107** (0.05)	0.011 (0.01)
<i>Bank holding company dummy</i>	-0.010*** (0.01)	-0.010*** (0.00)	-0.010*** (0.00)	-0.012*** (0.01)	-0.014*** (0.01)	-0.012*** (0.01)	0.006 (0.01)	-0.006 (0.00)	-0.010** (0.00)
<i>Metropolitan statistical area dummy</i>	-0.002 (0.00)	-0.002** (0.00)	0.003** (0.00)	0.002*** (0.00)	0.003** (0.01)	-0.003* (0.00)	0.007** (0.00)	0.002** (0.00)	-0.002 (0.00)
<i>State-level corporate tax rate</i>	0.236*** (0.07)			0.008*** (0.00)			0.009*** (0.00)		
<i>Peer liquidity index</i>		0.171** (0.16)			0.023*** (0.03)			0.035** (0.01)	
<i>State-level corporate tax rate × Peer liquidity index</i>			0.025*** (0.01)			-0.101*** (0.03)			-0.063*** (0.02)
<i>Constant</i>	-0.097*** (0.03)	-0.076*** (0.02)	-0.091*** (0.03)	-0.122*** (0.04)	-0.077*** (0.02)	-0.653*** (0.24)	-0.067*** (0.02)	-0.053*** (0.01)	-0.107** (0.05)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Adjusted-R ²	0.2900	0.2689	0.2895	0.1491	0.2720	0.2473	0.2013	0.2623	0.2718

Appendix C: Additional Results (continued)

Panel C: First-step results of Heckman self-selection model on loan sales

Dependent Variable	Loan Sales Dummy								
	full sample			before 2007			after 2007		
<i>Bank size</i>	0.315*** (0.01)	0.281*** (0.01)	0.304*** (0.01)	0.319*** (0.01)	0.288*** (0.01)	0.303*** (0.01)	0.278*** (0.01)	0.243*** (0.01)	0.271*** (0.01)
<i>Diversification ratio</i>	-0.183*** (0.06)	-0.030 (0.06)	-0.072 (0.06)	-0.185** (0.09)	-0.062 (0.09)	-0.045 (0.09)	-0.110 (0.07)	0.056 (0.07)	-0.021 (0.07)
<i>Bank liquidity ratio</i>	2.913 (6.25)	2.815 (5.95)	2.913 (6.18)	1.511 (8.48)	2.541 (8.41)	2.610 (8.65)	3.827 (9.44)	2.797 (8.62)	3.119 (9.14)
<i>Non-interest expense ratio</i>	0.665*** (0.13)	0.387*** (0.11)	0.668*** (0.13)	0.656*** (0.17)	0.469*** (0.13)	0.667*** (0.17)	0.583*** (0.20)	0.190 (0.20)	0.585*** (0.20)
<i>Non-performing loans ratio</i>	3.314*** (0.98)	4.036*** (1.00)	3.364*** (0.99)	79.146*** (15.29)	101.047*** (16.14)	86.513*** (15.64)	2.372*** (0.91)	2.911*** (0.94)	2.375*** (0.91)
<i>Local-market power</i>	-0.479*** (0.09)	-0.397*** (0.09)	-0.368*** (0.09)	-0.219 (0.15)	-0.087 (0.15)	-0.079 (0.15)	-0.762*** (0.12)	-0.708*** (0.12)	-0.674*** (0.12)
<i>Bank holding company dummy</i>	0.386*** (0.02)	0.414*** (0.02)	0.391*** (0.02)	0.253*** (0.04)	0.270*** (0.04)	0.259*** (0.04)	0.493*** (0.03)	0.525*** (0.03)	0.497*** (0.03)
<i>Metropolitan statistical area dummy</i>	-0.042*** (0.01)	-0.090*** (0.01)	-0.053*** (0.01)	-0.036 (0.02)	-0.077*** (0.02)	-0.048* (0.02)	-0.029 (0.02)	-0.073*** (0.02)	-0.038** (0.02)
<i>State-level corporate tax rate</i>	0.007*** (0.00)			0.010*** (0.00)			0.005*** (0.00)		
<i>Peer liquidity index</i>		0.027*** (0.00)			0.026*** (0.00)			0.025*** (0.00)	
<i>State-level corporate tax rate × Peer liquidity index</i>			0.001*** (0.00)			0.001*** (0.00)			0.001*** (0.00)
<i>Constant</i>	-5.670*** (0.08)	-5.209*** (0.07)	-5.515*** (0.07)	-5.908*** (0.12)	-5.364*** (0.12)	-5.638*** (0.12)	-5.139*** (0.10)	-4.714*** (0.09)	-5.036*** (0.10)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Pseudo-R ²	0.3506	0.3173	0.3621	0.3306	0.3076	0.3521	0.3680	0.3449	0.3063

Appendix C: Additional Results (continued)

Panel D: First-step results of Heckman self-selection model on mortgage securitization

Dependent Variable	Mortgage Securitization Dummy								
	full sample			before 2007			after 2007		
<i>Bank size</i>	0.242*** (0.01)	0.218*** (0.01)	0.235*** (0.01)	0.250*** (0.01)	0.234*** (0.01)	0.240*** (0.01)	0.233*** (0.01)	0.201*** (0.01)	0.228*** (0.01)
<i>Diversification ratio%</i>	0.026 (0.08)	0.172** (0.09)	0.121 (0.08)	0.037 (0.13)	0.136 (0.13)	0.142 (0.13)	0.030 (0.11)	0.216* (0.12)	0.120 (0.11)
<i>Bank liquidity ratio%</i>	-4.037 (7.49)	-3.569 (7.17)	-3.879 (7.44)	-5.093 (9.39)	-4.167 (9.28)	-4.478 (9.44)	-3.001 (12.63)	-2.980 (11.50)	-3.287 (12.25)
<i>Non-interest expense ratio%</i>	0.137 (0.27)	-0.126 (0.30)	0.144 (0.27)	-1.139 (0.85)	-1.194 (0.84)	-1.062 (0.84)	0.430* (0.26)	0.168 (0.28)	0.436* (0.26)
<i>Non-performing loans ratio%</i>	1.601*** (0.48)	1.865*** (0.49)	1.593*** (0.47)	1.928 (1.60)	3.044* (1.66)	2.128 (1.60)	1.634*** (0.51)	1.931*** (0.52)	1.603*** (0.50)
<i>Local-market power</i>	-0.256* (0.14)	-0.189 (0.14)	-0.156 (0.14)	-0.124 (0.21)	-0.038 (0.21)	-0.005 (0.21)	-0.373** (0.19)	-0.313* (0.19)	-0.277 (0.19)
<i>Bank holding company dummy</i>	0.129*** (0.03)	0.152*** (0.03)	0.132*** (0.03)	0.101** (0.05)	0.115** (0.05)	0.105** (0.05)	0.153*** (0.05)	0.184*** (0.05)	0.155*** (0.05)
<i>Metropolitan statistical area dummy</i>	0.115*** (0.02)	0.072*** (0.02)	0.108*** (0.02)	0.084** (0.04)	0.045 (0.04)	0.071* (0.04)	0.144*** (0.03)	0.097*** (0.03)	0.139*** (0.03)
<i>State-level corporate tax rate</i>	0.005*** (0.00)			0.008*** (0.00)			0.005*** (0.00)		
<i>Peer liquidity index</i>		0.025*** (0.00)			0.020*** (0.01)			0.028*** (0.01)	
<i>State-level corporate tax rate × Peer liquidity index</i>			0.001*** (0.00)			0.001*** (0.00)			0.001*** (0.00)
<i>Constant</i>	-5.333*** (0.10)	-5.012*** (0.10)	-5.240*** (0.10)	-5.444*** (0.15)	-5.119*** (0.15)	-5.260*** (0.15)	-5.228*** (0.15)	-4.854*** (0.14)	-5.177*** (0.14)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Pseudo-R ²	0.2350	0.2744	0.2612	0.2233	0.2761	0.2521	0.3226	0.3739	0.3463

Appendix C: Additional Results (continued)

Panel E: First-step results of Heckman self-selection model on non-mortgage securitization

Dependent Variable	Non-mortgage Securitization Dummy								
	full sample			before 2007			after 2007		
<i>Bank size</i>	0.358*** (0.01)	0.346*** (0.01)	0.358*** (0.01)	0.351*** (0.02)	0.343*** (0.02)	0.350*** (0.02)	0.346*** (0.01)	0.334*** (0.01)	0.348*** (0.01)
<i>Diversification ratio%</i>	-0.280*** (0.10)	-0.180* (0.10)	-0.257*** (0.10)	-0.429*** (0.15)	-0.369** (0.15)	-0.407*** (0.15)	-0.182 (0.13)	-0.054 (0.13)	-0.167 (0.13)
<i>Bank liquidity ratio%</i>	-1.948 (10.05)	-1.743 (9.81)	-1.874 (10.09)	-3.190 (11.36)	-2.875 (11.33)	-3.120 (11.43)	0.929 (20.31)	0.215 (18.97)	0.786 (20.27)
<i>Non-interest expense ratio%</i>	1.056*** (0.12)	0.789*** (0.10)	1.050*** (0.12)	1.173*** (0.17)	0.836*** (0.13)	1.156*** (0.17)	0.912*** (0.19)	0.688*** (0.17)	0.909*** (0.19)
<i>Non-performing loans ratio%</i>	12.222*** (1.60)	12.547*** (1.61)	12.128*** (1.60)	46.207*** (6.79)	47.124*** (6.73)	45.217*** (6.72)	9.356*** (1.67)	9.579*** (1.69)	9.236*** (1.67)
<i>Local-market power</i>	0.194 (0.15)	0.412*** (0.15)	0.242 (0.15)	0.166 (0.24)	0.426* (0.23)	0.204 (0.24)	0.200 (0.20)	0.401** (0.20)	0.245 (0.20)
<i>Bank holding company dummy</i>	-0.049 (0.04)	-0.050 (0.04)	-0.053 (0.04)	-0.119** (0.06)	-0.129** (0.06)	-0.121** (0.06)	0.035 (0.06)	0.042 (0.06)	0.028 (0.06)
<i>Metropolitan statistical area dummy</i>	0.006 (0.03)	0.004 (0.03)	0.013 (0.03)	-0.012 (0.05)	-0.003 (0.05)	-0.003 (0.05)	0.016 (0.04)	0.012 (0.04)	0.025 (0.04)
<i>State-level corporate tax rate</i>	0.001*** (0.00)			0.001** (0.00)			0.001*** (0.00)		
<i>Peer liquidity index</i>		0.026*** (0.01)			0.018** (0.01)			0.033*** (0.01)	
<i>State-level corporate tax rate × Peer liquidity index</i>			0.001*** (0.00)			0.001** (0.00)			0.001** (0.00)
<i>Constant</i>	-6.695*** (0.13)	-6.695*** (0.12)	-6.727*** (0.13)	-6.491*** (0.19)	-6.507*** (0.18)	-6.540*** (0.18)	-6.627*** (0.18)	-6.691*** (0.17)	-6.691*** (0.18)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Pseudo-R ²	0.2855	0.2273	0.2757	0.2355	0.1949	0.2526	0.2613	0.2324	0.3063

Appendix D: The Impact of Mortgage and Non-Mortgage securitization on bank's Z-scores – Heckman Self-selection Model

Appendix D reports the second-step results of Heckman self-selection models on mortgage (Panel A) and non-mortgage securitization ratios (Panel B). We also divide our sample into before- and after-2007 periods. Control variables include retained interest ratio, bank size, diversification ratio, liquidity ratio, non-interest expense ratio, non-performing loans ratio, local-market power index, bank holding company dummy and metropolitan statistical area dummy. All variable definitions are provided in Appendix A. We introduce three instruments in the Heckman and 2SLS models: 1) state-level corporate tax rate; 2) peer liquidity index; and 3) state-level corporate tax rate \times peer liquidity index. The first-step results are reported in Appendix C. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	Z-score								
	(1) (Corporate tax rate)	(2) (Peer liquidity index) full sample	(3) (Interaction term)	(4) (Corporate tax rate)	(5) (Peer liquidity index) before 2007	(6) (Interaction term)	(7) (Corporate tax rate)	(8) (Peer liquidity index) after 2007	(9) (Interaction term)
<i>Mortgage securitization ratio</i> $\%_{t-1}$	0.154 (0.05)	0.149 (0.05)	0.151 (0.05)	0.115 (0.11)	0.102 (0.12)	0.089 (0.12)	0.178 (0.06)	0.177 (0.06)	0.178 (0.06)
<i>Mortgage retained interest ratio</i> $\%_{t-1}$	0.088* (0.05)	0.083* (0.05)	0.081* (0.05)	0.079 (0.07)	0.081 (0.07)	0.070 (0.07)	0.107* (0.06)	0.101 (0.06)	0.100 (0.06)
<i>Bank size</i> $_{t-1}$	-0.063*** (0.01)	-0.085*** (0.02)	-0.081*** (0.01)	-0.061*** (0.02)	-0.100*** (0.03)	-0.102*** (0.02)	-0.051*** (0.02)	-0.051** (0.02)	-0.064*** (0.02)
<i>Diversification ratio</i> $\%_{t-1}$	0.338*** (0.07)	0.347*** (0.07)	0.349*** (0.07)	0.407*** (0.08)	0.408*** (0.08)	0.421*** (0.08)	0.257*** (0.10)	0.266*** (0.10)	0.266*** (0.10)
<i>Bank liquidity ratio</i> $\%_{t-1}$	-13.167 (8.16)	-12.492 (8.49)	-12.538 (8.39)	-5.110 (13.63)	-5.709 (13.40)	-5.124 (13.32)	-13.372 (10.31)	-13.381 (10.32)	-12.608 (10.54)
<i>Non-interest expense ratio</i> $\%_{t-1}$	-0.891** (0.35)	-0.924*** (0.35)	-0.858** (0.35)	0.203 (0.38)	0.335 (0.39)	0.347 (0.38)	-2.572*** (0.61)	-2.741*** (0.61)	-2.564*** (0.60)
<i>Non-performing loans ratio</i> $\%_{t-1}$	0.058 (0.05)	0.025 (0.06)	0.035 (0.05)	0.612 (0.47)	0.308 (0.62)	0.429 (0.59)	-0.000 (0.06)	-0.004 (0.06)	-0.018 (0.06)
<i>Local-market power</i> $_{t-1}$	-0.010 (0.10)	0.001 (0.10)	0.001 (0.10)	-0.001 (0.13)	0.015 (0.13)	0.018 (0.13)	-0.004 (0.14)	-0.017 (0.14)	0.005 (0.14)
<i>Bank holding company dummy</i> $_{t-1}$	-0.095*** (0.03)	-0.116*** (0.03)	-0.102*** (0.03)	-0.099*** (0.03)	-0.121*** (0.03)	-0.114*** (0.03)	-0.094** (0.04)	-0.101** (0.04)	-0.098** (0.04)
<i>Metropolitan statistical area dummy</i> $_{t-1}$	-0.050*** (0.02)	-0.056*** (0.02)	-0.055*** (0.02)	-0.032 (0.02)	-0.042* (0.02)	-0.042* (0.02)	-0.054** (0.03)	-0.052* (0.03)	-0.059** (0.03)
<i>Constant</i>	1.550*** (0.32)	2.101*** (0.49)	1.983*** (0.30)	1.250*** (0.44)	2.201*** (0.79)	2.218*** (0.45)	1.503*** (0.43)	1.511*** (0.57)	1.812*** (0.40)
<i>Inverse Mills Ratio</i>	-0.190*** (0.06)	-0.301*** (0.10)	-0.279*** (0.06)	-0.091 (0.09)	-0.282* (0.16)	-0.286*** (0.09)	-0.208** (0.09)	-0.208* (0.12)	-0.273*** (0.08)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Adjusted-R ²	0.2542	0.2643	0.2356	0.3343	0.3225	0.3214	0.3446	0.3645	0.3574

Appendix D (continued): The Impact of Mortgage and Non-Mortgage securitization on bank's Z-scores – Heckman Self-selection Model

Panel B: second-step results on non-mortgage securitization									
Dependent Variable	Z-score								
	(1) (Corporate tax rate)	(2) (Peer liquidity index)	(3) (Interaction term)	(4) (Corporate tax rate)	(5) (Peer liquidity index)	(6) (Interaction term)	(7) (Corporate tax rate)	(8) (Peer liquidity index)	(9) (Interaction term)
Instrument	full sample			before 2007			after 2007		
<i>Non-Mortgage securitization ratio</i> _{it-1}	0.137*** (0.03)	0.125*** (0.02)	0.134*** (0.03)	0.131*** (0.04)	0.122*** (0.02)	0.130*** (0.04)	0.082*** (0.06)	0.077*** (0.06)	0.079*** (0.06)
<i>Non-Mortgage retained interest ratio</i> _{it-1}	0.008 (0.02)	0.008 (0.03)	0.008 (0.02)	-0.010 (0.03)	-0.011 (0.03)	-0.010 (0.03)	0.106* (0.06)	0.105 (0.06)	0.105 (0.06)
<i>Bank size</i> _{it-1}	-0.049* (0.03)	-0.055** (0.03)	-0.048* (0.03)	-0.094*** (0.03)	-0.094*** (0.03)	-0.092*** (0.03)	0.010 (0.04)	-0.014 (0.03)	0.006 (0.04)
<i>Diversification ratio</i> _{it-1}	-0.470*** (0.08)	-0.479*** (0.08)	-0.474*** (0.08)	-0.546*** (0.12)	-0.551*** (0.12)	-0.550*** (0.12)	-0.451*** (0.11)	-0.456*** (0.11)	-0.450*** (0.11)
<i>Bank liquidity ratio</i> _{it-1}	-0.427 (0.76)	-0.438 (0.75)	-0.415 (0.76)	-0.269 (0.63)	-0.274 (0.63)	-0.246 (0.63)	-9.996 (12.06)	-10.033 (12.28)	-9.910 (12.10)
<i>Non-interest expense ratio</i> _{it-1}	0.476 (0.31)	0.550*** (0.17)	0.475 (0.31)	0.612 (0.39)	0.568*** (0.15)	0.577 (0.39)	0.558 (0.49)	0.577 (0.48)	0.559 (0.49)
<i>Non-performing loans ratio</i> _{it-1}	-0.066 (0.06)	-0.066 (0.06)	-0.065 (0.06)	-0.562 (0.78)	-0.569 (0.79)	-0.545 (0.78)	-0.116** (0.06)	-0.113* (0.06)	-0.115** (0.06)
<i>Local-market power</i> _{it-1}	0.544*** (0.11)	0.520*** (0.11)	0.548*** (0.11)	0.764*** (0.17)	0.660*** (0.16)	0.775*** (0.17)	0.409*** (0.15)	0.412*** (0.15)	0.407*** (0.15)
<i>Bank holding company dummy</i> _{it-1}	-0.239*** (0.04)	-0.239*** (0.04)	-0.241*** (0.04)	-0.100** (0.04)	-0.107** (0.04)	-0.102** (0.04)	-0.357*** (0.06)	-0.355*** (0.06)	-0.358*** (0.06)
<i>Metropolitan statistical area dummy</i> _{it-1}	-0.103*** (0.03)	-0.105*** (0.03)	-0.102*** (0.03)	0.015 (0.04)	0.010 (0.04)	0.017 (0.04)	-0.192*** (0.04)	-0.192*** (0.04)	-0.192*** (0.04)
<i>Constant</i>	1.918*** (0.54)	2.064*** (0.51)	1.914*** (0.53)	2.474*** (0.64)	2.515*** (0.63)	2.450*** (0.64)	1.021 (0.73)	1.493** (0.67)	1.101 (0.72)
<i>Inverse Mills Ratio</i>	-0.306*** (0.08)	-0.330*** (0.08)	-0.305*** (0.08)	-0.376*** (0.10)	-0.383*** (0.10)	-0.372*** (0.10)	-0.185* (0.11)	-0.257** (0.10)	-0.197* (0.11)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,258	69,258	69,258	29,638	29,638	29,638	39,620	39,620	39,620
Adjusted-R ²	0.2212	0.2173	0.2206	0.2965	0.3005	0.2964	0.3001	0.2964	0.3157