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Securitization and Bank Performance

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Abstract

Theory suggests that securitization provides financial institutions with an opportunity to lower the cost of funding; improve credit risk management and increase profitability. In practice, however, it might lead to adverse consequences through a number of indirect channels. Therefore, the net impact of securitization on bank performance is ambiguous. This study aims to evaluate whether banks improve their performance through the use of the securitization market by applying a propensity score matching approach. In other words, we build a counterfactual group of banks to assess what would have happened to the securitizing banks had they not securitized. Using US commercial banking data from 2001 to 2008, we first test these hypotheses using univariate analysis and find that securitizing banks are, on average, more profitable institutions, with higher credit risk exposure and higher cost of funding. However, the propensity score matching analysis does not provide evidence of significant causal effects of securitization on the performance of banks. Therefore, securitization does not seem to outperform alternative funding, risk management and profitability improvement techniques used by banks that have *ex-ante* similar characteristics to those securitizing. Our evidence raises important questions about the motives for banks' increasing securitization activities and consequent implications for the banking system.

Keywords: Securitization; Bank Performance; Propensity Score Matching
JEL Classification: G21; G32

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I. Introduction

The tremendous growth of the securitization market in recent years, and its consequent collapse during the recent financial turmoil, has highlighted the importance of understanding the implications of securitization for the banking sector. The market for mortgage-backed securities (MBS) increased from \$2.49 trillion in 1996 to \$8.9 trillion outstanding at year-end 2008. The outstanding volume of asset-backed securities (ABS) reached \$2.67 trillion at year-end 2008 from \$0.4 trillion in 1996.¹

In general, securitization can be defined as a structured process whereby a bank transforms its illiquid assets, traditionally held until maturity, into marketable securities. A typical securitization transaction involves the pooling of endogenous assets with fixed or nearly fixed cash flows and transferring the pool to a special purpose vehicle (SPV), a bankruptcy-remote entity that in turn finances the purchase through the issuance of floating rate notes backed by the pool.²

In theory, the benefits of accessing the securitization market from the originating bank's perspective can be substantial. By using securitization, a bank may be able to: *i*) lower its cost of funding; *ii*) improve risk management, and *iii*) increase profitability. However, the key to the realization of these potential benefits of securitization lies in the quality of the underlying receivables, which, in turn, is directly related to the underwriting and credit risk management employed. Therefore, in practice securitization might have both positive and adverse implications for bank performance.

In particular, for the cost of funding, securitization allows banks to borrow funds from capital markets at lower cost as the securities issued via an SPV can have a higher credit rating than that of the originator. This stems from the fact that the credit rating assigned to these securities by a rating agency is independent of the financial condition of the originating bank and is based on the expected performance of the underlying asset pool and credit enhancements provided. Further, having established itself in the securitization market, a bank has a broader choice of funding sources and can

¹ Source: Securities Industry and Financial Markets Association (SIFMA)

² In the most common case, the SPV employs tranching by issuing securities of different risk, duration and other characteristics with the senior tranche of investment grade being supported by mezzanine tranches, which in turn are supported by an unrated subordinated equity tranche. The latter is the most risky tranche of the securitization transaction and is commonly retained by the originating bank on its balance sheet. Tranching enables the SPV to split the credit risk and place it with parties that are willing or best able to absorb it. To ensure high credit rating for asset-backed securities from rating agencies, the SPV obtains credit enhancements, most of which typically come from the originating bank and can be provided in various forms from standby letters of credit to the purchase of the most junior securities issued by the SPV.

choose the best option based on the all-in-cost comparison.³ However, poorly performing receivables may hinder the bank's access to the market, require higher credit risk enhancements to achieve investment grade ratings, and significantly increase the cost of this funding source. Plus, a significant reliance on securitizations may result in a bank outgrowing other funding alternatives, such as traditional borrowing facilities, and therefore present significant liquidity issues if this funding source becomes unavailable.⁴

Further, securitization allows banks to reduce credit exposure by transferring the unexpected portion of the default risk to credit enhancers and outside investors.⁵ However, management's incentive to ensure the performance of the securitized pool may result in "cherry-picking"⁶ when designing securitization or providing implicit recourse to the buyer after conducting the transaction.⁷ Securitization may also trigger lax origination and monitoring processes.⁸ This could eventually lead to a lower quality balance sheet and higher default rates on bank's loans in future.

Finally, securitization enables banks to increase profitability through a number of channels including a better choice of funding sources and risk management discussed above. In terms of operating choices, securitization allows financial institutions to outsource, on an ongoing basis, the activity of comparative disadvantage, i.e., funding, while maintaining activities of comparative advantage, i.e., origination and possibly servicing. Plus, retaining the servicing function on the transferred assets allows the originating banks to enhance fee income. Furthermore, the additional capital released through securitization can be used by banks for expansion purposes or to retire existing debt, which in turn might increase earnings.

The net impact of securitization is therefore ambiguous and needs to be investigated empirically. Using US commercial banking data from 2001 to 2008, in this study we attempt to assess whether

³ Asset Securitization Comptroller's Handbook (1997)

⁴ Risk Management Credit Card Securitization Manual (FDIC, 2007)

⁵ The expected losses of the portfolio absorbed by the equity tranche are typically borne by the originator.

⁶ Selecting receivables of higher or the highest quality for securitization

⁷ SR 02-15 "Implicit Recourse Provided to Asset Securitizations" (Federal Reserve, 2002):

Banking organizations typically have provided implicit recourse in situations where the originating organization perceived that the failure to provide this support, even though not contractually required, would damage its future access to the asset-backed securities market. An originating banking organization can provide implicit recourse in a variety of ways:

- *Selling assets to a securitization trust or other special purpose entity (SPE) at a discount from the price specified in the securitization documents, which is typically par value;*
- *Purchasing assets from a trust or other SPE at an amount greater than fair value;*
- *Exchanging performing assets for nonperforming assets in a trust or other SPE;*
- *Funding credit enhancements beyond contractual requirements.*

By providing implicit recourse, a banking organization signals to the market that the risks inherent in the securitized assets are still held by the organization and, in effect, have not been transferred ...

For discussion of implicit recourse also see Higgins and Mason (2003), Gorton and Souleles (2005), Vermilyea, Webb and Kish (2008).

⁸ See Diamond (1984), Gorton and Pennacchi (1995), Keys *et al.* (2008).

banks improve their performance through the use of the securitization market. We estimate the causal effect of securitization on bank performance by applying a propensity score matching approach, which allows us to build the counterfactual and evaluate the performance of securitizing banks had they not securitized. Specifically, we look at the change in performance of first-time securitizers to disentangle the securitization effect. If securitization has a positive impact on bank performance, this should improve once banks start to securitize.

This paper makes three main contributions to the empirical literature. First, we examine the impact of accessing the securitization market on banks' performance in terms of the cost of funding, risk, and overall profitability. Second, to the best of our knowledge, this is the first study that estimates the effect of securitization on bank performance employing a propensity score matching approach. Finally, we conduct the analysis using comprehensive and updated dataset, which includes the latest available data for US commercial banks.

Overall, we find that securitizing banks are, on average, more profitable institutions, with higher credit risk exposure and higher cost of funding. However, the propensity score matching analysis does not provide evidence of significant causal effects of securitization on the performance of banks. Therefore, the access to the securitization market by US commercial banks does not seem to lead to the realization of its potential benefits, but rather it allows the banks to maintain their risky and more profitable activities.

The paper proceeds as follows. Section II provides a brief review of the relevant literature. Section III discusses methodological issues in estimating the effects of securitization on bank performance and the empirical design applied in this study to address these issues. Section IV provides the theoretical background to the propensity score matching approach. Data and preliminary analysis are presented in Section V. Section VI describes the propensity score matching analysis and the results are presented in Section VII. Finally, Section VIII concludes the paper.

II. Literature Review

There are three main strands in the literature on securitization that are related to our research. The first strand relates to the theoretical studies on the potential economic benefits of securitization. The second strand examines the motives for and determinants of securitization. The third strand empirically investigates the effects of securitization on banks.

i) Potential Economic Benefits of Securitization

The early studies by Greenbaum and Thakor (1987), Pavel and Phillis (1987), Hess and Smith (1988), and Zweig (1989) suggest that securitization provides means to reduce risk, diversify portfolios and fund both operations and new assets. Rosenthal and Ocampo (1988) argue that by reducing the funding yield premiums and the “excess” equity cushions entailed in traditional lending, securitization offers lower cost financing. Pennacchi (1988) also finds that funding through loan sales is less expensive for banks compared with traditional equity or deposit financing due to lower costs associated with required capital. Boot and Thakor (1993) show that, in the presence of asymmetric information, pooling assets and issuing multiple financial claims with different risk characteristics against the pool cash flow enables the issuer to increase its expected revenue. Flannery (1994), Lockwood *et al.* (1996) and James (1988) consider the role of securitization in mitigating the underinvestment problem of financial intermediaries. Lockwood *et al.* (1996) also suggest that the cash inflow from the ABS issue can be used to retire existing debt, which, in turn, reduces interest expense and increases reported earnings.

ii) Determinants of Securitization

The second strand of the literature investigates the motives for the use of the securitization market and, consequently, the characteristics that make financial institutions more likely to securitize.

Donahoo and Shaffer (1991) suggest that depository institutions securitize to reduce reserve and capital requirements. Jones (2000) argues that the so called “regulatory capital arbitrage” is not the only incentive to engage in securitization, but also increased economies of scale, reduced costs of debt financing, and better diversification of funding sources. Minton *et al.* (2004) and Calomiris and Mason (2004) provide an empirical test of the regulatory arbitrage hypothesis against the efficient contracting hypothesis, which suggests that securitization lowers the cost of debt finance. The evidence from both studies supports the efficient contracting view. In particular, Minton *et al.* (2004) find that unregulated finance companies and investment banks are more likely to securitize than commercial banks, and that risky and highly leveraged financial institutions are more likely to engage in securitization than the safer ones. Similarly, Pais (2005) finds that poor performing risky institutions are more likely to securitize. Bannier and Haensel (2007) also find consistent results using data on collateralized loan obligations (CLO) transactions by European banks from 1997 to 2004. In

particular, they find that securitization-active banks are large, lowly performing institutions with high credit risk and low liquidity.⁹ Panetta and Pozzolo (2009) results indicate that banks are more likely to securitize when they face lower direct and indirect costs and when they can gain larger benefits. They also find evidence that banks securitized to modify their asset portfolio, taking up riskier profit opportunities.

iii) Empirical Studies on the Effects of Securitization

The third strand of the literature empirically examines the effects of securitization on the issuing banks with slightly different focuses. One of the aspects analyzed is the quality of assets securitized, and the ensuing impact on bank risks. Using data on Canadian banks for the period between 1988 and 1998, Dionne and Harchaoui (2003) find a risk-increasing effect of securitization. The authors suggest that current regulation encourages banks to shift to more risky assets while securitizing their low risk assets. Ambrose *et al.* (2003) also find that, in response to regulatory capital incentives, lenders retain riskier loans in their portfolios while selling safer loans onto the secondary market. Contradictory evidence is found by Carey (1998); this study shows that the default rates on the loans kept by the issuer are lower than the default rates on the loans sold to the public. Similarly, the recent studies by Mian and Sufi (2008), Keys *et al.* (2008) and Dell'Ariccia *et al.* (2008) find evidence that in the last decade US banks securitized their worst mortgage loans.

The second aspect studied in this strand is the implicit recourse commonly provided by the originating bank and the resulting risk and performance implications for the issuer. In particular, Calomiris and Mason (2004) and Higgins and Mason (2003) argue that risk remains with the securitizing banks as a result of implicit recourse. Chen *et al.* (2008) find that risk retention by banks varies by type of securitization and is relatively low in case of mortgages, while relatively high for revolving loans such as credit loans. Similarly, Vermilyea *et al.* (2008) find evidence of implicit recourse in credit card securitizations using a model of fraud losses on US bank data from 2001 to 2006.¹⁰ In particular, they show that banks that securitize credit card receivables are more likely to claim fraud losses; and banks with poorly performing securitization portfolios are more likely to claim

⁹ The authors conclude that the securitization market seem to be strongly driven by credit risk management and liquidity raising incentives, rather than regulatory capital arbitrage.

¹⁰ The authors develop a model of implicit recourse based on the assumption that fraud losses on securitized assets are generally incurred by the originating bank, while credit losses are potentially borne by the owner of the securitized assets (i.e., by the SPV and thus potentially by the ABS investors).

fraud. Beneficial effects of recourse are found by Higgins and Mason (2003) in the form of increased short- and long-term stock returns and improved long-term performance.¹¹

Finally, a few authors focus on the reinvestment of securitization proceeds. Krahen and Wilde (2006) show that, under certain assumptions on banks reinvestment behavior and capital structure choice, the issue of collateralized debt obligations (CDOs) in true sale transactions can lead to an increase in the issuing intermediary's systematic risk. Based on a dataset of European CDOs, Haensel and Krahen (2007) show that securitization tends to increase the systematic risk of the issuing bank. Franke and Krahen (2005) argue that the combined effect of retaining the first loss piece and selling senior tranches to investors should result in an efficient risk allocation due to reducing the bank's exposure to extreme risks and hence have a positive impact on the bank solvency. However, their empirical analysis shows that banks use the risk reduction achieved through securitization to take on new risks. Consistently, Cebenoyan and Strahan (2004) find evidence suggesting that banks use risk-reducing benefits of securitization to engage in more profitable, but higher risk, activities and to operate with greater financial leverage. Purnanandam (2009) also provides consistent evidence, showing that US banks used the proceedings from securitizations to issue loans with higher than average default risk. In particular, the evidence shows that US banks using credit risk transfer (CRT) techniques to a larger extent before the 2007 subprime crisis had significantly higher mortgage charge-offs after the crisis. Jiangli and Pritsker (2008), on the other hand, suggest a positive role for mortgage securitization and relate the current turmoil in mortgage credit and securitization markets to recent excesses in those markets. Using US bank holding company data from 2001 to 2007, the authors evaluate empirically how the insolvency risk, leverage and profitability of securitizers would change if banks had to take the securitized assets back onto their balance sheet and find that mortgage securitization reduces bank insolvency risk, increases bank leverage and profitability.

This review reveals that the literature provides mixed evidence on the impact of securitization on the performance of the issuing bank. Our study contributes to the current debate and advances the existing literature by evaluating the impact of accessing the securitization market on banks' cost of funding, credit risk, and profitability employing a propensity score matching approach.

¹¹ This evidence is consistent with Gorton and Souleles (2005), who find that market prices of ABS-securities reflect the originator's ability to provide recourse.

III. Methodological Issue in Estimating Securitization Effects and Empirical Design

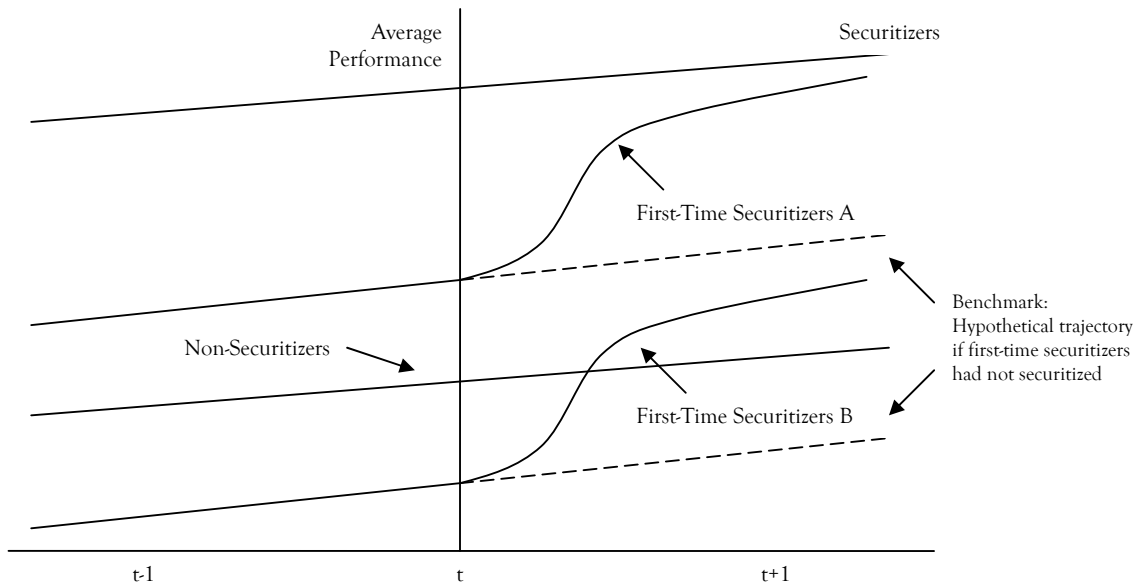
The analysis of the effects of securitization on bank performance involves several methodological issues. First, comparing securitizing banks with non-securitizers might yield biased estimates of the securitization effect if the difference in performance comes from other observable or unobservable characteristics of the banks, rather than the securitization status. Therefore, if securitizers are found to perform better, on average, than non-securitizers, it is not clear whether this is the effect of accessing the securitization market or it is due to differences in bank characteristics prior to securitization.

Second, considering securitizing banks only eliminates the possibility to define the hypothetical benchmark – i.e., the performance that banks would have had had they not securitized. Furthermore, the observed change in performance might be due to unobservable shocks affecting all banks equally.

In this study, we focus on first-time securitizers in an attempt to assess the securitization effect on bank performance. To better understand the logic underlying the analysis conducted in this paper, let us consider the following three types of banks: (i) “securitizers”, i.e., banks that have at least one securitization transaction conducted at the beginning of the observation period; (ii) “non-securitizers”, i.e., banks that never engage in securitization throughout the period; and (iii) “first-time securitizers”, i.e., banks that switch from non-securitizers into securitizers at time t by conducting their first securitization transaction. Figure 1 illustrates the theoretical trajectories of average performances of the three types of banks and their relative positions. Recall that theory suggests that securitization, when used properly, allows banks to improve their performance through a number of channels as discussed earlier. Therefore the securitizing banks are assumed to perform better than the non-securitizing banks. This is reflected in the figure by drawing the performance trajectory of securitizers above the performance trajectory of non-securitizers. However, as noted above, this could be both because securitizers were better performing prior to and/or the consequence of using the securitization market.

Looking at first-time securitizers might help to disentangle the securitization effect. In particular, if securitization has a positive impact on bank performance, the latter should improve once these banks start to securitize. As shown in the figure, the performance trajectory of the first-time securitizers should become steeper and closer to the one of the securitizers after time t .

Figure 1. Performance trajectories



To test this hypothesis empirically, we need to know what would have happened to the performance of the first-time securitizers had they not securitized. As it is impossible to observe the same bank in both states, we need to find an appropriate proxy for the counterfactual performance of first-time securitizers. Referring to Figure 1, we need to find a proxy for the dotted lines.

Good candidates for the counterfactual are the non-securitizing banks. The trajectory of the non-securitizers after time t could be considered as a proxy for the dotted lines. However this comparison would still entail the selection problem (Heckman and Smith, 1995) - first-time securitizers might be *ex-ante* different from those that never access the securitization market. These banks might be either better or worse performing at time $t-1$ compared to non-securitizers, which is reflected by trajectories First-Time Securitizers A and First-Time Securitizers B, accordingly.

To overcome this issue and disentangle the securitization effect, the *ex-post* performance of first-time securitizers (time $t+1$) should be compared with that of non-securitizers which are *ex-ante* as similar as possible to the former. This implies building a control group from the non-securitizers whose trajectory of *ex-ante* performance lies as close as possible to that of the first-time securitizers (time $t-1$). To carry out this analysis we apply a propensity score matching approach.

IV. Theoretical Background to the Propensity Score Matching Approach

This section discusses the propensity score matching (PSM) methodology and its application to our specific the case.

Matching has become a popular non-parametric approach for estimating causal effects and it is widely used in policy impact analysis. It is however relatively new to the finance literature: there are applications of the method to seasoned equity offerings in Cheng (2003), diversification in Villalonga (2004), and foreign investment in Navaretti and Castellani (2004) and Girma *et al.* (2009). The idea and methodology can be applied in any evaluation study where it is possible to identify: (i) a treatment; (ii) a group of treated individuals, and (iii) a group of untreated individuals (Caliendo and Kopeinig, 2005). In this study we apply PSM to evaluate the causal effect of securitization on bank performance with the first securitization considered as the treatment, the first-time securitizers as the group of treated units, and the non-securitizers as the group of untreated units.

To estimate the causal effect of securitization, we need to know what would have happened to the performance of securitizing banks had they not securitized. To do so, let S be a variable indicating securitization activity and taking value equal to one if bank i conducts a securitization transaction for the first time in period t (time interval between $t-1$ and t). Let $\Delta y_{i,t+1}^1$ be the performance gain achieved by bank i at time $t+1$ after having securitized assets in period t and $\Delta y_{i,t+1}^0$ be the hypothetical performance gain of the same bank i at the same time $t+1$ had it not securitized assets in period t (where $\Delta y_{i,t+1} = y_{i,t+1} - y_{i,t-1}$).

The effect of securitization on the performance of bank i , known in the evaluation literature as the average treatment effect on the treated, can be expressed as follows:

$$\hat{\alpha} = E(\Delta y_{i,t+1}^1 | S = 1) - E(\Delta y_{i,t+1}^0 | S = 1) \quad (1)$$

In equation (1) $E(\Delta y_{i,t+1}^0 | S = 1)$, which stands for the counterfactual mean or the hypothetical performance gain that the first-time securitizer would have had had it not securitized, is unobservable. This constitutes the fundamental problem of causal inference in evaluation studies (Holland, 1986).

To overcome this problem we need to find a proxy for the counterfactual mean $E(\Delta y_{i,t+1}^0 | S = 1)$. Using the mean outcome for non-securitizers as a proxy would yield estimates of the securitization effect plus selection bias (Heckman and Smith, 1995). Here the selection bias stems from the unit

heterogeneity, or the fact that first-time securitizers and non-securitizers might be systematically different prior to the securitization period t (i.e., at time $t-1$).

In experimental studies, the selection problem is dealt with by random assignment of treatment, which ensures that every individual has *ex-ante* the same chance of receiving treatment (Ravallion, 2003). In non-experimental studies, the selection problem is of paramount concern as there is no direct estimate of the counterfactual mean analogous to the one based on randomization (Dehejia and Wahba, 2002; Smith and Todd, 2005). Therefore, in this paper we try to replicate experimental studies conditions to estimate the counterfactual mean by using the matching approach.

The main idea behind the matching approach is to find a control group that is similar to the treatment group in all respects except the exposure to the treatment (Ravallion, 2003). Applying this idea to the case of securitization, we build the control group from non-securitizers that are similar to the first-time securitizers in all relevant pre-securitization characteristics.

Therefore the causal effect of securitization could be presented as:

$$\hat{\alpha} = E(\Delta y_{i,t+1}^1 | S = 1, X_{i,t-1}) - E(\Delta y_{i,t+1}^0 | S = 0, X_{i,t-1}), \quad (2)$$

where $E(\Delta y_{i,t+1}^1 | S = 1, X_{i,t-1})$ is the mean performance gain of the first-time securitizers at time $t+1$ after securitizing in period t ; $E(\Delta y_{i,t+1}^0 | S = 0, X_{i,t-1})$ is the weighted mean performance gain of the control group at the same time $t+1$; and $X_{i,t-1}$ is a vector of observed conditioning covariates.

The implementation of the matching approach may be complicated when the set of conditioning covariates X is large. However, Rosenbaum and Rubin (1983) suggest that dimensionality can be significantly reduced by using the propensity score, or the probability of receiving the treatment conditional on the relevant pre-treatment covariates.

Using the propensity score, the equation for the average securitization effect becomes:

$$\hat{\alpha} = E(\Delta y_{i,t+1}^1 | S = 1, p(X_{i,t-1})) - E(\Delta y_{i,t+1}^0 | S = 0, p(X_{i,t-1})) \quad (3)$$

where p is a propensity score conditional on $X_{i,t-1}$.

In other words, the average securitization effect is estimated as the difference between the mean performance gain of the first-time securitizers after their first securitization and that of the banks that had *ex-ante* similar likelihood of securitizing but did not.

For consistent estimates of the securitization effect, two key assumptions must hold: first, the conditional independence assumption and, second, the overlap assumption.

The conditional independence assumption requires the mean outcomes to be independent of the treatment after conditioning on a set of observable covariates (Smith and Todd, 2005) and can be formally stated as¹²:

$$(\Delta y_{i,t+1}^0, \Delta y_{i,t+1}^1) \perp S \mid X_{i,t+1}, \text{ or } (\Delta y_{i,t+1}^0, \Delta y_{i,t+1}^1) \perp S \mid p(X_{i,t+1}) \quad (4)$$

In other words, it assumes that there are no unobservable differences between first-time securitizers and non-securitizers after conditioning on $X_{i,t-1}$ so that any systematic differences in outcomes can be attributed to the securitization effect.¹³

The overlap, or common support, assumption requires an overlap in the distribution of covariates between the treated units and the control group members to make matching possible and can be formally stated as:

$$0 < \Pr(S = 1 \mid X_{i,t-1}) < 1 \quad (5)$$

This assumption imposes a positive probability of either securitizing ($S=1$) or not securitizing ($S=0$), to ensure the existence of potential matches for each first-time securitizer among non-securitizers.

When the conditional independence and overlap assumptions are satisfied, the mean outcome observed for the matched non-participant group can be substituted for the missing counterfactual mean for the participants (Smith and Todd, 2005). In other words, if the two assumptions hold, we can use the mean outcome for the matched non-securitizers as a proxy for the performance gain that

¹² Symbol \perp stands for orthogonality between two variables.

¹³ This is a strong assumption, as there may be systematic differences between the first-time securitizer and non-securitizer outcomes, even after conditioning on the observables. Such discrepancies may arise, for example, because of differences in performance across geographical markets the first-time securitizers and non-securitizers operate in. However, in this study we estimate the securitization effect on the change in the performance of banks measured as the difference in outcomes before and after securitization (Δ InterestExpense/Liabilities, Δ NPL, and Δ ROA). This is known as a difference-in-difference or double-difference matching strategy, where the first difference removes the unobserved heterogeneity and restores conditional independence and second produces the impact estimate (Smith and Todd, 2005; Essama-Nssah, 2006). As suggested by Smith and Todd (2005), the difference-in-difference matching estimator is the most robust.

the first-time securitizers would have had had they not securitized (i.e., $E(\Delta y_{i,t+1}^0 | S = 1)$ in equation 1).

V. Data and Preliminary Univariate Analysis

Bank data used in the empirical analysis were obtained from the Federal Reserve's Reports of Condition and Income ("Call Reports") that are filed by insured commercial banks on a quarterly basis and contain the complete balance sheet, income statement and detailed supporting schedules, including a schedule of off-balance-sheet items. Starting from June 2001, US banks are required to provide detailed information on securitization activities in their regulatory forms. Therefore, we use Call Reports from 2001:Q2 to the latest available of 2008:Q4 and average the data on yearly basis, to build the final data set of annual observations.¹⁴ The final data set contains 65,696 bank-years from 9,748 banks during 2001-2008.

As a preliminary step to the propensity score matching analysis (which is based on sub-samples of first-time securitizers and non-securitizers, as described in section VI), we begin with a cross-sectional analysis of the full sample and compare the characteristics of banks that securitize, on a general basis, with those that do not securitize.¹⁵

Table 1 presents the results of these comparisons and reports the means and standard deviations for the full sample, the securitizers and the non-securitizers.¹⁶ There are 9,748 banks in the sample, of which 9,290 non-securitizers and 458 securitizers. Despite the significantly smaller percentage (4.7 % of the sample), securitizers account for nearly 68% of the sample total assets.¹⁷

The first panel of Table shows the balance sheet structure - total assets, liquidity ratio, loan ratio, deposit ratio, and equity capital. The most significant difference is bank size, with the mean value of total assets for securitizers (\$16.1 billion) being approximately 42 times the mean size of non-securitizers (\$0.37 billion). This finding is consistent with previous research that documents that larger banks are more likely to securitize.¹⁸ Further, securitizers tend to hold less liquid assets (0.25% versus 0.27% of total assets), which is consistent with having a better access to external funding and

¹⁴ The securitization status of a bank is defined based on the quarterly data.

¹⁵ First-time securitizers are included in the group of securitizers as we analyze the differences between banks that never securitize and those that securitize at least once throughout the sample period.

¹⁶ Details on the construction of the variables are provided in the Appendix.

¹⁷ Calculated as the sum of the cross-sectional mean total assets of securitizing banks over the sum of the cross-sectional mean total assets of all sample banks.

¹⁸ Minton *et al.* (2004); Bannier and Haensel (2007); Martin-Oliver and Saurina (2007); Uzun and Webb (2007); Jiangli and Pritsker (2008); Minton *et al.* (2008).

thus needing a smaller liquidity buffer compared to non-securitizers. However, the loan ratio is higher for securitizers with the mean value of 65% versus 63% for non-securitizers.

We turn next to the liability side of the balance sheet. Both securitizers and non-securitizers are mainly financed by deposits; however non-securitizers rely on this source of funding to a larger extent (81% of total assets versus 73%). Further, 13% of total assets are funded by equity capital in the case of non-securitizers, while only 11% for securitizers.

The second panel of Table 1 contains information on banks' loan portfolio. The securitizers' loan portfolio is different in terms of both concentration and composition. In particular, it tends to be more concentrated, as indicated by the mean value of the Herfindahl-Hirschman Index of 0.61 versus 0.58 for non-securitizers, with real estate loans constituting more than 60% of total loans in both samples. Despite the similar relative distribution, there are differences in terms of the loan share values between securitizers and non-securitizers. Specifically, securitizers tend to hold less real estate (63% versus 66%)¹⁹ and commercial and industrial loans (19% versus 23%) and more consumer loans (14% versus 10%) and other loans (4% versus 2%) on the balance sheet.

Comparing the regulatory capital, we see that securitizers are significantly less capitalized than non-securitizers on the risk-adjusted basis, nonetheless they are overcapitalized in terms of regulatory requirements. For example, the mean total risk-based capital ratio for securitizers is 15.78% compared with 22.49% for non-securitizers. Securitizers also have lower Tier 1 leverage ratio than non-securitizers (10.55% versus 13.91%).²⁰ This finding is consistent with Cebenoyan and Strahan (2004), who find that banks that sell loans hold less capital. Similarly, Minton *et al.* (2008) find evidence that risk-adjusted capital ratios are lower for the net buyers of credit protection.

The last three panels are of a particular interest for this study, as they include the performance indicators that we consider in the propensity score matching analysis, i.e., cost of funding, risk, and profitability.

First, the cost of funding (measured as interest expenses over liabilities) is significantly higher for securitizers (1.7 % versus 1.6 % for non-securitizers). This finding is inconsistent with the efficient contracting hypothesis, which suggests funding cost reduction through the use of securitization market.

¹⁹ Minton *et al.* (2008) using US bank holding company data find similar evidence.

²⁰ Minton *et al.* (2004) find similar results.

Table 1: Summary Statistics for All Sample Banks and Univariate Tests of Differences in Characteristics between Securitizers and Non-Securitizers²¹

Variable	All Banks		Non-Securitizers		Securitizers		Difference in Means (absolute)	Difference in Means (percentage)	p-values
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev			
Balance Sheet Structure									
Total Assets (\$ billions)	1.1100	17.3223	0.3731	1.9786	16.0572	78.0081	15.6841	4203.73%	0.0000
Liquidity Ratio	0.2676	0.1421	0.2687	0.1426	0.2459	0.1302	-0.0228	-8.49%	0.0003
Loan Ratio	0.6339	0.1520	0.6330	0.1521	0.6517	0.1495	0.0187	2.95%	0.0093
Deposits/Assets Ratio	0.8023	0.1173	0.8056	0.1130	0.7341	0.1709	-0.0715	-8.88%	0.0000
Equity/Assets Ratio	0.1280	0.0904	0.1288	0.0915	0.1116	0.0625	-0.0172	-13.35%	0.0000
Loan Portfolio									
Real Estate Loan ratio	0.6556	0.1971	0.6569	0.1938	0.6284	0.2544	-0.0285	-4.34%	0.0184
C&I Loan Ratio	0.2275	0.1594	0.2292	0.1595	0.1943	0.1548	-0.0349	-15.23%	0.0000
Consumer Loan Ratio	0.0969	0.1147	0.0948	0.1068	0.1388	0.2165	0.0440	46.41%	0.0000
Other Loan Ratio	0.0200	0.0650	0.0191	0.0637	0.0385	0.0855	0.0194	101.57%	0.0000
Loan HHI	0.5834	0.1555	0.5821	0.1537	0.6083	0.1873	0.0262	4.50%	0.0034
Regulatory Capital									
Tier I Leverage Ratio	0.1375	0.1883	0.1391	0.1921	0.1055	0.0685	-0.0336	-24.16%	0.0000
Tier I Risk-Based Capital Ratio	0.2103	0.3218	0.2137	0.3286	0.1429	0.0930	-0.0708	-33.13%	0.0000
Total Risk-Based Capital Ratio	0.2217	0.3211	0.2249	0.3279	0.1578	0.0910	-0.0671	-29.84%	0.0000
Cost of Funding									
Interest Expense/Liabilities	0.0159	0.0109	0.0159	0.0112	0.0165	0.0043	0.0006	3.77%	0.0033
Risk Measures									
NPL Ratio	0.0108	0.0171	0.0107	0.0174	0.0112	0.0095	0.0005	4.67%	0.3468
RWATA Ratio	0.6851	0.1413	0.6819	0.1287	0.7503	0.2914	0.0684	10.03%	0.0000
Charge-Off Ratio	0.0055	0.2398	0.0029	0.0291	0.0566	1.0985	0.0537	1851.72%	0.2967
Allowance Ratio	0.0146	0.0132	0.0146	0.0129	0.0162	0.0173	0.0016	10.96%	0.0502
Loan Loss Provision Ratio	0.0052	0.2262	0.0028	0.0220	0.0537	1.0389	0.0509	1817.86%	0.2948
Operating Performance									
Return on Assets	0.0041	0.0123	0.0039	0.0123	0.0071	0.0116	0.0032	82.05%	0.0000
Return on Equity	0.0683	1.2898	0.0684	1.3211	0.0663	0.0701	-0.0021	-3.07%	0.8814
Net Interest Margin	0.0229	0.0067	0.0229	0.0065	0.0233	0.0105	0.0004	1.75%	0.3938
Interest Income/Net Operating Revenue	0.8363	0.1211	0.8414	0.1088	0.7324	0.2464	-0.1090	-12.95%	0.0000
Noninterest Income/Net Operating Revenue	0.1637	0.1211	0.1586	0.1088	0.2676	0.2464	0.1090	68.73%	0.0000
Revenue HHI	0.7768	0.9089	0.7784	0.9043	0.7442	0.9974	-0.0342	-4.39%	0.4724

Note: The table presents descriptive statistics for (i) all sample banks (9748 banks), (ii) non-securitizers (9290 banks), and (iii) securitizers (458 banks). *Mean* and *Std Dev* stand for the cross-sectional mean and standard deviation values of the individual bank time series averages, accordingly. The last three columns report the comparison analysis of bank-specific characteristics between securitizers and non-securitizers (the former includes the first-time securitizers). *Difference in Means* is calculated as the difference between securitizers' and non-securitizers' means, in absolute and percentage values, with the p-values of the tests on the equality of means reported in the last column.

Further we compare the risk profiles of securitizers and non-securitizers along five measures of risk, including the non-performing loan (NPL) ratio employed in propensity score matching analysis. We find that securitizers are more risky in all measures used, with statistical significance for the ratio of

²¹ For detailed description of the variables see Appendix

risk-weighted assets to total assets (RWATA) and for the allowance ratio. The difference in the charge-offs (5.66% of total assets for securitizers versus 0.29% for non-securitizers) and loan loss provisions (5.37% versus 0.28%, accordingly) is striking, however not statistically significant. Similar results are found by Jiangli and Pritsker (2008) and Minton *et al.* (2008) with provisions, charge-off and non-performing loan ratios higher for securitizers.²² The higher riskiness of the securitizing banks might also explain the observed higher cost for funds required by the market.

Finally, the last panel relates to banks operational performance. We find that return on assets, the profitability measure employed in the propensity score matching analysis, is significantly higher for securitizers (0.71% versus 0.39% for non-securitizers). As for the operating revenue structure, the main source of revenue for both securitizers and non-securitizers is interest income (over 70%); however the non-interest income share is significantly higher for securitizers (27% versus 16% for non-securitizers). The latter is consistent with securitizers having an additional source of income in the form of servicing fees and possibly more trading revenue.²³

Taken together, these comparisons suggest that securitizers improve their profitability through expanding riskier and hence more profitable loans in their portfolios while paying a higher cost of funds for the excessive risk taking; securitizing banks also hold less equity capital and increase their non-interest income through fees and trading revenues.

VI. Propensity Score Matching Analysis

a) First-Time Securitizers and Non-Securitizers

To disentangle the causal effect of securitization, in the propensity score matching analysis we focus on two groups of banks: (i) first-time securitizers, and (ii) non-securitizers. Given that securitization is a recurring activity, we focus on the first observed transaction²⁴ to build the subsample of first-time securitizers from the sample of securitizing banks. We drop the first-time securitizers of 2001 and 2008 as for these cases we are not able to collect pre- and post-securitization information, accordingly. Therefore, the treatment group for the propensity score matching analysis

²² Jiangli and Pritsker (2008) suggest that this could reflect securitization and/or size effect in allowing banks to extend loans with higher expected losses.

²³ Using US Bank Holding Company Data from 1999 to 2005, Minton *et al.* (2008) find that the net buyers of credit protection have dramatically more trading revenue than other banks.

²⁴ First securitization during the lifetime of a bank in the sample

consists of banks that conduct the first securitization in any year from 2002 to 2007. The control group is built from banks that do not securitize over the 2001-2008 period (i.e., from the sample of non-securitizers used in the univariate analysis in section V). This yields 198 first-time securitizers and 46,903 bank-years in the control group of non-securitizers over the 2002-2007 period. Panel A of Table 2 reports the statistics on the final unmatched sample by year.²⁵

Table 2: Statistics on the Number of First-time and Non-Securitizers

Year	Panel A. Unmatched Sample			Panel B. Matched Sample		
	First-Time Securitizers	Non-Securitizers	Total	First-Time Securitizers	Non-Securitizers	Total
2002	30	8119	8149	24	24	48
2003	41	7983	8024	38	38	76
2004	23	7845	7868	22	22	44
2005	36	7758	7794	30	30	60
2006	25	7659	7684	24	24	48
2007	43	7539	7582	38	38	76
Total	198	46903	47101	176	176	352

Note: The table reports the statistics on the number of first-time securitizers and non-securitizers. Panel A shows the number of banks that conduct first securitization in any year from 2002 to 2007 and their unmatched control group of non-securitizers. Panel B reports the statistics on the matched sample, i.e., first-time securitizers and their matches that have data for pre- and post-securitization years and satisfy the common support condition.

b) Implementation of the Propensity Score Matching

The implementation of the propensity score matching approach can be broadly broken down into three steps: (i) estimating propensity scores for first-time securitizers and non-securitizers; (ii) matching first-time securitizers with non-securitizers; and, finally, (iii) estimating the average securitization effect.

To estimate the propensity scores we use a probit regression of a dummy variable with a unit value for the first securitization, and zero otherwise.²⁶ According to the matching literature, the regressors included in the model should reflect both the institutional settings of banks and the theoretical and empirical background on the determinants of banks decision to securitize. It is also worth noting that

²⁵ For example, the 23 first-time securitizers in 2004 are banks that do not securitize in 2001, 2002, 2003 and securitize in 2004. The 7,845 non-securitizers are banks that do not securitize throughout the whole sample period, i.e., from 2001 to 2008.

²⁶ Caliendo and Kopeinig (2005) suggest that logit and probit models are preferable among the discrete models and usually yield similar outcomes for binary treatment case.

the main purpose of the propensity score estimation is not to predict the treatment, but to balance all the covariates between the two groups (Augurzky and Smidt, 2001). To do so, we define five sets of bank-specific variables. The first set reflects general characteristics of bank balance-sheet structure including bank size.²⁷ From the asset side, we include measures of bank liquidity, loans, and loan portfolio composition. The latter is captured in terms of both the breakdown of loans into four major categories (real estate, commercial and industrial, consumer, and other²⁸) and the Herfindahl-Hirschman Index (HHI) calculated using the four named loan shares. From the liability side, we include deposit and equity ratios.

The next four sets of variables reflect the most commonly cited motivating factors for securitization: regulatory capital relief, lower cost funding, risk management, and operating performance improvement. First, with respect to the regulatory capital relief hypothesis, we include Tier I risk-based capital ratio (Calomiris and Masson, 2004; Uzun and Webb, 2007; Bannier and Haensel, 2007; Minton *et al.*, 2008). The lower cost of funding hypothesis is captured by the average cost of debt calculated as the ratio of interest expenses to total liabilities (Martin-Oliver and Saurina, 2007). To reflect the risk management hypothesis, we use the non-performing loan ratio (Pais, 2005; Martin-Oliver and Saurina, 2007; Minton *et al.*, 2008). Finally, we capture banks operating performance by using a profitability measure such as return on assets (Minton *et al.*, 2004; Pais, 2005; Bannier and Haensel, 2007; Minton *et al.*, 2008).

One of the required conditions in the propensity score matching analysis is that the variables included in the model should not be affected by the treatment. To ensure this, the bank-specific variables employed in our propensity score model are lagged one year:

$$P(S_{it} = 1 | X_{i,t-1}, Z_{i,t-1}, St_i), \tag{6}$$

where S_{it} is a first-securitization dummy, $X_{i,t-1}$ is a vector of general balance sheet characteristics, $Z_{i,t-1}$ is a vector of variables capturing the four hypotheses on the motivation for securitization, and St_i are state dummies.

²⁷ Bank size is measured as natural logarithm of total assets. A few studies show that large banks are more likely to securitize referring this to the economies of scale enjoyed by large banks in underwriting and securitization, or diseconomies of scale in funding through deposits (Jiangli and Pritsker, 2008; Bannier and Haensel, 2007). Loutschina (2005) notes that only large banks have sufficient number and homogeneity of loans to access the securitization market independently of other financial intermediaries.

²⁸ Other Loan Ratio is dropped from the probit model due to the collinearity.

We estimate the propensity scores for the 198 first-time securitizers and 46,903 bank-years of non-securitizers reported in Panel A of Table 2 running the model year by year. The Pseudo-R² of the yearly regressions ranges from 0.08 to 0.21. For reporting reasons, we reproduce a pooled probit regression for the period from 2002 to 2007, as it yields qualitatively similar results. To control for dependence of standard errors for a given bank, we cluster the standard errors at the bank level. The estimates of the pooled regression are reported in Table 3 where Model II additionally incorporates year and state dummies.

Table 3: Determinants of Securitization Probability

Regressor	Model I Coef.	Model II Coef.
Size _{<i>i, t-1</i>}	0.145*** (0.021)	0.148*** (0.024)
Liquidity Ratio _{<i>i, t-1</i>}	0.073 (0.376)	-0.144 (0.389)
Loan Ratio _{<i>i, t-1</i>}	0.238 (0.362)	0.235 (0.377)
C&I Loans Ratio _{<i>i, t-1</i>}	0.269 (0.179)	0.288 (0.216)
Consumer Loans Ratio _{<i>i, t-1</i>}	0.162 (0.223)	0.265 (0.228)
Other Loans Ratio _{<i>i, t-1</i>}	0.564* (0.286)	0.487 (0.322)
Loan HHI _{<i>i, t-1</i>}	0.310 (0.212)	0.281 (0.231)
Deposits/Assets Ratio _{<i>i, t-1</i>}	-0.753*** (0.214)	-0.905*** (0.226)
Total Equity-to-Assets Ratio _{<i>i, t-1</i>}	0.391 (0.598)	0.323 (0.601)
Tier I Risk-Based Capital Ratio _{<i>i, t-1</i>}	-0.644* (0.287)	-0.557* (0.260)
Interest/Liabilities Ratio _{<i>i, t-1</i>}	1.092 (0.780)	0.439 (0.938)
NPL Ratio _{<i>i, t-1</i>}	-0.835 (2.669)	-1.122 (3.122)
Return on Assets _{<i>i, t-1</i>}	-5.681*** (1.576)	-5.309*** (1.512)
State Dummies	No	Yes
Year Dummies	No	Yes
Pseudo R ²	0.051	0.084
Log likelihood	-1211.53	-1163.67
Number of Observations	46187	44783

Note: The table presents the probit regression estimates of the likelihood to securitize assets. The dependent variable equals to one for first-time securitizers and zero for non-securitizers. All explanatory variables are lagged one year. Model I includes bank-specific characteristics. Model II adds state and year dummies. Robust standard errors corrected for clustering at the bank-level are reported in parentheses. *, **, *** stand for statistical significance at the 10%, 5% and 1% levels, respectively.

Overall the results are supportive of our predictions, providing significant evidence for the funding, regulatory capital relief and performance improvement hypotheses. In particular, we find that a bank is more likely to securitize if it has lower deposits to total assets, lower regulatory capital and is less profitable. These results along with the significant positive estimate for the size variable are consistent with previous studies on banks propensity to securitize.

Having estimated the propensity scores, we proceed to match first-time securitizers with non-securitizers. We employ nearest-neighbor matching where the unit chosen from the non-securitizers (i.e., unit j from the control group) as a match for the first-time securitizer (i.e., unit i from the treated group) is the one closest in terms of the propensity score²⁹:

$$|p_i - p_j| = \min_{k \in \{S=0\}} \{|p_i - p_k|\} \quad (7)$$

To avoid the risk of bad matches entailed in this approach, we impose a 1% tolerance level on the maximum propensity score distance allowed (the so called caliper).³⁰ We run nearest-neighbor matching year by year to ensure that each first-time securitizer is matched with an observation from the non-securitizer group of the same year the first securitization occurs. The empirical setting requires restricting the initial unmatched sample of first-time securitizers and non-securitizers to those with data from one year before until one year after the first-securitization year. Further, we impose the common support, or overlap condition, discussed earlier, by prohibiting the perfect predictability of first securitization given the observed covariates to ensure the existence of potential matches in the non-securitizer group.³¹ This leaves us with 176 first-time securitizers and their 176 controls, and this is the sample used for the estimation of the average securitization effects. Panel B of Table 2 reports the number of completed matches by year.

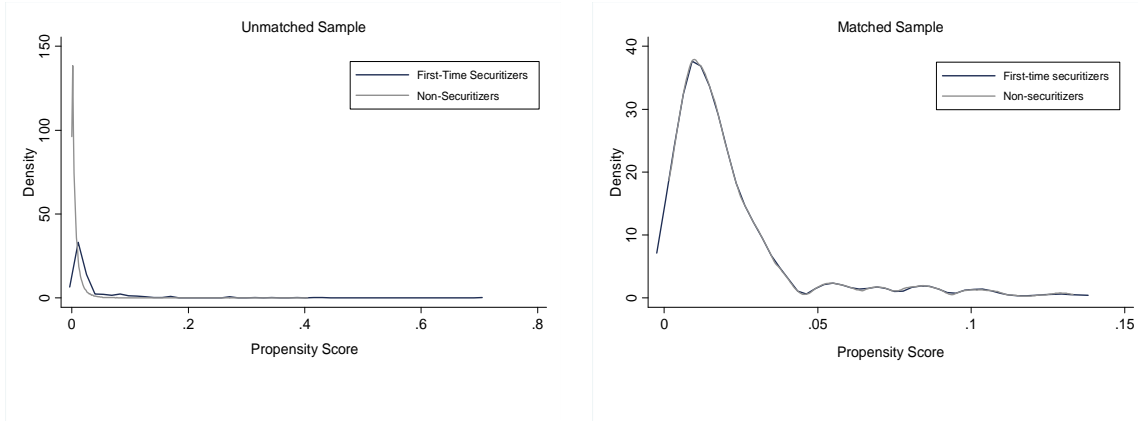
²⁹ There is a range of matching estimators available. All of those compare the outcome of the treated units with the outcome of the control group members to determine the average treatment effect and differ in the way the neighborhood for each treated unit is defined and the weights assigned to the neighbors (Caliendo and Kopeinig, 2005).

³⁰ Bad matches might occur if the closest neighbor is far away in terms of the propensity score. Applying caliper implies that a unit from the control group chosen as a match for a treated unit lies within the caliper (“propensity range”) and is closest in terms of the propensity score. In this case the matching quality rises; however, the variance of the estimates may increase if fewer matches can be performed as a result of excluding from the analysis the treated units with no matches found within the caliper (Smith and Todd, 2005).

³¹ The analysis is conducted using PSMATCH2 module for Stata developed by Leuven and Sianesi (2003).

To verify the quality of matching, we plot the distribution of the propensity score for the first-time securitizers and non-securitizers before and after matching (Figure 2). In the unmatched sample the propensity score distribution of the non-securitizers is skewed leftward, while it is very close to that of the first-time securitizers in the matched sample.

Figure 2: Distribution of the propensity score of first-time securitizers and non-securitizers before and after matching



Note: The graphs plot the propensity score distribution of the first-time securitizers and non-securitizers for the 2002-2007 period, before and after matching. The propensity score is derived from the estimation of the probit equation (6) year by year.

Further, since matching is conditioned on the propensity score rather than on all covariates, it also has to be checked whether the matching procedure is able to balance the distribution of all the relevant variables in both the control and treatment groups (Caliendo and Kopeinig, 2005). Rosenbaum and Rubin (1985) suggest a two-sample t-test for comparing the distributions of the covariates in the treated and matched control groups. In other words, we compare the first-time securitizers and non-securitizers before and after matching and check if there remain any differences in the balancing covariates after conditioning on the propensity score. The results of the tests are reported in Table 4. We find significant differences before matching, whereas in the matched sample the covariates are balanced in both groups suggesting successful matching.

Table 4: T-test for the equality of means of covariates before and after matching

Variable	Unmatched Sample			Matched Sample		
	Treated	Control	Difference	Treated	Control	Difference
Size _{i, t-1}	12.552	11.574	0.978***	12.339	12.357	-0.018
Liquidity Ratio _{i, t-1}	0.256	0.286	-0.029***	0.255	0.255	0.000
Loan Ratio _{i, t-1}	0.661	0.629	0.032***	0.664	0.669	-0.005
C&I Loans Ratio _{i, t-1}	0.214	0.235	-0.020*	0.216	0.219	-0.003
Consumer Loans Ratio _{i, t-1}	0.094	0.103	-0.009	0.089	0.076	0.013
Other Loans Ratio _{i, t-1}	0.030	0.017	0.013***	0.021	0.021	0.001
Loan HHI _{i, t-1}	0.604	0.566	0.038***	0.595	0.596	-0.001
Deposits/Assets Ratio _{i, t-1}	0.776	0.824	-0.048***	0.801	0.802	-0.001
Total Equity-to-Assets Ratio _{i, t-1}	0.111	0.115	-0.004	0.106	0.106	0.000
Tier I Risk-Based Capital Ratio _{i, t-1}	0.154	0.183	-0.028*	0.146	0.151	-0.004
Interest/Liabilities Ratio _{i, t-1}	0.016	0.015	0.000	0.015	0.015	0.000
NPL Ratio _{i, t-1}	0.009	0.010	-0.001	0.009	0.007	0.002
Return on Assets _{i, t-1}	0.005	0.006	-0.001	0.006	0.006	0.000
Number of Observations (total)	198	45989	(46187)	176	176	(352)

Note: The table reports the means of various bank-specific characteristic between the treated units (i.e., first-time securitizers) and controls (i.e., non-securitizers) before and after matching. The difference in means (i.e., column “Difference”) is calculated as the difference between first-time securitizers’ and non-securitizers’ means. *, **, *** stand for statistical significance at the 10%, 5% and 1% levels, respectively. The last row shows the number of treated and control units in each group with the total number of observations in a sample reported in brackets.

VII. Securitization Effects on Bank Performance: Results

We now use the matched sample to estimate the causal effects of securitization on three indicators of bank performance: cost of funding (interest expense to total liabilities ratio), risk (non-performing loan ratio), and profitability (return on assets).

To do so, we first pool the yearly matched first-time securitizers and non-securitizers. Second, we calculate the changes in performance using a one-year window around the first-securitization year. Finally, we estimate the average securitization effect as the difference in the mean changes in the performance indicators between the first-time securitizers and non-securitizers.

We run the analysis for the whole 2002-2007 sample with 352 banks in total and also split the period into three subperiods (i.e., 2002-2003, 2004-2005, and 2006-2007) to examine possible differences over time. The estimates of the average securitization effects for the four estimation periods are reported in Table 5 as “Diff” with statistical significance in parentheses, where the latter is calculated based on bootstrapped standard errors.

The interpretation of the estimates is as follows. The effect of securitization on bank performance is positive when: (i) the Diff for cost of funding and risk is negative implying a (larger) drop or a smaller rise in the indicators for the first-time securitizers compared to non-securitizers; or (ii) Diff for profitability is positive implying a (larger) rise or a smaller drop in the profitability for the first-time securitizers compared to non-securitizers.

Table 5: The Effect of Securitization on Bank Profitability, Risk and the Cost of Funds

Variable	2002-2007			2002-2003			2004-2005			2006-2007		
	First-Time Securitizers	Non- Securitizers	Diff (t-stat)	First-Time Securitizers	Non- Securitizers	Diff (t-stat)	First-Time Securitizers	Non- Securitizers	Diff (t-stat)	First-Time Securitizers	Non- Securitizers	Diff (t-stat)
Funding Cost	-0.001	-0.001	0.000 (0.06)	-0.010	-0.010	0.000 (0.08)	0.004	0.004	0.000 (0.00)	0.003	0.003	0.000 (0.09)
Risk	0.002	0.003	-0.001 (-0.71)	0.000	0.003	-0.003 (-1.37)	-0.007	-0.003	-0.004 (-0.72)	0.011	0.009	0.002 (0.52)
Profitability	0.000	-0.001	0.001 (0.42)	0.001	-0.002	0.003 (1.22)	0.001	0.001	0.00 (-0.35)	-0.002	-0.001	-0.001 (-0.45)
Observations	176	176		62	62		52	52		62	62	

Note: The table presents the propensity score matching estimates of the average treatment effect of securitization on the cost of funding, risk, and profitability for the first-time securitizers. The average treatment effect is the difference in the performance change (i.e., from year t-1 to year t+1 with the treatment in year t) between the first-time securitizers and matched non-securitizers. The first-time securitizers are banks that conduct first securitization in any year during the period of analysis and are matched with non-securitizers (i.e., banks that never engage in securitization throughout the 2001-2008 period) on a year-by-year basis. The average treatment effects are reported as “Diff” in the table with t-statistics in parentheses based on bootstrapped standard errors. The first column shows the estimates for the full sample, which is further split into three subsamples. The last row reports the number of first-time securitizers and non-securitizers for each estimation period.

First, for the cost of funding, we find no evidence for a securitization effect across all the periods considered. As for the credit risk, we find a positive effect for banks that securitized in any year from 2002 to 2005 as compared to their controls, while the result is opposite for those that securitized in years 2006 and 2007. Finally, the effect of securitization on profitability is found to be positive for the first-time securitizers of 2002-2003 and negative for those banks that securitized in 2006-2007. However, none of the estimates are statistically different from zero providing no evidence for significant impact of securitization.³² In other words, the results suggest that the first-time securitizers

³² As a robustness test, we also perform radius matching with a caliper of 0.01. The basic idea of this variant is to use not only the nearest neighbor but all of the comparison units within the caliper. The results remain unchanged (not reported but available upon request).

would have comparable cost of funding, credit risk and profitability had they remained non-securitizers. Referring to Figure 1, according to the obtained evidence the performance trajectories of the first-time securitizers (i.e., First-Time Securitizers A and First-Time Securitizers B) might slightly change the trend but remain close to the hypothetical trajectories presented by the dotted lines.

VIII. Conclusions

In this paper, we conduct an empirical analysis of the effects of securitization on bank performance. The theoretical predictions are that securitizing banks should have lower cost of funding, less credit risk exposure, and higher profitability compared to banks that do not securitize assets.

Using US commercial bank data from 2001 to 2008, we first find in the univariate analysis that securitizing banks tend to be more profitable institutions, however with higher credit risk exposure and higher cost of funding compared to non-securitizing banks.

Further, to disentangle the securitization effect, we assess what would have happened to the securitizing banks had they not securitized. We do so by applying a propensity score matching approach and estimate the causal effects of securitization by comparing the performance of first-time securitizers with that of banks that had ex-ante similar securitization likelihood but remained non-securitizers. We find that the first-time securitizers would have comparable cost of funding, credit risk and profitability had they not securitized.

Consequently we conclude that securitization as a funding, risk management and profitability improvement technique does not seem to outperform alternative means possibly used by the adequately matched non-securitizing banks. The obtained evidence raises important questions about the motives for banks' increasing securitization activities over the past decade and consequent implications for the banking system and is of a particular interest in light of the current financial crisis and the latest debates about re-considering the regulation of the securitization market.

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Appendix

Variable names and construction

Variable	Call Report Data Item
Balance Sheet Structure	
Total Assets (\$ billions)	RCFD2170
Liquidity Ratio	$(RCFD0081 + RCFD0071 + RCFD1754 + RCFD1773)/RCFD2170$
Loan Ratio	$RCFD1400/RCFD2170$
Deposits-/Assets Ratio	$RCFD2200/RCFD2170$
Equity-/Assets Ratio	$RCFD3210/RCFD2170$
Loan Portfolio Composition	
Real Estate Loan Ratio	$RCFD1410/RCFD1400$
C&I (Commercial and Industrial) Loan Ratio	$(RCFD1590 + RCFD1766)/RCFD1400$
Consumer Loan Ratio	$RCFD1975/RCFD1400$
Other Loan Ratio	$(RCFD1400 - RCFD1410 - RCFD1766 - RCFD1590 - RCFD1975)/RCFD1400$
Loan HHI (Herfindahl-Hirshman Index)	$(RCFD1410/RCFD1400)^2 + (RCFD1590 + RCFD1766/RCFD1400)^2 + RCFD1975/RCFD1400^2 + ((RCFD1400 - RCFD1410 - RCFD1766 - RCFD1590 - RCFD1975)/RCFD1400)^2$
Regulatory Capital	
Tier I Leverage Ratio	RCFD7204
Tier I Risk-Based Capital Ratio	RCFD7206
Total Risk-Based Capital Ratio	RCFD7205
Cost of Funding	
Interest Expense/Liabilities	$RIAD4073/RCFD2948$
Risk Measures	
NPL (Non-Performing Loan) Ratio	$(RCFD1407+RCFD1403)/RCFD1400$
RWATA (Risk-Weighted Assets to Total Assets) Ratio	$RCFDA223/RCFD2170$
Charge-Off Ratio	$RIAD4635/RCFD1400$
Allowance Ratio	$RCFD3123/RCFD1400$
Loan Loss Provision Ratio	$RIAD4230/RCFD1400$
Operating Performance	
Return on Assets	$RIAD4340/RCFD2170$
Return on Equity	$RIAD4340/RCFD3210$
Net Interest Margin	$RIAD4074/RCFD2170$
Interest Income/Net Operating Revenue	$RIAD4074/(RIAD4074+ RIAD4079)$
Noninterest Income/Net Operating Revenue	$RIAD4079/(RIAD4074+ RIAD4079)$
Revenue HHI (Herfindahl-Hirshman Index)	$(RIAD4074/(RIAD4074+ RIAD4079))^2 + (RIAD4079/(RIAD4074+ RIAD4079))^2$

Note: Variables used in the study. Data items are taken from Federal Reserve's Reports of Condition and Income (Call Reports).