Does Corporate Income Taxation Affect Securitization? Evidence from OECD Banks

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Abstract

Corporate income taxation, by affecting the after-tax cost of funding, has implications for a bank's incentive to securitize. Using a sample of OECD banks over the period 1999–2006, we find that corporate income taxation led to more securitization at banks that are constrained in funding markets, while it did not affect securitization at unconstrained banks. This is consistent with prior theory suggesting that the tax effects of securitization depend on the extent to which banks face funding constraints. Our results suggest that a country's tax system has distorting effects on banks' securitization decisions and therefore proposals of new taxes on bank profits are inappropriate.

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†Sadly, Jenny E. Ligthart suddenly passed away on November 21, 2012. She was always enthusiastic and tirelessly available to her students, anytime and anywhere. We remember her as an excellent researcher, a professional teacher, a helpful supervisor and a close friend.

1 Introduction

Securitization markets have grown rapidly since the 1990s. Before the outset of the subprime crisis, securitization had been seen as a blessing to the banking industry as it provides extra liquidity and improves risk sharing. The dark side of securitization, for instance misaligned incentive problems, gradually came to dominate the debate of securitization and financial turmoil, however. This naturally prompts our central question: why do banks securitize assets on such a large scale? While much attention has been paid to banks per se, tax is often neglected in the discussion of the driving forces of securitization. In practice, tax is actually considered a crucial factor in securitization transactions. Therefore, in this paper we seek to link taxation to securitization by empirically identifying the impact of corporate income tax (henceforth, CIT) on banks' incentive to securitize on-balance sheet assets.

How does tax matter in securitization processes? In a typical securitization transaction, the originator (usually a bank) transfers assets to a special purpose vehicle (henceforth, SPV), which issues asset backed securities (henceforth, ABS) to investors (Gorton and Souleles, 2007)[1]. The profits extracted by the originator, along with profits from other business, are subject to CIT of the jurisdiction in force where the bank is headquartered. By contrast, SPVs are usually structured as tax neutral, which serves to ensure as far as possible that no extra tax liability arises from securitization transactions. In this sense, the cost of off-balance sheet financing through securitization is independent of CIT. However, corporate income tax has an impact on the after-tax costs of debt and equity and therefore affects funding allocation between on and off-balance sheet financing. According to Pennacchi et al. (2013), by increasing the tax-adjusted cost of equity financing, a higher CIT rate indirectly induces banks that lack deposit market power and are therefore reliant on equity financing to fund partly through off-balance sheet securitization[2]. On the contrary, this tax effect is nil for banks having market power in deposit markets as they rely on cheap deposit financing and increase leverage, rather than turning to securitization when facing a higher tax rate. Overall, the tax impacts on securitization depend on bank funding constraints and essentially

[1] In this paper, the definition of securitization is restricted to the off-balance-sheet activity of issuing ABS. This definition is much narrower than the general concept which includes selling loans, issuing standby letters of credit and loan commitments.

[2] Albertazzi and Gambacorta (2010) also discuss that corporate income tax levied on bank profits changes the cost of bank equity.

funding costs. Pennacchi et al. (2013) also provide empirical evidence from mortgage sales by small banks using U.S. state-level tax variations.

Based on the theoretical framework in Pennacchi et al. (2013), we extend the analysis of tax incentives for bank securitization to the engagement of OECD banks in ABS markets during 1999–2006. To identify different responses of funding constrained and unconstrained banks to CIT, we construct a funding constraint dummy based on loan growth rates and deposit interest expenses. A bank is defined as funding constrained if it has relatively high growth in loans and pays relatively high interest expenses. The rationale is that if a bank has abundant loan origination opportunities to fund but is restricted by its limited funding capacities in deposit markets, it is likely to rely on expensive equity financing to fund asset expansion. When securitization is available as an alternative option, however, these funding constrained banks tend to securitize parts of assets, particularly in a high corporate income tax environment. We subsequently take advantage of cross-country tax variations to test whether funding constrained banks headquartered in high tax rate jurisdictions are inclined to issue more ABS.

Our empirical findings suggest that corporate income taxation led to more securitization at banks constrained at funding markets, while it did not affect securitization at funding unconstrained banks, in line with the predictions of prior theories. One percentage point rise in CIT rates increases the securitization asset ratio and securitization loan ratio by 0.07 and 0.14 percent, respectively[3]. Therefore, our findings of tax distorting effects are economically important, especially when taking into account the large scale of securitization.

There is growing literature that examines the determinants of securitization, including Loutskina (2011), Loutskina and Strahan (2009), Pavel and Phillis (1987), Greenbaum (1987), Carlstrom and Samolyk (1995), Demsetz (2000), Thomas (2001), Panetta and Pozzolo (2010), Bannier and Hänsel (2008), Calomiris and Mason (2004), Ambrose et al. (2005), Affinito and Tagliaferri (2010), and Cardone-Riportella et al. (2010). They find that the likelihood and intensity of securitization are largely determined by bank characteristics, such as funding ability, risk profile, capital adequacy and performance. Our paper adds to the securitization literature by empirically examining tax distorting effects on banks' incentive to securitize. This study also contributes to the research at the intersection of taxation and banking that

[3]See definitions of securitization asset ratio and securitization loan ratio in Appendix A2.

used to focus on distorting effects of corporate income taxation on leverages, locations and legal structures of banks (Huizinga, 2004), and pass-through of tax burdens (Demirgüç-Kunt and Huizinga, 1999, 2001; Albertazzi and Gambacorta, 2010; Huizinga et al., 2011).

Unlike Pennacchi et al. (2013) who utilize U.S. state-level tax variations, we provide empirical evidence of tax distorting effects on bank ABS issuance by exploiting variations across more heterogeneous OECD tax regimes. Our cross-country setting has the following advantages. First, there are considerable variations in corporate income tax rates across different national jurisdictions[4]. Second, our analysis incorporates the changes in tax rates by national tax authorities, which are exogenous to bank securitization decisions. Last, we show the generality of tax distorting effects in heterogenous securitization markets that differ in market size, participation and regulation. Another significant difference is that we focus on large OECD banks which are of regulation importance, while Pennacchi et al. (2013) use a sample of small banks that operate within a state or Metropolitan Statistical Area (henceforth, MSA).

The remainder of this paper is organized as follows. Section 2 briefly reviews a simplified framework for our tax incentive analysis. Section 3 presents data and descriptive summaries. Section 4 sets out our estimation strategies. Section 5 contains empirical analysis and robustness checks and compares our results with prior findings. Section 6 concludes the paper.

2 Theoretical Framework

In this section, based on models in Pennacchi (1988), Gorton and Pennacchi (1995) and Pennacchi et al. (2013), we review a simplified, analytical framework that illustrates the tax distorting effects on bank securitization and then derive testable hypotheses.

A bank can invest in loans and securities. A loan yields a return r_L when the bank implements screening and monitoring. At the same time, the bank incurs the cost of providing screening and monitoring services, c. By contrast, investment in money market securities pays an interest rate r_d, which is equivalent to the cost of wholesale deposit financing. In the end, all the bank's profits from both investments are subject to a CIT rate τ.

[4]Despite a general tendency of decline, CIT rates remain differentiated across countries. For instance, Ireland and Turkey have effective marginal CIT rates below 10 percent, while Germany and Japan have rates above 35 percent.

The on-balance-sheet financing of the bank consists of two sources of funds: equity and deposits. Let r_e and r_D denote the costs of equity and retail deposits, respectively. Pennacchi et al. (2013) model the imperfect competition in the retail deposit market by an increasing marginal cost of retail deposits, $\frac{\partial r_D}{\partial D} > 0$.

Assume two types of banks that differ in funding constraints. Funding unconstrained banks own market power in retail deposit markets but have no advantage at loan origination. Therefore, they raise funds at

$$r_{on} = r_d \tag{1}$$

where r_{on} is the marginal cost of on-balance-sheet financing and r_d is the cost of wholesale deposits. Due to limited loan origination opportunities, they invest excessive deposit funding into securities. By contrast, funding constrained banks lack deposit market power but have lots of credit origination opportunities. Funding asset expansion primarily by equity financing, they issue equity until the tax-adjusted cost of equity is equal to the cost of retail deposits

$$r_{on} = \frac{r_e}{1-\tau} = r_D \tag{2}$$

Essentially, they find funding loans profitable and invest no securities.

Assume that a securitization market opens, in which a bank is allowed to securitize parts of its loans in exchange for additional funding at the cost of r_d. Pennacchi et al. (2013) make this assumption as they treat competitively priced ABS and money market securities as substitutes whenever they share similar characteristics of liquidity and risk. Moreover, the cost of funding through securitization is independent of tax because the SPV is supposed to be structured as tax neutral[5]. When securitizing loans, the bank may benefit from a lower cost of financing $r_{on} - r_d$, depending on the funding constraint and the cost of on-balance-sheet financing. In this way, securitization acts as an off-balance-sheet substitute for the conventional on-balance-sheet funds.

[5]In practice, tax neutrality is usually accomplished in a variety of ways. First, offshore SPVs are widely used to maintain no taxable presence in originator's jurisdiction. Set up in tax havens or tax-friendly countries to OECD, such as Cayman Islands, Irish docks and Jersey, SPVs have access to tax avoidance strategies unpermitted in home jurisdictions. Second, SPVs are structured as tax transparent pass-through entities. For instance, REMIC and FAIST are treated as tax transparent and pass-through and therefore generally are not taxed in the U.S. Third, SPVs can be designed to not have any material income tax liability, i.e., its deductible expenses perfectly offset income and end up with nil taxable profit.

The extent to which a bank securitizes loans is limited by a moral hazard problem. Whenever some risk is transferred in securitization, the incentive for banks to screen and monitor remains suboptimally low in spite of certain features in securitization contracts targeted at remedying the moral hazard problem[6]. Rational investors of ABS who expect declined screening and monitoring services would discount the value of the loans by a discount factor η. Hence, suffering a loss of the loan value, the bank earns $\eta r_L - F$ in securitization instead of $r_L - c$ when holding loans on balance sheet until maturity, where F is the fixed cost of securitization[7].

Based on the trade-off between a saving of funding costs $r_{on} - r_d$ and loss in loan values $(1-\eta)r_L + F - c$, a securitization project is profitable only if the following condition holds:

$$(r_{on} - r_d) - [(1-\eta)r_L + F - c] > 0 \tag{3}$$

The funding-unconstrained banks cannot satisfy the condition (3) because their marginal cost of on-balance-sheet financing is already sufficiently low.

$$(r_{on} - r_d) - [(1-\eta)r_L + F - c] = -[(1-\eta)r_L + F - c] < 0 \tag{4}$$

Therefore they merely incur losses in securitization without effectively lowering costs of funding[8]. By contrast, funding constrained banks are likely to benefit from lower funding costs from securitization.

$$(r_{on} - r_d) - [(1-\eta)r_L + F - c] = (\frac{r_e}{1-\tau} - r_d) - [(1-\eta)r_L + F - c] \tag{5}$$

As $r_e > r_d(1-\tau)$, reflecting a tax advantage of debt financing to equity financing, the first term is positive. If the tax-adjusted cost of equity is sufficiently large, or the loss of loan value and fixed cost of securitization are sufficiently small, it is possible for the bank to

[6]Certain contract features, such as offering implicit recourse, holding equity tranche and overcollateralization, are designed to alleviate the moral hazard problem and to reduce the agency cost of securitization. Consistent with theoretical predictions of reduced incentives to carefully screen and monitor borrowers, some empirical studies find a decline in the credit quality in securitized loans (Keys, Mukherjee, Seru and Vig, 2010; Purnanandam, 2011; Keys, Seru and Vig, 2012).

[7]Fixed costs usually include the costs associated with setting up SPVs, rating fees, auditing and legal expenses.

[8]Gijle et al. (2013) find that banks experiencing deposits windfalls in U.S. shale-boom counties tend to fund their mortgage lending through low-cost deposits instead of securitization.

make profits in securitizing loans. Here, corporate income taxation plays a role. Notably, banks in a jurisdiction of higher tax rates have a higher tax-adjusted cost of equity, and thus a higher cost of the on-balance-sheet financing. The broader the gap between on-balance-sheet financing and securitization financing is, the more likely a bank will find securitization attractive. Moreover, given that a bank is determined to securitize assets, a higher tax rate that augments the marginal benefit of securitization is expected to increase the volume of securitization.

This simple framework identifies a micro channel that connects CIT and bank securitization, depending on bank funding constraints. From these predictions, we derive the following hypotheses:

Hypothesis 1: *Funding constrained banks, namely, banks with plentiful loan origination opportunities but limited deposit market power, are more likely to securitize and securitize more assets when subject to a higher rate of corporate income tax.*

Hypothesis 2: *Funding unconstrained banks, namely, banks with little loan origination capacities and substantial deposit market power, have no tax incentive to securitize assets.*

3 Data and Summary Statistics

We obtain information of bank asset securitization from ABS Alert database. This database provides information for each ABS issuance, including the names of sponsors and sellers, amount of issuance, country of denomination, pricing dates, seller types and collateral types. Importantly, it covers ABS with various kinds of collateral, such as residential mortgages, credit card receivables, home equity loans, auto loans and so forth. An underlying assumption for combining all types of ABS issuance together is that the tax incentive for banks to securitize does not depend on the type of collateral. We create the variable of the amount of securitization for each bank in a given year by aggregating its all ABS issuance within that year. Non-banks sponsors such as airlines, retailers, hedge funds and auto manufacturers, are dropped from our sample. Our analysis of securitization covers the period of 1999–2006, i.e., the booming period of asset-backed securities markets. Before the late 1990s, the securitization markets were quite small outside the U.S. We also exclude the period of the subprime crisis in which securitization was likely to be market-driven.

Bankscope reports information on balance sheets and income statements of financial institutions. Our bank sample includes seven types of banks headquartered in 29 OECD countries[9]. Since our focus is on large banks, we only include banks if their total assets rank in the upper quartile of size distribution in each country for at least one year in the time span. We adopt the consolidated financial statements under the International Financial Reporting Standards (IFRS) whenever available. Based on the accounting information, we construct the following bank-level regressors. First, a bank is classified as a funding constrained bank if it has a high growth rate of loans and pays relatively high interests on deposits at the same time. Hence, we create a funding constraint dummy *Itop25*, which takes the value of 1 if a bank is in the upper quartile of all bank-year observations in both loan growth rates and deposit interest expenses in a given year. In particular, the growth rate of gross loans serves as a proxy for a bank's lending capacities, as a higher growth rate indicates that the bank has plentiful profitable projects to fund. As for the proxy for deposit market power, we rely on the interest expenses on deposits. The rationale is that a bank with constrained deposit funds has to pay more interest expenses to attract extra deposits. Second, as other channels for securitization are widely discussed in literature, such as credit risk transfer (Panetta and Pozzolo, 2010; Bannier and Hänsel, 2008), regulatory capital arbitrage (Calomiris and Mason, 2004; Ambrose et al., 2005) and performance improvement (Affinito and Tagliaferri, 2010; Cardone-Riportella et al., 2010), we also include other bank level control variables, namely, a ratio of loan loss reserves to gross loans (*LLR/Gross Loans*), a ratio of equity to total assets (*Equity/TA*), and return on equity (*ROE*), which serve as indicators for risk profile, capital and performance, respectively. In the end, we adopt the logarithm of bank total assets (*Size*) to measure the size of banks[10].

To link the securitization information to bank-specific variables, we match sponsors in the ABS Alert database with banks in Bankscope, if they share identical names and country of residence[11]. Our final sample ends up with 5 636 banks with headquarters in 29 OECD

[9]Banks in our analysis include bank holding companies, commercial banks, cooperative banks, finance companies, investment banks, real estate and mortgage banks and savings banks. For countries in our sample, see the country list in Appendix Table A1.

[10]Bank total assets are transformed into million USD in 2005. In practice, we use the GDP deflator to correct for inflation where 2005 is the base year.

[11]In most cases, the originating bank acts as both sponsor and seller in the deal. In a few cases where the seller and the sponsor are different entities, it is usually the case that the seller is merely a securitization arm set up particularly for ABS issuance by its parent company, i.e. the sponsor. This is the compilation rule of the ABS Alert database. We choose the sponsor (parent companies or in some cases bank holding companies)

countries in the 1999–2006 period, of which 329 entities had at least one ABS issuance. Our unit of analysis is the bank-year observation.

In our empirical analysis, we implicitly assume that SPVs set up by banks successfully achieve tax neutral status[12]. We use effective marginal tax rates of CIT, which are based on statutory tax rates from the OECD tax database and the formula in Devereux and Griffith (2003). Additionally, macroeconomic control variables, including growth rates of GDP per capita, development of stock market and population growth rates, are obtained from the World Development Indicators (*WDI, 2011*). Appendix Table A2 provides detailed information for variable definitions and data sources.

Figure 1 plots the relationship between CIT rates and size of securitization markets. The horizontal axis is the average of effective marginal tax rates of CIT of each OECD country, while the vertical axis is the natural logarithm of aggregate ABS issuance denoted in billion USD from 1999 through 2006. The figure displays a clear upward trend which indicates that securitization markets are generally larger in high-tax jurisdictions at the aggregate level.

Figure 1 approximately here.

Table 1 provides an overview of descriptive statistics for the whole sample, subsamples of securitizing bank-year observations and non-securitizing ones. It is worth noting that the average securitization asset ratio in the securitizing group is 7.07 percent, while the unconditional average securitization asset ratio in the entire sample is merely 0.21 percent. This is because the majority of the whole sample banks (94 percent) do not securitize assets, therefore having zero securitization asset ratio and lowering the average value of the ratio. We find a similar situation for securitization loan ratios.

Table 1 approximately here.

4 Estimation

To assess the banks' incentive in securitization, we regress securitization variables on tax rates, interaction terms, bank-specific variables and country-level macroeconomic variables. Since

since we assume that the securitization decision is made at a high level in the parent company. In addition, Bankscope seldom collects accounting data for specific securitization arms.

[12]Due to data limitation, we have no information for SPVs in securitization transactions. However, this is a reasonable assumption as failure of SPVs to be tax neutral would lead to double taxation at both originator and SPV level, therefore making securitization transactions unprofitable (Gorton and Souleles, 2007).

we assume each bank in our sample makes funding decisions by trading off costs and benefits in securitization, we observe zero securitization in the dependent variables when some banks find securitization unprofitable. In this sense, our sample is left-censored at zero. Therefore, we employ Tobit regression as follows

$$SecuRatio_{i,j,t} = \begin{cases} SecuRatio^*_{i,j,t} & \text{if } SecuRatio^*_{i,j,t} \geq 0 \\ 0 & \text{if } SecuRatio^*_{i,j,t} < 0 \end{cases}, \tag{6}$$

$$\begin{aligned} SecuRatio^*_{i,j,t} =& \alpha_1 CIT_{j,t} \times Itop25_{i,j,(t-1)} + \alpha_2 CIT_{j,t} \times (1 - Itop25_{i,j,(t-1)}) + \alpha_3 Itop25_{i,j,(t-1)} \\ &+ \boldsymbol{\beta}' \mathbf{W}_{i,j,(t-1)} + \boldsymbol{\gamma}' \mathbf{Z}_{j,(t-1)} + \sum_t \delta_t T_t + \epsilon_{i,j,t} \end{aligned} \tag{7}$$

where i, j, t denotes the bank, the country and the year, respectively. Additionally, the dependent variable $SecuRatio_{i,j,t}$ is a ratio of total amount of securitization to bank total assets (securitization asset ratio, $SecuAsset$) or bank gross loans (securitization loan ratio, $SecuLoan$) for bank i in country j in year t. Accordingly, $SecuRatio^*_{i,j,t}$ is the latent variable in Tobit regressions. To identify tax effects on funding constrained and unconstrained banks, we interact the funding constraint dummy with tax rates, allowing tax incentives to vary depending on funding constraints. In particular, the coefficient α_1 shows the tax effect on banks with substantial loan expansion opportunities but limited deposit market power, while α_2 measures the sensitivity of funding unconstrained banks to corporate income taxes. If the former coefficient turns out to be positive and significant, we could interpret it as evidence for tax incentive at funding constrained banks to securitize more assets. By contrast, according to the theoretical predictions, funding unconstrained banks do not respond to tax rates when making securitization decisions. Hence, α_2 is expected to be insignificant.

Furthermore, $\mathbf{W}_{i,j,(t-1)}$ is a vector of other bank-specific regressors, including proxies of bank leverage, performance, risk and size. All bank-specific explanatory variables, including the funding constraint dummy, are lagged by one period to avoid a potential problem of endogeneity[13]. To prevent extreme values from biasing our empirical results, we winsorize

[13] Affinito and Tagliaferri (2010) argue that lagged bank-specific regressors have good properties with no weak instrument problem.

the bank-specific variables at the 5 percent level[14]. $\mathbf{Z}_{j,(t-1)}$ consists of macroeconomic control variables which are expected to have an impact on banks' securitization decisions. The parameters T_ts are year dummies, which capture common macroeconomic shocks to all banks within the same year, for instance business cycles. ε_{ijt} is an i.i.d. error term which follows a normal distribution. Finally, we run all regression with heteroscedasticity robust standard errors which are clustered at the bank level.

5 Empirical Results

In this section, we present the results of regressions. First, we look at the tax effects on funding constrained and unconstrained banks in baseline regressions, controlling bank-specific and macroeconomic variables. Next, we conduct several robustness checks. In the end, we compare our results with findings in prior literature.

5.1 Baseline Results

Table 2 presents the main results of this study. In each regression, the dependent variable is the securitization asset ratio and we focus on the coefficients of two interaction terms. The first two columns report the results for the benchmark regression. The estimated coefficient for the interaction between CIT rates and funding constraint dummy is positive and statistically significant at the 1 percent level, consistent with the prediction in Hypothesis 1 that corporate income taxes create an incentive for funding constrained banks to securitize assets. One percentage point rise in CIT rates increases the securitization asset ratio by 0.07 percent. In accordance with Hypothesis 2, we have an insignificant coefficient for the interaction term at funding unconstrained banks, indicating no tax effect on these banks.

Among bank-specific variables, we find that banks with a higher return on equity securitize more assets. This may indicate that when a higher return is required by equity holders, a bank has a higher on-balance-sheet cost of financing, enhancing the cost advantage of securitization funding. Moreover, we confirm that larger banks securitize more assets, reflecting the fixed cost of securitization. In practice, large fixed costs commonly act as the chief barrier for small banks to enter the securitization market. The coefficient of the ratio of volume of stock

[14] In practice, there are some abnormal values probably due to reporting errors. We alter the winsorizing level in one of our robustness checks, in which results remained substantially unchanged.

traded to GDP is negative and significant. One plausible reason is that securitization is more prominent in countries with a less active stock market, or in a bank-dominated financial system. We find a positive impact of population growth on securitization, as a high population growth creates high demands for loans, which transforms into a high supply of underlying assets that fuel the growth of the securitization market. The other regressors have little explanatory power.

To control for the reputation effect of securitization behavior, we include the lagged securitization asset ratio into our second specification. This is based on the fact that major players readily build up reputation in the ABS market, reflected by their repeated issuance in the consecutive years. By contrast, banks with no prior issuance find it difficult to start securitization transactions and keep out of the market. Columns 3 and 4 show that the estimated coefficient of the lagged dependent variable turns out to be positive and significant at the 1 percent level, confirming that banks with ABS issuance are likely to securitize assets in the following years and issue more ABS, which is consistent with Affinito and Tagliaferri (2010). All coefficients and marginal effects of other variables decline to some degree, indicating that the lagged dependent variable may have taken away some explanation power. Besides, the lagged dependent variable is also expected to capture the unobserved heterogeneity at individual banks. Nevertheless, we still have a significant tax effect at funding constrained banks, though the marginal effect is much smaller than that in the benchmark regression. Other results remain qualitatively unchanged.

To relax the restrictions of identical coefficients of the bank-specific and macroeconomic control variables for funding constrained and unconstrained banks in the baseline regression, we divide our sample into two corresponding subsamples and run Tobit regressions separately. In line with hypothetical predictions, we identify tax effects for the funding constrained banks only (see columns 5 to 8). In addition, the coefficient of the interaction between CIT rates and the constraint dummy is twice as large as in the benchmark regression, suggesting a much stronger tax incentive for the funding constrained banks. In addition, among the controls, performance, bank size and development of stock market significantly explain securitization activities as well.

5.2 Robustness Checks

In our first sensitivity analysis, the securitization loan ratio is adopted as an alternative proxy for the dependent variable, which measures the proportion of loans that have been pooled and securitized in asset-backed securities. It is noteworthy that the unconditional average of securitization loan ratio is 0.39 percent, greater than the unconditional average securitization asset ratio of 0.21 percent. Meanwhile, the subsample of the securitizing bank-year observations has an average securitization loan ratio of 13.4 percent, which is twice as large as the average securitization asset ratio of the whole sample. The regression output in the first two columns of Table 3 shows a much greater tax effect for the funding constrained banks. Specifically, the securitization loan ratio increases by 0.17 percent as CIT rates rise one percentage point. This greater tax incentive might be the result of the scale effect of dependent variables, because securitization loan ratios are always greater than securitization loan ratios. Besides, performance, bank size, development of stock market and population growth have greater marginal effects than in the benchmark regression.

Although our sample contains banks with headquarters in 29 OECD countries, U.S. banks account for more than 60 percent of the bank sample. Additionally, U.S. has the largest ABS market, accounting for roughly 74 percent of global issuance. To see whether our results are driven by a single country, we exclude U.S. banks to control for its overweight. Columns 3 and 4 in Table 3 report a significant tax effect in the non-U.S. sample. The marginal effect of tax incentive on the funding constrained banks is slightly greater than that in the benchmark case, suggesting that the variations of corporate income tax regimes across countries explain the tax incentive for banks to take advantage of securitization, in spite of the noise from the overwhelmingly high share of U.S. banks. In this sample, ROE does not exert an influence on banks' decisions, while less risky banks are candidates for securitization. This may reveal differences in risk strategies of U.S. and non-U.S. banks toward securitization. We may tentatively interpret it as no evidence of credit-risk transfer in non-U.S. banks. Finally, the development of stock market is irrelevant to bank securitization in non-U.S. countries.

As another robustness check, we re-define funding constrained banks by relaxing the criteria of a bank having substantial loan origination opportunities to the one that ranks in the top 35 percent of the distribution of loan growth rates among all bank-year observations. Likewise, we denote a bank that ranks in the top 35 percent in the distribution of deposit

interest expenses among all bank-year observations as the one with little deposit market power. As expected, we still have a significant tax effect, though slightly weaker than the benchmark case (see columns 5 and 6). This is because the top 35 percent sample has weakened funding constraints, reflected by a slower loan growth rate and lower interest expenses on deposits than in the top 25 percent sample of the benchmark regression. Therefore, corporate income taxes exert a weaker effect on these constrained banks.

We furthermore examine the tax distorting effects when allowing for regulatory arbitrage of deposit insurance premiums. Unlike deposits on the balance sheet, funding through securitization is believed to be less costly since it avoids regulatory costs such as deposit insurance premiums (Pavel and Phillis, 1987). To test the effect of deposit insurance on the tax incentive for securitization, we include a dummy that takes value of one if the explicit deposit insurance system is privately funded only, and zero if it is jointly funded by government and banks. If a bank tends to evade its contribution to the funded deposit insurance via securitization, the coefficient of the privately funded DI dummy should be positive. We collect the information of deposit insurance from the cross-country deposit insurance database in Demirgüç-Kunt et al. (2005). The first two columns in Table 4 report quantitatively and qualitatively unaltered results for tax effects, bank-specific and macroeconomic variables. The dummy for privately funded deposit insurance enters the regression with an insignificant coefficient, implying little evidence of regulatory arbitrage of deposit insurance premium. In sum, the results of tax effects are robust even when we take into account the potential impacts of deposit insurance systems on securitization.

To assess the effect of different regulation and characters of the issuing entity, bank types are included in regressions in columns 3 and 4. We leave commercial banks as the reference group. The inclusion of bank type dummies does not affect the tax effect. Most non-commercial banks are not significantly different from commercial banks, except bank holding companies, which are less active in securitization.

In the last column, we test whether corporate income taxes increase the amount of securitization by an ordinary least square regression at the securitizing bank-year observations only. The model predicts that CIT reduces the variable cost of securitization, hence predicting more ABS issuance from the funding constrained banks in higher tax environments. Regression output in column 5 suggests that funding constrained banks are inclined to securitize

more assets in response to high tax rates. The negative and significant coefficient of bank size suggests that the fixed cost of securitization is no longer a main consideration when determining the amount of ABS issuance, although it is a crucial factor in deciding whether to securitize or not. Furthermore, we have a positive effect of stock market on securitization.

In the above regressions, we reduce the effect of possibly spurious outliers by winsorizing the data of bank-specific variables at the 5 percent level. However, our analyses are not constrained by the specific winsorizing level. When relaxing the winsorizing level to 1 percent, the results remain substantially unchanged (unreported). Additionally, our results are robust to alternative proxies for bank level controls, for example, capital adequacy ratio, return on assets and the ratio of non-performing loans to gross loans (unreported).

5.3 Discussions

Our empirical studies show evidence of significant tax effects in the OECD large bank sample. However, it is interesting that the tax effects vanish when we look at OECD small banks only. This is incompatible with Pennacchi et al. (2013) who find evidence of tax effects on mortgage sales of U.S. small banks that operate within a state or MSA[15].

Though the mechanism of tax incentives is uniform across small and large banks, why cannot tax effects be identified in our small bank sample? The primary cause is the difference between loan sales markets in U.S. and ABS markets in OECD countries. U.S. has an integrated and highly developed loan sales markets that even small banks have access to, reflected by the fact that 35.4 percent of bank year observations in Pennacchi et al.'s sample report mortgage sales. ABS markets, however, are dominated by leading (usually large) banks. Small banks are less active or less involved, due to large fixed costs or lack of reputation and expertise. In that case, tax effects might be too weak to be identified in presence of excess zeros in dependent variables. By contrast, in a reduced sample of large banks only, corporate income taxation turns out to be an indispensable factor in their securitization decisions. This is of policy relevance because regulatory authorities are more concerned with securitization behavior of large banks which contribute to systemic risk and financial fragility.

[15] In our sample, the mean and median of total assets are 13.6 billion USD and 1,065 million USD, greater than 727 million USD and 169 million USD in Pennacchi et al. (forthcoming), where total assets are winsorized at the 1 percent level.

6 Concluding Remarks

"The evidence strongly suggests that without the excess demand from securitizers, subprime mortgage origination (undeniably the original source of crisis) would have been far smaller and defaults accordingly far fewer" (Greenspan's testimony to the House Committee on Oversight and Government Reform, 2008). In this sense, a clear understanding of the motives behind banks' surging supply of asset securitization is crucial. The current debate on securitization and crisis has resulted in fruitful discussions about regulating banks. For instance, BIS (2011) propose new measures, such as revised capital requirements and liquidity coverage ratios, to improve bank supervision. However, insufficient attention has been paid to tax systems. Besides, the debate on the role of taxation in the crisis has been restricted to excess leverages and distorted investments towards home ownership by certain income tax rules in some countries that fueled the housing bubbles (Keen, 2011; Shaviro, 2011).

Along with Pennacchi et al. (2013), we provide evidence of tax distorting effects on securitization using a sample of OECD banks over the period from 1999 to 2006. Consistent with the theoretical predictions, we find that banks with substantial loan origination capacities but little deposit market power are more likely to securitize and that they tend to securitize more assets under a higher CIT regime. This tax distorting effect is economically and statistically significant in all specifications. By contrast, corporate income taxation does not affect securitization at funding unconstrained banks. Our results are robust when controlling for deposit insurance systems, bank type dummies, excluding U.S. banks and using different criteria for funding constraints.

Our results have direct policy implications. Since the tax arbitrage has already contributed to excessive growth of securitization, we may need to address the tax distortions in current corporate income tax systems. In addition, the proposal of levying new taxes on banks may intensify distortions and therefore seems inappropriate. In 2009, Liberal Democrats proposed an extra tax of 10 percent on bank profits, in order to pay off UK's public deficit. Moreover, the Financial Activities Tax (FAT), which is levied on the sum of bank profits as one of the three options laid out in the International Monetary Fund interim report for the G20 in 2010 in response to the recent financial crisis, was expected to discourage undesirable risk taking and to raise additional revenues to pay for bailouts (IMF, 2010). However, in our point of view, these new taxes on banks could further distort banks' incentive to engage in

securitization and generate adverse effects on banks and securitization markets. In particular, to lower financing cost and to satisfy funding demand, banks are inclined to securitize more assets than the optimal amount, contributing to excessive securitization that threatens the safety and soundness of banking[16]. The overall costs of banking failures might outweigh the benefits from raising additional taxes (Chiorazzo and Milani, 2011). Finally, as Keen (2011) points out, one possible solution is to introduce an Allowance for Corporate Equity (ACE) system that allows a deduction for return on equity as well. This tax treatment might not only contain excess leverage, but also alleviate the tax disadvantage of on-balance sheet financing for funding constrained banks and therefore prevent their excessive securitization and risk taking.

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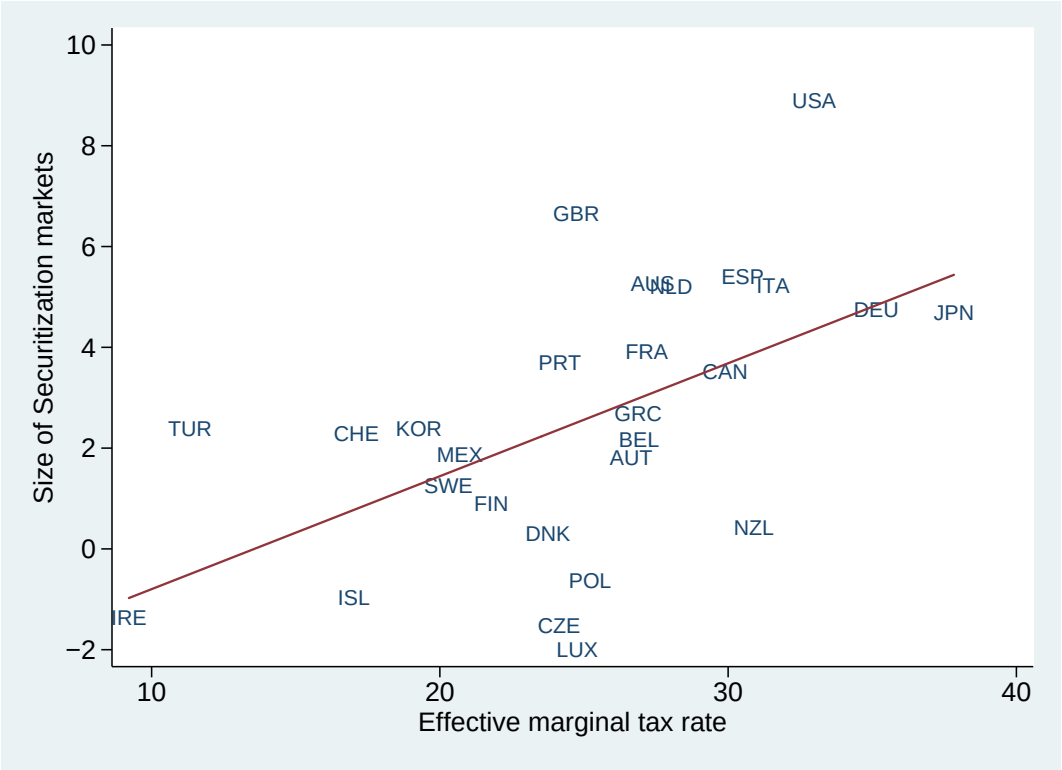
[16]Decreased incentives for monitoring and excessive securitization contributed to the increase of systemic risk and eventually the subprime crisis. Nijskens and Wagner (2011) find evidence that banks issuing CDS (credit default swaps) and CLOs (collateralized loan obligations) pose greater systemic risk.

Figure 1: The size of securitization markets and effective corporate income tax rates



Notes: We use the natural logarithm of aggregate ABS issuance in billion USD of each country as the measure of its size of securitization market. In addition, we adopt the average of effective marginal tax rates of CIT of each country. Sources: The ABS Alert database, the OECD tax database and Devereux and Griffith (2003).

Table 1: Descriptive Statistics

Full Sample	N	5%	95%	Median	Mean	Std. Dev.
SecuAsset	24,155	0.00	0.00	0.0	0.21	2.69
SecuLoan	24,155	0.00	0.00	0.00	0.39	9.30
CIT	24,155	23.52	33.23	32.99	31.83	3.98
Itop25	24,155	0.00	1.00	0.00	0.07	0.25
Equity/TA	24,155	4.18	14.93	8.45	8.74	2.81
ROE	24,155	1.54	23.76	11.69	11.80	5.97
LLR/Gross loans	24,155	0.39	4.15	1.29	1.53	0.91
Size	24,155	5.60	10.87	6.72	7.32	1.58
GDP per capita growth	24,155	0.10	3.61	1.69	1.65	1.10
Stock	24,155	44.07	283.77	170.99	181.81	76.24
Population growth	24,155	0.06	1.11	0.93	0.84	0.28
Securitizing bank-year obs.	N	5%	95%	Median	Mean	Std. Dev.
SecuAsset	704	0.10	26.14	2.31	7.07	14.15
SecuLoan	704	0.17	42.17	4.00	13.40	52.88
CIT	704	17.31	33.23	31.02	29.25	5.48
Itop25	704	0.00	1.00	0.00	0.19	0.39
Equity/TA	704	3.25	14.11	6.47	7.01	3.06
ROE	704	0.60	23.76	13.50	13.37	6.48
LLR/Gross loans	704	0.37	4.18	1.72	1.97	1.18
Size	704	8.04	10.87	10.87	10.17	1.02
GDP per capita growth	704	-0.14	4.09	1.81	1.92	1.45
Stock	704	38.23	283.77	124.24	131.47	78.85
Population growth	704	0.06	1.64	0.92	0.83	0.48
Non-securitizing bank-year obs.	N	5%	95%	Median	Mean	Std. Dev.
SecuAsset	23,451	0.00	0.00	0.00	0.00	0.00
SecuLoan	23,451	0.00	0.00	0.00	0.00	0.00
CIT	23,451	23.56	33.23	32.99	31.91	3.90
Itop25	23,451	0.00	1.00	0.00	0.07	0.25
Equity/TA	23,451	4.28	14.94	8.49	8.79	2.78
ROE	23,451	1.58	23.76	11.65	11.75	5.95
LLR/Gross loans	23,451	0.39	4.09	1.28	1.51	0.90
Size	23,451	5.58	10.60	6.67	7.24	1.52
GDP per capita growth	23,451	0.10	3.37	1.69	1.64	1.29
Stock	23,451	44.07	283.77	170.99	183.32	75.65
Population growth	23,451	0.08	1.11	0.93	0.84	0.28

Notes: Bank-specific covariates, such as loan growth rates, deposit interest expenses, the ratio of equity to total assets, return on equity, the ratio of loan loss reserves to gross loans, and bank size are winsorized at the 5 percent level. All variables are expressed in percentage, except Itop25 (dummy) and size (logarithm).

Table 2: Baseline Regression

	SecuAsset		Lagged Dep. Var.		Constrained		Unconstrained	
	Coeff	ME	Coeff	ME	Coeff	ME	Coeff	ME
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged SecuAsset			1.131***	0.092				
			(0.085)					
$CIT \times Itop25$	0.834***	0.071	0.489***	0.040	1.087**	0.141		
	(0.275)		(0.174)		(0.493)			
$CIT \times (1 - Itop25)$	0.057	0.005	0.071	0.006			0.061	0.005
	(0.189)		(0.115)				(0.167)	
Itop25	-13.629*	-1.022	-6.793	-0.504				
	(7.282)		(4.208)					
Equity/TA	0.372	0.032	-0.035	-0.003	1.010	0.131	0.271	0.022
	(0.353)		(0.196)		(0.845)		(0.295)	
ROE	0.415***	0.035	0.221**	0.018	0.746**	0.097	0.347**	0.028
	(0.144)		(0.091)		(0.359)		(0.138)	
LLR/Gross Loans	-0.109	-0.009	-0.010	-0.001	-0.575	-0.074	0.027	0.002
	(0.850)		(0.477)		(2.202)		(0.734)	
Size	10.008***	0.848	6.875***	0.557	9.521***	1.232	9.274***	0.742
	(1.296)		(0.865)		(2.032)		(1.296)	
GDP per capita Growth	0.199	0.017	0.231	0.019	0.771	0.100	-0.077	-0.006
	(0.500)		(0.334)		(1.102)		(0.576)	
Stock	-0.042***	-0.004	-0.034***	-0.003	-0.067**	-0.009	-0.033**	-0.003
	(0.015)		(0.010)		(0.031)		(0.013)	
Population Growth	9.777***	0.828	6.547***	0.531	3.080	0.399	10.208***	0.817
	(2.754)		(1.664)		(5.684)		(2.546)	
# Observations	24,155		24,155		1,662		22,493	
# Groups	4,566		4,566		1,104		4,520	
Year fixed effects	Yes		Yes		Yes		Yes	
Bank clustered St. Errors	Yes		Yes		Yes		Yes	
Pseudo R^2	0.179		0.253		0.087		0.194	

Notes: The dependent variable is the ratio of securitization amount to bank total assets. Standard errors are adjusted for clustering at the bank level and reported in parentheses below coefficients. Coefficients of year dummies are not reported. 'Coeff' refers to the estimated coefficients; 'ME' refers to the estimated marginal effects at variable means. ***, ** and * denote significance at 1, 5 and 10 percent level, respectively.

Table 3: Robustness Checks

	SecuLoan		Non-U.S.		Top35	
	Coeff	ME	Coeff	ME	Coeff	ME
	(1)	(2)	(3)	(4)	(5)	(6)
$CIT \times Itop25$	2.023**	0.170	0.662***	0.092		
	(0.813)		(0.148)			
$CIT \times (1 - Itop25)$	0.118	0.010	0.160	0.022		
	(0.542)		(0.111)			
Itop25	-32.756	-2.501	-7.747*	-0.930		
	(20.542)		(4.500)			
$CIT \times Itop35$					0.618**	0.053
					(0.265)	
$CIT \times (1 - Itop35)$					0.054	0.005
					(0.177)	
Itop35					-9.716*	-0.765
					(5.427)	
Equity/TA	0.918	0.077	0.212	0.030	0.357	0.030
	(1.105)		(0.257)		(0.357)	
ROE	0.893**	0.075	0.115	0.016	0.411***	0.035
	(0.366)		(0.088)		(0.147)	
LLR/Gross Loans	0.295	0.025	-1.061**	-0.148	-0.166	-0.014
	(2.592)		(0.440)		(0.860)	
Size	30.786***	2.587	3.474***	0.484	10.060***	0.855
	(8.246)		(0.463)		(1.297)	
GDP per capita Growth	0.864	0.073	0.312	0.043	0.175	0.015
	(1.512)		(0.325)		(0.496)	
Stock	-0.115**	-0.010	0.009	0.001	-0.042***	-0.004
	(0.048)		(0.010)		(0.015)	
Population Growth	29.723***	2.498	6.380***	0.890	9.813***	0.834
	(10.990)		(1.317)		(2.730)	
# Observations	24,155		5,570		24,155	
# Groups	4,566		1,018		4,566	
Year fixed effects	Yes		Yes		Yes	
Bank clustered St. Errors	Yes		Yes		Yes	
Pseudo R^2	0.149		0.086		0.179	

Notes: Dependent variables are the ratio of securitization amount to bank gross loans in regression 1 and the ratio of securitization amount to bank total assets in regression 2 and 3, respectively. Standard errors are adjusted for clustering at the bank level and reported in parentheses below coefficients. Coefficients of year dummies are not reported. 'Coeff' refers to the estimated coefficients; 'ME' refers to the estimated marginal effects at variable means. ***, ** and * denote significance at 1, 5 and 10 percent level, respectively.

Table 4: Robustness Checks

	DI		Bank Type		Securitizing Banks
	Coeff	ME	Coeff	ME	Coeff
	(1)	(2)	(3)	(4)	(5)
$CIT \times Itop25$	0.907***	0.077	0.867***	0.073	0.697**
	(0.275)		(0.275)		(0.345)
$CIT \times (1 - Itop25)$	0.160	0.014	0.105	0.009	0.045
	(0.191)		(0.181)		(0.123)
Itop25	-12.614*	-0.954	-13.439*	-1.002	-15.434**
	(7.402)		(6.965)		(7.092)
Equity/TA	0.433	0.037	0.420	0.035	0.355
	(0.371)		(0.357)		(0.226)
ROE	0.423***	0.036	0.432***	0.036	0.337**
	(0.146)		(0.147)		(0.154)
LLR/Gross Loans	-0.140	-0.012	-0.072	-0.006	-0.143
	(0.847)		(0.879)		(0.694)
Size	9.976***	0.845	10.134***	0.853	-6.107***
	(1.291)		(1.331)		(1.357)
GDP per capita Growth	0.267	0.023	0.286	0.024	0.264
	(0.521)		(0.480)		(0.314)
Stock	-0.044***	-0.004	-0.035**	-0.003	0.028**
	(0.015)		(0.014)		(0.012)
Population Growth	10.263***	0.869	10.173***	0.856	-1.190
	(2.661)		(2.749)		(0.889)
Privately Funded DI	2.490	0.216			
	(2.611)				
BHC			-3.996*	-0.330	
			(2.326)		
Cooperative Banks			1.070	0.091	
			(3.187)		
Finance Companies			3.964	0.349	
			(3.187)		
Investment Banks			2.289	0.198	
			(3.187)		
Mortgage Banks			1.942	0.167	
			(3.187)		
Savings Banks			-1.492	-0.124	
			(2.542)		
# Observations	24,155		24,155		704
# Groups	4,566		4,566		240
Year fixed effects	Yes		Yes		Yes
Bank clustered St. Errors	Yes		Yes		Yes
Pseudo R^2	0.180		0.181		n/a
R-squared	n/a		n/a		0.329

Notes: The dependent variable is the ratio of securitization amount to bank assets. We ran Tobit regressions for first and second models, and Ordinary Least Square regression for the last model. Standard errors are adjusted for clustering at the bank level and reported in parentheses below coefficients. Coefficients of year dummies are not reported. 'Coeff' refers to the estimated coefficients; 'ME' refers to the estimated marginal effects at variable means. 'Commercial Banks' act as the reference group in the second regression. ***, ** and * denote significance at 1, 5 and 10 percent level, respectively.

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APPENDIX

Table A1: Country List

Australia	Austria	Belgium
Canada	Czech Republic	Denmark
Finland	France	Germany
Greece	Hungary	Iceland
Ireland	Italy	Japan
Luxembourg	Mexico	Netherlands
New Zealand	Norway	Poland
Portugal	South Korea	Spain
Sweden	Switzerland	Turkey
U.K.	U.S.	

Table A2: Data Description and Sources

Variables	Descriptions	Sources
SecuAsset	The dependent variable for Tobit regressions, securitization asset ratio, which is a ratio of the total amount of ABS issuance to bank total assets.	ABS Alert database
SecuLoan	The dependent variable for Tobit regressions in robustness checks, securitization loan ratio, which is a ratio of the total amount of ABS issuance to bank gross loans.	ABS Alert database
CIT	Effective marginal tax rates of Corporate Income taxes. The EMTR is the percentage of change in a bank's tax obligation as income rises.	The OECD tax database and Devereux and Griffith (2003)
I_{top25}	Funding constraint dummy that takes value of one if the bank has loan growth rates greater than the top 25 percent of all bank year observations and deposit interest expenses greater than the top 25 percent of all bank year observations, and zero otherwise. Loan growth rates and deposit interest expenses refer to growth rates of gross loans and total interest expenses on deposits, respectively. Lagged by one period.	Bankscope
I_{top35}	Funding constraint dummy that takes value of one if the bank has loan growth rate greater than the top 35 of all bank year observations and deposit interest expenses greater than the top 35 of all bank year observations, and zero otherwise. Lagged by one period.	Bankscope
Equity/TA	Ratio of equity to total assets (data4009). Lagged by one period.	Bankscope
ROE	Return on equity (data4025). Lagged by one period.	Bankscope

Table A3: Data Description and Sources (Continued)

Variables	Descriptions	Sources
LLR/Gross Loans	Ratio of Loan loss reserves to gross loans (data4001). The fraction of the total loan portfolio that has been reserved for potential loss but not has been charged off. Lagged by one period.	Bankscope
Size	Logarithm of bank total assets. We adjust for incomparable units, currency denomination and inflation. Assets for all banks in all years are denoted in term of millions USD in 2005. Lagged by one period.	Bankscope and WDI, 2011
GDP per capita Growth	Annual growth rate of real GDP per capita.	World Development Indicators (WDI, 2011)
Stock	The volume of stock traded as a percentage of GDP.	World Development Indicators (WDI, 2011)
Population Growth	Annual growth rate of population.	World Development Indicators (WDI, 2011)
Privately Funded DI	Dummy variable indicating a country with a privately-funded deposit insurance system. Notably, Australia and New Zealand take the value of zero because of their implicit deposit insurance systems.	Demirgüç-Kunt et al. (2005) cross-country deposit insurance database
BHC	Dummy variable indicating a bank holding company.	Bankscope
Cooperative Banks	Dummy variable indicating a cooperative bank.	Bankscope
Finance Companies	Dummy variable indicating a finance company.	Bankscope
Investment Banks	Dummy variable indicating an investment bank.	Bankscope
Mortgage Banks	Dummy variable indicating a real estate and mortgage bank.	Bankscope
Savings Banks	Dummy variable indicating a savings bank.	Bankscope