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Are Covered Bonds a Substitute for Mortgage-Backed Securities?

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WP 2011-14

ARE COVERED BONDS A SUBSTITUTE
FOR MORTGAGE-BACKED SECURITIES?

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November 2011

Abstract: Covered bonds and mortgage-backed securities both allow mortgages to be financed with duration-matched bonds. Given the problems in the MBS market during the financial crisis, some suggest that covered bonds might be a substitute for MBS. We examine the use of covered bonds and MBS in the U.S. and Europe, finding that the two are used for different purposes. Covered bonds are used more to increase liquidity than are MBS. MBS are more often used in ways consistent with exploiting some kinds of agency problems.

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<center>**Are Covered Bonds a Substitute for Mortgage-backed Securities?**</center>

1. Motivation and main goal

The recent financial crisis has a number of causes, but many lay much of the blame on the movement of financing away from traditional bank lending to what is known as the shadow banking system (see, e.g., Adrian and Shin, 2009; Brunnermeier, 2009; Gorton and Metrick, 2009). The shadow banking system includes many things, but key among them are the mechanisms by which loans (and loan-like debt instruments) are financed by other than the originating bank. Securitization – the sale of bonds backed by the payments on a group of loans – plays a major role in the shadow banking system. The ability to easily securitize loans in the period before the recent crisis abetted the rapid increase in the issuance of the loans that were used as collateral for securitizations. However, the financial crisis exposed a lot of problems with the securitization process, especially for residential mortgages, the largest asset class used to back securitizations, leading to a rapid reduction in the issuance of new residential mortgage-backed securities (hereafter MBS[1]; see Figure 1). In the aftermath, there has been a search for alternatives to securitization (see Banking Supervision Committee of the European Central Bank, 2011).

One alternative to securitization for residential mortgages is covered bonds (CB), which have been used in some European countries for over a century. In the early stages of the crisis, the critiques on the shortcomings and complexities of the securitization process highlighted the robustness of traditional covered bond products (such as German Pfandbriefe). In this paper, we compare MBS to CB and we examine why banks issued each of these types of bonds. This allows us to address the question of whether covered bonds can be a substitute for MBS.

At a very basic level, MBS and CB work similarly. A bank originates a group of mortgages that are then put into a 'ring-fenced' pool.[2] While the characteristics of the ring fencing and the pool can differ across type of securities and across countries, the common characteristics are that the mortgages serve as specific collateral for the bonds, be they MBS or CB. This means that the mortgages are, in effect, financed by the bondholders giving banks access to a broader set of investors than traditionally-financed mortgages. The traditional model for mortgage financing is that the bank originating the loan would keep it on its balance sheet until the mortgage was repaid. The loan would be financed out of general liabilities which are primarily composed of bank

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[1] Securitizations backed by residential mortgages are sometimes abbreviated RMBS to differentiate them from securitizations backed by commercial mortgages (CMBS).

[2] As discussed below, the mortgages that go into a MBS or CB pool need not be originated by a bank, nor do all the mortgages in a pool have to be originated by the company issuing the MBS or CB.

deposits, plus capital. MBS and CB both allow banks to access bond investors as well as bank depositors to fund mortgages.

The similarities between MBS and CB suggest that the covered bond market might serve as an alternative to the securitization market for financing mortgages. To see whether banks issued CB for the same reasons that they issued MBS, we examine banks in Europe and the U.S. There are a number of possible reasons why a bank uses mortgages to back MBS or CB. One possibility that a number of studies have focused on is the originate-to-distribute (OTD) model, where banks originate loans only to collect the fee income from selling them (see, e.g., Rosen, 2011).[3] Alternatively, a bank may want to bring forward the profit from mortgages because it needs short-run liquidity. Selling loans into an MBS pool or selling CB accomplishes this. Related to this, a bank may also need to raise capital to satisfy regulatory (or market) requirements. Finally, banks may use MBS or CB for risk management (as Packer, et. al, 2007, suggest). We test whether banks systematically use MBS or CB for these reasons.

Bear in mind that banks might not view MBS and CB as substitutes since there are some real and some regulatory differences between issuing MBS and issuing CB. As we describe in the next section, the transfer of risk from banks to bondholders is more complete with MBS than with CB. In addition, regulatory capital relief can also be larger when loans are sold to a pool backing a MBS than when they are placed into a pool backing CB. While these factors seem less important than the similarities between MBS and CB, we find that banks use MBS and CB for different reasons and that these reasons are related to differences between MBS and CB.

We find CB issuance, but not MBS issuance, to be consistent with bank liquidity needs. Our results suggest that low liquidity banks are more likely to issue CB and that CB issuance leads to increases in liquidity. As evidence of this, we find that a bank is more likely to issue CB when it has relatively low return and a high loan-to-deposits ratio. After the issuance of CB, return increases and the loan-to-deposit ratio adjusted for CB issue decreases.

Our results indicate that MBS are more likely to be issued when banks are reducing risk, but there is little evidence that they are issued for liquidity reasons. There is no significant relationship between MBS issuance and changes in return. In addition, while banks with high loan-to-deposit ratios are more likely to issue MBS, the issuance of MBS does not predict lower loan-to-deposit ratios in the future. Also, MBS issuance has no effect on loan growth or capital ratios. But, consistent with risk management, banks are more likely to issue MBS when their loan provisions are high – indicating high risk – and having issued MBS is associated with lower loan provisions in the

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[3] There is evidence that using the OTD model can affect the risk of loans a bank originates (see Keys, et al., 2010; Purnandanam, 2011), something we do not explore here.

future. This is consistent with MBS, but not CB, allowing banks to transfer significant risk to bondholders.

We also examine whether agency problems can explain why banks issue MBS and CB, and find evidence that MBS issue is associated with these problems. For example, there is evidence of herding behavior for MBS but not for CB. Faster growth in MBS issuance in a country was positively associated future more MBS issuance by banks in that country but faster CB growth in a country had no significant impact on future CB issuance in that country.

During the runup to the recent financial crisis, some claim that banks took excessive risks. We find that, even after controlling for size, issuing MBS during the final years before the crisis (2006-2007) made a bank more likely to have been bailed out during the crisis, something not true for banks that had issued CB during those years, which suggest that banks involved in MBS were among those that took excessive risk.

The rest of the paper is as follows. Section 2 gives background on MBS and CB. Then section 3 sets out the empirical model and describes the data we use. The main analysis is in section 4. Section 5 examines whether banks that issued MBS or CB were more vulnerable during the financial crisis. Concluding comments are in section 6.

2. A comparison of MBS and CB

This section reviews securitization and the covered bond process. After carefully examining MBS and CB – which we refer to collectively as *secondary mortgage securities* or SMS – we show ways in which they are similar and different. This allows us to develop hypotheses about when they are used. As part of this, we present some background data.

2.1 Data

To examine the decision to issue SMS, we use data from six countries – France, Germany, Italy, Spain, the U.K., and the U.S. – over the period starting in 2003 and ending in 2007. At least some banks in these countries issued either CB or MBS, but our sample includes all banks with at least one billion dollars of total assets at the beginning of our sample period. We get balance sheet and income statement data from Bankscope and data on SMS issuance from Dealogic. House price indexes have been obtained from Eurostat for the European countries and from the Federal Housing Finance Agency in the U.S. To remove potential outliers, we trim our data at the 1st and 99th percentile of all variables used in the empirical analysis.[4]

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[4] All the empirical tests in this paper were re-run with winsorized data as opposed to the trimming of the 1st and 99th percentiles. The results do not suffer any significant changes.

The primary sample includes 711 banks, of which 121 issue CB at least once and 107 issue MBS at least once. Table 1 presents summary statistics for the sample. Panel A has data on the full sample, Panel B has data for banks that issue MBS, and Panel C has data for banks that issue CB. In Panels B and C, the data are for the year before the year in which the SMS was issued (a bank is in the data once for each year that it issues CB or MBS).

2.2 MBS

MBS are bonds that are collateralized by a group of mortgages. The process that produces MBS starts with the origination of mortgages. The typical path starts when a bank or other entity originates (makes) a mortgage. The mortgage may then be sold, eventually ending up with the firm that puts together the securitization (Figure 2). We focus on banks that put together securitizations, but it is also done by government-sponsored organizations (Fannie Mae and Freddie Mac in the U.S.). The securitizing organization sells the mortgages to a shell corporation it sets up. The shell corporation is known as a special purpose entity (SPE) or special purpose vehicle (see Figure 2).[5] The SPE issues bonds and uses the revenues from selling the bonds to pay for the mortgages it has purchased.[6] The SPE uses the principal and interest paid on the mortgages to repay the bondholders.[7]

There are several things about the securitization process that are relevant for this paper. First, the originating bank may or may not share the same corporate parent as the firm setting up the SPE (in Figure 2, compare the first example to the second example). Most banks originate mortgages, but few banks securitize them (only 15.4% of the banks in our sample ever do a mortgage securitization, and the banks in our sample are much larger than the average bank).[8] In part, this is because there are significant fixed costs in setting up an SPE and underwriting the bonds issued by the SPE. But, whatever the reason, it means that banks can sell loans as part of the securitization process without ever putting together a securitization and that securitizations can contain mortgages originated by banks other than the securitizing bank.[9] While we use the value of bonds sold by a bank as our measure of securitization, this both overstates and understates the impact of securitization on the bank's mortgage portfolio. To the extent that securitization contains mortgages originated by other firms, it overstates the impact

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[5] The SPE gives bondholders legal protections if the issuing bank becomes insolvent.
[6] The SPE also can get some initially equity funding.
[7] Any funds left over after these payments (and expenses) go to the equity owner of the SPE, typically the firm that sets it up.
[8] Rosen (2011) finds that of banks in the U.S. with traded stock (most of which are among the top 10% of U.S. banks in size), over 80% originate and sell mortgages as part of the securitization process, but less than 3% actually put together securitizations.
[9] This is true in Spain and the U.S.

while to the extent that the bank sells mortgages to other parties in addition to putting together a securitization, it understates the impact.[10]

A second feature of securitization that may be important is the accounting treatment of assets held in the SPE. The SPE is set up as a separate corporate entity to give its bondholders legal protection if the issuing bank becomes insolvent. This legal separateness may mean that regulatory accounting standards treat the mortgages as sold and not owned by the bank. This means that regulatory capital requirements for the bank are not applied to the mortgages in the SPE. In certain countries, such as the U.S., if the loans from a securitization were put in a SPE, the bank did not have to hold capital against them unless it had an ownership position in the SPE (or purchased bonds from it).[11] In other countries, such as Spain, any assets in an SPE were required to be consolidated on bank balance sheets. Thus, Spanish banks that securitized mortgages were required to hold capital against the loans in the SPE.

Panel B of Table 1 presents some balance sheet and income statement information for banks in our sample that issue MBS as of the year prior to the issue. On average, banks that issue MBS are more levered, which may contribute to why they have lower return on assets. MBS issuers also have lower ratios of loan provisions to total loans than other banks. In general, these differences are economically small. Banks that issue MBS also grow fast in the year prior to issue, something not surprising since they may be gathering loans to put into the MBS pool.

During 2003-2007, banks in four of the six countries in our sample did at least one mortgage securitization – in Germany, there was exactly one securitization (see Table 2). Securitization was most prevalent in the U.S., but was also not rare in Italy, Spain, and the U.K. The average size of a MBS issue was much larger in the U.S. than in European countries (average issue size was $1.7 billion in the US and $255 million in Europe). This may reflect that the issuing banks in the U.S. were much larger (average issuer size was $1.1 trillion in the US and $204 billion in Europe). The correlation between issuer size and bank size in our sample is 0.55.

The sample period ends right as the financial crisis was starting. This is in part because the crisis changed securitization markets. As Figure 1 shows, securitization grew rapidly in the period leading up to the financial crisis, but then securitization – at

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[10] An example of the latter would be if the bank sold its high quality (prime) mortgages to others (such as Fannie Mae and Freddie Mac for U.S. banks) and put together securitizations with its subprime mortgages.

[11] This has changed for some types of securitizations in the U.S. because the U.S. Financial Accounting Standards Board approved Financial Accounting Standards (FAS) 166 and 167, which took effect in late 2009. FAS 166 and FAS 167 meant that some types of securitizations, but not necessarily MBS, would have to be consolidated on a firm's balance sheet. The FDIC said that this would apply to regulatory capital, but delayed the implementation of the requirement.

least issuance by private firms – essentially stopped (privately-issued MBS issuance in the U.S. fell by 95% between 2006 and 2008).[12]

2.3 CB

Covered bonds have been around a lot longer than securitized bonds. The first mortgage securitization is thought to be in 1970 when banks and other lenders put together pools of home mortgages that were then guaranteed by the government agency known as Government National Mortgage Association (now also known as Ginnie Mae). The first covered bond, on the other hand, was issued in the 1700s to finance public works projects in Prussia. CB are still commonly used to finance public obligations in Europe. They are also used to finance residential mortgages, the focus of this paper.

Like MBS, CB are debt securities that are backed by a pool of mortgages. Except in the U.K. (see below), the pool of mortgages remains on the issuing bank's balance sheet. In its simplest form, a bank originates a mortgage, designates the mortgage as part of a pool (known as ring-fencing), then issues bonds collateralized by the pool (see Figure 4). The face value of mortgages in the pool is required to be at least as large as the face value of the CB, although the value of mortgages almost always exceeds the value of the bonds (overcollateralization). Thus, while the interest and principal on a covered bond may be paid out of the issuing bank's general funds, the ring-fenced pool is there to repay the bondholders if the issuer becomes insolvent.[13] One other important feature of CB is that if a mortgage in the CB pool defaults or is repaid early, the bank replaces the loan with a new mortgage. This keeps the size of the pool predictable.[14]

As with MBS, there are some differences in the structure and regulation of covered bonds across countries. As one example of this, in the United Kingdom, banks issue what are known as structured covered bonds. The key difference between structured CB and their more traditional cousins is that the issuer of structured CB is a limited liability partnership (analogous to an SPE). The partnership purchases the mortgages from the issuer and guarantees the bonds. This serves as a different way of ring-fencing the mortgages.

While 121 banks issued covered bond issues during our sample period, usage was not uniform across banks in different countries. CB were common in three of the six countries in our sample during 2003-2007 although there was at least one CB issue in all six countries (see Table 2). As noted above, covered bonds originated in Prussia, and they are still most common in Germany. Spain and the U.K. also have active CB markets, which is interesting because banks in those countries are the most active

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[12] Source: Inside Mortgage Finance.

[13] If the pool is not sufficient to repay bondholders, the bondholders become general creditors of the bank.

[14] Since the mortgages are naturally amortizing, the size of the pool can fall over time.

securitizers after the U.S. Some of the difference in CB markets may be driven by regulation. For example, in the U.S., the FDIC has not assured bondholders that CB have priority over the FDIC in case of bankruptcy. This means that the mortgages that are intended as collateral for CB may be claimed by the FDIC when a bank fails, increasing the risk for covered bondholders.

The average size of a covered bond issue is $576 million, about half as large as the average MBS issue. In Spain and the U.K., which have both CB and MBS, CB issues tend to be larger than MBS issues.

The volume of covered bonds issued was roughly flat during our sample period (see Figure 3).

2.4 Comparing CB and MBS

CB and MBS are similar in many of their basic economic functions, yet they have some potentially important differences. They both offer many possible benefits for loan originators.[15] They can increase liquidity for banks by allowing them to access a broader class of investors. As part of this, CB and MBS can make it easier for some lenders to specialize in particular types of lending such as mortgage loans. These can lead to more efficient loan provision. As described above, they can also allow regulatory arbitrage.[16]

The transfer of mortgages to an SPE in a MBS issue means that the issuing bank no longer bears the risk of the loans. This is in contrast to CB where, because the mortgage pool is constantly adjusted to maintain the pool size, the issuing bank bears the credit risk of the mortgages.[17] Possibly because of this, more information about the contents of mortgage pools is available for MBS investors than for CB investors.[18]

Since the pool of mortgages backing a MBS issue is static, this allows issuers to create a broader set of bonds that are backed by the pool. Specifically, the bonds in a MBS issue are often tranched. The tranching allows bonds to differ in the timing and security of repayment.

MBS and CB also differ in the degree to which moral hazard can be a problem. One potential issue for both kinds of bondholders is that the issuing bank may know more

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[15] For a more extensive discussion of why assets such as mortgages are securitized, see Elul (2005) and Kothari (2006).

[16] Securitization can also allow tax arbitrage (Kohler, 1998).

[17] The holders of covered bonds bear the residual risk that the issuing bank fails and the mortgage pool is not sufficient to repay the bonds. It is important to note that no covered bond failed, at least within the sample and the period that we have considered in this study.

[18] Rating agencies monitor asset quality for both types of pools. Also, there is no evidence that most MBS investors carefully analyzed detailed pool information before the financial crisis (see, for example, http://stonestreetadvisors.com/2011/02/15/john-paulsons-interview-with-the-financial-crisis-inquiry-commission-the-signs-were-there/).

about the credit risk of mortgage borrowers than investors do. During our sample period, it would have been difficult and expensive for investors to examine the credit risk of each mortgage in a pool. This gave banks an incentive to have the mortgages in a pool be riskier than investors thought. Many claim that this is what happened with subprime MBS in the U.S. during our sample period (e.g., Keys, et. al, 2010). Going forward, although not in our sample period, there is likely to be more attention paid to structuring MBS to reduce moral hazard.[19] As an alternative, banks can choose to issue CB where this moral hazard is limited because if a mortgage defaults, the bank must transfer a replacement loan from its general portfolio to the mortgage pool, thus restricting the potential gains from fooling investors.

3. Empirical model

As discussed in the last section, the major economic benefits for CB and MBS are similar, however there are some legal, regulatory, and structural features that may lead a bank to prefer one type of SMS over the other. The decision to issue a SMS also can be influenced by how it fits into a bank's overall strategy and situation. For some banks, SMS are part of a line of business. A bank may originate mortgages with the sole intent of financing those mortgages using a SMS. There is an expanding literature on the use of the originate-to-distribute (OTD) model as part of the securitization process (e.g., Purnanandam, 2009; Rosen, 2010a), but the same model can also be used when the end product is a covered bond. Alternatively, banks may use SMS for occasional balance sheet management. For example, a bank with sudden liquidity needs may issue a SMS to bring forward future profits on loans it owns. Still another possibility is that there may be agency reasons for issuing SMS. An example of this would be if banks were influenced by herd behavior (Scharfstein and Stein, 1999). The idea here is that a bank is more likely to issue SMS when other banks have recently done the same. The driving forces could be related to agency issues at the bank or among the purchasers of the SMS bonds. We explore which of these possibilities are consistent with the data on SMS issuance.

To investigate the reasons behind a SMS issue, we need to examine the factors that lead a bank to issue SMS and, then, how issuance affects the bank. The basic model for predicting issuance by bank i in year t is:

$$\text{SMS issue}_{i,t} = f(\text{bank characteristics}_{i,t-1}, \text{other controls}) \tag{1}$$

where the SMS issue can be either CB or MBS. Because banks in some countries can issue either type of bond, we use a multinomial logit framework to test (1). This explicitly assumes that banks are choosing among issuing CB, issuing MBS, or not

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[19] For example, the recent Dodd-Frank financial reform law in the U.S. will require securitizers to retain 5% of the credit risk in a MBS issue. This reduces the gain from putting bad mortgages into a pool.

issuing. Our results are robust to examining CB and MBS separately. To control for differences across countries, we include country dummies.

In addition to knowing which characteristics predict issuance, we also want to determine the effect of issuing SMS on banks. For this, we use the following:

$$\text{bank characteristic}_{i,t} = f(\text{CB issue dummy}_{i,t\&t-1}, \text{MBS issue dummy}_{i,t\&t-1}, \text{bank characteristics}_{i,t-2}, \text{other controls}) \tag{2}$$

where the dummies take the value 1 if bank i issues the appropriate SMS in year t or t-1 and where the bank characteristics are the same as those on the right-hand side of (1). We include bank fixed effects, so the coefficients on the SMS dummies indicate whether a particular characteristic is higher or lower after issuance relative to other times.

The bank characteristics included in the analysis are limited by data availability. The Bankscope data we use does not have widespread coverage of some balance sheet and income variables for many of the banks in the sample countries. The variables we use are intended to cover basic measures of profit and risk while also allowing us to include as large a sample of banks as possible. Profit is measured using return on assets, that is, income during divided by total assets at the end of the year (ROA; the results are robust to using the return on equity).

The first measure of risk we use is the loan-to-deposits ratio. Since loans are generally illiquid and deposits are generally liquid, higher values of this ratio suggest a less liquid, and therefore riskier, bank. But, this ratio has a problem when we want to look at the effect of CB issue on liquidity. The mortgages that back CB remain on a bank's balance sheet, thus inflating the bank's reported loans. From a liquidity perspective, these mortgages are different from other loans (including other mortgages) a bank has because they are matched to liabilities with a similar maturity profile.[20] For this reason, we create a CB-free loans-to-deposits ratio by subtracting the mortgages backing CB from total loans.[21] We use this adjusted loans-to-deposits ratio in the analysis below.

The capital-to-assets ratio (henceforth, the capital ratio) also is used measure to risk. Clearly, the smaller the capital buffer, the more likely insolvency is. One issue with the capital ratio is that regulators set minimum capital ratios for banks. We include a separate variable to indicate banks with low capital on the grounds that low-capital banks are likely to face more regulatory scrutiny. Since regulatory capital minimums are based on risk-based capital measures and we do not have these ratios, we define a low-capital bank as one with a capital ratio in the lowest 25% in a given year. The low-

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[20] There may be some minor liquidity issues because the mortgages in the CB pool have the risk of unexpected default and prepayment.

[21] Formally, the numerator of the adjusted loans-to-deposits ratio in year t is the total loans in year t minus the sum of all covered bonds issued in the years from 2003 to year t, inclusive.

capital variable is the interaction between the capital ratio and a zero-one dummy for whether a bank has low capital.

The loan-to-deposits ratio and the capital ratio do not separate banks by the riskiness of the assets they invest in beyond the notion that loans are often riskier than other bank assets. To further refine our estimate of bank risk, we use the ratio of loan loss provisions to total loans. Loan loss provisions are the capital that a bank sets aside to cover changes in future expected losses on loans the bank has made. It is, thus, an ex ante measure of the risk of a loan portfolio.[22] We also include loan growth in our analysis. Loan growth is the percentage change in loans from one year-end to the next year-end. More liquid banks should be able to make more loans, thereby growing faster.

We use these characteristics to capture whether banks are issuing SMS as a line of business or for balance sheet management. The basic model also allows us to shed some light on the possible agency reasons for issuance. Table 3 summarizes our hypotheses about how the regression results are related to the reasons for issuing SMS. If a bank is issuing SMS as a line of business, then we expect the primary impact of SMS issuance to be an increase in ROA. This would be reflected in a positive coefficient on the CB or MBS post-issue dummies in the ROA regression (equation (2)).

Banks could use SMS for different kinds of balance sheet management. First, SMS can be used to improve liquidity (by bringing forward future profits). We expect that this means that, all else equal, low-liquidity banks are more likely to use SMS. Support for this hypothesis would be if either a low ROA or a high loan-to-deposits ratio predicts SMS issuance. But, SMS are only valuable in this respect if they allow a bank to increase liquidity. So, we expect that low liquidity banks that issue SMS should see liquidity improve. A positive coefficient on the loan-to-deposits ratio in equation (1) and a negative coefficient on a SMS post-issue dummy in the adjusted loan-to-deposits ratio equation (2) regression are consistent with this. The question then arises as to whether the CB issue was responsible for the liquidity increase. If the unadjusted loan-to-deposit ratio increases after a CB issue when the adjusted loan-to-deposit ratio decreases, then the CB issue directly increased liquidity.

A second type of balance sheet management would be if banks use SMS to manage risk. If they do, then high values of the risk measures should predict SMS issue, and SMS issue should reduce risk. Table 3 gives the coefficients on the capital ratio, adjusted loan-to-deposit ratio, and provisions variables consistent with this hypothesis. Here, the inference must be somewhat indirect. We know whether the SMS issue occurred when a bank was reducing risk, but the data do not allow us to directly tie it to the bond issue. To examine whether the risk management is due to regulatory pressure,

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[22] As discussed later, the results are robust to using the ratio of chargeoffs to total loans, which is an ex post measure of bank risk.

we separately examine a capital ratio variable for low-capital banks. If the coefficient on this variable in equation (1) is negative and the coefficient on a SMS dummy in the low-capital regression using equation (2) is positive, then that suggests regulatory pressure may have played a role in the SMS issue.

There are a number of possible agency problems that could influence the decision to issue SMS. One that we can indirectly examine using the basic model is empire building. There is evidence that increasing the size of a bank increases CEO compensation even if profit does not rise (Bliss and Rosen, 2001; Hubbard and Palia, 1995). If the ability to SMS issuance leads to faster bank growth in the absence of increased profit, this would be consistent with bank CEOs increasing private benefits rather than shareholder utility (see Table 3).

The regression results also provide information about what the capital market requires before it purchases CB from a bank. Recall that the bank that issues CB is required to replace mortgages that have gone bad or been prepaid with new mortgages. In addition, if the bank becomes insolvent and the pool backing a CB is insufficient to cover the bonds, bondholders become a general creditor of the bank. For these reasons, the purchasers of CB are likely to care about the health of the issuing bank. If market participants are more likely to purchase CB from a low-risk bank, then banks with low risk should be more likely to issue CB and risk should not increase after the issue (see Table 3).

Finally, home prices went up significantly during our sample period (especially in Spain, the U.K., and the U.S.). This may have led banks to increase loans and to relax loan quality standards (Dell'Ariccia *et al.*, 2008). If banks are overenthusiastic, then home price increases should affect both the origination of mortgages that bank CB and MBS. But, price increases may also have made investing in SMS seem safer to investors (Rosen, 2010b). Issuing MBS (but not CB) allows banks to exploit overenthusiastic investors. To examine whether home prices affected SMS issuance, we include changes in home prices, measured at the national level, as a control.

4. Regression results

This section examines the relationship between SMS issuance and bank characteristics.

4.1 The impact of bank characteristics on the decision to issue SMS

The first step is to look at what determines whether and when a bank will issue a SMS. The results of estimating (1) using our sample over the period 2003-2007 are presented in Table 4A. We choose the case where banks do not issue SMS as our base. This means that the two other alternatives, issuing CB and issuing MBS, are compared to not issuing SMS.

The first column of Table 4A reports the coefficients for the comparison of CB to not issuing SMS. The coefficient on ROA of -2.025 is significantly different from zero. This means that banks with lower ROA in year t-1 are more likely to issue CB than not issue SMS in year t. To get a feel for the economic significance of this effect, for a bank with the mean values for all the other variables, increasing the ROA decreases the probability of issuing a CB by 3.50% per percentage increase in ROA (the marginal effect, as given in Table 4A). Given that one standard deviation in ROA is 30.3% of the mean ROA, this suggests that moderate increases in ROA can have a large impact on the probability of CB.[23]

The results for the first regression in Table 4A also show that banks with larger (adjusted) loan-to-deposits ratios, larger capital ratios, lower provision, and larger total assets are more likely to issue CB than not issue SMS. The largest economic impact in this group of variables comes from the assets variable, consistent with there being a substantial fixed cost to issue a covered bond, with the large banks able to spread the cost over a bigger pool of loans. But the impact of the loan-to-deposits ratio and the capital ratio are also large. Finally, there is no significant relationship between CB issuance and any of the low-capital variable, loan growth, or the home price index.

A comparison of issuing MBS to not issuing SMS is given in the second column of Table 4A. Banks with larger loan-to-deposits ratios, larger provisions, and larger total assets are more likely to issue MBS than not issue SMS. In addition, MBS are more common when home prices are higher.

We can also compare CB to MBS. The third column of Table 4A reports the p value for a test of whether the coefficients in the first column of the table are equal to those in the second column. Overall, we see significant differences in the effects bank characteristics have on the decisions to issue CB relative to MBS. For example, the p value for ROA is 0.001, meaning that the coefficient on ROA in the comparison of CB to not issuing SMS is significantly smaller than the coefficient on ROA in the comparison of MBS to not issuing SMS. However, these differences do not fit a simple pattern such as bank characteristics being more important for one type of SMS.

To fully test our predictions, we have to examine banks both before and after SMS issuance, but the results in Table 4A give an idea of which banks are issuing SMS. Banks with low liquidity are more likely to issue SMS, as the coefficients on ROA and the loan-to-deposits ratio are of the correct signs (although the coefficient on ROA in the MBS regression is not significant). Banks that issue CB are, by most measures, safer than average. They have larger capital buffers and lower provisions, although they also have a larger loans-to-deposit ratio. The banks that issue MBS, on the other hand, appear riskier than average. They have loans-to-deposits ratios and loan provisions that

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[23] There is a need to be careful when extrapolating from the marginal effect since it only holds exactly for a tiny change in ROA

are significantly above those of banks that do not issue SMS. Additionally, as noted above, it is clear that asset size is an important predictor of which banks issue SMS, something that we explore in the robustness checks that follow. Finally, it is worth noting that the house price index affects MBS issuance but not CB issuance, consistent with agency problems between banks and bond investors.

The results in Table 4A are robust to a number of changes. When the adjusted loan-to-deposit ratio is replaced by the balance sheet loans-to-deposits ratio (which includes the CB loan pool), the qualitative results are similar (see Table 4A). The loan ratio coefficients have the same signs no matter which ratio is used and the other coefficients are of about the same magnitudes across the two sets of regressions.

We also examine whether the estimated relationships may vary for banks that are particularly active issuers. To do this, we interact the independent variables in our baseline regression with dummies for whether a bank has issued CB or MBS in the last two-years. The results are shown in Table 4B. The results are completely in line with those of Table 4A and the only difference is that the estimated coefficients of the interaction variables are higher than those with no interaction suggesting that the characteristics that determine issuance of CB and MBS are more economically significant for more active issuers.

Given the institutional differences between the countries in the sample, it is possible that the determinants of CB and MBS issuance may vary in countries where both type of securities are frequently issued compared to those where only one of them is issued. In order to check for these potential differences we run the same set of regressions of Table 4A for banks in countries where both MBS and CB are frequently issued (Spain and the U.K.). The results are shown in Table 4C. Given the similarity between the coefficients in Tables 4A and 4C, there is no evidence that the factors driving SMS issuance are different between countries where both types of securities are issued and those where only one type is.[24]

Additional robustness tests are reported in Table 5. In order to facilitate comparison, the first column of the table gives the baseline results from Table 4. One issue with the baseline specification is that our measure of loan risk, provisions, is subject to strategic behavior by banks. There is evidence that banks have used provisions to smooth income, for example (Saurina, 2009; Sacasa, 2011). An alternative measure of loan risk is the ratio of loan chargeoffs to total loans. This is an ex post measure of losses, reflecting losses on loans made in the past and therefore might be less relevant for SMS issuance decisions today. As the results shown in the second column of Table 5 indicate, the results are very similar when provisions are replaced by chargeoffs. Also, we control for country effects using dummies, but it is

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[24] When we run logistic regressions predicting MBS issuance in the U.S. and CB issuance in Germany, the coefficients on the independent variables are similar to those in Tables 4A and 4C, further supporting the hypothesis that common factors drive SMS issuance across our sample countries.

possible that the cross-country differences are more subtle. To test this, we subtract from each of the bank characteristics the average value of that characteristic for banks in our sample from the same country. Using the netted variables as our controls not surprisingly affects the magnitudes of the coefficients in the regressions. However, as shown in the third column of Table 5, the same set of variables is statistically significant as in the baseline results presented in the first column.

Consistent with there being a large fixed cost to issue SMS, we find that large banks are more likely to issue these bonds than are small firms. We explore the effect of bank size in two ways. First, we drop small banks from the sample. The fourth column of Table 5 reports the results of a regression where all banks with total assets less than the median value ($40.2 billion) are excluded. The results for the large bank sample are qualitatively similar to those in the baseline sample. As a further robustness check, we create interactions between the key controls and our bank size measures. We add these interaction terms to the baseline model and run a regression on the full sample. The results are reported in the fifth and sixth columns of Table 5, with the sixth column giving the coefficients on the interaction terms. The results remain qualitatively similar.

4.2 The impact of SMS issue on bank characteristics

To complete the analysis of why banks issue SMS, we need to examine the effect of SMS issue on bank characteristics. This is done using fixed-effects regressions based on equation (2).

There is evidence that issuing CB improves profitability. The coefficient on the CB dummy in the regression reported in the first column of Table 6 is positive and significantly different from zero. To get an idea of the magnitude of the effect, a bank that has issued CB in the past two years has a ROA that is 0.072 larger than that of a non-issuing bank. This is roughly 9% of the mean and 31% of the standard deviation of ROA for banks in the sample.

The results are also consistent with banks improving liquidity after issuing CB. The increase in ROA suggests an increase in liquidity. Another measure of liquidity we use is the adjusted loan-to-deposits ratio. As shown in the second column of Table 6, the coefficient on the CB dummy is -0.025, which is significantly less than zero. Since the standard deviation for the adjusted loan-to-deposit ratio is 0.17, issuing CB leads to a decrease of 0.15 standard deviations in the ratio. This is consistent with a liquidity motive for issuing CB. For reference, if we run the same regression with the unadjusted loan-to-deposit ratio, the coefficient on the CB dummy is 0.028, which is significantly greater than zero (regression not shown). Thus, while issuing CB increases the loan-to-deposit ratio, it does so primarily because the mortgages backing CB stay on the issuing bank's balance sheet.

The loan growth regression provides a further check on liquidity changes. As shown in Table 3, an increase in loan growth after a SMS issue suggests that the issuance opened up space for the bank to grow. However, we do not find that banks significantly increase loan growth after CB issuance, although the coefficient on the CB dummy is of the correct sign for that (column 3 of Table 6).

Issuing CB is associated with lower risk. Following issuance, banks have lower loan-to-deposit ratios (column 2 of Table 6) and larger capital ratios (column 4 of Table 6). However, the impact on capital ratios is relatively small. Issuing a CB increases a bank's capital ratio by 0.080, or 3.7% of the standard deviation of the capital ratio.

Low-capital banks also might be using CB to stay above regulatory capital minimums. The capital ratio of a low-capital bank increases following a CB issue (column 5 of Table 6). But this may be no more than the standard risk reduction from increased capital, as the coefficient on the CB dummy in the low capital ratio regression (column 5) is significantly smaller than the coefficient on the CB dummy in the full sample capital ratio regression (column 4).

Profit and liquidity do not increase following issuance for banks that securitize mortgages. The coefficient on the MBS dummy in the regression in the first column of Table 6 is small in magnitude and not significantly different from zero. In addition, the coefficient on the MBS dummy in the provisions regression (column 2 of Table 6) is significantly positive and the coefficient is significantly negative in the loan growth regression (column 3 of Table 6), inconsistent with an increase in liquidity.

There is evidence that issuing MBS might reduce risk. Banks that issue MBS have lower provisions post-issue (column 5 of Table 6) and issuing MBS also leads to slower loan growth (column 3 of Table 6). Loan growth decreases by 0.17 standard deviations and provisions decrease by 0.04 standard deviations in the year following a MBS issue.

The results in Table 6 generally are robust to a variety of changes. For brevity, these results are not shown here. As examples of the robustness of the findings, if we examine the impact of SMS issuance in the last year (rather than the last two years), the signs and significance of the coefficients are similar. In addition, the results are also similar for active and non-active issuers, and for those in countries where both types of SMS are frequently issued.

There is one area where the robustness checks add some information. We find that the impact of SMS issue is generally bigger for large banks (see Table 7). But, this affects only the magnitude of the results. None of the qualitative results differ based on bank size.

4.3 The reasons for issuing SMS

We can use the results above along with the predictions in Table 3 to examine why banks issue CB and MBS. As shown in Table 8, the analysis supports the hypothesis that banks issue CB at least in part for profit and liquidity reasons. There is also evidence consistent with banks issuing SMS for risk management and possibly because of agency problems.

If banks are issuing SMS as a line of business, then the main effect of issuance should be an increase in profit. We find that issuing CB significantly increases profit while issuing MBS is associated with a statistically insignificant and economically small increase in profit. Of course, our evidence indicates that issuing either CB or MBS leads to changes in bank balance sheets. This implies that there are other reasons bank issue SMS, especially CB, beyond viewing them as a line of business.

Banks can use SMS for balance sheet management, including increasing liquidity and capital ratios (as suggested by Packer, et al., 2007). We find evidence consistent with both CB and MBS being used for balance sheet management, but of different kinds. Our results strongly suggest that liquidity increases when CB are issued but not when MBS are issued. There is also evidence indicating the issuance of MBS for risk management reasons.

Banks can issue SMS for reasons related to agency problems between bank managers and bank owners. For example, bank CEOs might want to build an empire to increase their compensation. The results are consistent with MBS being used, at least in part, for empire building. Issuing MBS is associated with increases in asset size, notwithstanding the movement of mortgages off the balance sheet to fund the SPE, but not with increases in profit.

There can be other agency reasons for banks to issue SMS. The rapid increase in banks that issued MBS (see Figure 1) might be a sign of herd behavior. Banks may have decided to securitize loans because securitization markets were hot. Hot markets may mean that bankers can take advantage of bond buyers (or the principals of the buyers) by issuing bonds at interest rates below their steady state (or fair) value, perhaps because bond purchasers are not paying close attention to markets (Rosen, 2010b). To test for herd behavior, we examine whether, all else equal, SMS issuance in year t at bank i was affected by SMS issuance at other banks in country c, the home of bank i, during years t-1 and t. Specifically, we add variables measuring CB issuance and MBS issuance to our SMS issuance regression, modifying (1) to:

$$\text{SMS issue}_{i,c,t} = f(\text{CB issue dummy}_{i,t\&t-1}, \text{MBS issue dummy}_{i,t\&t-1}, \text{CB total issue volume}_{c,t\&t-1}, \text{MBS total issue volume}_{c,t\&t-1}, \text{bank characteristics}_{i,t-2}, \text{other controls}) \quad (3)$$

where CB and MBS total issue volume is the total dollar volume of either CB or MBS issued by banks in country c during years t and t-1. The results of the regression are reported in Table 9. They show evidence of herd behavior among MBS-issuing banks but not for CB-issuing banks.

Overall, banks appear to be issuing CB for very different reasons than they issue MBS. In addition to being profitable, CB issues are associated with liquidity increases. Banks that issue MBS are reducing risk and may be taking advantage of agency problems. These differences between CB and MBS are consistent with a key difference in the structures of the two types of SMS. MBS but not CB offer banks an opportunity to transfer risk. Once mortgages are placed in a MBS pool, the issuing bank has no (direct) interest in them. On the other hand, the bank issuing CB must replace the defaulted mortgages in the bond pool. Thus, issuing MBS can reduce bank risk more than issuing CB. This ability to shed risk also makes moral hazard problems more severe. A bank that "fools" investors by putting mortgages that are riskier than the market thinks into a CB pool gets little benefit from this because if the mortgage holders default, the bank must replace the defaulted mortgages with new ones.[25] However, once mortgages go into the SPE backing MBS, all risk is borne by bondholders. This is consistent with MBS be more useful the CB for both risk management and exploiting certain kinds of agency problems.

While structural differences between MBS and CB are consistent with the risk management results, it is more difficult to come up with a reason why CB but not MBS are useful for liquidity. Issuing a SMS can add to liquidity by bringing forward future revenues or by financing mortgages with long-term bonds (those backing the mortgage pool) rather than with deposits. Both of these are available whether the SMS is CB or MBS.

5. Impact of the financial crisis

The recent financial crisis was exceptionally harmful. Many financial markets, including the private securitization market, were essentially shut down during the crisis. This caused problems for a number of banks. In order to mitigate the impact of the crisis, many governments took extraordinary actions to restart financial markets and to bail out troubled banks. In this section, we look at how SMS issuance in the pre-crisis period was related to bank bailouts.

To examine whether SMS issuance made a bank more likely to be bailed out, we define a bail out dummy that takes the value one if and only if a bank was bailed out by

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[25] The only benefit comes because there are some states where the bank fails and the CB mortgage pool is insufficient to pay bondholders.

its government in 2008. [26] In our sample, 11% of the banks received a bailout (see Table 1). For each bank, we ask how the bailout dummy is related to whether the bank issued SMS:

$$\text{bail out in 2008} = f(\text{dummy for CB issue in 2006-7, dummy for MBS issue in } \text{2006-7, bank characteristics in 2006}) \tag{4}$$

The results of this regression are reported in the first column of Table 10. The coefficient on the CB dummy is small and not significantly different from zero while the coefficient on the MBS dummy is positive and significantly different from zero. This implies that banks issued CB were no more likely to be bailed out than other banks while those that that issued MBS were more likely to be bailed out.

The coefficients on the bank size and capital ratio variables suggest that bank size and capital affected the chances of a bailout. This opens the possibility that the correlation between issuing MBS and being bailed out might be because the banks that issued MBS were larger or had lower capital than other banks. To test this, the regressions reported in columns 2-5 of Table 10 split the sample by bank size and capital ratio. The results show that for both large and small banks and for both low capital banks, issuing MBS is associated with a greater chance of being bailed out.

We do not know to what extent the need to be bailed out was related to the issue of MBS. One possibility is that banks that issued MBS also were involved in a lot of the complex financial products at the center of the financial crisis. It is possible that the MBS dummy is a proxy for a bank being involved in these other activities.

6. Concluding comments

Covered bonds and mortgage-backed securities are similar in the main economic function they perform: allowing banks to finance mortgages using duration-matched bonds. This has led some to suggest that, given the troubles in MBS markets following the recent financial crisis, that CB could be a good substitute for MBS. We examine whether banks, prior to the crisis, were using CB and MBS for the same reasons.

We find no evidence that CB and MBS were being used by banks for similar reasons. Both types of SMS seem to increase profit, although only weakly in the case of MBS. But, our results are consistent with liquidity improvement being a primary benefit of CB issuance, but not of MBS issuance. There is some indication, albeit indirect, that banks used MBS when they were attempting to reduce risk. Finally, agency problems may have pushed banks to issue MBS as there is evidence of herd behavior in their issue. The same is not true for CB.

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[26] To identify the receipt of aid by European Union banks, we accept the European Commission (EC) definition of State aid. This includes capital injections/recapitalization and debt guarantees. To identify the recipients of bailouts in the US, we rely on US Treasury data covering participation in the Asset Guarantee Program, the Capital Assistance Program and the Capital Purchase Program.

Since our results suggest that banks used CB and MBS for different reasons, the two may not be substitutes. As we refine this study, we plan to examine whether the real and regulatory differences between CB and MBS can explain the varied uses.

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Figure 1. MBS evolution in the US and Europe

United States   European Union
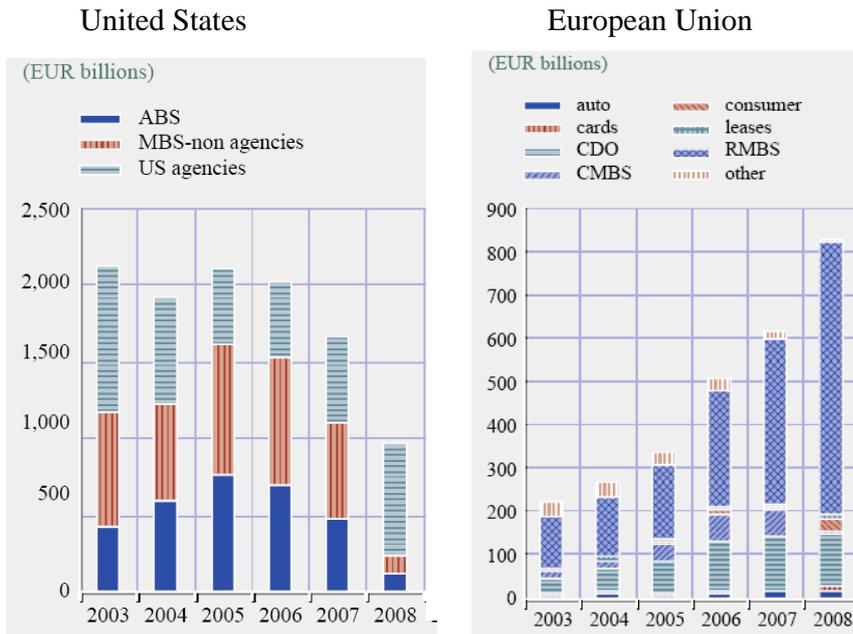
Source: ECB (2011)

Figure 2. MBS: origination vs. securitization

Bank securitizes its own loans
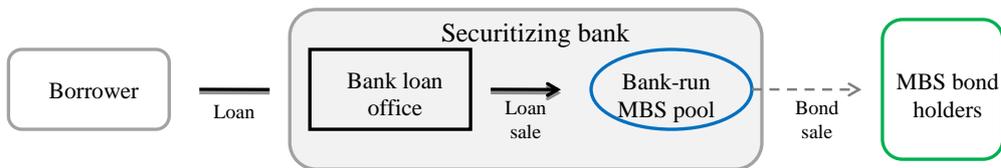

Bank purchases loans to securitize
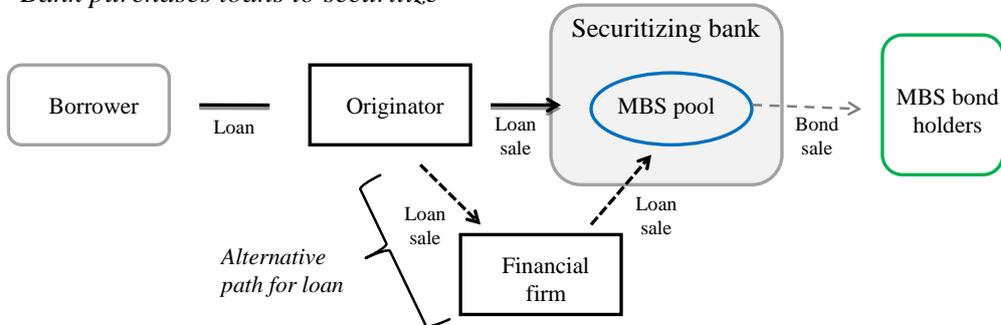
Figure 3. Covered bond issuance in the EU

self-funded covered bond issues (EUR billions; left-hand scale)
covered bonds issued (EUR billions; left-hand scale)
percentage of self-funded revenues (right-hand scale)
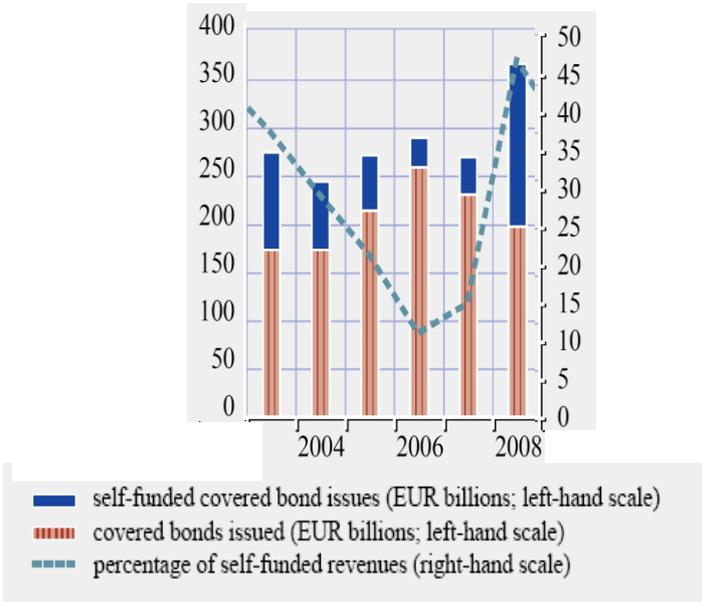
Note: **self-funded issunce** is the issuance made solely for the purpose of creating eligible collateral for Eurosystem credit operations

Source: ECB (2011)

Figure 4. CB funding steps
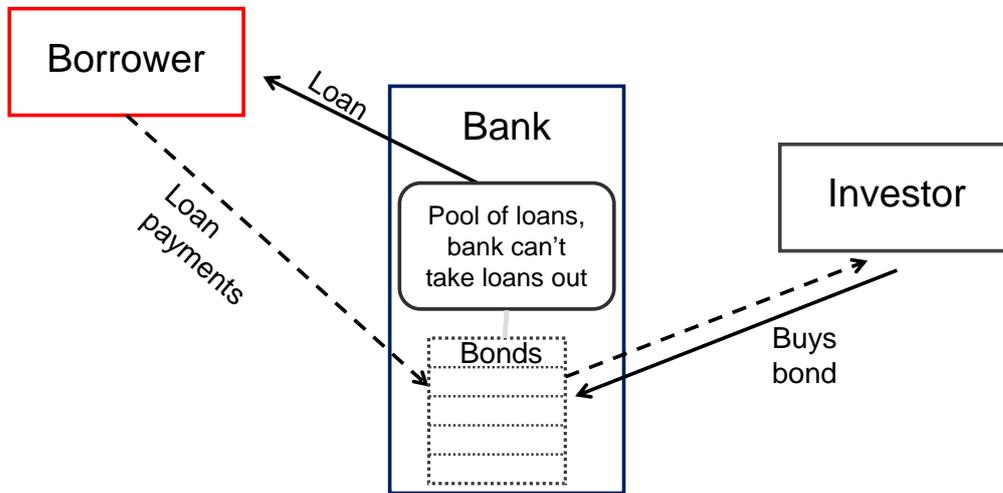
Table 1. Descriptive statistics

	ALL SAMPLE			MBS ISSUERS			CB ISSUERS		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
RoA (%)	0,76	0,72	0,23	0,68	0,64	0,19	0,81	0,78	0,26
Loans-to-deposits ratio (%)	0,83	0,79	0,17	0,86	0,82	0,19	0,79	0,77	0,13
Capital ratio (%)	5,94	5,56	2,16	5,61	5,51	2,20	6,32	6,24	2,08
% of banks in the Low CR group	25	-	-	34	-	-	18	-	
Capital ratio of banks in the Low CR group (%)	4,03	3,99	2,04	3,94	3,86	2,27	4,15	4,08	2,16
Provisions-to-loans ratio (%)	8,26	8,06	3,27	7,16	7,12	3,32	9,03	8,85	3,22
Net charge-offs ratio (%)	0,37	0,44	0,21	0,40	0,45	0,19	0,32	0,36	0,18
Loan growth (%)	8,07	9,31	1,93	12,16	12,19	1,85	9,18	9,37	1,96
Total assets ($ bil.)	38,51	40,22	6,13	39,81	40,66	6,52	36,23	37,96	5,3
Total assets (log)	10,54	10,39	2,17	10,83	10,60	2,08	10,68	10,42	2,23
Bail-out dummy	0,11	0,10	0,33	0,13	0,11	0,35	0,08	0,09	0,29
House price index (base: 2003= 100)	109	107	13	111	109	15	106	104	12
Observations	2170			193			221		

Note: Information on CB issuers and MBS issuers is shown only for the year prior to when a security was issued.

Table 2. SMS issue by country

	MBS			CB		
	Number (per year)	*Average issue size ($ mil.)*	*Average issuer size ($bil)*	*Number (per year)*	*Average issue size ($ mil.)*	*Average issuer size ($bil)*
Full sample	3,2	1,130	0,863	3,60	0,576	0,451
France	-	-	-	0,87	0,735	0,514
Germany	0,25	0,030	0,026	14,21	0,627	0,553
Italy	3,2	0,110	0,084	0,25	0,158	0,114
Spain	4,75	0,286	0,218	6,62	0,445	0,332
U.K.	3,14	0,375	0,321	3,12	0,602	0,406
U.S.	14,21	1,734	1,116	0,25	0,553	0,376

Table 3. Predicted signs on coefficients

	Possible reason for issuing SMS: Before issue	Direct effect of issuing SMS: After issue	Indirect effect of issuing SMS: After issue
Line of business:			
Profit	--	ROA +	--
Balance sheet management:			
Liquidity	ROA –, L/D +	ROA + L/D – and unadj. L/D +	Loan growth +
Capital for regulatory reasons	K/A – and low relative to reg. standards	--	K/A + given it was low relative to reg. standards before
Risk management	Paired before and after:* K/A –, L/D +, Prov/L+	--	Paired before and after:* K/A +, L/D –, Prov/L–
Agency reasons:			
Empire building	--	--	Both TA + and ROA not +
If the CB market requires (both of these are measures of safety for the CBs):			
Low risk	K/A +, Prov/L-	--	Not K/A –, not Prov/L+

* - Paired means both K/A changes, both L/D changes, and/or both Prov/Lchanges.

TA = total assets.
L/D = loan-to-deposits ratio (adjusted to net out CB issue).
Unadj. L/D = loan-to-deposits ratio (not adjusted to net out CB issue).
K/A = capital-to-asset ratio.
Prov/L = provisions-to-loans ratio.

Table 4A
Determinants of the use of securitization (baseline specification)

| | dum(non-issuer=0,CB=1,MBS=2) | | | | | | | | | | | | | |
| | CB | | | MBS | | | Comparison of CB to MBS | CB | | | MBS | | | Comparison of CB to MBS |
	Coeff.	*m.e (%).*	*p-value*	*Coeff.*	*m.e (%).*	*p-value*	*p-value*	*Coeff.*	*m.e (%).*	*p-value*	*Coeff.*	*m.e (%).*	*p-value*	*p-value*
RoA t-1	-2.025**	3.50	0.018	-0.482	-0.74	0.113	0.001	-1.907**	3.39	0.022	-0.485	-0.72	0.149	0.001
(Loans-covered bonds) to Deposits t-1	1.359***	2.63	0.004	5.101***	8.61	0.005	0.003	---			---			
Loans to Deposits t-1	---			---			0.329	1.322***	2.59	0.004	2.827***	4.91	0.004	0.304
Capital ratio t-1	1.228**	2.38	0.012	0.520	0.90	0.243	0.001	0.821**	1.28	0.007	0.140	0.21	0.412	0.003
Low CR t-1	0.130	0.18	0.362	0.359	0.59	0.548	---	0.155	2.76	0.407	0.035	0.05	0.526	0.082
Provisions to Loans t-1	-0.515**	-0.90	0.015	0.270**	0.37	0.031	0.001	-0.412**	-0.69	0.012	0.267**	0.36	0.037	0.001
Loan growth t-1	-1.932	-3.42	0.158	0.791	1.20	0.508	0.014	-1.690	2.90	0.151	0.700	1.08	0.461	0.010
Total assets (log) t-1	2.046***	3.64	0.003	1.014***	1.99	0.001	0.004	2.018***	3.51	0.003	1.014***	2.20	0.001	0.003
House price index t-1	0.349	0.56	0.285	0.508**	0.79	0.026	0.003	0.369	0.60	0.293	0.494**	0.75	0.022	0.002
Base category:				Non-issuer							Non-issuer			
Number of observations				2170							2170			
Number of groups				711							711			

legend: * p<.1; ** p<.05; *** p<.01

Table 4B (Active vs. non-active issuers)
Determinants of the use of securitization (baseline specification)

	dum(non-issuer=0,CB=1,MBS=2)													
	CB			MBS			Comparison of CB to MBS	CB			MBS			Comparison of CB to MBS
	Coeff.	_m.e (%)._	_p-value_	_Coeff._	_m.e (%)._	_p-value_	_p-value_	_Coeff._	_m.e (%)._	_p-value_	_Coeff._	_m.e (%)._	_p-value_	_p-value_
RoA t-1	-2.017**	3.43	0.016	-0.479	-0.72	0.115	0.001	-1.802**	3.28	0.018	-0.510	-0.77	0.152	0.001
(Loans-covered bonds) to Deposits t-1	1.352***	2.61	0.002	5.118***	8.60	0.008	0.003	---			---			
Loans to Deposits t-1	---			---			---	1.244***	2.71	0.002	2.691***	4.87	0.003	0.221
Capital ratio t-1	1.222**	2.37	0.012	0.540	0.94	0.261	0.370	0.819***	1.39	0.004	0.136	0.19	0.433	0.004
Low CR t-1	0.129	0.18	0.348	0.371	0.63	0.533	0.001	0.136	0.19	0.429	0.040	0.06	0.511	0.076
Provisions to Loans t-1	-0.523**	-0.91	0.017	0.254**	0.34	0.051	0.001	-0.417**	-0.70	0.015	0.268**	0.38	0.022	0.001
Loan growth t-1	-1.927	-3.40	0.160	0.819	1.27	0.455	0.020	-1.692	2.70	0.155	0.714	1.12	0.460	0.014
Total assets (log) t-1	2.060***	3.69	0.003	1.016***	2.04	0.002	0.003	2.017***	3.66	0.006	1.007***	2.17	0.001	0.003
House price index t-1	0.351	0.54	0.283	0.506**	0.77	0.023	0.002	0.362	0.58	0.315	0.485**	0.73	0.020	0.002

(continued on the next page)

Table 4B (continued)

Have you ever issued CB in the last 2 years?	2.024**	3.47	0.220	0.023	0.01	0.667	0.001	2.019**	3.25	0.207	0.027	0.04	0.514	0.001
Have you ever issued CB in the last 2 years? X RoA t-1	-2.710**	4.81	0.014	0.119	0.17	0.431	0.001	-2.677**	4.68	0.024	0.113	0.17	0.639	0.001
Have you ever issued CB in the last 2 years? X (Loans-covered bonds) to Deposits t-1	2.011***	3.52	0.003	0.014	0.01	0.721	0.001	---			---			---
Have you ever issued CB in the last 2 years? X Loans to Deposits t-1	---			----			---	2.008***	3.41	0.027	0.009	0.01	0.623	0.001
Have you ever issued CB in the last 2 years? X Capital ratio t-1	2.018**	3.55	0.022	0.018	0.03	0667	0.001	1.266**	2.78	0.012	0.028	0.04	0.318	0.001
Have you ever issued CB in the last 2 years? X Low CR t-1	0.146	0.21	0.217	0.035	0.05	0.201	0.001	0.146	0.20	0.411	0.139	0.19	0.199	0.001
Have you ever issued CB in the last 2 years? X Provisions to Loans t-1	-1.115**	-2.20	0.014	0.024	0.04	0.119	0.001	-0.882**	-1.43	0.037	0.020	0.03	0.115	0.001
Have you ever issued CB in the last 2 years? X Loan growth t-1	-2.770	-4.71	0.279	0.008	0.01	0.210	0.001	-1.667	2.77	0.216	0.031	0.04	0.228	0.001
Have you ever issued CB in the last 2 years? X Total assets (log) t-1	2.927***	5.03	0.002	0.018	0.02	0.114	0.001	2.816**	4.94	0.017	0.015	0.02	0.332	0.001
Have you ever issued MBS in the last 2 years?	0.032	0.05	0.837	2.638**	4.05	0.013	0.001	0.030	0.05	0.917	1.002***	2.16	0.001	0.001
Have you ever issued MBS in the last 2 years? X RoA t-1	0.004	0.01	0.689	-0.023	0.03	0.277	0.001	0.002	0.01	0.632	-0.039	0.04	0.277	0.001
Have you ever issued MBS in the last 2 years? X (Loans-covered bonds) to Deposits t-1	0.002	0.01	0.544	6.113***	9.01	0.006	0.001	---			---			---
Have you ever issued MBS in the last 2 years? X Loans to Deposits t-1	---			---			---	0.001	0.01	0.521	3.104**	5.15	0.022	0.001
Have you ever issued MBS in the last 2 years? X Capital ratio t-1	0.022	0.04	0.626	0.593	1.01	0.144	0.001	0.011	0.01	0.889	0.119	0.17	0.422	0.001
Have you ever issued MBS in the last 2 years? X Low CR t-1	0.008	0.01	0.776	0.375	0.64	0.382	0.001	0.019	0.03	0.644	0.044	0.06	0.773	0.001
Have you ever issued MBS in the last 2 years? X Provisions to Loans t-1	0.017	0.03	0.884	0.469**	0.78	0.021	0.001	0.044	0.06	0.338	0.588**	1.00	0.014	0.001
Have you ever issued MBS in the last 2 years? X Loan growth t-1	0.037	0.05	0.256	0.822	1.33	0.505	0.001	0.016	0.003	0.115	0.722	1.12	0.253	0.001
Have you ever issued MBS in the last 2 years? X Total assets (log) t-1	0.019	0.03	0.188	2.027***	3.46	0.004	0.001	0.032	0.05	0.382	2.006**	3.44	0.017	0.001

Base category:	**Non-issuer**	**Non-issuer**
Number of observations	**2170**	**2170**
Number of groups	**711**	**711**

legend: * p<.1; ** p<.05; *** p<.01

Table 4C (Subsample UK and Spain)
Determinants of the use of securitization (baseline specification)

	dum(non-issuer=0,CB=1,MBS=2)													
	CB			MBS			Comparison of CB to MBS	CB			MBS			Comparison of CB to MBS
	Coeff.	_m.e (%)._	_p-value_	_Coeff._	_m.e (%)._	_p-value_	_p-value_	_Coeff._	_m.e (%)._	_p-value_	_Coeff._	_m.e (%)._	_p-value_	_p-value_
RoA t-1	-3.239**	5.33	0.012	-0.464	-0.70	0.114	0.001	-3.115**	5.18	0.013	-0.429	-0.56	0.133	0.001
(Loans-covered bonds) to Deposits t-1	1.440***	2.70	0.002	5.351**	8.78	0.013	0.001	---			---			---
Loans to Deposits t-1	---			---			---	1.415***	2.68	0.002	3.415**	5.44	0.018	0.001
Capital ratio t-1	1.228**	2.39	0.025	0.153	2.53	0.252	0.001	1.250**	2.46	0.014	0.149	2.50	0.264	0.001
Low CR t-1	0.147	0.23	0.541	0.491	0.69	0.531	0.005	0.135	0.20	0.522	0.461	0.56	0.522	0.003
Provisions to Loans t-1	-0.738*	-0.98	0.079	0.258*	0.32	0.079	0.001	-0.720*	-0.93	0.070	0.257*	0.32	0.090	0.001
Loan growth t-1	-2.118	-3.69	0.192	0.706	0.87	0.505	0.032	-2.106	-3.66	0.194	0.709	0.88	0.533	0.024
Total assets (log) t-1	2.017**	3.49	0.032	1.324**	2.60	0.039	0.005	2.092**	3.12	0.028	1.306**	2.58	0.031	0.005
House price index t-1	0.257	0.32	0.299	0.739**	0.99	0.016	0.002	0.470	0.72	0.196	0.744**	1.00	0.025	0.002
Base category:				Non-issuer							Non-issuer			
Number of observations				496							496			
Number of groups				140							140			

legend: * p<.1; ** p<.05; *** p<.01

Table 5- Determinants of the use of securitization (baseline specification) (loans are net of covered bonds)

	Chargeoffs as a control			Profitability w.r.t. country average			Large bank subsample			Size-based interaction terms		
	Coeff.	*m.e.*	*p-value*	*Coeff.*	*m.e.*	*p-value*	*Coeff.*	*m.e.*	*p-value*	*Coeff.*	*m.e.*	*p-value*
										Coefficients for interaction of variables with log(TA)		
CB versus no issue												
RoA t-1	-1.314**	2.50	0.036	-0.914**	1.48	0.041	-0.908**	-1.45	0.040	-1.026**	2.14	0.040
(Loans-covered bonds) to Deposits t-1	2.260***	4.20	0.004	3.083***	4.99	0.001	2.316***	4.36	0.001	1.147**	2.25	0.022
Capital ratio t-1	1.301**	2.38	0.012	1.306**	2.45	0.013	1.353**	2.55	0.019	1.311**	2.46	0.037
Low CR t-1	0.201	0.28	0.284	0.234	0.33	0.366	0.100	0.14	0.371	0.024	0.02	0.214
Provisions to Loans t-1	---			-0.312**	0.43	0.013	-0.427**	0.76	0.010	-0.065**	0.09	0.023
Net charge-offs ratio t	-1.106***	2.27	0.002	---			---			---		
Loan growth t-1	-2.420	4.53	0.167	0.592	0.90	0.117	-0.980	1.55	0.127	-0.013	0.02	0.746
Total assets (log) t-1	4.620***	7.53	0.001	1.214***	2.33	0.001	1.645***	2.98	0.001	---		
House price index t-1	0.304	0.42	0.265	0.350	0.53	0.278	0.308	0.46	0.235	0.349	0.53	0.322
MBS versus no issue												
RoA t-1	-0.196	-0.28	0.097	-0.250	0.32	0.133	-0.381	0.62	0.134	0.019	0.02	0.417
(Loans-covered bonds) to Deposits t-1	5.154***	8.72	0.002	2.511***	4.65	0.002	4.220***	8.17	0.002	1.498**	2.79	0.040
Capital ratio t-1	0.480	0.80	0.384	0.563	0.91	0.324	0.426	0.40	0.352	0.363	0.59	0.261
Low CR t-1	0.295	0.44	0.286	0.271	4.75	0.511	0.293	0.45	0.501	0.074	0.11	0.257
Provisions to Loans t-1	---			0.014**	0.019	0.019	0.122**	0.15	0.026	0.017	0.02	0.325
Net charge-offs ratio t	-0.604	0.98	0.161	---			---			---		
Loan growth (covered bonds excluded) t-1	0.835	1.27	0.327	0.904	1.48	0.273	0.613	1.03	0.318	0.016*	0.02	0.069
Total assets (log) t-1	3.090***	5.01	0.001	1.035***	2.19	0.001	0.914***	1.48	0.001	---		
House price index t-1	0.515**	0.79	0.023	0.506**	0.70	0.025	0.511**	0.76	0.018	0.497**	0.68	0.019
Base category:	**non-issuer**			**non-issuer**			**non-issuer**			**non-issuer**		
Number of observations	**2170**			**2170**			**1787**			**2170**		
Number of groups	**711**			**711**			**622**			**711**		

legend: * p<.1; ** p<.05; *** p<.01

Table 6
Determinants of the use of securitization (forward looking regressions)

	Panel data with fixed effects										
	RoA t		**Loans to deposits t**		**Loan growth t**		**Capital ratio t**		**Provisions to loans t**		**Total assets (log) t**
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff*	*p-value*
RoA t-2	---		0.025	0.129	0.022	0.218	0.169 **	0.015	0.129 **	0.017	0.059 **	0.015
Loans to deposits t-2	0.024	0.259	---		1.443 **	0.030	-0.124 **	0.009	0.044 **	0.024	-0.027 **	0.027
Capital ratio t-2	0.163	0.162	-0.207 ***	0.003	0.067	0.134	---		0.030 **	0.028	0.054 ***	0.004
Low CR t-2	-0.017	0.246	0.043 **	0.019	0.030	0.211	---		0.021 **	0.026	0.036	0.252
Provisions to Loans t-2	-0.019 **	0.025	1.817 **	0.013	0.817 *	0.084	0.011 *	0.065	---		0.007	0.518
Loan growth t-2	0.047 *	0.054	0.050	0.184	---		0.007	0.447	0.019 **	0.038	0.014 *	0.060
Total assets (log) t-2	0.074 ***	0.007	-0.026 ***	0.001	0.006	0.106	0.085 **	0.013	0.015	0.359	---	
House price index t-2	0.019	0.110	0.228 **	0.015	0.562 ***	0.003	-0.017 *	0.051	0.031 **	0.024	0.011	0.291
Have you ever issued CB in the last 2 years?	0.072 **	0.030	-0.025 **	0.023	0.084	0.509	0.080 **	0.020	0.062	0.281	0.008 *	0.084
Have you ever issued MBS in the last 2 years?	0.004	0.144	0.010 *	0.051	-0.030 **	0.021	0.011	0.319	-0.007 *	0.040	0.053 **	0.019
Adjusted R^2	0.526		0.123		0.627		0.515		0.523		0.617	

legend: * p<.1; ** p<.05; *** p<.01
ºNote: Last two years are years t-1 and t.

Table 7
Determinants of the use of securitization (with interaction terms)

	RoA t		Loans (covered bonds excluded) to deposits t		Loan growth t		Capital ratio t		Provisions to loans t	
	Panel data with fixed effects									
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
RoA t-2	---		0.030	0.126	0.015	0.164	0.171 **	0.015	0.141 **	0.017
Loans ((covered bonds excluded) to deposits t-2	0.020	0.237	---		1.359 **	0.027	-0.124 **	0.014	0.035 **	0.032
Capital ratio t-2	0.167	0.144	-0.207 ***	0.004	0.054	0.119	---		0.030 **	0.024
Low CR t-2	-0.014	0.266	0.043 **	0.024	0.015	0.242	---		0.022 **	0.029
Provisions to Loans t-2	-0.027 **	0.026	1.816 **	0.013	0.027 *	0.066	0.017 *	0.034	---	
Loan growth t-2	0.039 *	0.059	0.064	0.193	---		0.006	0.335	0.014 **	0.033
Total assets (log) t-2	0.060 ***	0.005	-0.024 ***	0.002	0.003	0.120	0.087 **	0.011	0.009	0.402
House price index t-2	0.024	0.307	0.202 ***	0.007	0.632 ***	0.004	-0.014 **	0.046	0.031 **	0.011
Have you ever issued CB in the last 2 years?	0.086 **	0.030	-0.029 **	0.014	0.151	0.497	0.074 **	0.024	-0.074 **	0.017
Have you ever issued MBS in the last 2 years?	0.015	0.141	0.008 *	0.051	-0.014 **	0.026	0.011	0.350	0.012 **	0.044
Log assets t-2 * Have you ever issued CB in the last 2 years?	0.016	0.164	-0.006 *	0.897	0.073	0.433	0.075 **	0.021	0.056	0.364
Log assets t-2 * Have you ever issued MBS in the last 2 years?	0.004	0.172	0.001	0.131	-0.028 **	0.021	0.017	0.334	-0.006 *	0.037
Adjusted R^2	0.513		0.749		0.632		0.533		0.528	

legend: * p<.1; ** p<.05; *** p<.01
ºNote: Last two years are years t-1 and t.

Table 8. Predicted signs on coefficients

	CB			MBS		
	Before	After	Consistent with	Before	After	Consistent with
ROA	–	+	Profit, Liquidity	(–)	(+)	Empire building
Loan-to-deposit ratio	+	–	Liquidity, Risk management	+	+	
Capital ratio	+	+	Low risk	(+)	(+)	
Low capital	(+)			(+)		
Provisions	(+)	(+)		+	–	Risk management
Loan growth	–	(+)		(+)	–	Risk management

Parentheses indicate coefficients that are not significantly different from zero.

Table 9. Herd behavior

	Full sample				Large banks only			
	CB		MBS		CB		MBS	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
CB issue in the last 2 years	0.035**	0.001	0.018	0.136	0.038**	0.001	0.014	0.128
MBS issue in the last 2 years	0.053	0.136	0.115***	0.003	0.038	0.159	0.120***	0.002
Growth of CB issuance in your country in the last year	0.073	0.184	0.007	0.198	0.044	0.168	0.016	0.263
Growth of MBS issuance in your country in the last year	-0.059	0.139	0.138***	0.001	-0.014	0.127	0.143***	0.001
Observations	2170				1767			

legend: * p<.1; ** p<.05; *** p<.01

Table 10
Bailout regressions

	Full sample			Large banks			Small banks			Top 75% capital			Bottom 25% capital (low CR)		
	Coeff.		p-value	Coeff.		p-value	Coeff.		p-value	Coeff.		p-value	Coeff.		p-value
RoA 2006	0.054	**	0.037	0.070	**	0.041	0.092	**	0.050	0.016	*	0.061	0.071	**	0.024
Loans (covered bonds excluded) to Deposits 2006	1.166	**	0.024	0.862	**	0.022	1.214	**	0.028	0.632	**	0.043	1.363	**	0.040
Capital ratio 2006	-0.089	**	0.013	-0.037	**	0.007	-0.091	**	0.014	-0.084	**	0.027	-0.132	**	0.014
Low CR 2006	0.062	**	0.034	0.066	**	0.024	0.043	**	0.034	--			0.054	**	0.026
Provisions to Loans 2006	0.034	**	0.026	0.014	*	0.059	0.040	**	0.027	0.010	**	0.013	0.043	**	0.033
Net charge-offs ratio 2006	0.087	**	0.030	0.070	**	0.021	0.091	**	0.032	0.062	**	0.018	0.097	**	0.056
Loan growth 2006	1.231	***	0.008	1.047	***	0.004	1.309	**	0.013	0.914	**	0.023	1.123	***	0.005
Total assets (log) 2006	0.020		0.258	0.032		0.216	0.018		0.211	0.018		0.258	0.028		0.319
House price index 2006	0.065	*	0.053	0.011		0.685	0.010		0.750	0.013		0.132	0.031		0.225
Have you ever issued CB in the last 2 years (2006-07)	0.033		0.172	0.064		0.135	0.026		0.191	0.054		0.216	0.033		0.111
Have you ever issued MBS in the last 2 years (2006-07)	0.154	**	0.013	0.176	**	0.013	0.133	**	0.015	0.037	**	0.035	0.182	**	0.026
Adjusted R^2	0.819			0.728			0.717			0.623			0.608		

legend: * p<.1; ** p<.05; *** p<.01

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