

ARE COVERED BONDS A SUBSTITUTE FOR MORTGAGE-BACKED SECURITIES?

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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 CB might be a substitute for MBS. We examine the use of CB and MBS in the U.S. and Europe, finding that the two are used for different purposes. Banks are more likely to use CB to help with liquidity needs while MBS are associated with risk management and agency problems. Introducing MBS to markets where only CB are common or CB to markets where only MBS are common could have large effects. Our estimates suggest that between 20-25% of banks in Germany and the U.S. would switch from CB to MBS (Germany) or MBS to CB (U.S.) if access was similar to that in countries where both CB and MBS are common (Spain and the U.K.).

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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, 2011). 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 pre-crisis period 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. The problems led to a rapid reduction in the issuance of new residential mortgage-backed securities (hereafter MBS¹; 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, some 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.

To see whether banks issued CB for the same reasons that they issued MBS, we examine banks in Europe and the United States. In some countries – Spain and the United Kingdom in particular – both MBS and CB are commonly issued by banks. Examining security issuance in these countries allows us to determine the extent to which MBS and CB serve as substitutes. But, in many countries, banks tend to issue either MBS, as in the U.S., or CB, as in Germany. We compare the banks in Spain and the U.K. to those in Germany and the U.S. This allows us to estimate the benefits of having active markets for both MBS and CB.

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

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. 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 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. However, there are some real and some regulatory differences between issuing MBS and issuing CB. As we describe later, 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. There are also other regulatory issues that can affect the choice between MBS and CB.

When examining MBS and CB – which we refer to collectively as *secondary mortgage securities* or SMS – we focus on several possible reasons why a bank might use 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 mainly to collect the fee income from selling them (see, e.g., Rosen, 2011).² Banks may also want to free up assets (with MBS) or liabilities (with CB) to have the liquidity pursue other opportunities. 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 SMS for these reasons. Our analysis suggests that banks use MBS and CB for different reasons and that these reasons are related to differences between MBS and CB.

Issuing SMS, at a basic level, can be thought of as a loan sale. The bondholders pay cash to the issuing bank in return for repayment rights on the mortgages back the securities. The ability to convert loans to cash can increase bank liquidity. This can happen two ways. First,

² 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.

a bank with an unexpected liquidity need can issue a SMS to get liquidity. We find CB issuance, but not MBS issuance, to be consistent with banks issuing the bonds when they need liquidity. 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 decreases if we net out the paired CB pool and CB liabilities.

A second way that SMS can increase liquidity is by serving as an insurance policy for banks. Loutskina (2011) shows that the presence of an active MBS market allows banks to hold less liquid balance sheets. The idea is that the knowledge that a bank can sell loans into a securitization if necessary lets the bank hold less precautionary liquid assets. We find support for this for MBS but not for CB. Banks that have access to the MBS market (as measured by prior issuance) hold less liquid portfolios (larger loan-to-deposit ratios) than otherwise equivalent banks. As mentioned in the prior paragraph, this is not true for banks that have issued CB.

The transfer of risk from the issuing bank to bondholders is more complete with MBS than with CB. With MBS, bondholders have claims to the payments on a fixed pool of mortgages while with CB, the issuing bank is required to replenish the pool when there are defaults or prepayments and bondholders have a residual claim on the bank. Thus, it is not surprising that we find that MBS issuance is consistent with risk management on the part of banks. Banks are more likely to issue MBS when they are reducing risk and when their loan provisions are high, indicating greater risk. In addition, having issued MBS is associated with lower loan provisions in the future.

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 with 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. Our finding is similar to the findings in the literature that agency problems play a role in MBS markets. The mortgages sold into securitizations may have been screened less (e.g., Keys, *et al.*, 2010) and had been progressively weaker in the period leading up to the recent financial crisis (e.g., Brunnermeier, 2009; Demyanyk and Van Hemert, 2010). In addition, bank health affected the quality of loans in securitization pools (e.g., Titman and Tsyplakov, 2010; Ayotte and Gaon, 2011). We show another type of agency problem –

herding – also may be present in securitization markets. But, we find no evidence of strong agency problems associated with CB.

Our comparison of banks in Spain and the U.K. to those in Germany and the U.S. suggests that opening up either the CB or the MBS channel may lead to substantial changes in how banks finance mortgages. Over 20% of banks in Germany and the U.S. would switch the type of SMS they issue. In addition, about 8% of banks that did not issue SMS in a year would choose to do so – issuing MBS if they are German and CB if they are American. These are substantial impacts of opening a substitute channel for financing mortgages. Of course, legal and regulatory changes may be required to “open” these substitute channels.

Finally, 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. This suggests 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, 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 four countries over the period starting in 2003 and ending in 2007. Our baseline results come from Spain and the United Kingdom, the two European countries where both CB and MBS were common. We compare these countries to Germany, where CB but not MBS were commonly issued, and the United States, where MBS were common but CB were not. A large share of all SMS is issued by banks in these countries, but our results are robust to including additional countries.

We get balance sheet and income statement data from Bankscope and data on SMS issuance from Dealogic. House price indexes are obtained from Eurostat for the European countries and from the Federal Housing Finance Agency in the U.S. Since there are fixed costs to issue SMS, we include only banks with at least one billion dollars of total assets at the beginning of our sample period. To remove potential outliers, we trim our data at the 1st and 99th percentile of all variables used in the empirical analysis.³

The primary sample includes 377 banks including 42 that issue CB at least once and 38 that issue MBS at least once. Table I presents summary statistics for the sample presented three ways: for the full sample, for only banks that issue MBS, and for only banks that issue CB. For MBS and CB issuers, 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). There are 1,850 bank-year observations in our sample, of which 130 (7.03%) involve a MBS issue and 141 (7.62%) have a CB issue.

2.2 MBS: background

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 is then sold, eventually ending up with the firm that puts together the securitization (Figure 2). We focus on commercial banks that put together securitizations, but it is also done by investment banks and 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).⁴ The SPE issues bonds and uses the revenues from selling the bonds to pay for the mortgages it has purchased.⁵ The SPE uses the principal and interest paid on the mortgages to repay the bondholders.⁶

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

³ 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 are qualitatively similar.

⁴ The SPE gives bondholders legal protections if the issuing bank becomes insolvent.

⁵ The SPE also can get some initially equity funding.

⁶ Any funds left over after these payments (and expenses) go to the equity owner of the SPE, typically the firm that sets it up.

ever do a mortgage securitization, and the banks in our sample are much larger than the average bank).⁷ 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.

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. during our sample period, 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).⁸ 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.

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). MBS grew rapidly thereafter. The U.S. model was later exported to EU countries and, in particular, to the U.K. The Spanish model is a hybridization of U.S. and U.K. models and it adapts their structure to the Spanish civil and commercial legislation. The Spanish mortgage-backed securities were not regulated until the early 1990s.

During 2003-2007, securitization was common in some countries, but rare in others. Among the countries we focus on, the U.S., Spain, and the U.K. had active securitization markets, while there was essentially no MBS issuance in Germany (see Table II).⁹ In part, the lack of securitization in Germany is due to a combination of regulatory and historical

⁷ 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.

⁸ 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.

⁹ Dealscan reports one extremely small securitization in our sample by a German bank. We drop this in our analysis below.

factors. Until the late 1990s, German bank regulators frowned upon securitization (Deutsche Bundesbank, 1997). At that point, securitization was allowed, but the securitizing bank was only able to get relief from capital requirements if they met some fairly strict requirements. Once securitization was allowed, the strict requirements along with the highly liquid covered bond market, which offered an alternative funding market for mortgages, led to few banks attempting to issue MBS. There is something of a multiple equilibrium nature to these funding markets: because there is not an established MBS market (and there is a strong CB market) in Germany, the costs of issuing a MBS can be large, but if a MBS market was established and market participants were comfortable with German MBS, costs would likely fall.¹⁰ One of the things we do in this paper is to posit an alternative scenario by asking what MBS activity would be in Germany if German funding markets (CB and MBS) were similar to those in other countries.

Balance sheet and income statement information for banks in our sample that issue MBS – which includes commercial banking organizations in Spain, the U.K., and the U.S. – is reported in the middle columns of Table I. The data are as of the year prior to the MBS issue. On average, banks that issue MBS are more levered than other banks, 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.

Across the countries with active MBS markets, the average size of a MBS issue differed significantly (Table II). It was much larger in the U.S. than in European countries (average issue size was \$1.7 billion in the U.S. and \$255 million in Europe). This may be because the issuing banks in the U.S. were much larger (average issuer size was \$1.1 trillion in the U.S. 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 least issuance by private firms – essentially stopped (privately-issued MBS issuance in the U.S. fell by 95% between 2006 and 2008).¹¹

¹⁰ Evidence in favor of this argument includes data on non-mortgage asset-backed security (ABS) issuance. The ratio of MBS volume to ABS volume is much lower in Germany than in other European countries except France (European Central Bank, 2011). This suggests that the MBS market evolved different than markets for other asset-backed securities in German. One explanation for this is the presence of covered bonds.

¹¹ Source: Inside Mortgage Finance.

2.3 CB: background

Covered bonds have been around a lot longer than securitized bonds. The first covered bond 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. 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). In this simple version, the mortgages remain on the bank's balance sheet. The face value of mortgages in the pool needs to be at least as large as the face value of the CB, although the value of mortgages usually is required to exceed 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. 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.¹² A second key feature of CB is that the bonds are a general obligation of the bank. If the bondholders are not paid, they have a specific claim on the mortgage collateral pool and a general claim (*pari passu* with senior creditors) on the assets of the bank.

As with MBS, there are some differences in the structure and regulation of covered bonds across countries. As one example of this, in the U. K. banks can 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. But even in a structured CB issue, bond holders have a residual claim on the bank that is the general partner of the partnership (essentially, the issuer of the bonds).

Covered bonds are issued by financial institutions in many countries in Europe and elsewhere (see Table III). But the financial structure of the issuers varies across countries. We focus our attention on countries where there are a lot of CB and where can be issued by banks: Germany (Pfandbriefe), Spain (cédulas hipotecarias), and the U.K.

Our analysis leaves out countries with significant CB issuance, such as Denmark (mortgage banks) and France (obligations foncières), and some with limited issuance (e.g., Czeck Republic, Ireland, Italy, the Netherlands, and Portugal). In both Denmark and France,

¹² Since the mortgages are naturally amortizing, the size of the pool can fall over time.

CB were issued by specialty organizations rather than standard banks. In Denmark only pass-through mortgage banks were allowed to issue covered bonds until the last six months of our sample period.¹³ Covered bonds in France – obligations foncières – also are issued by specialized credit institutions rather than by banks. These specialized credit institutions do not originate the mortgages backing the bonds.¹⁴ Leaving out these and the other European countries with limited covered bond issuance minimizes differences in institutional details with affecting the qualitative results.

The issuance of covered bonds was roughly flat during our sample period but expanded rapidly during the financial crisis and the recent European crisis (see Figure 3). In part, this was because European regulatory authorities including the European Central Bank (ECB) absorbed some of the supply of covered bonds. For example, the ECB had two CB-buying programs called Covered Bond Protection Programs (CBPP). CBPP 1 in 2009-2010 and CBPP 2 in 2011-2012 authorized the purchase of €100 billion of CB. Banks started creating CB specifically to sell to the ECB rather than investors. This is one of the reasons we exclude the post-crisis period from our sample.

There has been essentially no CB issuance by U.S. banks.¹⁵ In part, this is due to regulation. The deposit insurer in the U.S. (the FDIC) has not clarified how bondholders will be treated when an issuing bank becomes insolvent, including whether bondholders have priority over the FDIC.¹⁶ 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. One question we address is whether MBS may have served as a substitute for CB issuance in the U.S.¹⁷

There is less variation across countries in average issue size or average issuer size for CB than for MBS (Table II). In part, this may be driven by the very large U.S. banks that issue MBS but not CB. The average issuer size for MBS in the U.S. is more than twice that of CB issuers or MBS issuers in other countries. While in Spain and the U.K., CB issues tend to be

¹³ In July 2007, rules in Denmark were changed in a way that allowed commercial banks to issue CB.

¹⁴ Also, bondholders have a senior claim on the obligations foncières rather than a claim that is *pari passu* with unsecured creditors as in other countries.

¹⁵ Non-U.S. banks have issued U.S. dollar-denominated covered bonds. These were issued after our sample ended, but had they been issued during the sample period we would have classified the securities by the home country of the issuing bank.

¹⁶ Two U.S. banks issued CB in 2006 using the British structured covered bond framework (see Table II). We drop these from our analysis.

¹⁷ U.S. banks also have the option of borrowing from a Federal Home Loan Bank (FHLB). The FHLBs are government-sponsored entities that have as one of their goals helping housing finance (see Flannery and Frame, 2006, for more details on the FHLBs). Member banks are allowed to borrow from FHLBs using mortgages as collateral for the loans. FHLB loans can be used for any purposes.

larger than MBS issues, the average size of a MBS in our sample, \$1.07 billion, is almost twice the average size of a CB issue, \$569 million.

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. We examine how bank profitability, balance sheet management, and agency problems affect and are affected by SMS issuance. This section discusses how CB and MBS might differ in their implications for these factors.¹⁸

The effect of issuing CB and MBS on bank profitability is similar. If banks view CB and MBS as lines of business, then profits are going to be effectively returns to loan origination.¹⁹ The level of profit may differ due to differences in the costs of issuing CB versus MBS and differences in regulatory costs, but banks should see profit increase with either CB or MBS activity.

CB and MBS also aid banks in balance sheet management. For one thing, they allow banks to increase liquidity. Looking at the big picture, banks can fund deposits from a broader class of investors (bond purchasers in addition to standard bank liability holders such as depositors). This makes it easier to originate mortgages. But, viewed at the time of the bond issuance (that is, after the mortgages have been issued), CB raise new on-balance sheet liabilities and MBS convert the mortgages into cash. In both cases, this lets the banks fund new assets or repay existing liability holders. Here it is important to be careful about what we mean by liquidity. If banks use the ability to tap bond markets to fund mortgages as a regular line of business, then SMS serve as the grease in a production process, facilitating greater loan originations and higher profits. This is liquidity in the sense that, for example, Loutskina (2011) uses it. But some banks may use SMS only occasionally when they have an unexpected need to convert loans into cash. We return to this differentiation below.

There are differences in the way that CB and MBS allow banks to manage risk. 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.²⁰ Possibly because of this, more information about the contents of mortgage pools is available

¹⁸ For a more extensive discussion of why assets such as mortgages are securitized see Elul (2005) and Kothari (2006).

¹⁹ Securitization can also allow tax arbitrage (Kohler, 1998).

²⁰ 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 issue has defaulted.

for MBS investors than for CB investors.²¹ In addition, 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 tranching. The tranching allows bonds to differ in the timing and security of repayment.

MBS and CB differ in the degree to which agency problems such as moral hazard can be a problem. One potential issue for both kinds of bondholders is that the issuing bank may know more 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 (even if such information was available). 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.²² 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.²³

3. Empirical model

3.1 Sample selection and identification issues

This section outlines our approach to examining the choice among CB, MBS, and not issuing SMS. As discussed in the last section, the major economic benefits for CB and MBS are similar, however there are some structural (including legal and regulatory) features that may lead a bank to prefer one type of SMS over the other. We first explore banks in Spain and the U.K. – the countries where both CB and MBS are common. In these countries, we expect that the impact of structural differences is small. The next step is to turn to Germany

²¹ 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/>).

²² 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.

²³ The moral hazard advantage of CB might be limited when they are designed to take advantage of Eurosystem lending operations. CB can be used as collateral for central banks loans in Europe. Since 2009, there has been a specific CB purchase program that has been actively embraced by banks. Banks have used so-called self-funded CB to increase their reserves that are eligible as collateral for borrowing from central banks. The bank issues a CB to itself and then tenders the CB as collateral for a loan. This allows the bank to, in effect, use the underlying mortgages as collateral. If the central banks do not carefully monitor the collateral, there can be moral hazard issues. Since our sample ends in 2007, this practice does not affect our empirical results.

and the U.S. – countries where one of the SMS channels is restricted. We ask whether CB issuance in Spain and the U.K. is similar to that in Germany, and do a similar exercise for MBS issuance in the U.S. After that, we look at the flip side: how would SMS issue change in Germany and the U.S. if the playing field between CB and MBS was more equal as in Spain and the U.K.

There are reasons other than the structural factors that may influence SMS issue, such as how the origination and issuance of securities 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, 2011; Rosen, 2011), 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 convert the loans used as collateral to cash or to realize future profits from the repayment of the loans. 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 are consistent with the data on whether a bank issues CB or MBS.

Importantly, 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 while to the extent that the bank sells mortgages to other parties in addition to putting together a securitization, it understates the impact.²⁴

3.2 The decision to issue SMS: empirical approach

To investigate the decision to issue a SMS, we initially focus on Spain and the U.K. Banks in these countries are able to choose among CB, MBS, and no SMS issue. We examine the factors that lead a bank to issue SMS using the following model for predicting issuance by bank i in year t :

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

²⁴ 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.

where the SMS issue can be either CB or MBS. We use a multinomial logit framework to test (1). The bank characteristics we include are described below. To control for differences across countries, we also include country dummies and cluster errors at the country level.²⁵

We follow this up by examining CB issuance in Germany and MBS issuance in the U.S. First, we estimate (1) using a separate logistic regression for each country.²⁶ Then, we use the estimates of (1) for Spain and the U.K. to ask how SMS issuance would change if Germany had an active MBS market and the U.S. had an active CB market. We do this by assuming that banks in Germany and the U.S. choose similarly to those in Spain and the U.K.

3.3 *The effects of issuing SMS on banks: lines of business or balance sheet management?*

In addition to knowing which characteristics predict issuance, we also want to determine the effect of issuing SMS on banks. For this, we pool the data for all the countries in the sample and examine the effect on SMS issuance on a set of bank characteristics measuring profitability, liquidity, and risk, among other things. The model we use is:

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

where the bank characteristics are the same as those on the right-hand side of (1). The SMS issuance variables are discussed below. We estimate this using OLS and include bank fixed effects so the coefficients on the SMS variables indicate whether a particular characteristic is higher or lower after issuance relative to other times. We run a single regression including data for Germany, Spain, the U.K., and the U.S. This implicitly assumes that, except for SMS markets, the factors that generate bank characteristic levels are similar across the countries in the sample.

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, liquidity, and risk while also allowing us to include as large a sample of banks as possible. Profit is measured using return on assets, that

²⁵ Many of the reasons to issue MBS also apply to asset-backed securities (ABS) backed by such things as auto loans or credit card receipts. The qualitative results in the paper are not affected if we include ABS issuance as an option for SMS issuance or as a control. In part, this is because there are only a small number of banks in Spain and the U.K. that issue ABS. Results including an ABS are not reported in the paper.

²⁶ Our results are robust to including Germany, Spain, the U.S., the U.K. plus other European countries in a single regression (see the appendix).

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) at a bank because they are matched to liabilities with a similar maturity profile.²⁷ For this reason, we create a CB-free loans-to-deposits ratio by subtracting the mortgages backing CB from total loans.²⁸ 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-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.²⁹ 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 IV summarizes our hypotheses about

²⁷ There may be some minor liquidity issues because the mortgages in the CB pool have the risk of unexpected default and prepayment.

²⁸ 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.

²⁹ 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.

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 ROA regression based on equation (2).

Banks could use SMS for different kinds of balance sheet management. First, SMS can be used to improve liquidity. Liquidity can be improved in several ways. Issuing a SMS can allow a bank to increase its cash holdings. It also can bring forward future profit since the profit on a mortgage held in portfolio accrues over time as payments are made. 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.

If SMS increase liquidity for banks, it may also show elsewhere on the banks' balance sheets. If it is generally easy to issue SMS, the ability to issue can allow banks to hold less liquid assets (Loutskina, 2011). This implies that the ability to issue SMS would allow banks to have larger loan-to-deposit ratios both before and after issue. Of course, we measure actual SMS issue rather than the ability to issue SMS. However, we can pick up this type of liquidity in the forward-looking regressions. We expect that banks that have issued a particular type of SMS will expect to have future access to the market and, thus, are able to keep less liquidity on their balance sheet. This implies a positive coefficient on the appropriate SMS post-issue dummy in the adjusted loan-to-deposits ratio equation (2) regression. Thus, there are differences in predictions for the liquidity of being able to meet an existing liquidity problem by actually issuing a SMS (as discussed in the prior paragraph) and the liquidity created by the knowledge that you could issue a SMS if necessary (as discussed in this paragraph).

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 IV 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, 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 IV).

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 IV).

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 back 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

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 for Spain and the

U.K. are presented in Table V. 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 V reports the coefficients for the comparison of CB to not issuing SMS. The coefficient on ROA of -3.239 is significantly different from zero. This means that banks with lower ROA in year $t-1$ are more likely to issue CB. To get a feel for the economic significance of this effect, we calculate the impact of marginally increasing ROA on the probability of issuing a CB for a bank with the mean values for all the other variables. This value, referred to as the marginal effect in the tables, shows that the probability of issuing a CB decreases by 5.33 percentage points per percentage point increase in ROA. Given that a one standard deviation change in ROA is 0.22 and the probability that a sample bank issues a CB in a year is 0.08, this suggests that moderate increases in ROA can have a large impact on the probability of issuing CB.³⁰

The results for the CB columns in Table V also show that banks with larger (adjusted) loan-to-deposits ratios, larger capital ratios, lower provisions, and larger total assets are more likely to issue CB when compared with not issuing 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 MBS columns of Table V. 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 final column of Table V 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.

³⁰ There is a need to be careful when extrapolating from the marginal effect since it only holds exactly for a tiny change in ROA

To fully test our predictions, we have to examine banks both before and after SMS issuance, but the results in Table V 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 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.

Several robustness tests are discussed briefly here. We can replace the adjusted loan-to-deposit ratio with the balance sheet loans-to-deposits ratio (which includes the CB loan pool) without changing the qualitative results. 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. We can replace provisions with chargeoffs without changing the qualitative results. Also, we control for country effects using dummies, but it is 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, the same set of variables is statistically significant as in the baseline results. 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. Our results are robust to dropping all small banks from the sample. In addition, using interaction terms between bank size and the other variables, we show that while the interactions terms are occasionally significant, the overall predictions remain qualitatively similar to those in the baseline model.

4.2 SMS issuance in Germany and the U.S.: actual and predicted

The next step in our analysis is to examine SMS issuance in the countries where one of the markets is inactive. For the reasons discussed earlier, there are barriers to issuing MBS in

Germany and CB in the U.S. To look at the impact of these barriers, we look at the issuance decision for the SMS market that is active in each country. This allows us to see whether banks are issuing SMS for similar reasons in the unconstrained countries as in the constrained countries. Our analysis does not capture the full cost of missing SMS markets because we take the portfolio of a bank as given. The difficulties of issuing MBS in Germany and CB in the U.S. may affect the decision to originate mortgages, something we cannot pick up.

Table VI presents the results of regressions for CB issuance in Germany and MBS issuance in the U.S. The coefficients are similar in sign and significance to the baseline results shown in Table V. This suggests that common factors drive the SMS issuance across countries.

Making use of the estimated coefficients of the subsample of Spanish and U.K. banks in Table V, it is possible to simulate the extent to which CB issuance in Germany and MBS issuance in the U.S. might change if the other type of security (MBS in Germany and CB in the U.S.) was easy to issue. We do this in two steps. First, we explore whether banks that issued CB in Germany would have issued MBS if the barriers to MBS issue were not present. We do the same for banks switching from MBS to CB in the U.S. The second step is to estimate which banks that did not issue a SMS would have issued one if the barriers to issuing MBS in Germany and CB in the U.S. were not there.

We rely on the baseline regressions for Spain and the U.K. to estimate the number of banks that would switch the type of SMS they issue if barriers in Germany and the U.S. were lower. For each German bank that issues a covered bond in a year, we ask whether they prefer MBS to CB using the coefficients reported in Table V. To do this, we calculate the predicted probabilities of issuing MBS and of issuing CB. If the probability of issuing MBS is larger than the probability of issuing CB we assume that the bank switches from CB to MBS. Our estimates imply that 20.3% of German banks that issue CB in a year would be more likely to issue MBS that year if they were in a Spanish-U.K. environment. A similar exercise for U.S. banks suggests that for 24.8% of MBS issues, CB would be preferred if there were no barriers to CB issuance.

To estimate the number of SMS non-issuers who might issue if barriers were lower, we find for each bank in Germany that does not issue CB the probability that bank would issue MBS using the coefficients in the MBS columns in Table V. So, for example, a German bank with the right-hand side variables equal to the sample means would have a predicted probability of issuing MBS of 19%. We then sum these probabilities to get the expected number of non-CB issuing banks that would issue MBS in Germany. As reported in the second row of Table VII, we estimate that there would be 35 MBS issues from these banks.

Since German banks issued 96 CB during our sample, adding 35 MBS would significantly increase total SMS issuance.

We conduct a similar exercise to find the proportion on non-MBS issuing U.S. banks that would issue CB if the conditions for CB issuance were similar to those in Spain and the U.K. We estimate that there would be 78 CB issues during our sample period, large compared to the 91 MBS issues we actually observe.³¹

For both Germany and the U.S. we find that the barriers to issuing SMS are important. Note that we do not estimate the welfare loss, if any, from the barriers. It could be that the gains from lowering the barriers are low.

4.3 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). The regression includes observations for the full sample. SMS issuance is controlled for in two ways. First, we include dummies for whether a bank has issued a particular kind of SMS in the prior two years. So, the CB dummy takes the value 1 if a bank has issued a CB in the prior two years (years t and $t-1$ for a characteristic measured at the end of year t). Second, we estimate the probability that a bank issues a particular kind of SMS in the prior two years using the regression results reported in Table V. We use this predicted probability to estimate (2). In Panel A of Table VIII, coefficients on the SMS variables for both approaches are reported. Each column reports coefficients from two different regressions, with SMS dummies in the first two rows and the predicted SMS issuance probabilities in the last two rows. For all the regressions, the other control variables given in (2) are included but not reported in the table.

There is evidence that issuing CB improves profitability. The coefficients on both CB variables in the regressions reported in the first column of Panel A of Table VIII are positive and significantly different from zero. The coefficient on the CB dummy in the first row is 0.072 meaning that 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 10% of the mean and 33% of the standard deviation of ROA for banks in the sample. The coefficient on the predicted

³¹ Note that this estimate should be viewed with caution since we do not control for borrowings from the FHLBs.

probability of issuing a CB, as given in the third row, is 0.094 indicating a similar sized impact.

The results are also consistent with banks issuing CB to meet an existing liquidity need. 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 first row of the second column of Panel A of Table VIII, 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 issuing CB to meet an existing liquidity need but not with the ability to issue CB allowing a bank to reduce the liquidity of its balance sheet. 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 IV, 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 in Panel A of Table VIII).

Issuing CB is associated with lower risk. Following issuance, banks have lower adjusted loan-to-deposit ratios (column 2 in Panel A of Table VIII) and larger capital ratios (column 4 in Panel A of Table VIII). However, the impact on capital ratios is relatively small. Using the coefficient from the first regression, 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 in Panel A of Table VIII). 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).

The effect of securitizing mortgages is different than the effect of issuing a covered bond. The impact of MBS issue on profit is insignificant and economically small in magnitude. There is also evidence that the ability to issue MBS allows banks to keep less liquid balance sheets as the coefficient on the MBS dummy in the lower adjusted loan-to-deposit ratio regression (column 2 in Panel A of Table VIII) is positive and significant. This result is

consistent with Loutskina (2011) although unlike her, we do not find that banks with access to MBS markets grow faster (column 3 in Panel A of Table VIII).

There is evidence that issuing MBS might reduce risk. Banks that issue MBS have lower provisions post-issue (column 5 in Panel A of Table VIII) and issuing MBS also leads to slower loan growth (column 3 in Panel A of Table VIII). Loan growth decreases by 0.17 standard deviations and provisions decrease by 0.04 standard deviations in the year following a MBS issue (coefficients from the first regression as reported in the second row of the table).

All the results in Panel A of Table VIII remain significant when the explanatory variables are shown as one-year lag instead of two-year lag, although the coefficients are smaller in magnitude (not shown for simplicity).

There are some banks that issue more often than others. To test whether active issuers use securitization for the same reasons as less active issuers, we introduce new interaction variables. Define an issuer as being active in the CB (MBS) market if it issues CB (MBS) more than twice during the sample period. We introduce two dummies for each type of security (CB and MBS). The first dummy takes the value one if and only if a bank has issued a CB (MBS) in the last two years and is an active issuer. The second takes the value one if and only if the bank has issued a CB (MBS) in the last two years and is non-active issuer. We run our forward-looking regressions with these dummies replacing the other SMS dummies. The results are shown in Panel B of Table VIII and are very similar to those in Panel A of the table.

The findings are also robust when we restrict the sample to just Spanish and U.K. banks (Table VIII, Panel B). We also conduct a similar set of robustness checks as in the last section. The results suggest that the impact of SMS issue is generally bigger for large banks. But, none of the qualitative results are different based on bank size.

4.4 The reasons for issuing SMS

We can use the results above along with the predictions in Table IV to examine why banks issue CB and MBS. Banks may issue SMS to increase profit, to manage their balance sheets, and for agency reasons. As shown in Table IX, the analysis supports the hypothesis that banks issue CB at least in part for profit and balance sheet management. 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.

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 CB occurs when there are immediate liquidity needs while the ability to issue MBS may reduce the need to keep as much balance sheet liquidity. 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 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 country 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 $t-1$. Again, this is run using OLS with bank fixed effects. The results of the regression are reported in Table X. They show evidence of herd behavior among MBS-issuing banks but not for CB-issuing banks.

Overall, banks appear to be issuing CB for 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.³² However, once mortgages go into the SPE backing MBS, all risk is borne by bondholders. This is consistent with MBS be more useful than CB for both risk management and exploiting certain kinds of agency problems.

The liquidity findings are consistent with a difference in the start up costs for issuing CB and MBS. Assume the costs to setting up a MBS program are larger than the costs for setting up a CB program but the costs of an individual issue are larger for CB. This would imply that a bank that had issued MBS could expect to do so relatively cheaply if the need arose in the future. This would allow them to reduce their balance sheet liquidity. If a bank had an existing liquidity need but not an established MBS program, it would make sense to issue CB. Of course, banks with an established MBS program and a liquidity need might issue MBS rather than CB, but as long as there are not a lot of these circumstances, this intuition is consistent with the results in the paper.

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 its

³² The only benefit comes because there are some states where the bank fails and the CB mortgage pool is insufficient to pay bondholders.

government in 2008.³³ In our sample, 11% of the banks received a bailout (see Table I). For each bank, we ask how the bailout dummy is related to whether the bank issued SMS:

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

We estimate this using logistic regression. The results of this regression are reported in the first column of Table XI. 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 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 XI split the sample by bank size and capital ratios. 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. In fact, we find they appear to be used for different reasons. Banks were more likely to use CB when they were liquidity constrained, and the use of CB improved liquidity. After using

³³ 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 bail outs in the U.S., we rely on U.S. Treasury data covering participation in the Asset Guarantee Program, the Capital Assistance Program and the Capital Purchase Program.

MBS, however, banks held less liquidity. There is also some indication 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.

Differences in the usage of CB and MBS suggest that having both types of secondary mortgage security available is important. We offer support for this by comparing countries where CB and MBS are both commonly used by banks with countries where only one of the two types of securities is common. We estimate that if MBS markets in Germany, where banks did not issue MBS in our sample period, were like those in Spain and the U.K., where both CB and MBS were issued, 20% of banks would switch from issuing CB to issuing MBS. Similarly, if regulatory issues surrounding CB issuance in the U.S. were resolved so that U.S. CB markets were like those in Spain and the U.K., we estimate that 25% of the banks that issue MBS would instead issue CB. In both Germany and the U.S., opening up the dormant SMS channel would also lead banks that would not otherwise issue SMS to issue them. This shows the importance of having active SMS markets.

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Table I. Descriptive statistics

Based on a sample of 377 banks in Germany, Spain, the U.S., and the U.K. from 2003-2007. To be in the sample, a bank must have at least \$1 billion in assets. Not all banks issued MBS or CB while some banks issued MBS and/or CB multiple times.

	ALL SAMPLE			MBS ISSUERS			CB ISSUERS		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
<i>ROA (%)</i>	0.73	0.70	0.22	0.66	0.61	0.17	0.83	0.75	0.24
<i>Loans-to-deposits ratio (%)</i>	0.81	0.74	0.12	0.87	0.80	0.17	0.78	0.76	0.11
<i>Adjusted loans-to-deposits ratio (%)</i>	0.72	0.70	0.16	0.81	0.76	0.19	0.68	0.65	0.16
<i>Capital ratio (%)</i>	5.97	5.50	2.13	5.57	5.50	2.27	6.38	6.27	2.13
<i>% of banks in the Low CR group</i>	24.96	-	-	34.04	-	-	18.61	-	
<i>Capital ratio of banks in the Low CR group (%)</i>	4.12	3.85	2.02	3.89	3.82	2.19	4.23	4.04	2.12
<i>Provisions-to-loans ratio (%)</i>	8.62	8.01	3.23	7.18	7.10	3.30	9.13	8.79	3.26
<i>Net charge-offs ratio (%)</i>	0.44	0.53	0.26	0.41	0.43	0.17	0.31	0.33	0.17
<i>Loan growth (%)</i>	8.11	9.35	1.85	12.10	12.23	1.79	9.13	9.42	1.91
<i>Total assets (\$ bil.)</i>	38.48	40.03	6.17	39.24	40.13	6.72	36.12	37.59	5.43
<i>Total assets (log)</i>	10.55	10.43	2.12	10.72	10.50	2.13	10.71	10.29	2.34
<i>Bail-out dummy</i>	0.11	0.10	0.30	0.14	0.12	0.34	0.09	0.10	0.22
<i>House price index (base: 2003= 100)</i>	107.3	105.1	12.1	111.3	109.7	15.26	106.19	104.4	12.23
<i>Observations</i>	1850			130			141		
<i>Banks</i>	377			38			42		

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

Table II. SMS issue by country

Based on a sample of 377 banks in Germany, Spain, the U.S., and the U.K. from 2003-2007. To be in the sample, a bank must have at least \$1 billion in assets. Not all banks issued MBS or CB while some banks issued MBS and/or CB multiple times.

	All banks	MBS			CB		
	<i>Obs.</i>	<i>Obs.</i>	<i>Average issue size (\$ mil.)</i>	<i>Average issuer size (\$bil)</i>	<i>Obs.</i>	<i>Average issue size (\$ mil.)</i>	<i>Average issuer size (\$bil)</i>
Full sample	1850	172	1,072	76.6	202	569	41.3
Germany	402	-	-	-	96	627	46.7
Spain	284	43	286	33.8	58	445	31.8
U.K.	212	38	375	41.1	48	602	42.1
U.S.	952	91	1,734	111.7	-	-	-

Table III. Covered bond holdings by country, 2007.

This includes covered bonds backed by pools of mortgages. Covered bonds backed by mixed pools of assets (that may include mortgages and others assets such as public sector assets) are issued in France but excluded from this table. Source: European Covered Bond Council.

	Amount outstanding (EUR billions)	Share of total outstanding
Austria (e)	4.1	0.4%
Canada	2.0	0.2%
Czech Republic	8.2	0.8%
Denmark	244.7	22.9%
Finland	4.5	0.4%
France	63.6	5.9%
Germany	206.5	19.3%
Hungary (e)	6.0	0.6%
Ireland	13.6	1.3%
Latvia	0.1	0.0%
Luxembourg	0.2	0.0%
Netherlands	15.7	1.5%
Norway	6.4	0.6%
Poland	0.7	0.1%
Portugal	7.9	0.7%
Slovakia	2.7	0.3%
Spain	267.0	25.0%
Sweden	92.3	8.6%
Switzerland	29.0	2.7%
United Kingdom	82.0	7.7%
United States	12.9	1.2%
<i>Total</i>	1,070	

(e) – Estimated.

Table IV. Predicted signs on the regression coefficients

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

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 V. Determinants of the use of securitization:
Baseline specification for Spain and the U.K.**

Multinomial regression on 496 observations of banks in Spain and the U.K over 2003-2007. The dependent variable is an indicator variable for whether a bank issues a CB, a MBS, or neither in year t . Control variables are as of the end of year $t-1$ (except for ROA which is for the full year). M.e. stands for marginal effect, which is the impact of marginally increasing the given variable on the probability of issuing a CB or MBS for a bank with the mean values of all the other variables. The p-values in the final column are for the test that the coefficient for the choice between CB and not issuing SMS equals the coefficient for the choice between MBS and not issuing SMS. Standard errors are clustered at the country level.

	CB			MBS			Comparison of CB to MBS
	<i>Coeff.</i>	<i>m.e (%)</i>	<i>p-value</i>	<i>Coeff.</i>	<i>m.e (%)</i>	<i>p-value</i>	<i>p-value</i>
<i>ROA</i>	-3.239**	5.33	0.012	-0.464	-0.70	0.114	0.001
<i>Adjusted loans-to-deposits ratio</i>	1.440***	2.70	0.002	5.351**	8.78	0.013	0.001
<i>Capital ratio</i>	1.228**	2.39	0.025	0.153	2.53	0.252	0.001
<i>Low CR</i>	0.147	0.23	0.541	0.491	0.69	0.531	0.005
<i>Provision- to-loans ratio</i>	-0.738*	-0.98	0.079	0.258*	0.32	0.079	0.001
<i>Loan growth</i>	-2.118	-3.69	0.192	0.706	0.87	0.505	0.032
<i>Total assets (log)</i>	2.017**	3.49	0.032	1.324**	2.60	0.039	0.005
<i>House price index</i>	0.257	0.32	0.299	0.739**	0.99	0.016	0.002
Base category:	Non-issuer						
Number of observations	496						
Number of groups	140						

Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

**Table VI. Determinants of the use of securitization:
Covered bonds in Germany and mortgage-backed securities in the U.S.**

The first regression is over 399 observations of German banks over 2003-2007. The dependent variable is an indicator variable for whether a bank issues a CB or not in year t . The second regression is over 950 observations of U.S. banks over 2003-2007. The dependent variable is an indicator variable for whether a bank issues a MBS or not in year t . For both regressions, control variables are as of the end of year $t-1$ (except for ROA which is for the full year). M.e. stands for marginal effect, which is the impact of marginally increasing the given variable on the probability of issuing a CB (Germany) or MBS (U.S.) for a bank with the mean values of all the other variables. Standard errors are clustered at the country level.

	Germany - CB			U.S. - MBS		
	<i>Coeff.</i>	<i>m.e (%)</i>	<i>p-value</i>	<i>Coeff.</i>	<i>m.e (%)</i>	<i>p-value</i>
<i>ROA</i>	-3.788***	5.68	0.006	-0.714	-1.01	0.227
<i>Adjusted loans-to-deposits ratio</i>	2.108***	3.15	0.003	5.370***	8.80	0.005
<i>Capital ratio</i>	1.424***	2.68	0.010	0.166	0.22	0.190
<i>Low CR</i>	0.130	0.18	0.227	0.463	0.55	0.382
<i>Provisions to Loans</i>	-0.741*	-1.01	0.054	0.282**	0.36	0.035
<i>Loan growth</i>	-3.130	-5.29	0.123	0.442	0.49	0.197
<i>Total assets (log)</i>	2.039**	3.55	0.018	1.251**	2.47	0.024
<i>House price index</i>	0.296	0.69	0.316	0.762**	1.05	0.026
Base category:	Non-issuer					
Number of observations	399			950		
Number of groups	106			131		

Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Table VII. Effect of market restrictions on SMS issue in Germany and the U.S.

The table presents the results for simulations under which German and U.S. banks are assumed to issue CB and MBS under the same conditions as Spanish and U.K. banks do. A bank that issues a CB in Germany is assumed to switch to a MBS if the predicted probability of issuing a CB is lower than the predicted probability of issuing a MBS using the coefficients from the results reported in Table V. A similar exercise establishes the banks in the U.S. that would switch from a MBS to a CB. For German banks that do not issue CB, the probability that they would issue MBS is calculated using the coefficients from the results reported in Table V. These probabilities are summed across all German banks that did not issue CB in a given year to get the percent of banks that switch from not issuing a SMS to issuing MBS. Again, a similar exercise is done to derive the percentage of U.S. banks that switch from not issuing a SMS to issuing CB.

	Switch from	Switch to	Pct. of banks that switch	Number of switches (obs.)
Germany	CB	MBS	20.3%	20 out of 96
	0	MBS	11.4% *	35 out of 306
U.S.	MBS	CB	24.8%	23 out of 91
	0	CB	9.1% **	78 out of 861

Table VIII, Panel A. Effects of the use of CB and MBS

Regressions on the effects of SMS issue for 1,850 observations of banks in Germany, Spain, the U.K., and the U.S. over 2003-2007. Each column reports results from two regressions. Dependent variables are given in the column header and are for year t (year-end values except for ROA). The dummies for SMS issue take the value 1 if and only if a bank issues that type of SMS at least once in years t-1 or t. Predicted probabilities of issuing a SMS are based on coefficients reported in Table V. All the regressions have bank fixed effects and controls for balance sheet, income statement, and house price variables (coefficients not reported). Standard errors are clustered at the country level.

	ROA		Adjusted loans-to-deposits		Loan growth		Capital ratio		Capital ratio For the bottom 25% capital (low CR)		Provisions to loans		Total assets (log)								
	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>							
First set of regressions: using SMS dummies																					
<i>Have you issued CB in the last 2 years?</i>	0.072	**	0.030	-0.025	**	0.023	0.084	0.509	0.080	**	0.020	0.032	**	0.014	0.062	0.281	0.008	*	0.084		
<i>Have you issued MBS in the last 2 years?</i>	0.004		0.144	0.010	*	0.051	-0.030	**	0.021	0.011		0.319	0.004		0.286	-0.007	*	0.04	0.053	**	0.019
Second set of regressions: using predicted probability of issuing SMS																					
<i>Predicted probability of issuing CB in the last 2 years</i>	0.094	***	0.008	-0.048	**	0.032	0.090	0.353	0.092	**	0.027	0.038	***	0.007	0.078	0.217	0.015	*	0.063		
<i>Predicted probability of issuing MBS in the last 2 years?</i>	0.010		0.177	0.012	*	0.076	-0.054	***	0.008	0.015		0.340	0.008		0.319	-0.009	**	0.032	0.050	**	0.012

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

Table VIII, Panel B. Effects of the use of CB and MBS: robustness

Each column reports results from two regressions. Dependent variables are given in the column header and are for year t (year end values except for ROA). Regressions in the first rows are for 1,850 observations of banks in Germany, Spain, the U.K., and the U.S. over 2003-2007. Regressions in the last rows are for 496 observations of banks in Spain and the U.K. over 2003-2007. The dummies for SMS issue take the value 1 if and only if a bank issues that type of SMS at least once in years t-1 or t. All the regressions have bank fixed effects and controls for balance sheet, income statement, and house price variables (coefficients not reported). Standard errors are clustered at the country level.

	ROA		Adjusted loans-to-deposits			Loan growth		Capital ratio		Capital ratio For the bottom 25% capital (low CR)		Provisions to loans		Total assets (log)					
	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>	<i>Coeff.</i>	<i>p-value</i>					
First set of regressions: active versus non-active issuers																			
<i>Have you issued CB in the last 2 years and you are a non-active issuer?</i>	0.021	*	0.064	-0.011	**	0.018	0.063	0.513	0.062	**	0.026	0.018	**	0.024	0.033	0.266	0.013	*	0.094
<i>Have you issued CB in the last 2 years and you are an active issuer?</i>	0.086	**	0.013	-0.043	***	0.002	0.090	0.668	0.093	**	0.018	0.004	0.316	0.060	0.499	0.010	0.236		
<i>Have you issued MBS in the last 2 years and you are a non-active issuer?</i>	0.003		0.228	0.004	*	0.063	-0.021	**	0.023	0.013	0.356	0.015	0.302	-0.005	*	0.062	0.021	*	0.068
<i>Have you issued MBS in the last 2 years and you are an active issuer?</i>	0.016	*	0.058	0.013	**	0.041	-0.048	**	0.026	0.015	0.228	0.023	0.628	-0.014	**	0.028	0.094	**	0.025
Second set of regressions: includes only banks in Spain or the U.K.																			
<i>Have you issued CB in the last 2 years?</i>	0.094	**	0.037	0.037	*	0.088	0.099	0.688	0.093	**	0.015	0.029	**	0.032	0.066	0.321	0.018	*	0.062
<i>Have you issued MBS in the last 2 years?</i>	0.002		0.225	0.009	*	0.08	-0.053	**	0.013	0.013	0.441	0.012	0.522	-0.012	*	0.029	0.079	**	0.016

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

Table IX. Interpretation of regression results

	CB			MBS		
	Before	After	Consistent with	Before	After	Consistent with
ROA	-	+	Profit, Liquidity (1)	(-)	(+)	Empire building
Adjusted loans- to-deposits ratio	+	-	Liquidity (1), Risk management	+	+	Liquidity (2)
Capital ratio	+	+	Low risk	(+)	(+)	
Low capital	(+)			(+)		
Provisions	(+)	(+)		+	-	Risk management
Loan growth	-	(+)		(+)	-	Risk management

Liquidity (1) is issuance to meet an existing liquidity need.

Liquidity (2) is the ability to issue leading to less need for balance sheet liquidity.

Parentheses indicate coefficients that are not significantly different from zero.

Table X. Tests for the presence of herd behavior in issuing CB and MBS

This table reports selected results for multinomial regressions testing whether the issue of SMS by a bank in year t is affected by issuance of SMS by other banks in the same country in year $t-1$ over 2003-2007. The full sample regression contains 1,845 observations for banks in Germany, Spain, the U.K., and the U.S. The large bank regression contains 331 observations for banks with over \$50 billion in total assets in Germany, Spain, the U.K., and the U.S. In both regressions, the dependent variable is an indicator variable for whether a bank issues a CB, a MBS, or neither in year t . Control variables are as of the end of year $t-2$ (except for ROA which is for the full year $t-2$). Coefficients on the control variables ROA, the adjusted loan-to-deposit ratio, the capital ratio, the provisions-to-loans ratio, loan growth, the log of total assets, and the house price index are not shown. The dummies for SMS issue take the value 1 if and only if a bank issues that type of SMS at least once in years $t-1$ or t . The growth of CB or MBS issuance is for the home country of the bank in year $t-1$. Standard errors are clustered at the country level.

	Full sample				Large banks only (assets>\$50bln)			
	CB		MBS		CB		MBS	
	<u>Coeff.</u>	<u>p-value</u>	<u>Coeff.</u>	<u>p-value</u>	<u>Coeff.</u>	<u>p-value</u>	<u>Coeff.</u>	<u>p-value</u>
<i>CB issue in the last 2 years</i>	0.031**	0.001	0.013	0.131	0.034**	0.001	0.017	0.120
<i>MBS issue in the last 2 years</i>	0.068	0.132	0.119***	0.003	0.042	0.143	0.119***	0.001
<i>Growth of CB issuance in home country in the last year</i>	0.051	0.181	0.006	0.185	0.049	0.172	0.013	0.274
<i>Growth of MBS issuance in home country in the last year</i>	-0.054	0.127	0.135***	0.001	-0.011	0.132	0.132***	0.001

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

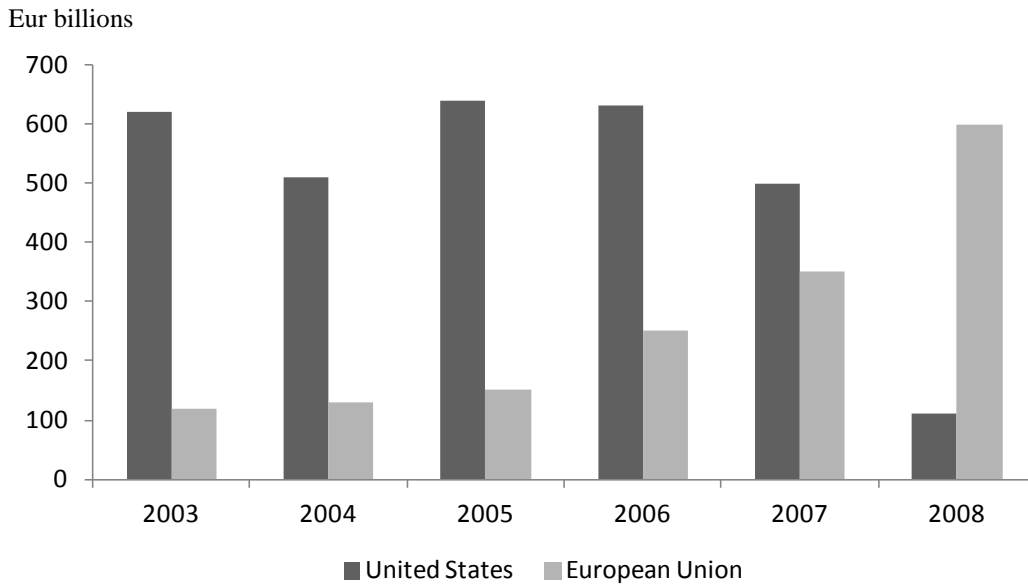
Table XI. Bailout regressions

This table reports selected results for logistic regressions where the dependent variable takes the value one if and one if a bank was bailed out by its government in 2008. The regression contains observations for banks in Germany, Spain, the U.K., and the U.S. The large bank regression contains observations for banks with over \$50 billion in total assets. All other banks are in the small bank regression. The top 75% and bottom 25% by capital are using year-end 2006 capital ratios. Control variables are as of the end of 2006 (except for ROA which is for the full year). Coefficients on the control variables ROA, the adjusted loan-to-deposit ratio, the capital ratio, the provisions-to-loans ratio, loan growth, the log of total assets, and the house price index are not shown. The dummies for SMS issue take the value 1 if and only if a bank issues that type of SMS at least once in 2006 or 2007. Standard errors are clustered at the country level.

	Full sample		Large banks (assets > \$50bil.)		Small banks (assets ≤ \$50bil.)		Top 75% of banks by capital ratio		Bottom 25% of banks by capital ratio (low CR banks)	
	<u>Coeff.</u>	<u>p- value</u>	<u>Coeff.</u>	<u>p-value</u>	<u>Coeff.</u>	<u>p-value</u>	<u>Coeff.</u>	<u>p-value</u>	<u>Coeff.</u>	<u>p-value</u>
<i>ROA</i>	0.054 **	0.037	0.070 **	0.041	0.092 **	0.050	0.016 *	0.061	0.071 **	0.024
<i>Adjusted loans-to-deposits ratio</i>	1.166 **	0.024	0.862 **	0.022	1.214 **	0.028	0.632 **	0.043	1.363 **	0.040
<i>Capital ratio</i>	-0.089 **	0.013	-0.037 **	0.007	-0.091 **	0.014	-0.084 **	0.027	-0.132 **	0.014
<i>Low CR</i>	0.062 **	0.034	0.066 **	0.024	0.043 **	0.034	--		0.054 **	0.026
<i>Provisions-to-loans</i>	0.034 **	0.026	0.014 *	0.059	0.040 **	0.027	0.010 **	0.013	0.043 **	0.033
<i>Loan growth</i>	1.231 ***	0.008	1.047 ***	0.004	1.309 **	0.013	0.914 **	0.023	1.123 ***	0.005
<i>Total assets (log)</i>	0.020	0.258	0.032	0.216	0.018	0.211	0.018	0.258	0.028	0.319
<i>House price index</i>	0.065 *	0.053	0.011	0.685	0.010	0.750	0.013	0.132	0.031	0.225
<i>Have you issued CB in the last 2 years (2006-07)</i>	0.033	0.172	0.064	0.135	0.026	0.191	0.054	0.216	0.033	0.111
<i>Have you issued MBS in the last 2 years (2006-07)</i>	0.154 **	0.013	0.176 **	0.013	0.133 **	0.015	0.037 **	0.035	0.182 **	0.026
Adj. R ²	0.819		0.728		0.717		0.623		0.608	

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

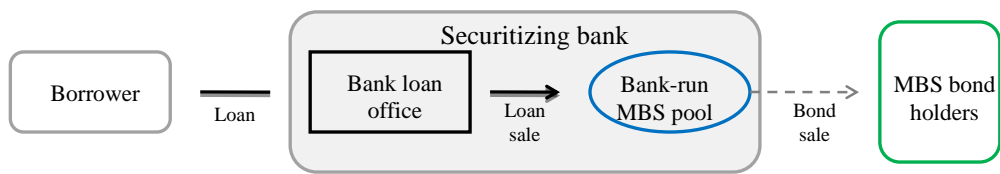
Figure 1. MBS issuance evolution in the U.S. and Europe



Source: European Central Bank (2011) and author's calculations.

Figure 2. MBS: origination vs. securitization

Bank securitizes its own loans



Bank purchases loans to securitize

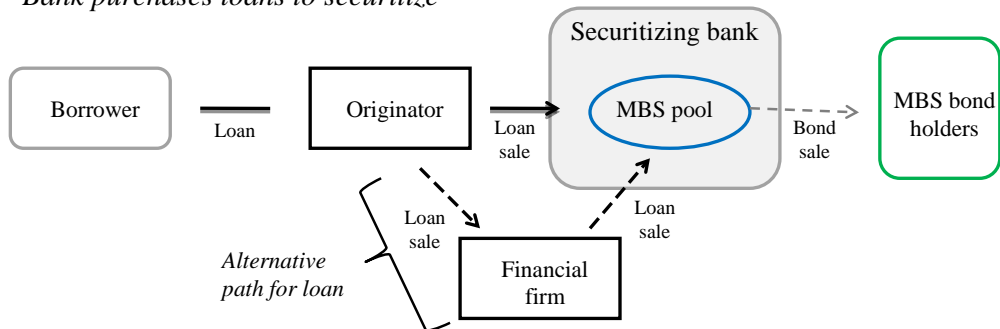
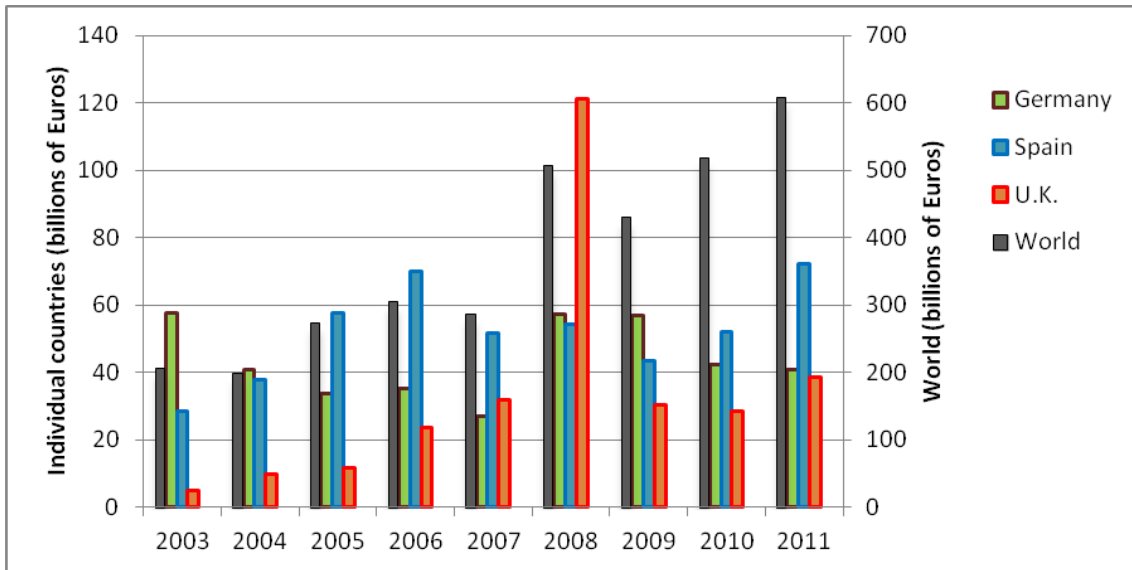


Figure 3. Covered bond issuance in the European Union.



Source: European Covered Bond Council

Figure 4. CB funding steps

