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THE CASE OF SPAIN

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by Santiago Carbó-Valverde,[2] David Marqués-Ibáñez[3] and Francisco Rodríguez Fernández[4]

In 2011 all ECB publications feature a motif taken from the €100 banknote.

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Abstract: While the 2007-2010 financial crisis has hit a variety of countries asymmetrically, the case of Spain is particularly illustrative: this country experienced a pronounced housing bubble partly funded via spectacular developments in its securitization markets leading to looser credit standards and subsequent financial stability problems. We analyze the sequential deterioration of credit in this country considering rating changes in individual securitized deals and on balance sheet bank conditions. Using a sample of 20,286 observations on securities and rating changes from 2000Q1 to 2010Q1 we build a model in which loan growth, on balance-sheet credit quality and rating changes are estimated simultaneously. Our results suggest that loan growth significantly affects on balance-sheet loan performance with a lag of at least two years. Additionally, loan performance is found to lead rating changes with a lag of four quarters. Importantly, bank characteristics (in particular, observed solvency, cash flow generation and cost efficiency) also affect ratings considerably. Additionally, these other bank characteristics seem to have a higher weight in the rating changes of securities issued by savings banks as compared to those issued by commercial banks.

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Non-technical summary

In the 2007-2010 financial crisis, the economies of different countries have been affected with various degrees of intensity according to their exposure to some of its main drivers. In Spain securitization activity grew spectacularly mostly in sync with large increases in bank credit to the private sector. The spectacular upward swing in the Spanish credit cycle was buttressed by relatively loose lending practices and large increases in housing prices (see Jimenez et al., 2010, and Reinhart and Rogoff, 2009). Hence the recent episode of financial instability in Spanish shares many common features with prior instances of banking problems (i.e. large increases in loan growth coupled with housing price bubbles). These features also emerged together with new factors such as a more extensive use of securitization activity and market funding by banks which probably helped to augment the swing in the credit cycle.

We focus on the recent Spanish credit cycle which largely explains the episodes of financial instability and uncertainty that the Spanish banking sector suffered during 2009 and 2010. These episodes gave, in turn, rise to the implementation of bank restructuring plans in 2010 and 2011. We characterize the sequential evolution of the credit cycle by combining information at the individual security (mortgage-backed securities, MBS, and asset-backed securities, ABS), institution (i.e. bank), and geographical (i.e. region in which each bank operates) levels. The information is quarterly and the sample period ranges from the first quarter of 2000 to the first quarter of 2010. We identify the sequential influence of housing prices, lending patterns and securitized flows on the credit quality of each individual institution and securitization deals over time. The main aim is to illustrate a predictability chain in which changes in housing prices and securitization activity may have led to poorer credit quality standards and loan defaults, generating financial instability.

We approximate credit risk developments at the bank level by considering non-performing loans of each institution and rating changes at the individual security level. Importantly, our database allows us to identify not only the rating of these securities at the time of origination but also over time. We also analyze to what extent housing prices, securitization activity and lending may have asymmetric effects across institutions and geographically (at the regional level) by identifying the role of each one of these factors.

We find that loan growth significantly affects loan performance with a lag of at least two years. Additionally, overall on balance-sheet bank loan performance is also found to explain rating changes of securitized assets with a lag of four quarters partly indicating that there is a considerable lag before ratings are reassessed. We also find that bank characteristics (in particular, observed solvency, cash flow generation and cost efficiency) also affect the ratings of securities deals which are no longer on banks' balance-sheet. Additionally, these bank characteristics seem to have a higher weight in the rating changes of securities originated by savings as compared to those originated by commercial banks.

1. Introduction

The economies of different countries have been affected with different degrees of intensity according to their exposure to some of the main drivers of the financial crisis.[1] Securitization, which has been largely blamed as one of the main contributors to the financial meltdown, is an important example in place. While in some countries, securitization played a very large role, in other nations the resort to activities in these markets was insignificant from a macroeconomic perspective. Similarly, some economies have experienced large increases in housing prices in the years prior to the crisis while in other countries housing prices remained stable.

It is highly likely that by augmenting the amount of funding available to banks, securitization activity had a significant and positive impact on credit growth during the years prior to the credit crisis (Loutskina and Strahan, 2009, Altunbas *et al.*, 2009). In a number of countries experiencing a period credit growth, securitization activity probably strengthened the feedback effect between increases in housing prices and the credit expansion. The growth in securitization issuance also led to laxer credit standards and looser screening of borrowers thereby supporting higher credit growth in the years prior to the crisis (Keys, Mukherjee, Seru and Vig, 2010). This is because securitization involves a longer informational distance than ordinary loans between the loan's originator and the ultimate bearer of the loan's default risk. Hence securitization can potentially reduce lenders' incentives to carefully screen and monitor borrowers thereby affecting loan quality. Other factors contributing to laxer credit screening standards in the years prior to the crisis include the degree of competition in the banking system, external financial imbalances, the level of private sector debt, corporate governance in the banking sector, the relative tightness of monetary policy, the intensity of banking supervision.

Spain has attracted a big deal of the international attention during the current crisis.[2] In this country, securitization activity grew spectacularly mostly in sync with large increases in

[1] Acharya and Richardson (2009).
[2] See for instance Krugman (2009) or Taylor (2010).

bank credit to the private sector. Indeed Spain has been largely labeled as a market in which securitization activity grew from being almost insignificant in the late 1990's to finance a large portion of bank lending to the private sector in the years running up to the banking problems.[3] On the back of an exceptional growth in bank credit, this country also recorded a large rise in private sector debt. As in many episodes of banking problems across the world, the spectacular upward swing in the Spanish credit cycle was buttressed by looser lending practices and large increases in housing prices (see Tornell and Westermann, 2002, and Reinhart and Rogoff, 2009). Hence the recent Spanish episode of financial instability shares many common features with many early episodes of banking problems (i.e. large increases in loan growth coupled with housing bubbles). These features also emerged together with new factors such as financial innovation in securitization markets.[4]

In this paper we focus on the recent Spanish credit cycle which largely explains the banking problems in this country and, in particular, the episodes of financial instability and uncertainty that the Spanish banking sector suffered during 2009 and 2010. These episodes gave, in turn, rise to the implementation of banking restructuring plans in 2010 and early 2011. We characterize the sequential evolution of the credit cycle and claim that securitization and, in particular, mortgage-backed securitization (*MBS* onwards), together with housing prices, may have had a large and lasting effect – through excessive lending – in triggering the banking problems in Spain. We conduct our empirical analysis of the credit cycle by combining information at the individual security (mortgage-backed securities, *MBS*, and asset-backed securities, *ABS*), institution (i.e. bank), and geographical (i.e. region in which each bank operates) levels. The information is quarterly and the sample period runs from 2000Q1 to 2010Q1. We identify the sequential influence of housing prices, lending patterns and securitized

[3] Securitization issuance totaled 5 billion in 1999 and 90 billion in 2006.

[4] Although it goes beyond the specific goal of this paper, Spain also pioneered some of the macro-prudential supervision initiatives undertaken in the years that preceded the financial crisis. In particular, the role of counter-cyclical provisions implemented in 2000 as a way of reducing pro-cyclicality in the banking system. This provisioning has been largely identified as an attenuating factor that may have reduced the impact of the financial crisis on Spain. These provisions have even inspired some of the proposals for reform of the financial system architecture to be incorporated in the new Basle III regulatory initiatives.

flows on the credit quality of each individual institution and securitization deal over time. The main aim is to illustrate a predictability chain in which changes in housing prices and securitization activity may have led to poorer credit quality standards and loan defaults, generating financial instability.

We approximate credit risk developments at the bank level by considering non-performing loans of each institution and rating changes at the individual security level. Importantly, our database allows us to identify not only the rating of these securities at the time of origination but also their evolution over time. We also analyze to what extent housing prices, securitization activity and lending may have asymmetric effects across institutions and geographically (at the regional level) by identifying the role of each of these factors. Our results suggest that credit developments in Spain were not that different from those experienced by other countries in previous episodes of banking problems identified by earlier literature (see Reinhart and Rogoff, 2009). We find that loan growth significantly affects loan performance with a lag of at least two years. Additionally, overall bank loan performance is also found to explain ex-post rating changes with a distance of four quarters. It is also remarkable that originating bank characteristics (in particular, observed solvency, cash flow generation and cost efficiency) also affect considerably the ratings of securities deals which are no longer on the balance-sheet. Additionally, these bank characteristics seem to have a higher weight in the rating changes of securities originated by savings banks as compared to those originated by commercial banks.

The paper is structured in five sections following this introduction. Section 2 surveys the main literature and the empirical evidence on the role of securitization in the crisis. The case of Spain is discussed in Section 3. Section 4 describes the main hypotheses, data and empirical methodology. The results are discussed in Section 5. The paper ends up in section 6 with a summary of the main conclusions and policy implications.

2. Lending, securitization and financial stability: the Spanish case

2.1. Securitization and financial stability

The crisis has shown that securitization is heavily dependent on markets' perceptions and could be subject to sudden bouts of illiquidity generated from investors' concerns. Namely the consequences of the increased participation in bank funding by financial markets' investors and the large increases in securitized assets, can led to acute liquidity crises. According to Kane (2010), the pre-crisis bubble in securitization can be traced back to the wrong incentives while Fahri and Tirole (2009) link securitization as a major contributing factor to incentives towards leverage and the building up of systemic risks.

Overall, the rapid development in the market for credit risk transfer played a major role altering banks' functions. Structurally, securitization allowed banks to turn traditionally illiquid claims (overwhelmingly in the form of bank loans) into marketable securities. The development of securitization has therefore allowed banks to off-load part of their credit exposure to other investors thereby lowering regulatory pressures on capital requirements allowing them to raise new funds. The massive development of the private securitization market experienced in recent years coincided with a period of low risk aversion and scant defaults. This resulted in a number of shortcomings in firms' risk management tools and models, which often used default figures from this period and tended to underestimate default and liquidity risks. The most prominent example is the securitization of mortgage loans which diversify idiosyncratic risks but renders the underlying portfolio subject to macroeconomic risks including declines in housing prices.

A number of studies have analyzed the impact of securitization on financial stability from a wider perspective. The broad idea is that the availability of credit risk transfer mechanisms has changed banks' role dramatically from their traditional relationship based lending to originators and distributors of loans. This change has implications on bank's incentives to take on new risks (Shin, 2009).

However, the overall view prior to the crisis was that in addition to allowing lenders to conserve costly capital, securitization improved financial stability by smoothing out the risks

among many investors (Duffie, 2008). Indeed, a widely held view prior to the recent global credit crisis, underlined the positive effect of securitization in diversifying credit risk across the financial system, strengthening its overall resilience (Greenspan, 2005). From the perspective of individual banks securitization was expected to be used to modify their risk profile by allowing them to manage more effectively their credit risk portfolio geographically or by sector. Scant early empirical evidence from the pre-crisis period also goes in this direction. Jiangli and Pritsker (2008) argue that securitization increased bank profitability and leverage while reducing overall insolvency risk. Other studies also found a positive effect of securitization on bank performance. In particular, banks more active in the securitization market were found to have lower solvency risk and higher profitability levels (Duffee and Zhou, 2001; Cebenoyan and Strahan, 2004; Jiangli *et al.*, 2007).

At the same time there were progressively more skeptical views on the impact of securitization on the financial system stability. Some argue that by making illiquid loans liquid securitization could increase, other things being equal, the risk appetite of banks (Calem and LaCour, 2003; Wagner, 2007; and Brunnermeier and Sannikov, 2009). Risk sharing within the financial sector through securitization can also amplify bank risks also at the systemic risk level (Brunnermeier and Sannikov, 2010). Wagner (2007) shows that the liquidity of bank assets attained to securitization increases banking instability and the externalities associated with banking failures, as banks have stronger incentives to take on new risk.

2.2. Lending and housing prices and securitization

An important feature in many countries is the role of securitization in the lending and housing prices boom and burst. At the macroeconomic level, the dynamics of the relationship between lending, housing prices and securitization have been largely unexplored although a rising interest has recently emerged with the financial crisis. There is an empirical literature studying the interaction of lending and housing prices both at the international (Hofmann, 2001; Tsatsaronis and Zhu, 2004) and the individual country levels (Gerlach and Peng, 2005; Gimeno and Martínez-Carrascal, 2005). In addition the cyclical component of mortgage credit and its

interaction with property prices has also been underscored (Borio and Lowe, 2002, for a broad sample of industrialized countries; Goodhart, 1995, for the United Kingdom; and Oikarinen, 2009, for Finland). Rajan (2005) suggests that developments in the financial sector such as securitization may have enhanced more 'financial-sector-induced' procyclicality than in the past creating higher probability for banking problems.

Interestingly, most of the evidence tends to suggest a strong impact from housing prices to credit than from credit to housing prices. In this respect recent evidence has also shown that subprime credit activity did not seem to have had much impact per se on subsequent housing price returns, as shown by Coleman *et al.* (2009) for the United States. On the other hand, securitization seems to have strengthened the impact of housing prices on mortgage credit (as shown by Carbó and Rodriguez, 2010 for Spain). This latter factor seems to be particularly important in light of the recent crisis. In this respect there is mounting evidence suggesting that securitization activity has led to laxer screening of borrowers in the years prior to the crisis. The reasoning tends to be that by creating – informational – distance between the loan's originator and the ultimate bearer of the loan's default risk, securitization reduces lenders' incentives to carefully screen and monitor borrowers. In other words, the idea is that as securities are passed through from originating banks' balance sheets to the markets there are incentives for financial intermediaries to devote less effort to screen borrowers. In the short-term this would contribute to looser credit standards, less credit-worthy borrowers than in the past were denied credit would be able to obtain it. In the long-term, this would lead to higher default rates.

The laxer screening of borrowers is typically linked to an expansion in the credit granted. Indeed, Mian and Sufi (2008) – using comprehensive information broken down by United States postal zip codes – show that securitization played an important role in the expansion of the supply of credit. In this direction Dell'Ariccia *et al.* (2008) suggest that lending standards declined more in those United States areas experiencing larger credit booms, housing price increases and higher mortgage securitization rates. Results from Keys *et al.* (2010) suggest that existing securitization practices did adversely affect the screening incentives. Analyzing the

subprime lending they show that conditional on being securitized, the portfolio with greater ease of securitization defaults by around 10%-25% more than a similar risk profile group with a lesser ease of securitization. These results suggest that screening and monitoring incentives may diminish with securitization.

There is also evidence that securitization has quantitatively increased the amount of credit granted making it less dependent on specific banking or monetary policy conditions (Loutskina, 2010). Loutskina and Strahan (2009) show that the increasing depth of the mortgage secondary market fostered by securitization has reduced the effect of lender financial conditions on credit supply. In line with this hypothesis, Altunbas *et al.* (2010) find that, prior to the current financial crisis, banks making more use of securitization were more sheltered from the effects of monetary policy changes. However, their macro-relevance exercise highlights that the shock-absorber role of securitization on bank lending could even reverse in a situation of financial distress.

2.3. Securitization, risk-taking and rating changes

A recent strand of the literature concentrates on the role that securitization has on risk-taking and the determinants of the credit quality of the securities themselves. This is the area where our paper aims to contribute by analyzing the determinants of rating changes also considering the relationships between securitization, lending and financial instability addressed in the previous sections.

Part of the most recent empirical literature questioned whether securitization activity makes further acquisition of risks more attractive for banks. Krahnen and Wilde (2006) report an increase in the systemic risk of banks, after securitization. Michalak and Uhde (2009) provide empirical evidence that securitization has a negative impact on banks' financial soundness. Insterjord (2005) highlights that when the bank has access to a richer set of tools to manage risk it behaves more aggressively in acquiring new risks. Similarly, Hansel and Krahnen (2007) find that the activity of the European *CDO* market has enhanced the risk appetite of the banks that are active in this market.

Enhancement of risk appetite is also related to the regulatory capital arbitrage. Securitization has often been used by banks to lower their regulatory needs for costly equity capital charges. However banks may have an incentive to securitize less risky loans thereby lowering their capital positions (Calem and LaCour-Litle, 2003). This behavior derives from the existence of high capital standards to exploit the benefits of securitizing assets to undertake regulatory capital arbitrage. Through securitization banks can potentially increase capital adequacy ratios without decreasing their loan portfolios' risk exposure. In other words, banks may securitize less risky loans and keep the riskier ones. Ambrose *et al.* (2005) empirically showed that securitized loans have experienced lower ex-post defaults than those retained in balance sheet.

Bank capitalization plays a role in this respect. De Marzo (2010) suggests that pooling has an information destruction effect that is costly for the intermediary. This effect is reduced if the intermediary's private information is positively correlated across the assets. Hence if the incentives of investors and banks are misaligned, banks – as originators – should also have adequate capital so that warranties and representations can be taken seriously to avoid a bad use of securitization (Ashcraft and Schuermann, 2008).

A more scant but very recent literature considers the dynamics of rating changes in securitized deals. Rating agencies perform a unique role in this respect. Analyzing downgrades, Higgins *et al*. (2010) find that *ABS* downgrades have an impact on the originating bank parent's performance. Ashcraft *et al*. (2010) find evidence that ratings levels were less conservative around the *MBS* market peak of 2005-2007. The involvement of rating agencies should go beyond providing passive credit-quality certification and theoretically includes a more active approach over the economic cycle. This is crucial for our analysis as large part of our empirical analysis revolves around the issue of how rating changes of the underlying deals are determined.

3. The Spanish case: a changing role for securitization

Little has been said or explored on a possible role for securitization supporting credit growth in countries that experienced a lending and housing bubble in the years before the crisis, such as Spain. Housing prices in the years prior to the crisis grew steeply in some European countries including the UK, Ireland and Spain. Indeed in Spain housing prices increased by more than 180% between 1997 and 2007. Mortgage financing has also been the focus of the debate in these countries. Almazán *et al.* (2008) analyze securitization trends in Spain during 1999-2006, before the financial crisis. They suggest that the main driver of loan securitization in those years was liquidity needs.

ABS securitization typically involves selling a large portfolio of loans (including mortgages, consumer loans or loans to small and medium sized companies) to a special purpose vehicle (*SPV* or "fondo de titulización"). The SPV or "fondo de titulización" issues in turn asset-backed securities (also called "bonos de titulización") to fund the transaction. Those bonds are bought in turn by investors, either directly or via conduits such as SIVs (Special Investment Vehicles). As noted by Martín-Oliver and Saurina (2007) in Spain the originating bank also acts as the servicer of the loan portfolio (i.e. receiving monthly payment, dealing with arrears and so on) while borrowers are not typically aware of whether their loans have been securitized or not. Through this procedure, banks can transfer credit risk out of their balance sheets to outside investors.

As for the specific regulation of these instruments in Spain, it was not until 1992 (Law 19/1992 of securitization vehicles) that the creation of SPVs to securitize mortgage loans was authorized. The legal authorization for the setting up of SPVs to securitize assets other than mortgages was granted in 1998 (Royal Decree 926/1998).

As shown by Almazan *et al*. (2008), even if the main regulation on *MBS* in Spain was implemented in 1998, the rise in securitization was noticeable from 2001 onwards and, in particular, from 2005 onwards. Housing prices also increased considerably during that period. Carbó and Rodriguez (2010) analyze the relationship between housing prices and mortgage

credit in Spain. Using cointegration analysis and Vector-Error-Correction (*VEC*) models on a sample covering the 1988Q4 to 2008Q4 period, they find that both housing prices and mortgage credit interact in the short- and in the long-run. Their results also suggest that there were a regime shift in mortgage lending in Spain starting in 2001, when mortgage credit securitization grew substantially, although the role of securitization is not analyzed explicitly.[5]

The evolution of securitization in recent years offers some relevant information on the magnitude of *MBS* and *ABS* securitization in Spain. Using data from the European Securitization Forum, Figure 1 depicts the issuance and outstanding values of *MBS* and *ABS* (including *CDO*s) in Euro area countries comparing 2006Q1 and 2010Q1. Netherlands is the country with the largest outstanding values of *MBS* and *ABS* issued in 2010Q1 (Eur 300.8 bln), followed by Spain (289.4 bln), Italy (Eur 211.7 bln) and Germany (Eur 93.7 bln). Figure 2 shows the evolution in the issuance and outstanding values for Spain, well as the total number of upgrades and downgrades of these securities from 2008Q1 to 2010Q1. The issuance of ABS grew constantly from Eur 3 bln in 2008.Q1 to Eur 16 bln in 2009.Q1, and then declined progressively afterwards to Eur 1 bln in 2010Q1. As for *MBS*, the issuance was particularly high in 2008Q2 (Eur 20 bln) and 2008Q4 (Eur 10 bln) also declining during 2009 down to Eur 1 bln in 2010Q1. The outstanding values of these securities give an idea of the significant potential risk transferring associated to them. In particular, the outstanding values of Spanish *ABS* grew from Eur 42 bln in 2008.1 to Eur 81 bln in 2009.4, declining to 75 bln in 2010Q1. As for the MBS, the outstanding values changed from Eur 112 bln in 2008.1 to Eur 172 in 2009.2, falling afterwards down to Eur 164 bln in 2010.Q1.

Importantly, there were a significant number of rating changes during this period. In particular, there were 43 upgrades and 871 downgrades, which give an idea of the deterioration of these instruments during the crisis. This deterioration is linked to the evolution of loan

[5] As for the specific relationship between financing and housing prices, Gimeno and Martínez Carrascal (2010) carry out an application to the Spanish case. This represents the first explicit approach to the interaction between financing and housing prices in Spain. Their results show that growing imbalances in the mortgage credit market tend to bring down housing prices in the long run, whereas in the short-term increases in mortgage credit bring about a rise in housing prices. Similarly, Martínez-Pagés and Maza (2003) use an error correction model, where real income and nominal interest rates are posited as the main variables explaining the evolution of Spanish housing prices.

performance. While before 2007Q4 loan default rates where around 1%, this rate increased from 1.3% in 2008Q1 to 5.65% in 2010Q1. Importantly, the rise in default rates was preceded by a very significant loan growth in previous years and, in particular, during 2006 where annual loan growth was above 25% on average (Figure 3).

4. Data and methodology

4.1. The database

Our sample consists of *MBS* and *ABS* issued by Spanish banks. We have information on 985 securities of which 565 are *MBS* (504 Residential Mortgage-Backed Securities and 61 Commercial Property Mortgages) and 420 are *ABS* (220 on Corporate Loans, 126 on *CDO*s and 74 on Consumer Loans). The data frequency is quarterly covering the 2000Q1 to 2010Q1 period. The information on *MBS* and *ABS* securitization at issuance is obtained from Dealogic while the information on rating changes is obtained from Moody's and ABS-NET. Bank-level information is obtained from balance-sheet and income statements provided by the Spanish Banking Association (*AEB*) and the Spanish Confederation of Savings Banks (*CECA*). The database covers 720 rating changes (86 upgrades and 634 downgrades), without including the rating at origination. The panel is unbalanced and the total number of observations is 20,286.

4.2. Empirical strategy

4.2.1 Identification and empirical model

We aim to identify the main determinants of the changes in the quality of *MBS* and *ABS* over time as the main drivers of risk transferring at Spanish banks. One important identifying assumption in our model is that we are focusing on securities/instruments (*MBS* and *ABS*) which allow issuers to transfer risk, as opposed to other instruments (such as covered bonds) which retain a big deal of the risk within the bank balance sheet. This will also permit us to analyze the speed of adjustment of rating changes to changes in market fundamentals, bank credit quality and other bank conditions. In order to achieve these objectives convincingly, we need to identify to what extent the volume of securities issued by banks in previous periods – along with

market fundamentals liquidity and other loan supply conditions – may affect current loan growth of the bank that issue the instrument. Additionally, we hypothesize that lagged loan growth – along with other bank-level variables – may also affect the quality and ex-post performance of the underlying loan portfolio attached to each security issued by the bank on top of market fundamentals.

To understand our estimation, consider three reduced-form equations of loan-growth of the bank that issue the instrument, the performance of the loan portfolio of that bank and the rating of the instrument issued by that bank:

$$Loan\ growth_{i,j,t} = f\ (loan\ growth_{i,jt-1},\ bank\ conditions_{i,j,t},\ market\ fundamentals) \quad (1)$$

$$NPL\ ratio_{i,j,t\ =} = f\ (NPL\ ratio_{i,j,t-1},\ loan\ growth_{i,j,t-l},\ bank\ conditions_{i,j,t},\ market\ fundamentals) \quad (2)$$

$$Rating_{i,j,t} = f\ (NPL\ ratio_{i,j,t-l},\ bank\ conditions_{i,j,t},\ market\ fundamentals) \quad (3)$$

All variables are expressed at the instrument-level. In equation 1, the loan growth in period *t* of the bank *j* that issues the instrument *i* is explained by the one-quarter lagged loan growth of that bank (since we expect current loan supply to be affected by lagged loan supply), a vector of other bank characteristics and a vector market fundamentals. The vector of bank conditions includes the solvency ratio at the beginning of the quarter ($Equity/Total\ assets_{ijt-1}$), size (log of total assets), observed deposit funding at the beginning of the quarter ($Deposits/total\ liabilities_{ijt-1}$), the volume of securitization of the same bank in the last four quarters ($Securitization_{ij(t-1,t-4)}$), an indicator of market power ($Lerner\ index_{ijt}$),[6] the efficiency ratio ($Cost/income\ ratio_{ijt}$) a measure of customer service expansion in the last two years ($Branch\ growth_{ijt-8}$) and an indicator of observed cash-flow generation at the beginning of the quarter (RoE_{ijt-1}). In principle, loans are expected to grow with observed solvency, deposit funding, securitization and cash-flow. We also hypothesize that higher competition (lower Lerner index)

[6] The Lerner index is computed at the bank-level as the difference between the price of total assets interest and non-interest income/total assets) and their estimated marginal costs, divided by the price of total assets. Marginal costs are estimated using a translog cost function of total bank costs including one output (total assets) and three inputs (deposits, labor and physical capital).

may foster risk-taking by banks and accelerate loan growth. Additionally, an increase in the efficiency ratio (higher costs) may reduce loan supply. As for the market and macro fundamentals in equation (1), we include the 1-year euribor rate (*1-year Euribor rate*$_t$) as a proxy for market funding costs, *GDP* growth (*GDPG*$_{ijt}$) and lagged housing prices (*Real housing prices growth*$_{ijt-1}$).

As for equation (2), the ratio of non-performing loans over total assets in period *t* of the bank *j* that issues the security *i* (*Non-performing loans ratio*$_{ijt}$) is explained by lagged non-performing loans (*Non-performing loans ratio*$_{ijt-1}$) – since we also expect loan performance to be explained by past performance – a vector of bank conditions and market fundamentals. In equation (2) the vector of bank conditions includes one year, two years and four years-lagged loan growth in order to estimate how loan performance is affected by previous loan growth. It also includes market power (*Lerner index*$_{ijt}$), the efficiency ratio (*Cost/income ratio*$_{ijt}$), a measure of customer service expansion in the last two years (*Branch growth*$_{ijt-8}$) and the indicator of observed cash-flow generation at the beginning of the quarter (*RoE*$_{ijt-1}$). The lagged ratio of loan-loss provisions (*Ratio of provisions on loan losses*$_{ijt-1}$) is also included as an ex-ante indicator of bank loan performance. As for market and macroeconomic controls in equation (2), we include *GDP* growth (*GDPG*$_{ijt}$).

Our main equation showing securitization quality, as expressed by the rating of the security *i* at time *t* (*Rating*$_{ijt}$) is explained by one year, two years and four years-lagged loan performance (non-performing loan or *NPL* ratio) in order to capture the speed of adjustment of the instrument's rating to the quality of the loan portfolio of the bank that issue that security. The vector of bank conditions includes observed bank solvency (*Equity/Total assets*$_{ijt-1}$), size (log of total assets), efficiency (*Cost/income ratio*$_{ijt}$) and cash-flow generation (*RoE*$_{ijt-1}$). Market fundamentals include the maturity of the instrument (*Years to maturity*$_{ijt}$) as well as the 1-year euribor rate (*1-year Euribor rate*$_t$), *GDP* growth (*GDPG*$_{ijt}$) and lagged real housing prices (*Real housing prices growth*$_{ijt-1}$). In equation (3) it would be interesting to see if expected credit ratings respond negatively to a deterioration of loan performance or bank solvency, efficiency or

RoE. Similarly, the rating is expected to be negatively related to interest rates and positively to *GDP* or observed housing prices growth. The definition of the variables and the main sources are shown in Table 1. It should be noted that *GDP* growth and real housing prices growth have been computed regionally, taking the branch distribution of the issuing bank across the different regions as a weighting factor for those banks operating in multiple regions.

As for the cross-section and over time variation of our main dependent variable showing changes in the rating of the instruments ($Rating_{ijt}$), Figure 4 depicts the number of securities and their rating during 2000Q1-2010Q1. The number of securities issued significantly increases over time and, in particular, during the years of the crisis. MBS and ABS issuance were more intense from 2007 onwards. It can be also observed that the ratings for issues originated prior to the crisis tend to substantially worsen during the crisis.

4.2.2 GMM simultaneous estimation methodology

Two main caveats determine the selection of our estimation method. First, endogeneity is a potential concern in estimating equations (1) to (3) since they relate to a similar set of potentially endogenous regressors such as bank profitability or efficiency to our main dependent variables. Secondly, cross-equation relationships are present. In particular, equations (1) and (2) are needed to identify (3) and impose some cross-equation restrictions since lagged loan growth affects loan performance in equation (2) and, at the same time lagged (observed) loan performance might determine the current rating of the instrument in equation (3). To obtain efficient estimates and address the issue of endogeneity and cross-equation restrictions we propose to estimate (1), (2) and (3) jointly using a General-Method of Moments (*GMM*) approach with fixed effects and time dummies. All variables (excepting size) are expressed as ratios or growth rates so that we can interpret the coefficient as marginal effects on those rates and ratios.

Lagged values of these explanatory variables (i.e., variables lagged an additional period) are used as instruments. This treatment eliminates perhaps the most obvious source of

endogeneity, but, as is well understood, it does not eliminate all such sources of endogeneity if errors are correlated over time. The primary concern here is that some unobservable aspect of the environment in which securities are rated is associated with bank loan growth as well as the variables measuring loan performance. Our primary defense is to include market-specific measures that control for those otherwise unobservable aspects of the change in markets over time, as it is the use of market fundamentals in our specification. Additionally, we have included measures of market population, population density, and regional unemployment rates (not reported) as instruments for loan growth and loan performance.

The *GMM* estimation relies on a set of orthogonality conditions which are the products of equations and instruments. Initial conditions for estimation are obtained using three-stage least squares (*3SLS*), which is a restricted version of the simultaneous equation *GMM* model. Unlike the standard *3SLS*, the *GMM* estimator allows for heteroskedasticity in addition to cross-equation correlation when some variables appear both as exogenous and (lagged) endogenous variables in the different equations (Hansen, 1982; Wooldrige, 2002).

5. Results

5.1. Baseline model

The results of the baseline model are shown in Table 2. The equation of the loan growth of the bank issuing the security is shown in the second column. As expected, the lagged loan growth of the bank is positively and significantly related to current loan growth. As for other bank conditions, the observed solvency at the beginning of the quarter (*Equity/Total assets*$_{ijt-1}$), the observed the deposit ratio (*Deposits/total liabilities*$_{ijt-1}$), the lagged values of securitization (*Securitization*$_{ij(t-1,t-4)}$) and branch growth (*Branch growth*$_{ijt-8}$), and the observed return on equity (*RoE*$_{ijt-1}$) are positively and significantly related to current loan growth. Some of these variables have a particularly high economic impact. In particular, a 10% increase in the lagged solvency ratio explains a .89% increase in loan growth, a 10% growth in the deposit ratio increases loan growth by .78%, and a 10% increase in securitization over the last year increases current

quarterly loan growth by .96%. The Lerner index is negatively and significantly related to loan growth, which suggests that higher competition stimulates lending.

As for market fundamentals, market rates (*1-year Euribor rate*$_t$) are negatively and significantly related to loan growth, as expected. In particular, a 10% increase in this rate reduces loan growth by 3.9%. *GDP* growth and one quarter-lagged real housing prices growth are positively and significantly related to loan growth so that a 10% increase in these variables is shown to have a 10.4% and a 7.1% increase, respectively, on loan growth. Table 2 also includes a dummy to check whether the behavior of the main dependent variable differs between *MBS* and *ABS*. In the case of loan growth, *MBS* issuance seems to be more intensively related to loan growth than *ABS* issuance, since a big deal of lending growth during the sample period has been related to mortgage financing.

The results of the equation where loan performance (*non-performing loans or NPL ratio*$_{ijt}$), is the dependent variable are shown in the third column of Table 2. As for loan growth values, only the two years and four years-lagged values of this variable seem to affect current loan performance. We also tested if two quarters and three quarters-lagged loan growth affect loan performance significantly but the coefficients of these variables were not significant either. The magnitude of the estimated coefficient of lagged loan growth increases with the order of the lag, revealing that current loan performance is mostly explained by high-order lagged loan growth, which is indicative of some lack of institutional memory behavior in lending standards, suggesting that looser credit quality standards in periods of credit expansion lead to poorer ex-post loan performance as the time from the last peak of the lending cycle increases. Higher inefficiency (*Cost/income ratio*$_{ijt}$) and lagged branch growth (*Branch growth*$_{ijt-8}$) are found to be negatively and significantly related to the non-performing loans ratio which advocates for a negative effect of operating costs on loan risk. The lagged ratio of provisions on loan losses to total assets – as an ex-ante indicator of loan performance – is positively and significantly related to the NPL ratio while the impact of *GDP* on this ratio is negative and significant, as expected.

The fourth column in Table 2 shows the results for our main equation of securitization quality as indicated by the ratings of *MBS* and *ABS* jointly considered. Lagged values of the NPL ratio are negatively and significantly related to the rating of the instrument, although they are only significant for one, two and four years-lagged values. The one quarter, two quarters and three quarters-lagged values of the *NPL* ratio (not shown in the table for simplicity) where not found to be statistically significant either. These results indicate that ratings are related to the quality of the on-balance sheet loan portfolios but only after four or more quarters. Therefore, investors are informed on the quality of the securities with a delay of at least one year in relation to on-balance sheet loans. The intensity of the adjustment increases with the order of the lag, which suggests that persistent loan deterioration tend to affect ratings more significantly. As for instrument-level and market fundamentals, the maturity of the instrument (*Years to maturity*$_{ijt}$), and observed *GDP* growth and real housing prices growth are positively and significantly related to the rating of the instrument while market interest rates have a negative impact.

As expected, market fundamentals have an impact on *MBS* and *ABS* ratings. More interestingly, also the characteristics of the originating bank have an effect on the ex-post rating changes of the loans they originated. These characteristics include bank capital, size, profitability (*RoE*) and cost inefficiency, with solvency and profitability having a particularly high positive economic impact (estimated coefficients are .104 and .078, respectively). This is issue is particularly interesting as once issued, the expected payoffs of *MBS* and *ABS* securities are expected to depend entirely on the underlying loans and not on the health of the bank that originated them. Although we are agnostic about the interpretation of the significance of these results on rating changes, we hypothesize that rating agencies may possibly rely on bank characteristics (other than loan performance) since they may face some opaqueness in determining the quality of the security over time. Presumably, higher ratings are partly based on the assumption that better banks make better loans, and therefore produced better collateral underlying their securities. Hence ex-post (i.e. after securitization) changes in the financial

situation of the issuing bank might probably have an impact on the securitized loans ratings which was not already been accounted for by the markets.

The inclusion of a dummy distinguishing between *MBS* and *ABS* shows that ratings levels are significantly higher for *MBS* than for *ABS* in the sample period. The latter indicates that it is worthwhile breaking down the estimations by instrument to check if our results and financial stability implications differ between *MBS* and *ABS*.

5.2. Breakdown by *MBS* and *ABS*

Tables 3 and 4 offer the results for *MBS* and *ABS* respectively. While the estimations are similar to the baseline model, some differences between the *MBS* and *ABS* cases deserve specific attention. To examine these differences from a statistical standpoint, we conduct tests of the differences between the coefficients. Besides, we also include a dummy that distinguishes collateral type by instrument. In particular, in the case of *MBS*, the dummy takes the value 1 if the instrument is backed by a residential mortgage and zero if it is backed by a commercial real estate loan. As for *ABS*, the dummy takes the value 1 if the security is backed by a corporate loan and zero for other types of collateral and *CDOs*.

While the loan growth equation and the non-performing loan equations offer similar results, the rating equation provides some interesting differences between *MBS* and *ABS*. In particular, the speed at which the deterioration in on-balance sheet loan portfolio is reflected on the rating of the instrument is lower for *ABS* since only the two years and four years-lagged values of the *NPL* ratio are statistically significant, while in the case of *MBS* the one year-lagged value of the *NPL* ratio is significant, as it happened in the baseline model.[7] It should be also noted that the economic impact of *NPL* ratios on the rating is higher in the case of *ABS* (the differences with the estimated coefficients of *MBS* are significant at the 1% level). Other significant differences are found such as the higher impact of solvency ratios and the maturity of the instrument in the rating of *ABS* and the higher impact of size, efficiency, RoE, the market

[7] These differences between *MBS* and *ABS* are also supportive of the hypothesis that opaqueness may be related to the complexity of the instrument, thereby making more difficult to assess the quality of *ABS* compared to *MBS*, as suggested, *inter alia*, by Fender and Mitchell (2005).

interest rate and, in particular, of real housing prices on the rating of *MBS* compared to the rating of *ABS*.

Regarding the type of collateral, the dummies included in Tables 3 and 4 indicate that the rating of residential mortgage loans is significantly higher than the rating of commercial real estate loans. Similarly, the rating of *ABS* backed with corporate loans seems to be significantly higher than the rating of *ABS* backed by consumer loans and receivables.

5.3. Risk-transferring vs. retained issuance

An important feature of our data is that during the 2008-2010 period, Spanish banks issued much more *MBS* and *ABS* deals than any time before – as shown above in Figures 1 and 2 –. These issues however, were not passed-through from banks' balance sheets to outside investors but were retained on the originating banks' books instead. The overwhelming motivation for the creating of these retained *ABS* and *MBS* securities was to pledge them as collateral with the central bank in order to obtain liquidity. Hence relative to the pre-crisis, when there was strong demand from investors' for *MBS* and *ABS*, in the 2008-2010 period there was a completely different motivation for banks for their involvement in securitization markets. Indeed during the latter phase, securitization did not offer banks the possibility of obtaining long-term funding and the transferring of underlying credit risks. This different motivation, in turn, implies a different relationship between banks and the *MBS* and *ABS* deals they originated. In other words, there might be a relationship between the recourse to securitization (i.e. to cover liquidity needs) and bank weakness that is unique to this period. We would expect, as a result a closer relationship between bank characteristics and rating changes during the crisis.[8]

In table 5, we explore whether there are differences in the results obtained for both time periods. Overall, all the statistical relationships found in Table 3 hold for both periods but there are some differences also in the magnitude of the coefficients that are worthwhile noting. In particular, the Lerner index seems to be a significant determinant of loan growth only during the

[8] We are most grateful to an anonymous referee and the editor of the Journal of International Money and Finance for pointing this.

first period. A likely explanation for this result is that the impact of competition on bank risk-taking happened mostly before the crisis when most risks (i.e. real estate and construction exposure) were actually being accumulated. We also find, as expected, that the magnitude of the coefficients of the impact of bank-level characteristics on securitized deals' rating is significantly larger for the crisis period (2008-2010).

5.4. Governance, ownership and specialization issues

An important factor affecting rating changes and risk transferring in securitization is the extent to which certain type of intermediaries may have had more incentives to create and transfer lower quality risks than others. These differences may be then related to ownership, governance and specialization issues. The issuers in our sample are both commercial (9,128 observations) and savings banks (11,158 observations). As for some potentially significant institutional differences, savings banks in Spain are stakeholder-based firms and do not quote in stock markets as most commercial banks do. Additionally, savings banks have been more specialized in lending than commercial banks and, hence, they may have had more incentives to securitize loans given that their loan growth has been higher than for commercial banks in the years before the crisis. Even if both commercial and savings banks are subjected to the same supervision and regulation in Spain, the abovementioned differences in ownership and specialization may have resulted in different issuance practices. We wonder the extent to which rating changes reflect these potential differences between commercial and savings banks.

Table 6 replicates the baseline model for commercial and savings banks separately. Although the signs and main relationships are similar, some specific explanatory variables in the model exhibit statistically significant differences between both types of institutions. This is the case of market power in the loan growth equation, which is only significant in the savings banks equation, suggesting that the role of competition in stimulating loan growth has been more intense at savings banks. There are also some significant differences in the determinants of the rating equation. The economic impact (size of the coefficients) of the lagged NPL ratios on the instrument rating is higher for securities issued by savings banks (with the differences being

significant at 5% level) suggesting that the evolution of the abovementioned loan portfolio has a higher weight in rating changes of savings banks securities. It suggests that savings banks are affected by lower territorial and business diversification than commercial banks and that makes any deterioration in their loan performance to have a higher impact on the ratings. Other bank characteristics and, in particular, observed solvency and RoE also exhibit a significantly higher coefficient in the rating equation of the instruments issued by savings banks. As for market fundamentals, interest rates and *GDP* seem have a larger economic impact on the ratings of the securities issued by commercial banks while the observed real housing prices growth affects more significantly the ratings of securities issued by savings banks (all differences being statistically significant at 5% level) which suggests that regional conditions such as differences in housing prices may have had a significant impact on the ratings of those institutions (as savings banks) which are closely linked to regional territories.

5.5. Additional robustness tests

We tried several other specifications of our empirical model for robustness purposes. As for estimation method, we also run a separate estimation for each equation using *3SLS*. We also tried to estimate each equation separately using maximum likelihood techniques. Although the results of these alternative specifications were clearly in line with the reported *GMM* simultaneous equations results, the goodness of fit of the *GMM* model seem to be better, with larger determination coefficients (R^2). Additionally, the Sargan test suggests that the instrument specification better suited the *GMM* model compared to other specifications.

Regarding the specification of the model, we also wondered whether the issuance of MBS or ABS in certain periods might have more likelihood of having a more stark deterioration in credit quality, *ceteris paribus*, in ex-post rating changes. To check this potential 'vintage' effect, we run our model in a subsample of securities that suffered rating downgrades during 2007 to 2010. We then restrict the time dummies in the model to the years 2000 to 2006 and we check if some of these dummies are significant. The results suggest that the securities issued in 2005 and 2006 were more likely to be downgraded in the crisis years. As our baseline model

includes time dummies (which are not shown for exposition simplicity) we control for this potential vintage effects.

Finally, in order to further explore the contribution of real housing prices growth to loan growth, loan performance and the subsequent rating changes, we introduce an additional robustness test. In particular, we build a dummy that takes the value 1 if the security was issued by a bank established in a region where housing prices have grown during 2000 to 2006 over the median value of regional real housing growth in Spain. For those banks operating in various regions we estimate a weighted average of the housing prices in these regions, using the territorial distribution of the branches of the bank as a weighting factor. We then re-run three alternative estimations of the baseline model by interacting the dummy with the variables *Deposits/total liabilities*$_{ijt-1}$ – to check if liquidity is more important for loan growth in regions with high real housing price growth – the *ratio of provisions on loan losses*$_{ijt-1}$ – to analyze if loan-loss provisioning has been more significant in regions with higher growth in housing prices – and *Securitization*$_{(ijt-1,t-4)}$ – to identify how housing prices interact with past securitization trends of the issuing bank.

The results are shown in Table 7. Lagged securitization growth is found to have a higher impact on loan growth in the regions showing larger housing prices growth (the coefficient of the interaction term is .118). Similarly, liquidity seems to have a higher impact on loan growth in regions with higher housing prices growth (the coefficient of the interaction term is .124). Finally, the impact of loan-loss provisions on ex-post lending performance also seems to be larger in regions exhibiting the larger hosing price growth (the coefficient of the interaction term is .096).

6. Conclusions

We analyze the changes in the quality of *MBS* and *ABS* securitization in Spain from 2000Q1 to 2010Q1 using a comprehensive database at the instrument-level. In particular, our empirical model shows the sequence of credit quality by analyzing the effects on the loan growth on loan performance and, subsequently, of loan performance on the rating of the instrument.

Importantly, our results suggest that bank characteristics such as solvency, cash flow generation and cost efficiency (on top of loan performance) affect ratings considerably. We also find that these bank characteristics have a higher impact on the rating changes of savings banks as compared with commercial banks, as well as those of these institutions located in regions with the higher growth in housing price in the years before the crisis. In terms of sequence, loan growth significantly affects loan performance with a lag of at least two years. Additionally, on-balance sheet loan performance is found to lead rating changes with a lag of four quarters.

Our results are robust to different specifications and robustness tests. All in all, these results advocate for further research on the consequences of risk transferring through securitization in countries like Spain, which have been largely dependent on market financing during the upswing of the cycle.

We wonder to what extent our results could be generalized to other countries. Considering the importance of the securitization industry in the United States, it would be interesting to know whether the statistical relationship between ex-post bank characteristics and ratings would also hold in this country. Particularly as the relationship between mortgage lender and security issuer can be, in principle, more distant in this country than in Spain. Additionally, one identifying assumption of our model is that we focused on those securities (MBS and ABS) which allow issuers to transfer credit risks, as opposed to other instruments (such as the covered bond market) which usually involve a larger retention of the underlying risk within banks' own balance sheets. However, in the United States, covered bonds have been scantly used. More research is needed in these directions in order to ascertain the risk-transferring properties of *MBS* and *ABS* in a wider set of countries as well as on the differentiated impact according to the type of funding sources.

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Figure 1. Outstanding MBS and ABS values by Euro Area country
(in EUR billions, 2010 Q1)

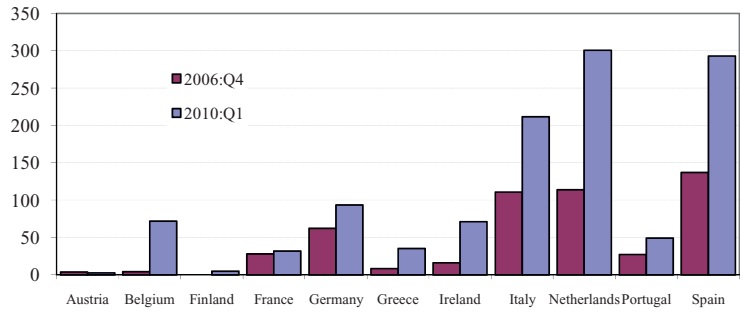
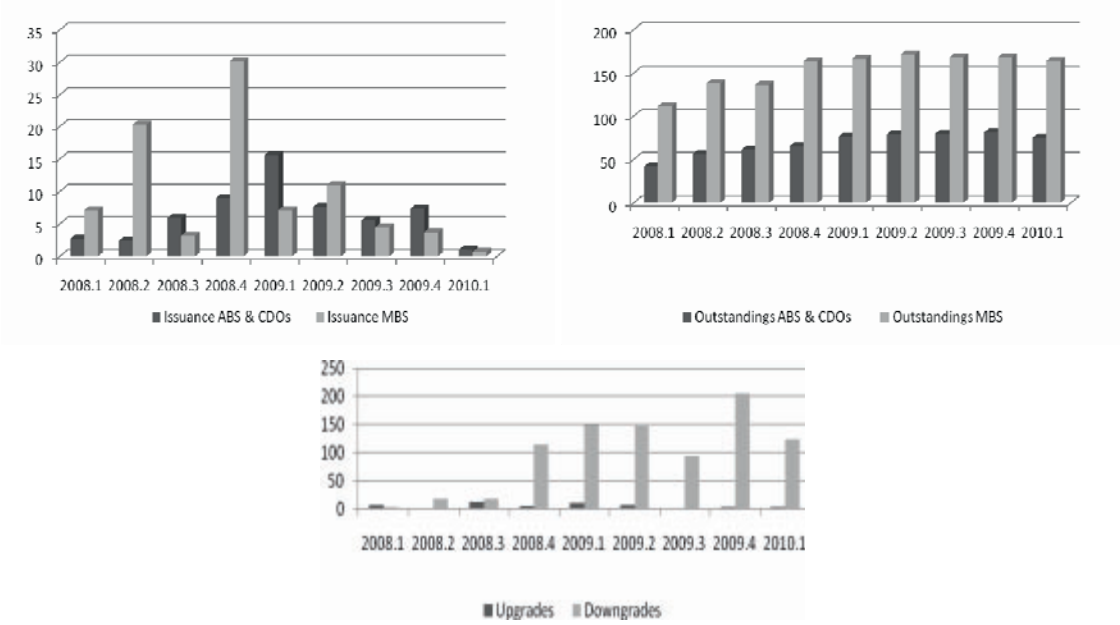


Figure 2. MBS and ABS&CDOs in Spain: Issuance, outstanding values and rating changes
(2008Q1-2010Q1)

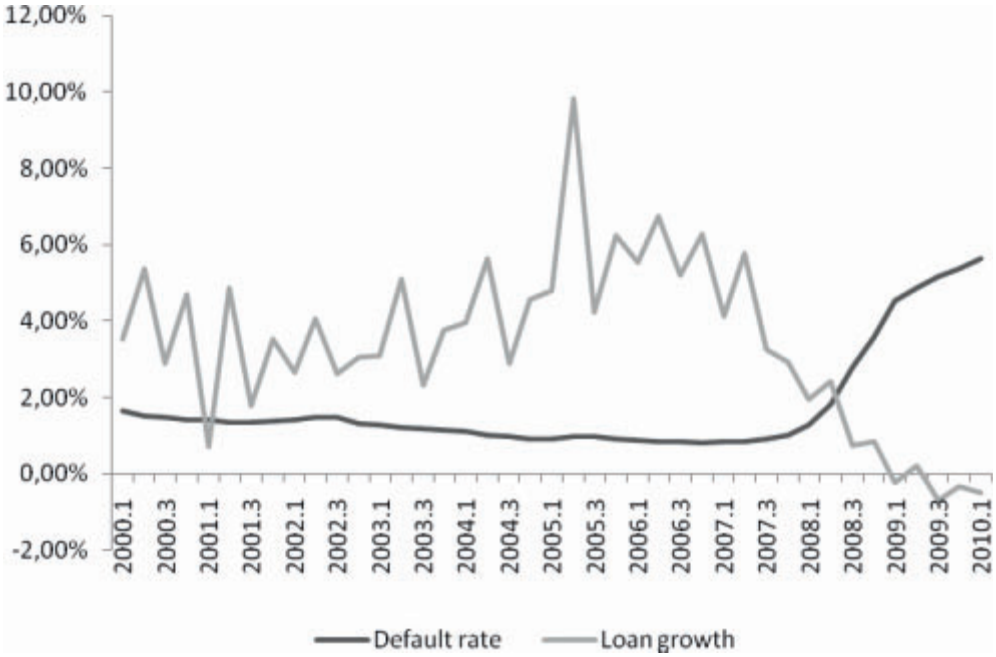
(in EUR billions)



Source: European Securitization Forum and own elaboration.

Figure 3. Lending growth and loan quality in Spain

(2000Q1-2010Q1)



Source: Bank of Spain.

Figure 4. Rating of MBS and ABS in the sample

(2000Q1-2010Q1)

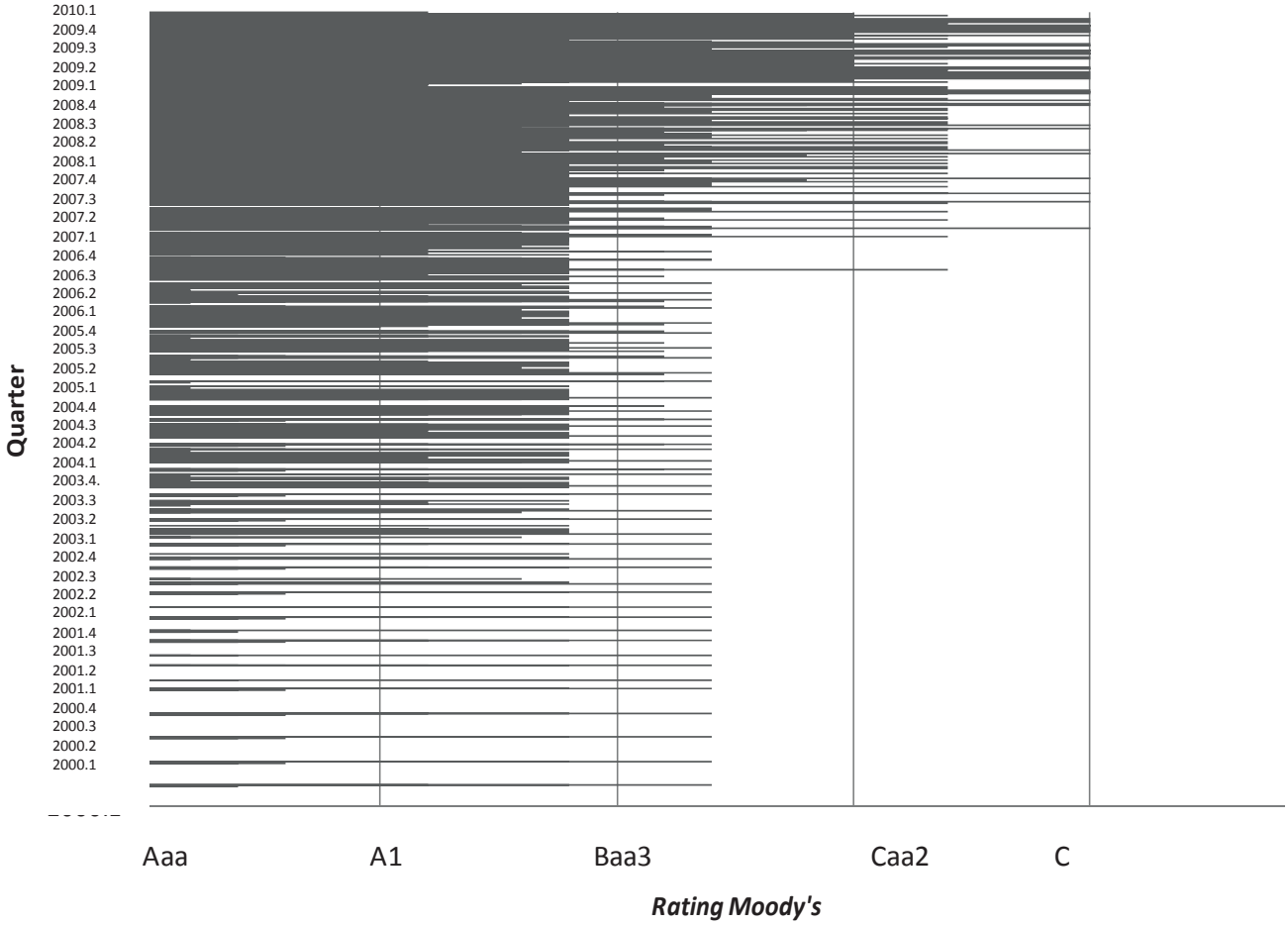


TABLE 1. Definition of the variables and descriptive statistics

	Mean	*Std. Dev.*	*Source*
Loan growth$_{ijt}$	0.11	0.07	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
Non-performing loans ratio$_{ijt}$	0.03	0.02	Information of Prudential Relevance Reports for data from 2007 to 2009. For the remaining periods the information has been gathered from quarterly bank reports and publicly available information provided by the banks to the Spanish Securities Exchange Commission (CNMV), as well as from occasional reports and memos provided by the banks.
Rating$_{ijt}$	79.1	34.8	Moody's, Fitch and S&P
Equity/Total assets$_{ijt}$	0.09	0.05	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
Size (logTA)$_{ijt}$	15.39	2.16	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA)
Deposits/total liabilities$_{ijt-1}$	0.71	0.19	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
Lerner index$_{ijt}$	0.22	0.04	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
Cost/income ratio$_{ijt}$	0.58	0.39	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
Branch growth$_{ijt}$	0.04	0.05	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
RoE$_{ijt}$	0.11	0.6	Quarterly accounting statements published by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA).
Ratio of provisions on loan losses$_{ijt}$	0.44	0.17	Information of Prudential Relevance Reports for data from 2007 to 2009. For the remaining periods the information has been gathered from quarterly bank reports and publicly available information provided by the banks to the Spanish Securities Exchange Commission (CNMV), as well as from occasional reports and memos provided by the banks.
1-year Euribor rate$_{t}$	0.03	0.02	Bank of Spain
GDPG$_{ijt}$	0.03	0.02	Spanish Statistical Office (INE)
Real housing prices growth$_{ijt}$	0.05	0.04	Spanish Statistical Office (INE)

TABLE 2. Baseline model of credit quality
GMM simultaneous estimation with fixed effects
(p-values in parentheses)

	Loan growth$_{ijt}$	*Non-performing loans ratio$_{ijt}$*	*Rating$_{ijt}$*
Loan growth$_{ijt-1}$	0.004**	-	-
	(0.002)		
Loan growth$_{ijt-4}$	-	0.028	-
		(0.321)	
Loan growth$_{ijt-8}$	-	0.063*	-
		(0.031)	
Loan growth$_{ijt-16}$	-	0.085**	-
		(0.004)	
Equity/Total assets$_{ijt-1}$	0.089**	-0.034*	0.104**
	(0.001)	(0.023)	(0.003)
Size (logTA)$_{ijt}$	0.016	0.017	0.031*
	(0.089)	(0.339)	(0.048)
Deposits/total liabilities$_{ijt-1}$	0.078**	-	-
	(0.002)	-	
Securitization$_{ij(t-1,t-4)}$	0.096**	-	-
	(0.002)	-	
Lerner index$_{ijt}$	-0.014*	-0.017	-
	(0.028)	(0.143)	
Cost/income ratio$_{ijt}$	-0.018	0.048*	-0.033*
	(0.234)	(0.027)	(0.011)
Branch growth$_{ijt-8}$	0.029*	0.019**	-
	(0.031)	(0.005)	
RoE$_{ijt-1}$	0.018*	-0.017*	0.078**
	(0.022)	(0.044)	(0.016)
Non-performing loans$_{ijt-1}$	-	0.019*	-0.014
		(0.019)	(0.287)
Non-performing loans$_{ijt-4}$	-	-	-0.051*
			(0.039)
Non-performing loans$_{ijt-8}$	-	-	-0.076**
			(0.003)
Non-performing loans$_{ijt-16}$	-	-	-0.189**
			(0.002)
Ratio of provisions on loan losses$_{ijt-1}$	-	0.027**	0.167**
		(0.003)	(0.003)
Years to maturity$_{ijt}$	-	-	0.046*
			(0.017)
1-year Euribor rate$_{t}$	-0.039**	-	-0.034*
	(0.002)		(0.030)
GDPG$_{ijt}$	0.104**	-0.043**	0.018**
	(0.003)	(0.004)	(0.004)
Real housing prices growth$_{ijt-1}$	0.071**	-	0.091**
	(0.003)		(0.002)
Dummy MBS/ABS (1,0)	0.031*	-0.002	0.178**
	(0.019)	(0.084)	(0.004)
Adjusted R2	0.84	0.86	0.90
Sargan test of overidentyfing restrictions	153.21		
	(0.001)		
Number of observations	20,286		

TABLE 3. Credit quality: MBS
GMM simultaneous estimation with fixed effects
(p-values in parentheses)

	Loan growth$_{ijt}$	***Non-performing loans ratio$_{ijt}$***	***Rating MBS$_{ijt}$***
Loan growth$_{ijt-1}$	0.003**	-	-
	(0.002)		
Loan growth$_{ijt-4}$	-	0.031	-
		(0.397)	
Loan growth$_{ijt-8}$	-	0.083*	-
		(0.039)	
Loan growth$_{ijt-16}$	-	0.104**	-
		(0.002)	
Equity/Total assets$_{ijt-1}$	0.072**	-0.053**	0.102**
	(0.001)	(0.009)	(0.002)
Size (logTA)$_{ijt}$	0.004	0.004	0.054*
	(0.106)	(0.457)	(0.042)
Deposits/total liabilities$_{ijt-1}$	0.071**	-	-
	(0.002)	-	
Securitization$_{ij(t-1,t-4)}$	0.107**	-	-
	(0.001)	-	
Lerner index$_{ijt}$	-0.018*	-0.012	-
	(0.020)	(0.143)	
Cost/income ratio$_{ijt}$	-0.012	0.031*	-0.047*
	(0.299)	(0.021)	(0.016)
Branch growth$_{ijt-4}$	0.033*	0.026**	-
	(0.018)	(0.003)	
RoE$_{ijt-1}$	0.023*	-0.034*	0.095**
	(0.031)	(0.026)	(0.013)
Non-performing loans$_{ijt-1}$	-	0.024*	-0.008
		(0.022)	(0.446)
Non-performing loans$_{ijt-4}$	-	-	-0.087*
			(0.034)
Non-performing loans$_{ijt-8}$	-	-	-0.113**
			(0.002)
Non-performing loans$_{ijt-16}$	-	-	-0.205**
			(0.003)
Ratio of provisions on loan losses$_{ijt-1}$	-	0.035**	0.197**
		(0.002)	(0.002)
Years to maturity$_{ijt}$			0.054*
			(0.019)
1-year Euribor rate$_{t}$	-0.025**	-	-0,021**
	(0.001)		(0.004)
GDPG$_{ijt}$	0.009**	-0.061**	0.020**
	(0.003)	(0.002)	(0.002)
Real housing prices growth$_{ijt}$	0.083**	-	0.293**
	(0.002)		(0.002)
MBS collateral type (1=residential mortgage; 0=commercial RE loan)	-	-	0.089**
			(0.005)
Adjusted R2	0.87	0.88	0.92
Sargan test of overidentyfing restrictions	144.46		
	(0.001)		
Number of observations	11,765		

TABLE 4. Credit quality: ABS
GMM simultaneous estimation with fixed effects

(p-values in parentheses)

	Loan growth$_{ijt}$	***Non-performing loans ratio$_{ijt}$***	***Rating ABS$_{ijt}$***
Loan growth$_{ijt-1}$	0.005**	-	-
	(0.002)		
Loan growth$_{ijt-4}$	-	0,006	-
		(0.511)	
Loan growth$_{ijt-8}$	-	0.069*	-
		(0.024)	
Loan growth$_{ijt-16}$	-	0.187**	-
		(0.002)	
Equity/Total assets$_{ijt-1}$	0.044*	-0.018**	0.188**
	(0.027)	(0.006)	(0.002)
Size (logTA)$_{ijt}$	0.004	0.008	0.014
	(0.154)	(0.632)	(0.092)
Deposits/total liabilities$_{ijt-1}$	0.087**	-	-
	(0.003)	-	
Securitization$_{ij(t-1,t-4)}$	0.126**	-	-
	(0.001)	-	
Lerner index$_{ijt}$	-0.034**	-0,024*	-
	(0.009)	(0.032)	
Cost/income ratio$_{ijt}$	-0.026	0.058*	-0.011*
	(0.138)	(0.012)	(0.035)
Branch growth$_{ijt-4}$	0.041	0.035**	-
	(0.097)	(0.002)	
RoE$_{ijt-1}$	0.013	-0.013*	0.042*
	(0.107)	(0.046)	(0.015)
Non-performing loans$_{ijt-1}$	-	0.016*	-0.016
		(0.027)	(0.427)
Non-performing loans$_{ijt-4}$	-	-	-0.035
			(0.181)
Non-performing loans$_{ijt-8}$	-	-	-0.195*
			(0.047)
Non-performing loans$_{ijt-16}$	-	-	-0.322**
			(0.003)
Ratio of provisions on loan losses$_{ijt-1}$	-	0.011**	0.114**
		(0.002)	(0.004)
Years to maturity$_{ijt}$			0.093*
			(0.010)
1-year Euribor rate$_{t}$	-0.033**	-	-0,018**
	(0.001)		(0.003)
GDPG$_{ijt}$	0.011**	-0.033**	0.027**
	(0.002)	(0.003)	(0.002)
Real housing prices growth$_{ijt}$	0.071	-	0.029*
	(0.127)		(0.014)
ABS collateral type (1=corporate loans; 2=other loans and receivables)	-	-	0.050**
			(0.006)
Adjusted R2	0.76	0.79	0.83
Sargan test of overidentyfing restrictions	137.17		
	(0.001)		
Number of observations	8,521		

TABLE 5. Baseline model of credit quality: two periods (2000-2007, 2008-2010)
GMM simultaneous estimation with fixed effects
(p-values in parentheses)

	2000-2007			*2008-2010*		
	Loan growth$_{ijt}$	***Non-performing loans ratio$_{ijt}$***	***Rating$_{ijt}$***	***Loan growth$_{ijt}$***	***Non-performing loans ratio$_{ijt}$***	***Rating$_{ijt}$***
Loan growth$_{ijt-1}$	0.003**	-	-	0.008**	-	-
	(0.002)			(0.002)		
Loan growth$_{ijt-4}$	-	0.012	-	-	0.038	-
		(0.485)			(0.422)	
Loan growth$_{ijt-8}$	-	0.084**	-	-	0.058*	-
		(0.015)			(0.023)	
Loan growth$_{ijt-16}$	-	0.093**	-	-	0.067*	-
		(0.002)			(0.010)	
Equity/Total assets$_{ijt-1}$	0.081**	-0.038**	0.124**	0.094**	-0.019*	0.118**
	(0.001)	(0.020)	(0.002)	(0.001)	(0.021)	(0.003)
Size (logTA)$_{ijt}$	0.019	0.019	0.038**	0.014	0.012	0.040*
	(0.071)	(0.503)	(0.030)	(0.076)	(0.326)	(0.056)
Deposits/total liabilities$_{ijt-1}$	0.071**	-	-	0.092**	-	-
	(0.002)	-		(0.002)	-	
Securitization$_{ij(t-1,t-4)}$	0.092**	-	-	0.115**	-	-
	(0.002)	-		(0.002)	-	
Lerner index$_{ijt}$	-0.018**	-0.010	-	-0.004	-0.004	-
	(0.016)	(0.134)		(0.032)	(0.236)	
Cost/income ratio$_{ijt}$	-0.014	0.042*	-0.036*	-0.013	0.041*	-0.041*
	(0.235)	(0.022)	(0.009)	(0.240)	(0.021)	(0.010)
Branch growth$_{ijt-8}$	0.034*	0.015**	-	0.021*	0.016**	-
	(0.031)	(0.006)		(0.028)	(0.004)	
RoE$_{ijt-1}$	0.022*	-0.021*	0.072**	0.016*	-0.014*	0.082**
	(0.020)	(0.040)	(0.012)	(0.023)	(0.038)	(0.011)
Non-performing loans$_{ijt-1}$	-	0.016*	-0.011	-	0.014*	-0.012
		(0.012)	(0.235)		(0.025)	(0.275)
Non-performing loans$_{ijt-4}$	-	-	-0.040**	-	-	-0.058*
			(0.024)			(0.031)
Non-performing loans$_{ijt-8}$	-	-	-0.071**	-	-	-0.093**
			(0.002)			(0.003)
Non-performing loans$_{ijt-16}$	-	-	-0.164**	-	-	-0.203**
			(0.001)			(0.002)
Ratio of provisions on loan losses$_{ijt-1}$	-	0.024**	0.163**	-	0.029**	0.145**
		(0.002)	(0.002)		(0.003)	(0.003)
Years to maturity$_{ijt}$	-	-	0.048*	-	-	0.032*
			(0.014)			(0.014)
1-year Euribor rate$_{t}$	-0.044**	-	-0.031*	-0.032**	-	-0.031*
	(0.002)		(0.026)	(0.002)		(0.026)
GDPG$_{ijt}$	0.101**	-0.040**	0.021*	0.119**	-0.049**	0.019**
	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.004)
Real housing prices growth$_{ijt-1}$	0.086**	-	0.098**	0.054**	-	0.082**
	(0.003)		(0.002)	(0.003)		(0.002)
Dummy MBS/ABS (1,0)	0.042*	-0.003	0.193**	0.030*	-0.001	0.143**
	(0.017)	(0.076)	(0.003)	(0.014)	(0.092)	(0.004)
Adjusted R2	0.86	0.82	0.88	0.79	0.82	0.91
Sargan test of overidentyfing restrictions	148.16			156.01		
	(0.001)			(0.001)		
Number of observations	15,382			5,004		

TABLE 6. Credit quality: commercial vs. savings banks
GMM simultaneous estimation with fixed effects

(p-values in parentheses)

	Securities issued by commercial banks			*Securities issued by savings banks*		
	***Loan growth**$_{ijt}$*	***Non-performing loans ratio**$_{ijt}$*	***Rating**$_{ijt}$*	***Loan growth**$_{ijt}$*	***Non-performing loans ratio**$_{ijt}$*	***Rating**$_{ijt}$*
***Loan growth**$_{ijt-1}$*	0.003**	-	-	0.007**	-	-
	(0.002)			(0.004)		
***Loan growth**$_{ijt-4}$*	-	0.016	-	-	0.017	-
		(0.408)			(0.384)	
***Loan growth**$_{ijt-8}$*	-	0.043*	-	-	0.088*	-
		(0.016)			(0.037)	
***Loan growth**$_{ijt-16}$*	-	0.048*	-	-	0.096**	-
		(0.016)			(0.004)	
***Equity/Total assets**$_{ijt-1}$*	0.063**	-0.050*	0.111**	0.116**	-0.021**	0.128**
	(0.001)	(0.013)	(0.06)	(0.001)	(0.008)	(0.002)
***Size (logTA)**$_{ijt}$*	0.011	0.011	0.056*	0.023	0.013	0.012
	(0.115)	(0.261)	(0.037)	(0.081)	(0.423)	(0.079)
***Deposits/total liabilities**$_{ijt-1}$*	0.062**	-	-	0.083**	-	-
	(0.003)	-		(0.004)	-	
***Securitization**$_{ii(t-1,t-4)}$*	0.123**	-	-	0.088**	-	-
	(0.001)	-		(0.002)	-	
***Lerner index**$_{ijt}$*	-0.007	-0.011	-	-0.026*	-0.011	-
	(0.071)	(0.212)		(0.021)	(0.247)	
***Cost/income ratio**$_{ijt}$*	-0.026	0.060*	-0.024**	-0.013	0.061*	-0.068*
	(0.361)	(0.021)	(0.007)	(0.207)	(0.035)	(0.003)
***Branch growth**$_{ijt-8}$*	0.015*	0.013**	-	0.037*	0.029**	-
	(0.037)	(0.008)		(0.026)	(0.003)	
***RoE**$_{ijt-1}$*	0.026*	-0.023*	0.032*	0.011*	-0.009*	0.126**
	(0.019)	(0.037)	(0.011)	(0.027)	(0.049)	(0.008)
***Non-performing loans**$_{ijt-1}$*	-	0.014**	-0.003	-	0.022*	-0.018
		(0.009)	(0.326)		(0.011)	(0.340)
***Non-performing loans**$_{ijt-4}$*	-	-	-0.032*	-	-	-0.063**
			(0.031)			(0.019)
***Non-performing loans**$_{ijt-8}$*	-	-	-0.064**	-	-	-0.129**
			(0.007)			(0.004)
***Non-performing loans**$_{ijt-16}$*	-	-	-0.116**	-	-	-0.216**
			(0.004)			(0.003)
***Ratio of provisions on loan losses**$_{ijt-1}$*	-	0.021**	0.103**	-	0.041**	0.197**
		(0.002)	(0.003)		(0.004)	(0.004)
***Years to maturity**$_{ijt}$*	-	-	0.068*	-	-	0.031*
			(0.014)			(0.011)
***1-year Euribor rate**$_{t}$*	-0.027**	-	-0.051*	-0.021**	-	-0.027*
	(0.002)		(0.022)	(0.008)		(0.023)
***GDPG**$_{ijt}$*	0.148**	-0.058**	0.021**	0.091**	-0.031**	0.008**
	(0.002)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)
***Real housing prices growth**$_{ijt-1}$*	0.026**	-	0.016*	0.127**	-	0.148**
	(0.005)		(0.028)	(0.003)		(0.001)
Dummy MBS/ABS (1,0)	0.018*	-0.001	0.246**	0.023*	-0.001	0.163**
	(0.014)	(0.112)	(0.003)	(0.016)	(0.142)	(0.006)
Adjusted R2	0.82	0.84	0.84	0.81	0.84	0.88
Sargan test of overidentyfing restrictions	141.06			153.07		
	(0.001)			(0.008)		
Number of observations	9,128			11,158		

TABLE 7. Credit quality: tests on the impact of housing prices
GMM simultaneous estimation with fixed effects
(p-values in parentheses)

	Regional housing prices and deposits			*Regional housing prices and securitization*			*Regional housing prices and loan-loss provisions*		
	Loan growth$_{ijt}$	***NPL ratio$_{ijt}$***	***Rating$_{ijt}$***	***Loan growth$_{ijt}$***	***NPL ratio$_{ijt}$***	***Rating$_{ijt}$***	***Loan growth$_{ijt}$***	***NPL ratio$_{ijt}$***	***Rating$_{ijt}$***
Loan growth$_{ijt-1}$	0.004**	-	-	0.003**	-	-	0.004**	-	-
	(0.005)			(0.003)			(0.006)		
Loan growth$_{ijt-4}$	-	0.015	-	-	0.018	-	-	0.011	-
		(0.335)			(0.308)			(0.226)	
Loan growth$_{ijt-8}$	-	0.036*	-	-	0.091*	-	-	0.061*	-
		(0.026)			(0.040)			(0.043)	
Loan growth$_{ijt-16}$	-	0.050*	-	-	0.103**	-	-	0.115*	-
		(0.014)			(0.001)			(0.013)	
Equity/Total assets$_{ijt-1}$	0.053**	-0.061*	0.106**	0.101**	-0.027**	0.116**	0.103**	-0.017**	0.132**
	(0.001)	(0.011)	(0.04)	(0.002)	(0.006)	(0.008)	(0.002)	(0.005)	(0.004)
Size (logTA)$_{ijt}$	0.018	0.018	0.045*	0.037	0.012	0.026	0.044	0.018	0.014
	(0.124)	(0.204)	(0.029)	(0.083)	(0.603)	(0.113)	(0.108)	(0.292)	(0.098)
Deposits/total liabilities$_{ijt-1}$	0.043**	-	-	0.077**	-	-	0.040**	-	-
	(0.002)			(0.005)			(0.003)	-	
Deposits/total liabilities$_{ijt-1}$X high regional real housing prices growth dummy	0.118**	-	-	-	-	-	-	-	-
	(0.009)								
Securitization$_{ij(t-1,t-4)}$	0.112**	-	-	0.080**	-	-	0.093**	-	-
	(0.002)			(0.003)			(0.004)	-	
Securitization$_{ij(t-1,t-4)}$X high regional real housing prices growth dummy	-	-	-	0.124*	-	-	-	-	-
				(0.016)					
Lerner index$_{ijt}$	-0.010	-0.007	-	-0.025*	-0.018	-	-0.014*	-0.008	-
	(0.124)	(0.296)		(0.034)	(0.263)		(0.036)	(0.311)	
Cost/income ratio$_{ijt}$	-0.036	0.051*	-0.024*	-0.018	0.052*	-0.055*	-0.018	0.065*	-0.061*
	(0.250)	(0.017)	(0.012)	(0.243)	(0.028)	(0.002)	(0.352)	(0.041)	(0.002)
Branch growth$_{ijt-8}$	0.013*	0.011*	-	0.030*	0.026**	-	0.028*	0.034**	-
	(0.028)	(0.015)		(0.019)	(0.006)		(0.020)	(0.002)	
RoE$_{ijt-1}$	0.022*	-0.020*	0.038*	0.017*	-0.007*	0.110**	0.018*	-0.012*	0.119*
	(0.016)	(0.044)	(0.018)	(0.022)	(0.041)	(0.006)	(0.024)	(0.046)	(0.015)
Non-performing loans$_{ijt-1}$	-	0.017**	-0.005	-	0.016*	-0.013	-	0.027*	-0.017
		(0.006)	(0.253)		(0.017)	(0.257)		(0.010)	(0.396)
Non-performing loans$_{ijt-4}$	-	-	-0.038*	-	-	-0.052**	-	-	-0.050**
			(0.026)			(0.014)			(0.029)
Non-performing loans$_{ijt-8}$	-	-	-0.068**	-	-	-0.140**	-	-	-0.117**
			(0.004)			(0.006)			(0.006)
Non-performing loans$_{ijt-16}$	-	-	-0.123**	-	-	-0.202**	-	-	-0.203**
			(0.006)			(0.004)			(0.004)
Ratio of provisions on loan losses$_{ijt-1}$	-	0.016**	0.114**	-	0.059*	0.175**	-	0.048**	0.181**
		(0.001)	(0.004)		(0.013)	(0.005)		(0.006)	(0.006)
Ratio of provisions on loan losses$_{ijt-1}$ X high regional real housing prices growth dummy	-	-	-	-	-	-	-	0.096*	-
								(0.026)	
Years to maturity$_{ijt}$	-	-	0.052*	-	-	0.027*	-	-	0.040**
			(0.011)			(0.016)			(0.008)
1-year Euribor rate$_{t}$	-0.022**	-	-0.059*	-0.014**	-	-0.031*	-0.015**	-	-0.014*
	(0.003)		(0.026)	(0.006)		(0.028)	(0.004)		(0.035)
GDPG$_{ijt}$	0.128**	-0.054**	0.014**	0.082**	-0.022**	0.011**	0.089*	-0.027**	0.006**
	(0.004)	(0.005)	(0.002)	(0.003)	(0.007)	(0.002)	(0.011)	(0.002)	(0.002)
Dummy MBS/ABS (1,0)	0.025*	-0.005	0.260**	0.028**	-0.003	0.144**	0.041*	-0.003	0.149**
	(0.011)	(0.199)	(0.005)	(0.006)	(0.190)	(0.008)	(0.019)	(0.122)	(0.004)
Adjusted R2	0.84	0.82	0.81	0.83	0.85	0.90	0.83	0.83	0.89
Sargan test of overidentyfing restrictions	150.18			161.16			155.18		
	(0.003)			(0.004)			(0.004)		
Number of observations	20,286			20,286			20,286		