Lending relationships and credit rationing: the impact of securitization

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Abstract

Do lending relationships mitigate credit rationing? Does securitization influence the impact of lending relationships on credit rationing? If so, is its impact differently in normal periods versus crisis periods? This paper combines several unique data sets to address these questions. Employing a disequilibrium model to identify credit rationing, we find that more intense lending relationships, measured through their length and lower number, considerable improve credit supply and reduce the degree of credit rationing. In general, we find that a relationship with a bank that is more involved in securitization activities relaxes credit constraints in normal periods; however, it also increases credit rationing during crisis periods. Finally, we study the impact of different types of securitization – covered bonds and mortgage-backed securities (MBS) – on credit rationing. While both types of securitization reduce credit rationing in normal periods, the issuance of MBS by a firm's main bank aggravates these firm's credit rationing in crisis periods.

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1. Introduction and motivation

The global financial crisis of 2008/9 and the ensuing flight away from risk have affected credit flows towards various groups of firms to different degrees, depending on their size, location and risk features. Firms relying heavily on bank credit such as small and medium sized enterprises (SMEs) are particularly vulnerable to the credit crunch. At the same time, SMEs typically benefit from intense bank-firm relationships, which may help mitigating supply side effects stemming from shocks to the banking system. We study whether intense bank-firm relationships help in reducing credit rationing. Furthermore, we investigate how securitization and shocks to the issuance of securitization affect firms' financing constraints during normal periods and during crisis periods. The 2008/9 worldwide financial crisis provides an opportunity to study the role of lending relationships and these banks' involvedness in securitization activities on the degree of credit rationing.

In this paper, we test three different hypotheses combining several unique data sets on Spanish firms. First, do more intense lending relationships help firms to be less financially constrained? That is, even in normal times, lending relationships can help firms to be less financially constrained. Petersen and Rajan (1994) were the first investigating this question using data on firms' reliance on trade credit. They found that firms with longer bank-firm relationships were less likely to employ costly trade credit. We test this first hypothesis employing a disequilibrium model (see Maddala (1980) for the introduction of this model; or Carbó et al. (2009) for an application to finance), as recently the assumption that trade credit is more costly than bank credit has been subjected to criticism (Burkart et al. (2011)). Second, we investigate whether positive liquidity shocks due to a greater issuance of securitized assets and negative liquidity shocks due to a drying up of these markets, as well as shocks to the health of the

banking system generate a supply effect. The bank lending channel would imply that firms borrowing from banks subject to a larger shock to their financial health face larger financing constraints than otherwise similar firms. Finally, we address whether firms with more intense bank-firm relationships are better hedged against this supply side effect than otherwise similar firms.

These questions are of great concern to governments as SMEs are the backbone of OECD economies accounting for up to 97% of all firms, between 40 and 60% of GDP, and up to 70% of employment (and even higher percentages in non OECD countries). Our results are relevant for both practitioners and policy makers. For example, our insights may help in designing financial regulation on bank liquidity in order to dampen the impact on firm credit rationing.

Our findings can be summarized as follows. First, firms with a more intense lending relationship as measured through its length and lower number of banks they are dealing with, enjoy a greater credit supply and lower degree of credit rationing. These results are in line with previous findings (e.g., Petersen and Rajan (1994)) but we are employing a disequilibrium model. Second, firms whose main bank is more involved into securitization enjoy lower credit constraints in normal periods; however, they also face increased credit rationing during crisis periods. This shows that securitization generates supply effects which depend on whether we are in normal or crisis periods. Finally, we study heterogeneity within securitization activity by investigating the impact of different types of securitization – covered bonds and mortgage-backed securities (MBS) – on credit rationing. While both types of securitization reduce credit rationing in normal periods, a firm's main bank issuing MBS aggravates credit rationing in crisis periods.

Our paper is related to two strands of literature. The first strand concerns the topic of securitization in normal times and crisis periods. Securitization may stimulate loan supply by increasing the liquidity of banks' balance sheets (see e.g. Wagner and Marsh (2006) or Duffie (2007)) or improving a banks' risk absorption capacity. During stress periods, however, banks relying on securitization may face additional liquidity problems or capital constraints reducing their willingness to provide loans.

The empirical work on the causes for banks to participate in the securitization markets and the consequences of securitization on bank's willingness to grant loans, and their screening and monitoring incentives is developing rapidly (see e.g. Dell'Ariccia et al. (2009); Mian and Sufi (2009); Keys et al. (2010), or Panetta and Pozzolo (2010)). Initial empirical work on how loan sales impact lending relationships show that selling of loans does not hamper the bank-firm relationship (e.g. Drucker and Puri (2009)). Hirtle (2007) studies the use of credit derivatives and finds that these enhance a bank's loan supply. Our paper is closest related to recent empirical work on the impact of securitization on bank lending (see e.g. Goderis et al. (2007), Jiménez et al. (2010) or Carbó et al. (2011)). Goderis et al. (2007), for example, investigate the impact of a bank's securitization activity on the aggregate loan growth of a bank's portfolio. They find that banks who are active in securitization exhibit a larger loan growth than banks not being active in securitization. We improve upon their work as we employ bank-firm level lending relationship information and their main bank's activity in securitization to study how securitization affects credit constraints at the firm level. Jiménez et al. (2010) employ detailed bank-firm level data from the Spanish credit registry. They find that banks with more securitizable assets make more loans available to firms. However, there is a substantial crowding out effect taking place as this expansion crowds out bank loans from other banks within the same firm. They conclude that in general equilibrium,

the impact of securitization is close to zero due to the crowding out of existing bank credit. They develop a clever identification strategy to pin down the supply effect of securitization. Their identification strategy relies on employing firm fixed effects to absorb credit demand shocks, allowing comparing within the same firm the impact of bank credit supply shocks. This implies that they consider only firms with at least two bank relationships. This may be a restriction as many firms have one bank only and exactly those single relationship firms may be the ones where shocks to the bank relationship are most cumbersome (see e.g. Degryse et al. (2011) showing that shocks stemming from bank mergers are most severe for single relationship firms). Our approach is to estimate a disequilibrium model containing a loan demand, loan supply and transaction equation. This allows studying how securitization activity of the firm's main bank impacts credit supply and credit rationing. We estimate the level of firm financing constraints and we find that a greater intensity of securitization by a firm's main bank reduces credit constraints to a greater extent. Carbó et al. (2011) analyze the deterioration of credit quality in Spain considering rating changes in securitized deals. Their results suggest that loan growth significantly affects loan performance with a lag of at least two years while loan performance is found to explain rating changes with a lag of four quarters. They also find that although securitized products are supposed to ensure remoteness from their originating bank, bank characteristics (in particular, observed solvency, cash flow generation and cost efficiency) affect ratings considerably.

A second strand of related papers addresses the question on how relationship banking affects credit availability in normal times and in crisis periods. Most studies find that relationship borrowers (longer duration, wider scope, fewer banks, geographically close banks) have better access to credit. Petersen and Rajan (1994), for

example, find that firms with stronger relationships have a higher debt to assets ratio, and resort less often to trade credit. Cole (1998) reports that bank-firm relationships of more than 3 years already have a large impact on credit availability. Agarwal and Hauswald (2010) find that relationship banking enhances credit availability when bank and borrowers interact in person but not in case of e-loans. (For a comprehensive overview, see Degryse et al. (2009), their Table 4.9, Panel C). Other papers study the impacts of bank distress on borrowing firms and the role of relationships. The closest to our work are recent papers that look into the question whether the US financial crisis spurred a supply side effect. Puri, Rocholl and Steffen (2010), for example, employ loan application data at German savings banks in the period 2006-2008. They investigate whether savings banks which are exposed to shocks from Landesbanken (whom they own) stemming from the US, behave differently than non-exposed savings banks, i.e. who own Landesbanken without exposure to the US financial crisis. They find evidence for a supply side effect in that the affected banks reject substantially more loan applications than non-affected banks. Furthermore, bank relationships mitigate supply side effects as firms with longer relationships are less likely to be rejected even when their savings bank is exposed to a financial shock. We contribute to this literature by investigating how a firm's main bank's previous access to additional liquidity impacts credit supply when the securitization market dries up.

The remainder of the paper is organized as follows. The second section provides the data and methodology. Section 3 presents the results of our analysis. Section 4 concludes.

2. Data and methodology

2.1. Data

We combine different data sources for our empirical analysis. The primary source of firm-level information is the SABI (*Sistema de Análisis de Balances Ibéricos*) database by Bureau Van Dijk. SABI includes accounting and financial information on more than 700,000 Spanish firms since 1990. Firms are included in the database when they have at least one employee. SABI includes information on headquarters' location, date of constitution, firm industry, number of employees, legal form of the business, whether the firm is quoted on a stock exchange and, most importantly for our purposes, the name of the bank(s) with whom the firm operates. The information on bank-firm relationships and other key variables is only available for a smaller set of firms. Furthermore, the SABI database is updated regularly such that some information such as the one on bank-firm relationships is overwritten. We resolve this issue by retrieving information on bank-firm relationships from previous versions of the database. Our final sample covers 56,752 firms over the period 1993-2008, which represents around 7% of total firms in Spain on average over the sample period[1]. Due to entry and exit of the firms, the panel is unbalanced and the number of firm-year observations is 326,332. If both consolidated and non-consolidated accounts are available, we choose the consolidated ones.

2.2. Hypotheses and Empirical Methodology

To structure our analysis, we develop a number of hypotheses to explore (i) how the intensity of lending relationships affect firm's credit rationing before and during the

[1] All territories in Spain are represented with a coverage of at least 6% of total firms in each territory.

crisis, and (ii) to study the role of different types of securitization (covered bonds versus MBS) on firms with intense lending relationships before and during the crisis. We formulate three hypotheses.

Hypothesis 1: Firms with more intense lending relationships (i.e. longer duration, larger fraction borrowed from banks, fewer relationships) enjoy a greater credit supply. All else equal, these firms are less likely to be credit rationed.

Hypothesis 2: Firms borrowing from banks issuing (to a greater degree) covered bonds are less likely to be credit rationed when their banks are subject to shocks affecting their financial health.

Hypothesis 3: Firms borrowing from banks issuing (to a greater degree) MBS are more likely to become credit rationed when their banks are subject to shocks affecting their financial health.

Our first hypothesis stems from the literature on relationship banking arguing that firms with intense lending relationships face lower credit constraints (e.g. Petersen and Rajan (1994)). The second and third hypotheses are based on the differential characteristics of MBS and covered bonds – MBS allow issuers to transfer risk whereas covered bonds largely remain on the bank's balance sheet (see also Carbó et al. (2011).

The test of the three hypotheses requires identifying constrained firms. In a seminal credit rationing paper, Stiglitz and Weiss (1981) show that loan markets in the presence of asymmetric information can be frequently characterized by a disequilibrium status. Although some accounting ratios can be relevant indicators of firm financing constraints, it is also possible to infer lending demand and availability and to estimate the probability of credit rationing from a disequilibrium model. From an econometric point of view, the main challenge associated with estimating the market model in disequilibrium is that one has to obtain estimators for the parameters of loan supply and

demand functions using only observed volume of transactions in the loan market. As demand and supply for bank loans are not observed (see however Cheng and Degryse (2010), or Kirschenmann (2010)), a disequilibrium model can solve this problem, by assigning the observations either to the demand or the supply equation. Maddala and Nelson (1974) discuss the appropriate maximum likelihood method for this class of disequilibrium models, which has been used for empirical analysis of credit markets in different countries (see e.g. Sealey (1979); Perez (1998), Ogawa and Suzuki (2000); Atanasova and Wilson (2004); Steijvers (2008), or Carbó et al. (2009)).

We set up a model of bank loan demand by individual firms, allowing for the possibility that the firms cannot borrow as much as they would like. We follow Carbó et al. (2009) to measure constrained versus unconstrained firms; however, we augment their model to incorporate the role of lending relationships and the securitization activity of the main bank holding a relationship with the firm. A disequilibrium model with unknown sample separation, as described by Maddala (1980), is employed. The basic structure of the model consists of two reduced-form equations: a desired demand equation for bank loans and an availability equation that reflects the maximum amount of loans that banks are willing to lend on a collateral basis. A third equation is a transaction equation. In this model, the realized loan outstanding is determined by the minimum of desired level and ceiling. The loan demand ($Loan_{it}^{d}$), the maximum amount of credit available ($Loan_{it}^{s}$) and the transaction equation ($Loan_{it}$) of firm *i* in period *t* are:

$$Loan_{it}^{d} = \beta_0^d + \beta_1^d Activity_{it}^{d} + \beta_2^d Size_{it} + \beta_3^d Substitutes_{it} + \beta_4^d Cost_{it} + u_{it}^{d} \quad (1)$$

$$Loan_{it}^{s} = \beta_0^s + \beta_1^s Collateral_{it} + \beta_2^s Default\ risk_{it} + u_{it}^{s} \quad (2)$$

$$Loan_{it} = Min(Loan_{it}^{d}, Loan_{it}^{s}) \quad (3)$$

The amount of bank credit demanded is modelled as a function of the level or the expansion of firm activity, firm size, other sources of capital that are substitutes to bank loans, and the cost of bank credit. The maximum amount of credit available to a firm is modelled as a function of the firm's collateral and default risk. All level variables are expressed in terms of ratios to reduce heteroscedasticity. Thus, the size effect of "total assets" in the demand function above is estimated as part of the constant term, while the constant term is estimated as a coefficient of the reciprocal of total assets (the same logic is applied to the collateral effect of total assets and the constant term in the availability function). Firm activity is represented by the level of sales over the one-year lagged total assets. Both firm production capacity (total assets) and sales are expected to increase (the level of) loan demand. Cash flow as a ratio of lagged total assets is used to control for the effect of substitute funds on the demand for bank loans and, therefore, the expected sign of this variable is negative. The cost of bank credit is expressed as the percentage point spread between the interest rate paid[2] by the firm and short-term prime rate and it is also expected to affect loan demand negatively[3].

In the availability equation, a firm's "collateral" is proxied by the ratio of tangible fixed assets to lagged total assets and the expected sign is positive since the maximum amount supplied by a bank will increase with the level of collateral. We assume here that tangible assets are taken as collateral or, if not, are potentially attachable as collateral by the bank. We also include the age of the firm as a proxy of reputation and information availability on the firm. The Lerner index – the difference between banks' prices and marginal costs divided by prices– is included as an indicator

[2] The "interest paid" was computed from the income statement. We divided it by bank loans outstanding. We implicitly assume that the year-end loan balance is roughly equal to the weighted average balance during the year.

[3] Since interest rates are central in this model, loan prices were alternatively introduced in levels instead or relative to short-term prime rate. The results remain statistically unaltered.

of bank market power in the regions[4] where the firm operates. Firms' default risk is measured by the ability to pay interest (proxied by the operating profit/interest ratio) and the ability to pay short-term debt (proxied by the current assets/current liabilities ratio). A high operating profit/interest ratio or a high current assets/current liabilities ratio indicates that the default risk is low. Therefore, the expected signs of the collateral variable and the variables that indicate the ability to pay interest and short term debt are all expected to be positive. Both demand and availability equations contain regional GDP (*log(GDP))* to control for macroeconomic conditions across regional markets.

The simultaneous equations system in (1), (2) and (3) is estimated using full information maximum likelihood (FIML), as shown by Maddala and Nelson (1974). The FIML routine employed also incorporates fixed firm effects to account for unobservable firm-level influences. Based upon the estimates of this system it is possible to compute the probability that loan demand exceeds credit availability, as shown in Gersovitz (1980) and, therefore, to classify the sample into constrained and unconstrained firms. Formally, a firm is defined as financially constrained in year *t* if the probability that the desired amount of bank credit in year *t* exceeds the maximum amount of credit available in the same year is greater than 0.5. Hence, the probability that firm will face a financial constraint in year *t* is derived as follows:

$$\Pr(loan_{it}^{d} > loan_{it}^{s}) = \Pr(X_{it}^{d}\beta^{d} + u_{it}^{d} > X_{it}^{s}\beta^{s} + u_{it}^{s}) = \Phi\left(\frac{X_{it}^{d}\beta^{d} - X_{it}^{s}\beta^{s}}{\sigma}\right) \qquad (4)$$

where X_{it}^{d} and X_{it}^{s} denote the variables that determine a firm's loan demand and the maximum amount of credit available to a firm, respectively. The error terms are assumed to be distributed normally, $\sigma^2 = \text{var}(u_{it}^{d} - u_{it}^{s})$, and Φ (.) is a standard normal

[4] See Table 1 for a detailed definition on how the Lerner index is computed for banks operating in various regions.

distribution function. Since $E(loan_{it}^{d}) = X_{it}^{d}\beta^{d}$ and $E(loan_{it}^{s}) = X_{it}^{s}\beta^{s}$, $\Pr(loan_{it}^{d} > loan_{it}^{s}) > 0.5$, if and only if $E(loan_{it}^{d}) > E(loan_{it}^{s})$.

Testing Hypothesis 1 implies adding bank-firm lending relationship variables to the Bank Loan supply equation (2). We include three indicators capturing the strength of a bank-firm relationship. In particular, we add the length of the relationship – measured as the number of years of the relationship between the firm and its main bank (we assume the main bank is either the only bank working with the firm or the bank with the longest relationship); a dummy variable showing whether the firm has a single (0) or multiple (1) bank relationships and an interaction term of the lagged collateral variable (tangible fixed assets/total assets) times the length of the relationship trying to capture the impact of the length of the bank-firm relationship on the value of asset tangibility as collateral.

Similarly, testing Hypotheses 2 and 3 requires adding variables regarding different types of securitization to the loan supply equation. In particular, we include for each firm the main bank's issuance of MBS in a given year as a ratio of this bank's total loans at the beginning of that period, the main bank issuance of covered bonds in a given year as a ratio of total loans at the beginning of the period, the main bank size (as a proxy for the presence of that bank in debt and capital markets) and the main bank cost-to-income ratio (as a proxy for the efficiency of the bank that may also influence its ability to lend at a lower cost). In order to capture whether the relationship between MBS and covered bonds issuance and loan supply varied during the crisis years, we also include an interaction term between each one of the securitization issuance variables and a time dummy taking the value 1 for 2007 and 2008 and zero otherwise. An additional specification also considers a dummy which takes the value 1 for 2008 (when the crisis was more developed) and zero otherwise.

The definition and sources for our main variables are shown in Table 1; their descriptive statistics are in Table 2. The data show that the average duration of the bank-firm relationship is 6.6 years. Additionally, 49% of the firms work with a single bank. As for the issuance of securities by the main bank, 13% of the loans over the period are securitized as MBS while 17% are securitized as covered bonds in our sample.

2.3. Spain as an empirical laboratory

Spain offers a particularly advantageous environment in which to analyze our hypotheses. Spain has a banking-oriented financial system with a large fraction of its economic activity driven by the small and medium-sized firms which are highly dependent on bank credit and the most likely to be credit rationed. In 2008 SMEs represent 99.6% of the total number of firms and 53% of total employment in Spain. Spain is also a relatively attractive environment to study relationship lending because Spanish banks may focus more on relationship lending than in some other countries, particularly the U.S. For example, in the U.S. lenders historically had more transactions-based lending technologies such as small business credit scoring that can also be used in lending to opaque firms.

Another important feature that makes the Spanish case a particularly interesting one is the role of the lending cycle and securitization before and during the financial crisis of 2007-2008. Spain has featured in a particularly prominent fashion in the current crisis attracting a big deal of international attention. Securitization activity grew spectacularly in this country in parallel with large increases in bank credit to the private sector. Indeed Spain has been largely labeled as a country where 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 crisis. As shown in

Figure 1, lending to firms in Spain varies significantly over the business cycle. In particular, the yearly lending growth rates at the beginning of our sample period in 1996 were 4.9%. Lending to firms increased significantly in the years prior to the crisis reaching 30.1% in November 2006 and falling sharply afterwards to 6.8% in December 2008.

On the back of an exceptional growth in bank credit the 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 particularly loose 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 a large number of prior banking crises (i.e. large increases in loan growth coupled with housing bubbles). These features also emerged together with new factors such as financial innovation in general and most significantly in securitization markets.

Little has been said or explored on a possible role for securitization in triggering lending in countries that experienced a lending and housing bubble in the years before the crisis. On the latter, housing prices in the years prior to the crisis have been particularly noticeable in some European countries, the UK, Ireland and Spain -where housing prices have increased by more than 180% only between 1997 and 2007- the largest growth among major industrialized countries.

The evolution of securitization in recent years offers some relevant information on the magnitude of MBS and covered bonds securitization in Spain. According to the Securitization Industry and Financial Market Association (SIFMA) Spain was the third largest country in Europe in terms of outstanding MBS securitization with € 163.8 bln. Only the UK (€ 530.3 bln) and Netherlands (€188.9 bln) exhibit higher outstanding

MBS values. As for covered bonds, the European Covered Bond Council (ECBC) reports that Spain was the second largest market of covered bonds in Europe with an outstanding amount of Eur 352 bln, after Germany (Eur 719.4 bln). Given the importance of securitization in Spain, we wonder to what extent those banks more active in MBS and covered bond issuance have altered their lending to firms thereby augmenting or mitigating credit rationing. Furthermore, we investigate the effects of securitization during normal periods and during financial crisis.

Using Dealogic and AIAF data Figure 2 shows the stock of covered bonds and ABS[5] issued by Spanish commercial and savings banks from 1999 to 2008. Covered bond issuance by commercial banks increased from € 0.5 bln to € 112 bln in that period while in the case of savings banks the stock of covered bonds grew from € 0.7 bln to € 135 bln. As for ABS, the stock at commercial banks was € 0.5 in 1999 and it continuously increased to € 126 bln in 2008 while the change at commercial banks during the same period was from € 0.4 to € 134 bln.

3. Results

3.1. Baseline model

The estimated parameters of the baseline disequilibrium model (equations (1)-(3)) are reported in column I of Table 3. The top panel displays the result for the "demand for bank loans". All the variables have the expected signs. As shown by the demand equation parameters, a 1% increase in sales over total assets augments the desired demand of bank loans by 0.35% while a 1% increase in cash flow reduces loan demand by 0.98%. Additionally, a 1% increase in the cost of funds (loan interest spread) is found to reduce the desired demand of bank loans by 1.16%.

[5] ABS encompass MBS and some other forms of asset backed securities like consumer finance. There are no separate data available on MBS. However, we expect thatin Spain more than 90% of ABS are MBS.

The middle panel of Table 3 displays the results for the "supply of bank loans". As for the credit availability function, a 1% increase in collateral (measured by tangible fixed assets over total assets) increases the availability of loans by 1.32%. The age of the firm has a positive and significant impact on the supply of loans (the coefficient being 0.32) while a 1% increase in bank market power (Lerner index) has a negative impact on loan supply of 0.75%. The ratio "current assets/current liabilities" is not significant. The log(GDP) has a positive and significant impact in both the loan demand and loan supply equations.

The estimation of the baseline model also reveals that 30.3% of the firms were constrained within our sample.

3.2. Relationship lending and credit rationing

Column II in Table 3 offers the first test on hypothesis 1. In particular, two dimensions of relationship lending – the length (number of years) of the relationship with the main bank and the dummy showing the single vs. multiple relationships – are added to the baseline model. Column II of Table 3 reveals that firms with a longer relationship with the main bank obtain a larger loan supply from their banks. In particular a 1% increase in the length of the relationship increases the loan supply by 0.14%. Additionally, it is shown that those firms having multiple bank relationships are less likely to obtain bank loans, a result that suggests that the link between the bank and the firm weakens with multiple bank relationships.

Column III in Table 3 investigates whether observed collateral values mitigate or strengthen the effects of the length of the relationship on loan supply. We add an interaction term between the asset tangibility variable and the length of the relationship variable. Both the length variable and the interaction terms are significant and positive

at the 1% level which suggests that both collateral value and the length of the relationship are positive drivers of loan supply.

Taking the estimates of column III in Table 3 as a reference, Figure 3 depicts the estimated evolution of firm financing constraints within our sample, along with the average length of the relationships and the average percentage of firms having multiple vs. single relationships with banks. All the variables are adjusted to their mean in each year. Figure 2 shows that the percentage of constrained firms increased from 30.83% in 2006 to 36.80% in 2008. During the same time period, the average length of lending relationships within our sample decreased from 7.12 to 6.53 years and the percentage of firms having relationships with multiple banks increased from 41.2% to 43.3%.

3.3. The role of securitization

Table 4 explores the role of banks' activities for the two types of securitization we study both for normal periods and during crisis periods. In particular Table 4 investigates the impact of banks' activities in MBS and covered bonds on financing constraints. In this table, we extend the loan supply equation not only incorporating the characteristics of the lending relationship with the main bank but also to include the securitization activity of the firm's main bank as well as other control variables of the characteristics of the firm's main bank such as its size and efficiency. Column I in table 4 shows that both the issuance of MBS and covered bonds (as a percent of total assets) at the beginning of the period has a positive impact on current lending to firms. The economic impact of a 1 percentage point change in the covered bonds issuance is significantly higher than the impact of MBS (coefficients being 0.74 and 0.14 respectively). This result suggest that covered bonds, which theoretically are meant to be liquidity generation devices, have a higher impact on lending to firms than MBS

securitization, which theoretically are meant to be risk transferring devices. Additionally, we find that the size of the main bank does not seem to have an impact on loan supply to firms while efficiency does have a positive impact (lower cost-to-income ratio) on loan supply, suggesting that reducing operating costs affects loan supply positively.

Taking the results of column 1 in Table 3 as a reference, Figure 4 compares the percentage of constrained firms with the percentage of firms whose main banks issues MBS and covered bonds. While both MBS and covered bond issuance increase in the years before the crisis –in parallel to a decrease in firm financing constraints, the percentage of firms whose main banks was issuing MBS increased from 65.27% to 67.12% from 2006 to 2008 while the percentage of firms whose main bank was issuing covered bonds decreased from 68.32% to 57.47% in the same period.

In order to investigate whether MBS and covered bond issuance had a differential effect on loan supply during the crisis we interact the issuance variables with a time dummy taking the value 0 up to 2006 and 1 for 2007 and 2008. The results suggest that the issuance of MBS had a negative impact on loan supply during the crisis (the total impact during the crisis (-0.2317) is the sum of the two coefficients +0.1378 and -0.3717) while covered bonds have a slightly higher positive effect during the crisis (the total impact during the crisis (0.7241) is the sum of the two coefficients 0.7115 and 0.0126). This result suggests that while MBS may impact positively in loan supply, this effect may turn negative during the downside of the lending cycle. These results hold when we restrict our crisis dummy to include 2008 only (see Model III of Table 4)[6].

[6] For expositional simplicity we only use the dummy that compares the 1993-2006 vs. 2007-2008 in the rest of the tables.

3.4. Robustness check: the size of the firm, bank ownership and bank real estate exposure issues

The different specification of the disequilibrium model in Tables 3 and 4 seem to offer consistent values of the main posited variables, with little variation between them. Importantly, as shown for all the specifications, the coincidence in the classification of firms between the baseline model and the rest of specification is around 90%, which reinforces the robustness of the model to specification changes.

We finally estimate three additional specifications to check the robustness of the results to firm size, bank ownership and bank real estate exposure issues. As for firm size, we extend our model by including a dummy which takes the value zero if the firm is large and one if the firm is an SME. We consider that the firm is an SME if the number of employees is lower than 500. As for bank ownership, the idea is to check whether there are differences in loan supply to firms between commercial and savings banks. Savings banks in Spain are stakeholder-based firms and do not quote in stock markets as commercial banks do. Additionally, savings banks have been more specialized in traditional lending activities than commercial banks and are frequently tied to a specific territory. Hence savings banks are more likely to get involved in relationship lending. Due to their specialization, savings banks are also, in principle, more likely to securitize loans given that their loan growth has been higher than the loan growth of commercial banks in the years before the crisis. Even if both commercial banks 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 lending practices.

We add these variables to the two first specifications discussed in Table 4. The results of these extended models are shown in Table 5, columns I and II. The findings

confirm that SMEs are more likely to be credit rationed since the coefficient of the dummy variable for firm size is negative and significant. As for bank ownership, we find that loan supply seem to be significantly higher at savings banks since the dummy exhibits a positive and significant sign.

We also wonder how the effects found for securitization depend upon specific bank characteristics. In particular we wonder whether these effects are significantly different at firms whose main bank exhibits a high vs. low liquidity and for firms whose main bank is a commercial vs. a savings bank. In order to undertake these tests, we interact the securitization variables with these dummies[7]. As for the liquidity dummy, the variable takes the value 0 for those firms operating with a bank whose liquidity ratio (liquid assets/total assets) is below the median of the sample and 1 for those firms operating with a bank whose liquidity ratio is over the median. The results are shown in Table 6. While the liquidity of the banks does not seem to affect the impact of covered bond securitization on loan supply, it has a positive and significant effect in the case of MBS. This result suggests that positive effect of securitization on loan supply is conditioned to the liquidity holdings of the lender while the positive effect of covered bond securitization on loan supply seems to be unconditional on the liquidity level of the main bank. As for the interaction of securitization and bank ownership, no differences are found for MBS securitization while covered bond securitization seems to have a more significant and positive effect on bank loan supply at savings banks compared to commercial banks.

Finally, we test if banks with different exposure to the construction and real estate sector have a systematically different behaviour in what the relationship between lending patterns and securitization is concerned. As noted by Jiménez et al. (2010)

[7] We also tested the interaction between the dummy showing single vs. multiple bank relationships and securitization but no significant differences were found.

Spain experienced a housing price bubble in the years before the financial crisis and this could have induced banks with higher exposure to the real estate and construction sector to securitize loans to a larger extent. Jiménez et al (2010) show that banks with more real estate loans as a fraction of their total loan portfolio lend to smaller firms that have more tangible assets and rely on longer term financing so that loans of real-estate dependent banks are more likely to be collateralized and have longer maturity. We also consider the exposure to the real estate and construction sector by looking at the share of loans that is given out to the real estate sector (residential, commercial, and construction). Since we rely on publicly available data from annual reports and prudential information reports published yearly by the banks we could only observe this exposure since 2000. Our tests consists of re-running our baseline model shown in Table 4 for two groups of firms: i) those working with banks below the median value of the exposure to real estate sector (low real estate exposure banks) at the beginning of the year; ii) and those working with banks over the median value of the exposure to real estate sector (high real estate exposure banks) at the beginning of the year. The results are shown in Table 7, including in the last column a variance-covariance test for differences between both groups. Although the coefficients of low and high real estate exposure banks achieve the same signs and significance there are some statistical differences in the magnitude of the coefficients that are worth noting. In particular, the banks with a lower exposure to real estate assets show a significantly higher positive impact of the length of the relationship and single vs. multiple relationships on loan supply. Besides, the issuance of MBS and covered bonds have a significantly larger positive impact on loan supply for these low exposure banks and the positive (negative) effects of covered bonds (MBS) during crisis years is shown to be also larger (smaller) for banks with a lower exposure to real estate sector. Interestingly, the percentage of

constrained firms for the sub-sample of firms working with banks having a low real estate exposure is lower (28.55%) than in the sub-sample of firms having relationships with banks showing a larger exposure to real estate assets (32.28%).

4. Conclusions

The pros and cons of securitization are hotly debated. In this paper we investigate the role of securitization for credit rationing through its influence on lending relationships during normal and crisis periods. Employing a disequilibrium model, we first establish that firms with a more intense lending relationship as measured through its length and the lower number of banks they are dealing with, enjoy a greater credit supply and lower degree of credit rationing.

Securitization activity of the firm's main bank helps in reducing credit constraints. Indeed, firms having relationships with banks being more involved in securitization activities enjoy lower credit constraints in normal periods; however, they also face increased credit rationing during crisis periods. This shows that securitization generates supply effects which differ in normal and crisis periods. Finally, we show that there is heterogeneity within securitization. We do this by investigating the impact of different types of securitization – covered bonds and mortgage-backed securities (MBS) – on credit rationing. While both types of securitization reduce credit rationing in normal periods, the main bank issuance of MBS aggravates credit rationing in crisis periods.

References

Atanasova C.V., and N. Wilson (2004), Disequilibrium in the UK corporate loan market, *Journal of Banking and Finance,* 28: 595-614.

Burkart, M., T. Ellingsen and M. Giannetti (2011), What you sell is what you lend? Explaining Trade Credit Contracts, *Review of Financial Studies*, 24, 1261-1298.

Carbó, S., Rodríguez, F. and G. F. Udell (2009), Bank Market Power and SME Financing Constraints, *Review of Finance*, 13: 309-340.

Carbó. S., Marqués, D. and F. Rodríguez (2011), Securitization, risk transferring and financial instability: the case of Spain, *Journal of International Money and Finance*, forthcoming.

Cheng, X. and H. Degryse (2010), Information Sharing and Credit Rationing: Evidence from the Introduction of a Public Credit Registry, EBC working paper.

Degryse, H., M. Kim and S. Ongena (2009), The Microeconometrics of Banking: Applications, Methods and Results, *Oxford University Press*.

Degryse, H., N. Masschelein and J. Mitchell (2011), Staying, Dropping or Switching: The impact of Bank Mergers on Small Firms, *Review of Financial Studies*, 24, 1102-1140.

Dell'Ariccia, G., D. Igan and L. Laeven (2008), Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market, available at www.ssrn.com.

Duffie D. (2007), Innovations in Credit Risk Transfer: Implications for Financial Stability, Stanford University Working Paper.

Gersovitz, M. (1980), Classification Probabilities for the Disequilibrium Model, *Journal of Econometrics,* 41: 239-246.

Hirtle, B. (2007), Credit Derivatives and Bank Credit Supply, Federal Reserve Bank of New York Staff Report no. 276.

Jiménez, G., A.R. Mian, J.L. Peydró, and J. Saurina (2010), Local Versus Aggregate Lending Channels: The Effects of Securitization on Corporate Credit Supply in Spain, NBER Discussion Paper 16595.

Keys, B., T. Mukherjee, A. Seru and V. Vig (2010), Did Securitization Lead to Lax Screening: Evidence from Subprime Loans 2001-2006, *Quarterly Journal of Economics*, 125(1).

Kirschenmann, K. (2009), Credit rationing in small business bank relationships, mimeo.

Loutskina, E. and P. Strahan (2009), Securitization and the declining impact of bank financial condition on loan supply: Evidence from mortgage originations. *Journal of Finance*, 64(2), 861-922.

Mian, A.R. and A. Sufi (2009), The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis., *Quarterly Journal of Economics,* 124.

Maddala, G.S. and F.D. Nelson (1974), Maximum likelihood methods for models of markets in disequilibrium, *Econometrica* 42: 1013-1030.

Maddala, G.S. (1980), Disequilibrium, self-selection and switching models, Social Science Working Paper 303, California Institute of Technology, February.

Ogawa, K. and K. Suzuki (2000), Demand for bank loans and investment under borrowing constraints: a panel study of Japanese firm data, *Journal of the Japanese and International Economies* 14: 1-21.

Panetta F. and A. Pozzolo (2010), Why Do Banks Transfer Credit Risk? Bank-Level Evidence From Over One Hundred Countries, mimeo.

Perez, S.J. (1998), Testing for credit rationing: an application of disequilibrium econometrics, *Journal of Macroeconomics* 20: 721-739.

Petersen, M. and R. Rajan (1994), The Benefits of Lending Relationships: Evidence from Small Business Data, *Journal of Finance*, 1, pp.3-37.

Puri, M., J. Rocholl and S. Steffen (2010), Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing between Demand and Supply Effects, *Journal of Financial Economics*, forthcoming.

Reinhart, C and K. S. Rogoff (2009), This Time It's Different: Eight Centuries of Financial Folly, Princeton: Princeton University Press.

Sealey, C.W. (1979), Credit rationing in the commercial loan market: estimates of a structural model under conditions of disequilibrium, *Journal of Finance* 34: 689-702.

Steijvers, T. (2008), Existence of credit rationing for SME's in the Belgian corporate bank loan market, mimeo.

Stiglitz, J. and A. Weiss (1981), Credit rationing in markets with imperfect information, *American Economic Review* 71: 393-410.

Tornell, A. and F. Westermann (2002), Boom-bust cycles in middle income countries: Facts and explanation, National Bureau of Economic Research Working Paper Series 9219.

Wagner, W and I.W. Marsh (2006), Credit Risk Transfer and Financial Sector Performance. *Journal of Financial Stability* 2, 173–193.

TABLE 1. DEFINITION OF THE MAIN POSITED VARIABLES

	Definition	Source
Sales	Total sales during the year.	SABI
Cash flow	Net income plus depreciation plus changes in deferred taxes.	SABI
Loan interest spread	Difference between loan interest rates and interbank rates. The loan interest rate is computed as a ratio of loan expenses and bank loans outstanding. We implicitly assume that the year-end loan balance is roughly equal to the weighted average balance during the year.	SABI and ECB
GDP	Gross domestic product	Spanish Statistical Office (INE)
Tangible assets	Fixed assets on firm's balance sheet (thousand of euros). This is considered as proxy of collateral.	SABI
Age of the firm	Number of years since the firm was created.	SABI
Lerner index	Ratio "(price of total assets - marginal costs of total assets)/price". The price of total assets is directly computed from the bank-level auxiliary data as the average ratio of "bank revenue/total assets" for the banks operating in a given region using the distribution of branches of banks in the different regions as the weighting factor. Marginal costs are estimated from a translog cost function with a single output (total assets) and three inputs (deposits, labor and physical capital) using two stage least squares and bank fixed effects.	Spanish Commercial Banks Association (AEB) and the Spanish Savings Bank Confederation (CECA).
Default risk	This risk variable is defined as the ratio of operating profits to interest paid. A proxy for operating risk showing how many times interest paid are covered by operating profits.	SABI
Length (n. years relationship)	Number of years of bank-firm relationship with the main bank	SABI
Single vs. multiple bank relationships	A dummy that takes the value 0 if the relationship is just with one bank and 1 if it is with more than 1 bank.	SABI
Main bank issue MBS (% loans)	Main bank's issuance of MBS in a given year as a ratio of this bank's total loans at the beginning of the period.	Dealogic
Main bank issue covered bonds (% loans)	Main bank issuance of covered bonds in a given year as a ratio of total loans at the beginning of the period.	Dealogic
Main bank size /(log total assets)	Size (total assets) of the bank that holds the main relationship with the firm.	Spanish Commercial Banks Association (AEB) and the Spanish Savings Bank Confederation (CECA).
Main bank cost-to-income-ratio	Efficiency (cost/income ratio) of the bank that holds the main relationship with the firm.	Spanish Commercial Banks Association (AEB) and the Spanish Savings Bank Confederation (CECA).

TABLE 2. DESCRIPTIVE STATISTICS (1993-2008)

	1993-1996	1997-2000	2001-2004	2005-2006	2007-2008	1993-2008	Std. dev.
Sales	13953,2	16632,5	17267,3	19718.4	16121.0	16287.3	5230.1
Cash flow	1326.3	1532.2	1639.6	1824.1	1653.4	1590.5	698.3
Loan interest spread	0.0168	0.0159	0.0141	0.0127	0.0125	0.0131	0.0089
GDP	45258	49223	53524	59599	57412	52228	14431.6
Tangible assets	1395.5	1458.4	1606.1	1892.5	1694.2	1539.6	394.7
Age of the firm	10.12	10.26	10.54	11.31	10.88	10.53	6.3
Lerner index	0.2102	0.2304	0.2403	0.2419	0.2412	0.2488	0.1721
Default risk	3.14	3.84	3.04	5.42	5.23	4.12	2.1
Length (n. years relationship)	6.25	6.43	6.59	6.87	6.71	6.60	3.44
Single vs. multiple bank relationships	0.53	0.51	0.50	0.48	0.44	0.49	0.48
Main bank issue MBS (% loans)	0.0	0.06	0.11	0.14	0.11	0.13	0.05
Main bank issue covered bonds (% loans)	0.0	0.05	0.14	0.17	0.21	0.17	0.04
Main bank size /(log total assets)	8.14	8.46	8.88	9.03	8.89	8.63	1.59
Main bank cost-to-income-ratio	0.70	0.68	0.64	0.60	0.68	0.66	0,28

TABLE 3. ESTIMATED PARAMETERS OF THE DISEQUILIBRIUM MODEL. ALTERNATIVE SPECIFICATIONS: BASELINE MODEL AND RELATIONSHIP LENDING (1993-2008)

Switching regression model estimated by full information maximum likelihood (FIML) with firm fixed effects
p-values in parenthesis
Standard errors are clustered at the regional level

	(I)		(II)		(III)	
Demand for bank loans	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
Sales/total assets(t-1)	0.3526*** (0.000)	0.01	0.3728*** (0.000)	0.01	0.3243*** (0.000)	0.01
Cash-flow/total assets(t-1)	-0.9861*** (0.000)	0.06	-1.1106*** (0.000)	0.06	-0.8435*** (0.000)	0.07
Loan interest spread	-1.1640*** (0.000)	0.03	-1.0563*** (0.000)	0.03	-1.0388*** (0.000)	0.03
Log(GDP)	0.0147* (0.042)	0.01	0.0128** (0.015)	0.01	0.0131** (0.018)	0.01
Supply of bank loans						
Tangible fixed assets/total assets(t-1)	1.3285*** (0.000)	0.01	1.1728*** (0.000)	0.01	-	-
Age of the firm	0.3226*** (0.000)	0.01	0.2989*** (0.000)	0.01	0.3125*** (0.000)	0.01
Banks' market power (Lerner index)	-0.7523** (0.023)	0.01	-0.7088*** (0.03)	0.01	-0.7112** (0.007)	0..01
Loan interest spread	1.2860*** (0.000)	0.05	1.1363*** (0.000)	0.04	1.0780*** (0.000)	0.05
Default risk	0.0012 (0.752)	0.02	0.0010 (0.805)	0.01	0.0008 (0.721)	0.01
Log(GDP)	0.0662*** (0.002)	0.01	0.0798** (0.006)	0.01	-0.0693** (0.007)	0.01
Extended supply: relationship lending						
Length (n. years relationship)	-	-	0.1480*** (0.001)	0.01	0.1374*** (0.001)	0.01
Single vs. multiple bank relationships	-	-	-0.6928*** (0.001)	0.01	-0.6055*** (0.001)	0.01
Tangible fixed assets/total assets(t-1) X Length	-	-	-	-	1.2230*** (0.001)	0.01
Reciprocal of total assets in the loan demand equation	389664.1*** (0.000)	1338.2	397351.1*** (0.000)	1356.2	384521.6*** (0.000)	1322.4
Reciprocal of total assets in the loan supply equation	294386.6*** (0.000)	2577.3	297806.9*** (0.000)	2604.3	284020.2*** (0.000)	2523.6
S.D. of the disturbance in demand equation	1.3215*** (0.000)	0.01	1.2843*** (0.000)	0.01	1.2082*** (0.000)	0.01
S.D. of the disturbance in supply equation	0.3704*** (0.000)	0.01	0.3952*** (0.000)	0.01	0.4228*** (0.000)	0.01
Correlation coefficient between both disturbances	0.5325*** (0.000)	0.04	0.5581*** (0.000)	0.04	0.5731*** (0.000)	0.04
Log likelihood	169044		176320		172106.5	
Percentage of borrowing constrained firms	30.3%		28.4%		28.2%	
Coincidence in the classification of firms as constrained (relative to specification (I))	-		95.5%		95.4%	
Observations	326,332		326,332		326,332	
Number of firms	56,752		56,752		56,752	

, **. * : Statistically significant at 10%, 5% and 1% level, respectively*

TABLE 4. ESTIMATED PARAMETERS OF THE DISEQUILIBRIUM MODEL. ALTERNATIVE SPECIFICATIONS: RELATIONSHIP LENDING AND SECURITIZATION (1993-2008)

Switching regression model estimated by full information maximum likelihood (FIML) with firm fixed effects
p-values in parenthesis (Standard errors are clustered at the regional level)

	(I)		(II)		(III)	
Demand for bank loans	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
Sales/total assets(t-1)	0.3157*** (0.000)	0.01	0.3326*** (0.000)	0.01	0.3014*** (0.000)	0.01
Cash-flow/total assets(t-1)	-0.9632*** (0.000)	0.03	-0.9203*** (0.000)	0.06	-0.9046*** (0.000)	0.04
Loan interest spread	-1.1408*** (0.000)	0.04	-1.1524*** (0.000)	0.03	-1.1237*** (0.000)	0.03
Log(GDP)	0.0137** (0.044)	0.01	0.0120** (0.021)	0.01	0.0110** (0.031)	0.01
Supply of bank loans						
Tangible fixed assets/total assets(t-1)	1.4435*** (0.000)	0.01	1.3269*** (0.000)	0.01	1.3418*** (0.000)	0.01
Age of the firm	0.3299*** (0.000)	0.01	0.3683*** (0.000)	0.01	0.3533** (0.000)	0.01
Banks' market power (Lerner index)	-0.7461** (0.027)	0.04	-0.7010*** (0.021)	0.01	-0.7146*** (0.023)	0.01
Loan interest spread	1.0604*** (0.000)	0.05	1.4782*** (0.000)	0.04	1.4333*** (0.000)	0.04
Default risk	0.0012 (0.895)	0.00	0.0010 (0.831)	0.00	0.0011 (0.814)	0.00
Log(GDP)	0.0723*** (0.001)	0.02	0.0802*** (0.001)	0.02	0.0865*** (0.001)	0.02
Extended supply (I): relationship lending						
Length (n. years relationship)	0.1231*** (0.001)	0.01	0.1126*** (0.001)	0.01	0.1135*** (0.001)	0.01
Single vs. multiple bank relationships	-0.6424*** (0.001)	0.01	-0.6908*** (0.001)	0.01	-0.7032*** (0.001)	0.01
Tangible fixed assets/total assets(t-1) X Length	1.2350*** (0.001)	0.01	1.2122*** (0.001)	0.01	1.1255*** (0.001)	0.01
Extended supply (II): Main bank characteristics and securitization issues						
Main bank issuance of MBS (MBS issuance/total loans)t-1	0.1423** (0.001)	0.01	0.1398** (0.001)	0.01	0.1185** (0.001)	0.01
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1	0.7394*** (0.001)	0.01	0.7115*** (0.001)	0.01	0.6374*** (0.001)	0.01
Main bank issuance of MBS (MBS issuance/total loans)t-1 X Dummy (1993-2006 vs. 2007-2008)	-	-	-0.3711** (0.013)	0.01	-	-
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1 X Dummy (1993-2006 vs. 2007-2008)	-	-	0.0126** (0.030)	0.01	-	-
Main bank issuance of MBS (MBS issuance/total loans)t-1 X Dummy (1993-2007 vs. 2008)	-	-	-	-	-0.3460** (0.010)	0.01
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1 Dummy (1993-2007 vs.2008)	-	-	-	-	0.0128** (0.026)	0.01
Main bank size	0.0132 (0.153)	0.02	0.0152 (0.206)	0.02	0.0149 (0.211)	0.02
Main bank cost-to-income ratio	-0.1937** (0.023)	0.01	-0.1844** (0.030)	0.01	-0.1725** (0.032)	0.01
Reciprocal of total assets in the loan demand equation	369224.8*** (0.000)	1430.0	385663.2*** (0.000)	1314.5	372334.4*** (0.000)	1315.5
Reciprocal of total assets in the loan supply equation	261360.3*** (0.000)	2287.6	272882.7*** (0.000)	2564.2	278266.5*** (0.000)	2544.8
S.D. of the disturbance in demand equation	1.2793*** (0.000)	0.01	1.2346*** (0.000)	0.01	1.2367*** (0.000)	0.01
S.D. of the disturbance in supply equation	0.3369*** (0.000)	0.01	0.3455*** (0.000)	0.01	0.3267*** (0.000)	0.01
Correlation coefficient between both disturbances	0.4593*** (0.000)	0.03	0.5286*** (0.000)	0.04	0.5124*** (0.000)	0.04
Log likelihood	126920		152114		150130	
Percentage of borrowing constrained firms	29.18%		30.22%		30.20%	
Coincidence in the classification of firms as constrained (relative to specification (I))	89.1%		91.3 %		91.3 %	
Observations	326,332		326,332		326,332	
Number of firms	56,752		56,752		56,752	

, **. * : Statistically significant at 10%, 5% and 1% level, respectively*

TABLE 5. ESTIMATED PARAMETERS OF THE DISEQUILIBRIUM MODEL. ROBUSTNESS TESTS: BANK OWNERSHIP AND FIRM SIZE (1993-2008)

Switching regression model estimated by full information maximum likelihood (FIML) with firm fixed effects
p-values in parenthesis
Standard errors are clustered at the regional level

	(I)		(II)	
Demand for bank loans	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
Sales/total assets(t-1)	0.2257*** (0.000)	0.01	0.3526*** (0.000)	0.01
Cash-flow/total assets(t-1)	-0.9013*** (0.000)	0.03	-0.9267*** (0.000)	0.05
Loan interest spread	-1.1102*** (0.000)	0.03	-1.1391*** (0.000)	0.04
Log(GDP)	0.0148** (0.032)	0.01	0.0118** (0.026)	0.01
Supply of bank loans				
Tangible fixed assets/total assets(t-1)	1.3251*** (0.000)	0.01	1.3543*** (0.000)	0.01
Age of the firm	0.3403*** (0.000)	0.01	0.3628*** (0.000)	0.01
Banks' market power (Lerner index)	-0.7128** (0.016)	0.05	-0.6413*** (0.024)	0.01
Loan interest spread	1.0256*** (0.000)	0.04	1.3357*** (0.000)	0.06
Default risk	0.0015 (0.884)	0.00	0.0017 (0.785)	0.00
Log(GDP)	0.0718*** (0.001)	0.01	0.0826*** (0.001)	0.02
Extended supply (I): relationship lending				
Length (n. years relationship)	0.1308*** (0.001)	0.01	0.1149*** (0.001)	0.01
Single vs. multiple bank relationships	-0.6608*** (0.001)	0.01	-0.7135*** (0.001)	0.01
Tangible fixed assets/total assets(t-1) X Length	1.2432*** (0.001)	0.01	1.2219*** (0.001)	0.01
Extended supply (II): Main bank characteristic, securitization issues and firm size type				
Main bank issuance of MBS (MBS issuance/total loans)t-1	0.1458** (0.001)	0.01	0.1054** (0.001)	0.01
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1	0.7012*** (0.001)	0.01	0.5977*** (0.001)	0.01
Main bank issuance of MBS (MBS issuance/total loans)t-1 X Dummy (1993-2007 vs. 2007-2008)	-	-	0.0117** (0.030)	0.01
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1 X Dummy (1993-2006 vs. 2007-2008)	-	-	-0.3242** (0.013)	0.01
Main bank size	0.0093 (0.251)	0.02	0.0159 (0.220)	0.01
Main bank cost-to-income ratio	-0.1782** (0.020)	0.01	-0.1927** (0.032)	0.01
Main bank (0: commercial bank; 1: savings bank)	0.0536** (0.013)	0.02	0.0481** (0.012)	0.02
Type of firm (0: large firm; 1: SME)	-0.0884*** (0.003)	0.02	-0.0784*** (0.003)	0.02
Reciprocal of total assets in the loan demand equation	360281.4*** (0.000)	1412.3	382632.1*** (0.000)	1320.4
Reciprocal of total assets in the loan supply equation	251487.7*** (0.000)	2327.2	272612.5*** (0.000)	2537.9
S.D. of the disturbance in demand equation	1.2234*** (0.000)	0.01	1.2570*** (0.000)	0.01
S.D. of the disturbance in supply equation	0.3650*** (0.000)	0.01	0.3548*** (0.000)	0.01
Correlation coefficient between both disturbances	0.4671*** (0.000)	0.02	0.5081*** (0.000)	0.04
Log likelihood	129288		154662	
Percentage of borrowing constrained firms	29.04%		30.14%	
Coincidence in the classification of firms as constrained (relative to specification (I))	88.7%		89.6 %	
Observations	326,332		326,332	
Number of firms	56,752		56,752	

, **. * : Statistically significant at 10%, %% and 1% level, respectively*

TABLE 6. ESTIMATED PARAMETERS OF THE DISEQUILIBRIUM MODEL. ROBUSTNESS TESTS: INTERACTION BETWEEN SECURITIZATION AND BANK CHARACTERISTICS (LIQUIDITY & OWNERSHIP)

Switching regression model estimated by full information maximum likelihood (FIML) with firm fixed effects
p-values in parenthesis
Standard errors are clustered at the regional level

	(I)		(II)	
Demand for bank loans	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
Sales/total assets(t-1)	01635*** (0.000)	0.01	0.2675*** (0.000)	0.01
Cash-flow/total assets(t-1)	-0.8453*** (0.000)	0.03	-0.9092*** (0.000)	0.05
Loan interest spread	-1.0034*** (0.000)	0.03	-1.1326*** (0.000)	0.04
Log(GDP)	0.0145** (0.030)	0.01	0.0115** (0.021)	0.01
Supply of bank loans				
Tangible fixed assets/total assets(t-1)	1.2634*** (0.000)	0.01	1.3533*** (0.000)	0.01
Age of the firm	0.3103*** (0.000)	0.01	0.3127*** (0.000)	0.01
Banks' market power (Lerner index)	-0.7270** (0.014)	0.05	-0.64661*** (0.020)	0.01
Loan interest spread	1.0518*** (0.000)	0.04	1.3239*** (0.000)	0.06
Default risk	0.0025 (0.658)	0.00	0.0005 (0.788)	0.00
Log(GDP)	0.0744*** (0.001)	0.01	0.0831*** (0.001)	0.02
Extended supply (I): relationship lending				
Length (n. years relationship)	0.1385*** (0.001)	0.01	0.1204*** (0.001)	0.01
Single vs. multiple bank relationships	-0.6952*** (0.001)	0.01	-0.7344*** (0.001)	0.01
Tangible fixed assets/total assets(t-1) X Length	1.1694*** (0.001)	0.01	1.208*** (0.001)	0.01
Extended supply (II): Main bank characteristic, securitization issues and firm size type				
Main bank issuance of MBS (MBS issuance/total loans)t-1	0.1394** (0.001)	0.01	0.1218** (0.001)	0.01
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1	0.7135*** (0.001)	0.01	0.6831*** (0.001)	0.01
Main bank issuance of MBS (MBS issuance/total loans)t-1 X Main bank liquidity ratio dummy (0: low liquidity; 1: high liquidity)	0.0118*** (0.001)	0.01	-	-
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1 X Main bank liquidity ratio dummy (0: low liquidity; 1: high liquidity)	0.0631 (0.186)	0.01	-	-
Main bank issuance of MBS (MBS issuance/total loans)t-1 X Main bank ownership (0: commercial bank; 1: savings bank)	-	-	0.0080 (0.127)	0.06
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1 X Main bank ownership (0: commercial bank; 1: savings bank)	-	-	0.0836** (0.006)	0.01
Main bank size	0.0081 (0.328)	0.02	0.0114 (0.274)	0.01
Main bank cost-to-income ratio	-0.1657** (0.022)	0.01	-0.1628** (0.024)	0.01
Type of firm (0: large firm; 1: SME)	-0.0915*** (0.004)	0.02	-0.0715*** (0.004)	0.02
Reciprocal of total assets in the loan demand equation	361148.2*** (0.000)	1406.1	36150.0*** (0.000)	1294.7
Reciprocal of total assets in the loan supply equation	250127.5*** (0.000)	2116.8	270279.4*** (0.000)	2602.4
S.D. of the disturbance in demand equation	1.2654*** (0.000)	0.01	1.1851*** (0.000)	0.01
S.D. of the disturbance in supply equation	0.3543*** (0.000)	0.01	0.3314*** (0.000)	0.01
Correlation coefficient between both disturbances	0.4705*** (0.000)	0.02	0.5104*** (0.000)	0.04
Log likelihood	129634		154485	
Percentage of borrowing constrained firms	29.13%		30.14%	
Coincidence in the classification of firms as constrained (relative to specification (I))	88.5%		89.3 %	
Observations	326,332		326,332	
Number of firms	56,752		56,752	

, **. * : Statistically significant at 10%, %% and 1% level, respectively*

TABLE 7. ESTIMATED PARAMETERS OF THE DISEQUILIBRIUM MODEL. ROBUSTNESS CHECK: MAIN BANKS HAVING A LOW VS. HIGH REAL ESTATE EXPOSURE (2000-2008)

Switching regression model estimated by full information maximum likelihood (FIML) with firm fixed effects
p-values in parenthesis (Standard errors are clustered at the regional level)

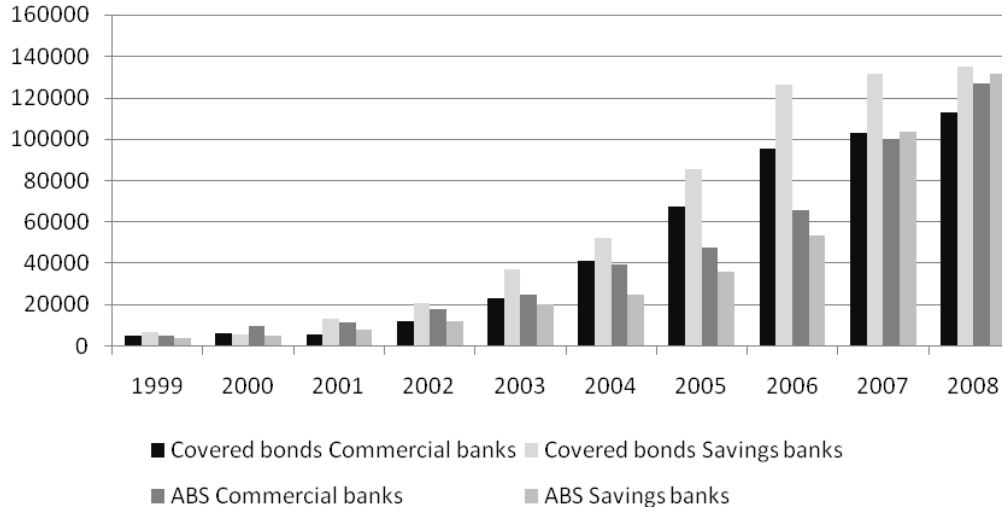
	Low real estate exposure		**High real estate exposure**		**Coefficient differences (p-values)**
Demand for bank loans	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	
Sales/total assets(t-1)	0.3123*** (0.000)	0.01	0.2819*** (0.000)	0.01	0.012**
Cash-flow/total assets(t-1)	-0.8862*** (0.000)	0.06	-0.9218*** (0.000)	0.04	0.121
Loan interest spread	-1.1142*** (0.000)	0.03	-1.1375*** (0.000)	0.03	0.194
Log(GDP)	0.0116** (0.021)	0.01	0.0104** (0.031)	0.01	0.079
Supply of bank loans					
Tangible fixed assets/total assets(t-1)	1.1432*** (0.000)	0.01	1.4163*** (0.000)	0.01	0.014**
Age of the firm	0.3132*** (0.000)	0.01	0.3721** (0.000)	0.01	0.054*
Banks' market power (Lerner index)	-0.7157*** (0.024)	0.01	-0.7402*** (0.021)	0.01	0.683
Loan interest spread	1.5543*** (0.000)	0.04	1.4089*** (0.000)	0.04	0.075*
Default risk	0.0007 (0.826)	0.00	0.0014 (0.761)	0.00	0.143
Log(GDP)	0.0694*** (0.001)	0.02	0.0677*** (0.001)	0.02	0.329
Extended supply (I): relationship lending					
Length (n. years relationship)	0.1363*** (0.001)	0.01	0.1012*** (0.001)	0.01	0.024**
Single vs. multiple bank relationships	-0.7423*** (0.001)	0.01	-0.6852*** (0.001)	0.01	0.044**
Tangible fixed assets/total assets(t-1) X Length	1.1832*** (0.001)	0.01	1.1014*** (0.001)	0.01	0.078*
Extended supply (II): Main bank characteristics and securitization issues					
Main bank issuance of MBS (MBS issuance/total loans)t-1	0.1533** (0.001)	0.01	0.1052** (0.001)	0.01	0.018**
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1	0.8227*** (0.001)	0.01	0.6138*** (0.001)	0.01	0.006***
Main bank issuance of MBS (MBS issuance/total loans)t-1 X Dummy (1993-2006 vs. 2007-2008)	-0.2359** (0.011)	0.01	-0.3602** (0.014)	0.01	0.012**
Main bank issuance of covered bonds (covered bonds issuance over total loans)t-1 X Dummy (1993-2006 vs. 2007-2008)	0.0178** (0.031)	0.01	0.0120** (0.027)	0.01	0.010**
Main bank size	0.0133 (0.287)	0.02	0.0156 (0.227)	0.02	0.443
Main bank cost-to-income ratio	-0.1931** (0.025)	0.01	-0.1699** (0.031)	0.01	0.013**
Reciprocal of total assets in the loan demand equation	383244.5*** (0.000)	1297.8	368553.3*** (0.000)	1390.2	
Reciprocal of total assets in the loan supply equation	265005.3*** (0.000)	2323.5	268210.3*** (0.000)	2656.4	
S.D. of the disturbance in demand equation	1.2654*** (0.000)	0.01	1.2280*** (0.000)	0.01	
S.D. of the disturbance in supply equation	0.3217*** (0.000)	0.01	0.3054*** (0.000)	0.01	
Correlation coefficient between both disturbances	0.5039*** (0.000)	0.03	0.5265*** (0.000)	0.04	
Log likelihood	157358		152108		
Percentage of borrowing constrained firms	28.55%		32.28%		
Observations	219,543		219,543		
Number of firms	44,633		44,633		
, **. * : Statistically significant at 10%, %% and 1% level, respectively*					

FIGURE 1. LENDING TO FIRMS IN SPAIN (yearly growth rates)

Source: Bank of Spain

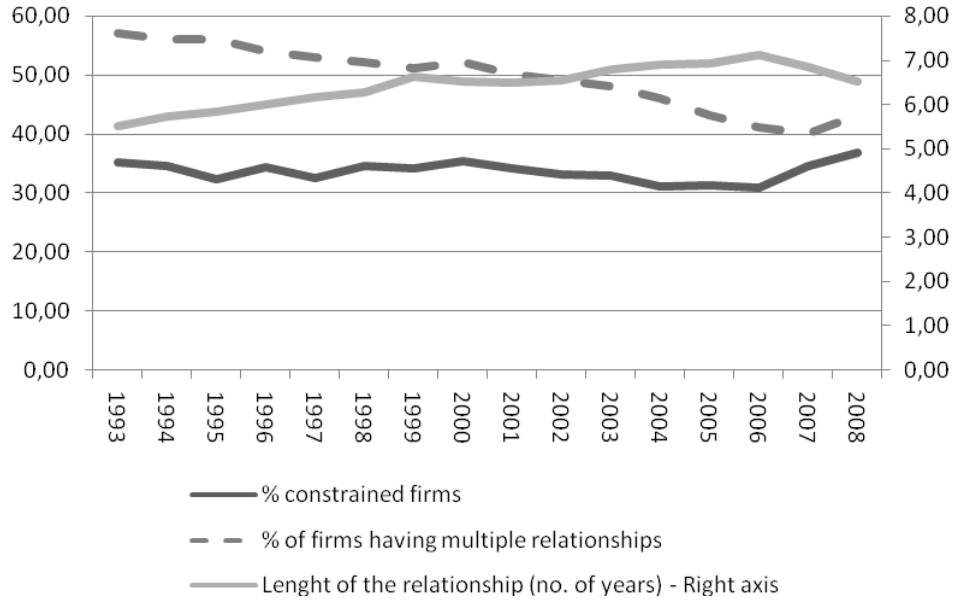
FIGURE 2. COVERED BONDS AND ABS SECURITIZATION IN SPAIN (1996-2008)

Stock data. Euro million.



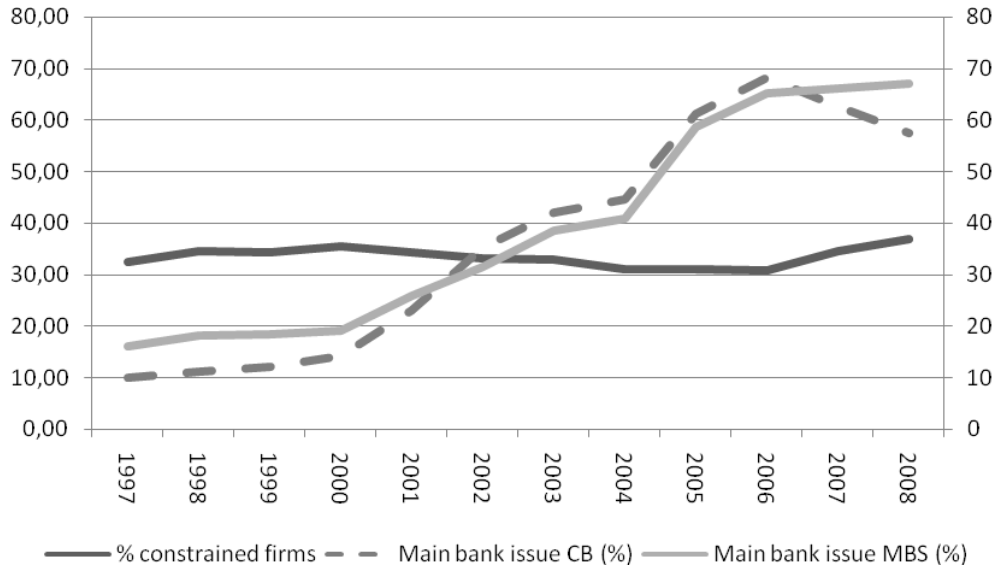
Source: Dealogic and AIAF (Asociación de Intermediarios de Activos Financieros)

FIGURE 3. CONSTRAINED FIRMS AND RELATIONSHIP LENDING



Source: Own estimations from SABI and Bankscope data

FIGURE 4. CONSTRAINED FIRMS AND SECURITIZATION



Source: Own estimations from SABI and Bankscope data