The Real Effects of the Bank Lending Channel

Gabriel Jiménez
Banco de España
PO Box 28014, Alcalá 48, Madrid, Spain
Telephone: +34 91 3385710, Fax: +34 91 3386102
E-mail: gabriel.jimenez@bde.es

Atif Mian
Princeton University and NBER
26 Prospect Avenue Princeton, NJ 08540, USA
Telephone: (609) 258 6718 Fax: (609) 258 6718
E-mail: atif@princeton.edu

José-Luis Peydró*
ICREA-Universitat Pompeu Fabra, Cass, CREI, Barcelona GSE and CEPR
Ramon Trias Fargas 25, 08005 Barcelona, Spain
Telephone: +34 93 5421756, Fax: +34 93 5421746
E-mail: jose.peydro@upf.edu

Jesús Saurina
Banco de España
PO Box 28014, Alcalá 48, Madrid, Spain
Telephone: +34 91 3385080, Fax: +34 91 3386102
E-mail: jsaurina@bde.es

November 2014

* The results or views expressed in this study are those of the authors and do not necessarily reflect those of the Banco de España or the Eurosystem. Corresponding author: jose.peydro@upf.edu. We thank Michael Weber for excellent research assistance. We also thank seminar participants at Universitat Pompeu Fabra, University of Chicago, European Central Bank, MIT, New York Federal Reserve, University of Michigan (Ross), Notre Dam, and University of California Berkeley and also Joshua Angrist, Xavier Freixas, Asim Khwaja, Amir Sufi and Jaume Ventura for helpful comments.

The Real Effects of the Bank Lending Channel

Abstract

For policy and academia it is crucial to quantify the real effects of the bank lending channel. We analyze the impact of securitization of real estate assets on the supply of credit to non real-estate firms, including risk-taking, and the associated real effects. For identification, we use the credit register of Spain, matched with firm- and bank-level balance-sheet data, and generalize the Khwaja and Mian (2008)'s loan-level estimator to firm-level in order to identify the real aggregate effects of the bank lending channel. The robust results suggest a strong impact on credit supply to non real-estate firms of banks' ability to securitize real-estate assets. However, this strong loan-level credit channel is neutralized by firm-level equilibrium dynamics in good times. In consequence, we find *no* real and credit effects at the firm-level. Importantly, securitization implies higher bank risk-taking, both by relaxing lending standards of existing borrowers – cheaper and less collateralized credit with longer maturity – and by a credit expansion on the extensive margin to first-time bank borrowers that substantially default more.

JEL: E32, E44, G01, G21, G28.

Keywords: Bank lending channel, Real effects of credit, Credit supply, Macroprudential policy, Real estate, Securitization.

1. Introduction

Financial crises are in general preceded by strong bank credit booms (Schularick and Taylor (2012); Jordà, Schularick and Taylor (2013)). A primary suspect in those booms is the credit supply channel, i.e. credit growth dictated by frictions in the credit supply process rather than firm economic fundamentals (demand side). Securitization, especially of real estate related assets (i.e. loans collateralized by real estate assets), has been over the last decade a crucial financial instrument and, by affecting bank capital and liquidity, may have strongly influenced credit supply.[1] In this paper we analyze the effects of the securitization of real estate related assets on credit supply, including the associated risk-taking and the real effects associated.

While shocks to balance sheets of banks may have real effects at the firm level via credit supply (Bernanke (1983); Holmstrom and Tirole (1997); Diamond and Rajan (2006); Adrian and Shin (2011); Stein (1998 and 2011)), firm fundamentals (the demand side) are also important. Most calls for policy makers to "lean against the wind" in the midst of a credit boom, or to subsidize banks in a credit crunch as in the recent crisis, are based on the premise that the primary failure lies on the supply side. Furthermore, credit supply side failures at the loan-level only reflect partial equilibrium outcomes, whereas general equilibrium effects could be very different and require a macroprudential approach (Hanson, Kashyap and Stein (2010)). For example, a reduction in credit supply due to an adverse bank balance sheet shock may not imply any negative real effects if affected firms can go elsewhere to compensate for the loss in credit – i.e., what matters most for real effects is the firm-level "aggregate" bank lending channel. Therefore, to identify the real effects of the bank lending channel, one needs to take into account the firm-level credit supply effects of a bank shock.

We analyze both the (aggregate) firm-level and the (more local) loan-level effects of securitization of real estate related assets. In particular, we analyze credit volume, terms and defaults for non real-estate firms, and also the associated real effects. For identification of credit supply we use the exhaustive credit register from Banco de

[1] Bank capital and liquidity influence the severity of frictions stemming from agency problems in banks (see e.g. Diamond and Rajan (2000), Morrison and White (2005), Allen and Gale (2007)). Therefore, securitization of real estate assets – by affecting bank capital and liquidity – affects credit supply, even for the loans to the non-real estate sector (see e.g. Shin (2009)).

España, matched with firm- and bank-level balance-sheet data. Moreover, the rapid expansion in global market for securitized products enabled Spanish banks – especially those with ex-ante large real estate related assets – to potentially access wholesale financing by securitizing those assets. The boom in securitization was between 2004 and 2007, especially stemming from foreign investors. For the analysis of the loan-level channel, we use the Khwaja and Mian (2008)'s (KM henceforth) technique, which is the main used in the literature. KM estimate the supply-induced bank lending channel effect at the *loan-level* by using firm fixed effects that absorb firm fundamentals shocks (proxying overall firm-level credit demand). Moreover, to analyze the (aggregate) *firm-level* credit supply implications, we extend the KM technique by estimating the otherwise unobservable covariance between bank-specific (credit supply) shocks and firm-specific (credit demand) shocks (this covariance is related to difference between the OLS and fixed effect estimator in the loan-level regression), and use it to construct an unbiased estimate of the aggregate firm-level impact of the bank lending channel that explicitly takes into account firm-level equilibrium adjustments.

Using ex-ante bank variation in real estate related holdings to proxy for the capacity of banks to securitize assets during the global securitization boom, we test whether securitization of real estate assets expands credit supply and encourages riskier lending in the non-real estate sectors of the economy. We utilize the comprehensive loan level data from the credit register of Banco de España. The data include loan level information for *all* bank loans granted at quarterly frequency in Spain, a bank dominated financial system, from 1999Q4 to 2009Q4, covering a whole credit cycle. Given the very large dataset, we restrict to loans with an average borrowing of at least €60,000, where the median loan in our sample is of €288,000. Loan information is then merged with balance sheet information for the borrower (firms) and the lender (banks). For example, firm total employment, assets and sales, and bank size, capital, liquidity and NPLs.

We show that securitization activity is indeed higher for banks with more real estate related assets before the boom, and that these banks have stronger ex-post credit growth for non-real-estate firms. We also show that the securitization-induced credit growth is primarily driven by changes in the banks' credit supply. Thus improved access to wholesale financing allows banks to increase credit supply. The

effect is also economically large: one standard deviation increase in ex-ante (2000) exposure to real estate more than doubles the growth in credit supply to non-real-estate firms between 2004 and 2007.

Crucially, despite a large bank-firm lending channel impact, the *net* impact of securitization at the firm aggregate level may be significantly lower due to "crowding out" of the credit at the firm level. Crowding out may occur for several reasons: First, some firms may not be credit constrained and, hence, may not want to increase their net borrowing. If a bank offers to increase its credit supply for such a firm, the firm is likely to ask for better terms and likely to cut back its borrowing from other banks. Second, even for firms that are credit-constrained, banks may not be willing to go beyond the firms' total debt capacity.[2] An advantage of our modification to the KM technique is that we can incorporate such crowding out effects and still isolate credit availability from firm fundamentals.

We indeed find strong support for the crowding out hypothesis. For the set of firms with multiple borrowing banking relationships at the time of securitization boom, the *firm-level* aggregate impact of credit supply is close to zero despite a large loan-level impact of credit supply for these firms![3] Crowding out thus dramatically reduces the net impact of securitization-induced credit supply on the *quantity* of credit supplied.

There is, however, a significant impact on the *price* of credit in the aggregate firm-level channel. We show that firms with unused lines of credit start to disproportionately favor banks with greater access to securitization, suggesting improved credit terms through a revealed preference argument. Consistent with this interpretation, we also find that securitization leads to a reduction in the rate of collateralization and a lengthening of loan maturity at the firm-level. All these results suggest that securitization leads to softer lending terms for borrowers in the intensive margin. Despite the zero aggregate firm-level impact of securitization-induced credit

[2] Due to agency problems (e.g., Stiglitz and Weiss (1981), Holmstrom and Tirole (1997)), a lower cost of debt (from credit supply shocks) may not translate into higher aggregate firm-level credit volume. For example, total borrowing capacity of firms may be fixed in the short run if they need to have scarce collateral or equity to credibly commit to banks against future misbehaviour. In such a scenario, greater willingness by some banks to lend is likely to lead to a shift in borrowing towards banks that want to expand credit rather than an aggregate firm-level increase in lending.

[3] As we explain in detail later, these results are based on firms with multiple banking relationships at the start of securitization boom in 2004 (so that we can use firm fixed effects to control for firm fundamentals in loan-level regressions). Such firms represent almost 80 percent of overall bank credit in Spain.

supply channel on the *quantity* of credit, there could be some positive real effects through the softening on credit terms. However, we find *no* evidence of any significant impact on real firm outcomes, including firm sales or employment.

For the main regressions we directly analyze the impact of ex-ante real estate related assets (i.e., mortgages as well as loans to construction and real estate developers) in 2000 on credit supply over 2001-2009 as in banking models it matters not only the actual liquidity used (securitized assets) but the liquidity that can be accessed (capacity to securitize real estate related assets due to ex-ante real estate related assets).[4] However, results are robust to two-stage instrumental variable regressions, where we instrument the actual bank securitized assets with ex-ante bank exposure to real estate assets in 2000 – the F-statistic on the first stage is 16 for the excluded instrument and also other statistics point out that it does not suffer from weak instrument problems (Staiger and Stock (1997)). Moreover, when we only instrument ABS, we find in general stronger economic effects on credit supply than instrumenting total securitization (covered bonds plus ABS).[5] Importantly, results are only statistically and economically significant when there was a global expansion of securitization in 2004-07, and not in the period 2001-04, when there was a real estate price boom (as in the 2004-07 period), but not a securitization boom.

The results above are based on firms that already have borrowing relationships at the time of securitization boom. When we look at the effect of securitization on the extensive margin of lending to new clients, we find a large effect on credit quantity. Growth in credit to new clients between 2004 and 2007 is much stronger for banks with greater exposure to securitization. A one standard deviation increase in ex-ante exposure to real estate assets generates credit to new clients that is equivalent to 10.7 percent of bank assets. Importantly, new credit granted is riskier for banks with higher ex-ante real estate assets, as it is about a third more likely to default.

All in all, securitization leads to higher bank risk-taking, both by softer credit terms for firms with established access to credit and also by a large effect on credit

[4] Securitization by affecting the ability to *access* future liquidity (against illiquid assets) it can affect *current* bank credit supply for all type of loans (see e.g. Diamond and Rajan (2006), Allen and Gale (2007), Shin (2009)). Spain was the second European country in terms of ABS and covered bonds.

[5] Results are also robust to for example multi-clustering of standard errors, or to controlling non-parametrically for savings banks (with firm fixed effects for each bank type) or directly by excluding savings banks from the regressions. Moreover, probably as we analyse non-real estate firms, results show that the borrower shocks are uncorrelated to the supply shock, and that the main bank channel is uncorrelated to unobserved borrower fundamentals (see the section on Results).

extension to new clients that turn out to be significantly more risky ex-post. The expansion in credit adds fragility to the financial system as new loans are significantly more likely to default during the downturn. These results are consistent with Shin (2009), as his model suggests that securitization – by increasing credit supply to marginal, new borrowers – increases credit risk, and therefore can be detrimental for financial stability. Dell'Ariccia and Marquez (2006) also show higher loan defaults stemming from banks' lending to new borrowers in credit expansions. Results are also consistent with models in which higher bank liquidity implies more risk-taking in bank lending due to banks' more hazard (see e.g. Allen and Gale (2007), Diamond and Rajan (2001)).

Finally, we analyze whether the 2008 collapse in the securitization market implies a credit crunch. There is a sharp reversal in the loan-level bank lending channel. However, the aggregate impact is more modest – though economically and statistically significant in some quarters – as firms are partially able to adjust their borrowing from less affected banks.

Our paper contributes to the literature on the bank lending channel in two ways.[6] First, we analyze the real effects of the bank lending channel, including financial stability aspects. Most papers in the literature analyze only credit implications of the bank channel, but not the real effects. Moreover, there is a large literature following Kashyap and Stein (2000) that analyze the bank lending channel at the bank level. However, bank level analysis cannot identify credit supply (Kwhaja and Mian (2008)). We argue in this paper that neither bank level nor just loan level can identify the real effects of the bank lending channel, but only a combination of both loan-level and firm-level analysis. There is a large number of recent papers that use the KM methodology in loan-level regressions to isolate credit supply (e.g. Amiti and Weinstein (2011), Schnabl (2012), Iyer et al. (2014)), and we extend the KM framework to identity firm-level effects through credit supply. The modification of KM in conjunction with Banco de España's exhaustive credit register matched with firm-level (and bank-level) balance-sheet variables allows the identification of the

[6] See for example Bernanke (1983), Bernanke and Gertler (1995), Kashyap and Stein (2000), Peek and Rosengren (2000), Ashcraft (2005), Khwaja and Mian (2008), Paravisini (2008), Maddaloni and Peydró (2011), Iyer and Peydró (2011), Jiménez et al. (2012, 2014).

real effects of the bank lending channel.[7] As theory shows, the bank lending channel is important only if there is real economy or financial stability implications. Therefore, it is crucial to identify the aggregate firm-level effects of the bank lending (supply) channel and not only the loan-level.[8] Indeed, our results reveal that while the bank transmission mechanism is strong, its aggregate (net) credit and real impact at the firm-level is substantially reduced due to the crowding out effects for large segments of the borrowers.

Second, the role of financial innovation and real estate in precipitating credit booms and subsequent financial crises through banks is emphasized by numerous economic historians (e.g. White (1996), Calorimis (2008), Bordo (2009) and Kindleberger (1978)). There is moreover an emerging literature on the effects of securitization on lending. Securitization is associated with lax lending and excessive credit creation in mortgage markets during the 2000's (Keys et al. (2010), Mian and Sufi (2009), Loutshina and Stahan (2009)). As Shin (2009), among others, theoretically shows, securitization may affect the general supply of credit, even outside mortgages and real estate markets. Our paper shows the effects of securitization of real estate related assets on banks' credit supply and risk-taking. Therefore, we contribute to this literature by analyzing the effects for the supply of credit for non real-estate firms and the results show that risk-taking and credit supply induced by securitization are especially strong in the extensive margin of lending.

The rest of the paper is organized as follows. Section 2 provides the empirical strategy, including the KM extension, the data, shock, institutional details, and some bank level effects. Section 3 presents and discusses the firm-level and loan-level results, and Section 4 concludes.

[7] Peek and Rosengren (2000) identify real effects by exploiting credit supply shocks that are independent of economic fundamentals. However, as the majority of crucial shocks to banks (e.g. crises, runs, monetary policy, capital) are not independent of economic fundamentals (i.e., they are not "natural experiments"), a key contribution of our paper is to extend the KM framework to identify the firm-level aggregate bank lending channel while still isolating the credit supply. Given our results are statistically not different when controlling (or not) for firm fixed effects, the bank supply shock in our paper (securitization of real estate assets) is independent of non-real estate firm fundamentals (demand). However, our analysis is more general, i.e. to shocks that affect both banks and borrowers.

[8] Our framework uses loan-level credit register data that are increasingly available in many countries around the world – there are at least 129 countries with either public or private credit registers (Djankov, McLiesh and Shleifer (2007)). Our tool is thus practical to implement and should help central banks to gain a better understanding of the overall strength of the bank lending channel in the economy. This is even more important nowadays given the new macroprudential supervision powers for the Federal Reserve and the European Central Bank, and also given the new bank capital and liquidity regulation (Basel III).

2. Empirical Strategy

This section provides the empirical strategy to estimate the firm-level (and loan-level) bank lending channel, including the KM extension, the matched firm-bank dataset (with comprehensive credit data matched with firm and bank balance sheet data), the securitization shock, the institutional details of the Spanish financial system, and some initial bank level evidence.

2.1 Framework

We follow the KM framework (see Khwaja and Mian (2008)) that have also been used in numerous papers to identify the credit supply effects at the bank-firm (loan) level (among many others, Amiti and Weinstein (2011), Schnabl (2012), Iyer et al. (2014), Bonacsorsi di Patti and Sette (2012), Paravisini et al. (2012))[9] and extend the KM technique to analyze the firm-level analysis, which we explain in this subsection.

Consider an economy with banks and firms indexed by i and j respectively. Firm j borrows from n_j banks at time t and assume (without loss of generality) that it borrows the same amount from each of the n_j banks. The economy experiences two shocks at t: a firm-level credit demand shock η_j that proxy for firm-level fundamentals and a bank-specific credit supply shock δ_i. η_j reflects changes in the firm's fundamentals as for example productivity or customer demand shocks, or risk shock, which are all largely unobserved. Therefore, it represents unobserved firm-level fundamentals. δ_i reflects instead changes in the bank's funding situation, such as a run on short term liabilities (a negative shock) or new opportunities to access wholesale financing (a positive shock). In this paper, δ_i is access to securitization that we proxy with the initial exposure to real estate assets of bank i.

Let y_{ij} denote the log change in credit from bank i to firm j. Then the basic credit channel equation in the face of credit supply and demand shocks can be written as:

$$y_{ij} = \alpha + \beta * \delta_i + \eta_j + \varepsilon_{ij}. \tag{1}$$

Equation (1) assumes that the change in bank credit from bank i to firm j is determined by an economy wide secular trend α, bank (credit supply) and firm(credit demand) shocks, and an idiosyncratic shock $\varepsilon_{ij.}$ While equation (1) is reduced form in

[9] For a complete list of papers using KM framework, see http://scholar.google.com/scholar?oi=bibs&hl=en&cites=2881126704992564729&as_sdt=5.

nature, it can be derived as an equilibrium condition by explicitly modeling credit supply and demand schedules (see KM). We keep the analysis deliberately simple here to focus on the core estimation problem.

β if often referred to as the "bank lending channel", and we refer to it as the loan-level (local) lending channel in this paper. It can be estimated from (1) using OLS, giving us $\hat{\beta}_{OLS} = \beta + \frac{Cov(\delta_i, \eta_j)}{Var\,(\delta_i)}$. The expression implies that as long as credit supply and demand shocks are significantly correlated, $\widehat{\beta}_{OLS}$ in (1) would be a biased estimate of the true β. For example, if banks receiving a positive liquidity shock are more likely to lend to firms that simultaneously receive a positive credit demand boost, then β would be biased upwards.[10] KM resolve this issue by focusing on firms with $n_j \geq 2$, and absorbing out η_j though firm fixed-effects. The estimated coefficient $\widehat{\beta}_{FE}$ then provides an unbiased estimate of β.

However, $\widehat{\beta}_{FE}$ does not give us a complete picture of the net firm-level effect of bank lending channel on the economy. In particular, individual firms affected by some banks (in the loan-level channel due to a positive β in equation (1)) may seek alternative sources of bank financing to compensate for any loss of credit. Alternatively, it firms benefit from greater provision of credit via a positive credit supply shock to an individual bank, their borrowing from elsewhere may be cut either voluntarily or due to a crowding-out effect. What it matters for real effects is this firm-level credit availability. Thus, in order to gain a complete picture of the bank lending channel effect, one must compute its consequences at the aggregate firm level. We can do so by estimating the related firm-level version of (1):

$$\bar{y}_j = \bar{\alpha} + \bar{\beta} * \bar{\delta}_j + \eta_j + \bar{\varepsilon}_j. \qquad (2)$$

$\bar{y}_j$ denotes the log change (t+1 over t) in credit for firm j across *all* banks.[11] It is not a simple average of y_{ij} from (1) since a firm can start borrowing from new banks as well in the extensive margin (potentially a key margin for firms' adjustment of credit supply shocks). $\bar{\delta}_j$ denotes the average initial exposure to real estate assets of banks initially lending to firm j at time t, i.e. $\bar{\delta}_j = \sum_{i \in N_j} \frac{\delta_i}{n_j}$ where N_j represents the set of

[10] Another example is Caballero, Hoshi and Kashyap (2008), which find that banks closer to the minimum capital requirements lend more to low net worth (zombie) firms.

[11] Depending on data availability, it could also include non-bank sources of credit as well. For example, Banco de España has also non-bank finance for firms.

banks lending to firm j at time t and $\bar{\varepsilon}_j$ is an idiosyncratic error term.[12] The same firm-level fundamentals shock η_j appears in both equations (1) and (2) under the assumption that the shock on firm fundamentals equally affects a firm's borrowing from all banks. Note that this shock is about firm fundamentals such as unobserved risk or productivity shocks.

The aggregate impact of credit supply channel is captured by the coefficient $\overline{\beta}$, which we refer to as the firm-level aggregate lending channel. If there is no adjustment at firm-level in the face of bank-specific credit channel shocks, the $\overline{\beta} = \beta$. However, if there is some adjustment at firm-level, for example a crowding-out effect, then $\overline{\beta}$ should be lower (in absolute value) than β. In the limit case, that firms can adjust perfectly their sources of finance, then in the initial time t the current banks' shocks $\bar{\delta}_j$ is not binding for them, and hence $\overline{\beta} = 0$.

How does one estimate $\overline{\beta}$? An OLS estimate of (2) yields $\hat{\bar{\beta}}_{OLS} = \beta + \frac{Cov(\delta_i, \eta_j)}{Var\,(\bar{\delta}_j)}$.[14] While the variance of $\bar{\delta}_j$ can be estimated in data (banks' securitization or initial real estate assets), the covariance term between unobserved firm (credit demand) and bank (credit supply) shocks is unobservable to the econometrician. However, a unique advantage of the preceding fixed-effects estimator at loan level is that it allows us to back-out the covariance term. Since $\widehat{\beta}_{FE}$ is an unbiased estimate of β, we can write $Cov\,(\delta_i, \eta_j) = (\widehat{\beta}_{OLS} - \widehat{\beta}_{FE}) * Var\,(\delta_i)$, where the variance of bank (credit supply) shocks δ_i, can be estimated directly from data. Thus the firm-level aggregate lending channel effect, $\overline{\beta}$, can be estimated as:

$$\hat{\bar{\beta}} = \hat{\bar{\beta}}_{OLS} - (\widehat{\beta}_{OLS} - \widehat{\beta}_{FE}) * \frac{Var(\delta_i)}{Var\,(\bar{\delta}_j)} \tag{3}$$

The second term on the right hand side of (3) is the adjustment term that corrects for any bias in the OLS estimate of (2). The adjustment term corrects for the otherwise unobserved covariance between bank (credit supply) and firm (demand) shocks. The extra variance term in the denominator corrects for the fact that the variance of bank shocks averaged at the firm level may be different from the variance

[12] Of course, if within the banks lending to the firm previous to the shock, there is heterogeneity in loan volumes, then one should weight the different bank specific shocks by the amount each bank lent to the firm.

[14] This follows from $Cov(\bar{\delta}_j, \eta_j) = Cov(\sum_{i \in N_j} \frac{\delta_i}{n_j}, \eta_j) = Cov(\delta_i, \eta_j)$.

of bank shocks overall. Note that if the bank shock is independent of the firms, like in a natural experiment for bank shocks, then the OLS firm-level coefficient provides the firm-level aggregate bank lending channel.

Equation (3) is simple and practical to implement, as loan level credit register data are now available in most countries of the world. The procedure can be summarized as follows. For any given bank shock δ_i that is suspected of generating a bank transmission channel, run OLS and FE versions of (1) to estimate $\widehat{\beta}_{OLS}$ and $\widehat{\beta}_{FE}$ respectively. Then estimate firm level equation (2) using OLS to generate $\widehat{\widehat{\beta}}_{OLS}$. Finally plug these three coefficients in (3) to estimate the unbiased impact of credit supply channel at the firm level.

We also perform some robustness for our KM extension. Our extension uses simplifying assumptions to keep the analysis tractable. Real world data may not satisfy some of these assumptions. How robust is equation (3) to such perturbations? Since close-form solutions are not possible with more generic assumptions, we present numerical solutions to the model under alternative scenarios. Table I summarizes the results of our simulation exercise. Panel A takes our baseline scenario, i.e. the model presented above, and calibrates it using different assumptions on two key parameters of interest: the (unobservable) correlation between firm (credit demand) and bank (credit supply) shocks (ρ), and the extent of firm-level adjustment to bank transmission shocks (Λ). Λ=100% implies there is full adjustment at the firm-level making $\overline{\beta}$ =0. The calibration exercise assumes that true β=0,5 shocks are normally distributed with mean zero and variance equal to 1.0, and the variance roughly reflects the variance for firm-level credit changes from 2004Q4 to 2007Q4.

The results show that while OLS estimate $\widehat{\widehat{\beta}}_{OLS}$ and $\widehat{\beta}_{OLS}$ can be significantly biased with high absolute levels of ρ, our fixed-effects and bias-correction procedure in (3) successfully backs out the true coefficients of interest. The baseline analysis assumes that banks continue to lend to firms after realization of shocks. This may not happen in practice. Some loans may be dropped (terminated credit relationships) for idiosyncratic reasons and others due to either credit supply or credit demand shocks. Our OLS and FE regressions from the preceding section ignore such dropped loans. Do ignoring dropped loans change the results in Panel A? We test this by simulating dropped loans and then running our estimation procedure on surviving loans. In

particular, add a first-stage before our estimation procedure that drops some loans from our sample depending on the loans' firm (credit demand) shock, the bank (credit supply) shock, and an idiosyncratic factor. The probability of a loan getting dropped is modelled as a probit, with weights on various factors chosen to match what we find in data.[15] We then rerun our estimation procedure on the remaining sample. The results in Panel B show that our estimate of betas remains valid even when conditioning on loans that do not get dropped.[16]

2.2 Datasets

Another crucial aspect of the identification is the exhaustive credit data matched with precise firm- (and bank-) level balance-sheet data. Our data come from loan level credit register of Banco de España, which is also the banking supervisor in Spain. It covers *all* loans to *all* non-financial firms. For computational purposes, we restrict to loans with an average borrowing of at least €60,000. We further restrict the data to *non real-estate* loans in order to analyze the securitization of real estate assets on loans to non-real estate firms.

We match each loan to selected firm characteristics (in particular firm identity, industry, location, the level of credit, firm size, number of employees and sales) and to bank balance-sheet data. Both loan and bank level data are owned by Banco de España in its role of banking supervisor. The firms' dataset is available from the Spanish Mercantile Register, which is administrative data, at a yearly frequency (and represents 70% of outstanding bank loans from the CIR).[17]

The credit data come at quarterly frequency and cover the period from the fourth quarter of 1999 to the fourth quarter of 2009. The 10 year coverage has the advantage of covering the full lending cycle in Spain. There are 487,090 firms borrowing from any of a possible of 215 banks during this time period. In order to avoid data management issues due to large size, we randomly sample 10% of the firms based on the random penultimate digit of the firm fiscal identity number. Once a firm is selected, we keep all of its loans over the 10 year period in our sample. Our 10%

[15] We set these parameters such that the coefficient on supply shock is -0.25 (as we will see in column (7) of Table V). The coefficient on demand shock is also assigned the same magnitude. Finally, the level effect is chosen such that about a third of total loans are dropped, as in our Spanish data.

[16] Our model also assumes that each firm borrows the same amount initially from its set of lenders. We also tested for robustness of our results to this assumption by simulating borrowing across banks by a firm that matches our data.

[17] We use SABI produced by INFORMA D&B in collaboration with Bureau Van Dijk.

random sample consists of 48,709 firms. While a firm may have multiple loans from the same bank at a point in time, we aggregate loans at the firm-bank-quarter level which forms our unit of analysis. Thus a "loan" in this paper refers to firm-bank pair.

Firms can enter and exit the sample during our sample period. The average tenure of a firm in our sample is 25.7 quarters (out of a possible of 41 quarters), with a median tenure of 26 quarters and 25th and 75th percentile of 14 and 41 quarters respectively. The distribution of bank credit across firms is highly skewed with top 10% of firms borrow 75.3% of total credit in the economy (Figure 1, top-left panel). The skewed nature of firm-size distribution is typical around the world. The dotted line in the top-left panel of Figure 1 shows that the cumulative distribution function of credit across banks is very similar to the CDF picture for firms. As with firms, the top 10% of banks dominate the credit market.

There is a tendency for banks to merge over our sample period as well. There are 246 banks at the beginning of sample period and 214 banks by our sample's end. However, major bank mergers (in terms of size) happen before 2001Q4. Therefore, in order to keep a more consistent panel, we focus on the period 2001Q4 till 2009Q4 in our analysis.[18] Since our core variation of interest occurs around 2005, starting in 2001Q4 does not constrain our analysis.

The top-right panel in Figure 1 plots the total cumulative bank credit over time. There is a sharp increase in the growth of bank credit in 2004 followed by sudden stagnation in 2008 when the global financial crisis hits. One of our aims in this paper is to test the extent to which the boom in credit between 2004 and 2007 can be attributed to the rise in securitization (we also aim to analyze the stagnation and fall in 2008 and 2009). As such many of our tests focus on loans outstanding in 2004Q4, and follow them forward.

Table II presents summary statistics for this set of firms. There are 29,848 firms taking out 67,838 loans in the fourth quarter of 2004. Since the KM and our extension relies on firms with at least two banking relationships, Table II also presents summary statistics for this subset of firms. There are 15,697 such firms taking out 51,397 loans. While about half the total firms have multiple banking relationships, they represent 78% of total firm credit in the economy.

[18] If a bank is acquired by another bank, its loan portfolio shows up in the portfolio of the acquiring bank in our sample.

The average loan size is €288,000 and the average firm borrows a total of €662,000 from the banking sector. 1.9% of loans are in default as of 2004Q4. However, there is a sharp increase in defaults in 2008 and, by the end of 2009, almost 8% of loans are in default (Figure 1 bottom-left panel).

One of our key variables at bank level is a bank's exposure to real estate related assets at the beginning of our sample period. This variable is constructed as the share of total bank loans that go to the real estate sector (residential mortgages as well as loans to construction and real estate firms). The average exposure to real estate sector is 44% with a standard deviation of 15.7%. The idea is to take into account the original stock of financial assets (i.e. real estate related loans) that directly or indirectly can be easily securitized.[19] Finally, we also have information at the loan level on total loan commitments, credit drawn, whether the loan is collateralized by an asset and the maturity of the loan. For the summary statistics of all the credit, firm and bank variables, see Table II.

2.3 The Spanish Financial System and the Securitization Boom

Since securitization is largely limited to real estate loans, we discuss some key features of the Spanish mortgage industry. There is no counterpart to Freddie Mac and Fannie Mae in Spain. Consequently all mortgage loans are held by banks on their books in the beginning of our sample period when there is negligible securitization. This helps to explain the high share of real estate loans on banks' books in Spain. Another difference from the U.S. is that mortgage loans in Spain have full recourse to the borrower.

Banks in Spain can be classified in two broad categories: commercial banks and savings banks. Out of the 192 banks in 2004Q4 for which we have financial information are 46 savings banks representing 41.9% of total bank assets. Commercial banks are traditional banks (including foreign banks) that have shareholders as owners of the bank. Savings banks on the other hand rely on a general assembly for governance, consisting of representatives of depositors and government. The general assembly elects a board of directors who look for a professional manager to run the banking business. Commercial banks profits can either be retained as

[19] There was almost no securitization of loans to real estate developers in Spain. However, these loans turn into mortgages – often from the same bank – after sale of houses and then may be securitized.

reserves or pay out as dividends. For the savings banks, the profits are either retained or paid out as social dividend (i.e. to build and run educational facilities, libraries, sport facilities, pensioners clubs and so on where the savings banks operate). However, despite their differences in governance structures, both commercial banks and savings banks operate under the same regulatory framework and compete against each other in common markets.[20]

The global boom in market-mediated securitization that we exploit is well known. Adrian and Shin (2009) and Ashcraft, Goldsmith-Pinkham and Vickery (2010) show that the issuance of non-GSE ABS and subprime MBS in the U.S. rose dramatically during 2004 to 2007. Securitization was driven by a series of global factors, such as global trade imbalances and accommodative monetary policy in the U.S. Furthermore, the rise in securitization was not limited to the U.S. Countries with characteristics similar to the U.S., such as large current account deficits and a housing boom, also saw a rise in the issuance of mortgage-backed securities. One such country was Spain.[21] The lower-right panel in Figure I plots Spanish house prices over time. There is a sharp increase in the growth of house prices beginning in 2001 that runs until 2007 when the global recession kicks in.

We use the term "securitization" for issuance of both covered bonds and asset-backed securities by banks in Spain. While the two securities differ in some aspects, they share the basic characteristic of allowing banks to access liquidity by pledging their real estate assets and, therefore, allowing them to increase credit supply. Spanish banks were the second largest issuers of both covered bonds and ABS in Europe.

Covered bonds are backed by a portfolio of real estate collateralized loans with a loan-to-value ratio of at most 80%. Moreover, banks can only issue covered bonds up to 80% of the total value of the underlying backing pool of collateralized loans. Finally, covered bonds also provide recourse to the issuing bank if needed. Thus covered bonds are heavily collateralized, and their sole purpose is the provision of liquidity for banks. There is no capital advantage for issuing covered bonds and these

[20] Historically, savings banks have focused on households and engaged in providing mortgage and deposit facilities. Commercial banks, on the other hand, have been more dominant in lending to the corporate sector. However there has been considerable convergence in the scope of the two types of banks since liberalization began around mid-seventies. Nonetheless, there remain differences between savings banks and commercial banks today with savings banks being more reliant on lending to real estate and household sectors.

[21] In the case of Spain, the majority of buyers were from other Euro Area countries, notably Germany though they were also from Asia (source: BIS, ECB and Banco de España).

bonds remain on a bank's balance sheet. Asset backed securities (ABS) are issued by selling a portfolio of loans (usually mortgages). In Spain the originating bank is usually the servicer of loans as well. Thus one important difference between covered bonds and ABS is that ABS unable banks to transfer some credit risk out of their balance sheet. However, even this distinction is not black and white. In certain cases, banks provide "credit enhancement" to an ABS, thus promising to absorb a certain percentage of the first losses in case of default. The accounting rules in Spain instructed banks to keep ABS on their balance sheets if they retain some component of credit risk. Since we do not know exactly whether a given ABS issuance is kept on the books or not, we cannot back out all ABS issuance at the bank level from bank balance sheets alone. This is one of the reasons we use banks' holding of real estate related assets as our main proxy for access to securitization.[22]

Figure 2 plots the aggregate issuance of asset-backed securities and covered bonds in Spain over time. The top panel plots the annual flow, while the bottom panel shows the stock of securities issued. The issuance of securitized assets (whether ABS or covered bonds) was close to negligible in the early 2000s. However, in 2004 there was a strong increase and by 2008, the stock of securitized assets represents 29.9% of total bank credit.

2.4 Bank Level Evidence

As highlighted earlier, 44% of bank loans are granted to the real estate sector in Spain. Therefore, securitization (i.e. issuance of ABS and covered bonds) provides a novel opportunity for banks to use their real estate assets as collateral for wholesale financing and, therefore, increase their supply of credit to non real-estate firms. Securitization thus enhances a bank's access to liquidity, especially for banks with larger loan portfolios backed by real estate assets.

The effect of securitization is not uniform across all banks. Since securitization depends on real estate assets, banks with greater exposure to real estate assets before the securitization boom are impacted more. This is confirmed in the top panel of Figure 3 that plots the change in securitized assets between 2004 and 2007 for a bank

[22] The other main reasons is that access to liquidity is what matters in banking models for credit supply (not necessarily the bank liquidity – securitization – used). However, we also run a two-stage IV model and results are similar. See the next Sections.

against its exposure to real estate assets in 2000. One can see that banks with greater exposure to real estate assets are able to securitize more assets.

This result is confirmed by columns (1) through (3) of Table III. Columns (1) and (2) present the bivariate relationship in un-weighted and weighted (by bank assets) regression. The correlation between real estate exposure and securitization at the bank level is strong and highly significant. Since there is negligible securitization in the beginning of 2000s, an equivalent test for new securities issued is to regress the stock of securities issued by 2007 against initial real estate assets. This is done in column (3) and the correlation becomes even stronger.

Does increased access to liquidity due to securitization also lead banks to extend more credit? The bottom panel of Figure 3 presents preliminary evidence in this regard. It plots the change over 2004-07 in bank credit to non-real-estate sector against a bank's initial exposure to real estate. There is a strong and significant relationship between the two. This is further confirmed by column (4) of Table III. Column (5) shows that the same result holds if we replace real estate exposure with issuance of new asset-backed securities between 2004 and 2007.

Figure 3 and Table III provide preliminary evidence in favour of the presence of a bank lending channel. However, such evidence cannot be considered conclusive since banks with higher real estate exposure (our ex-ante proxy, instrument, for securitization) might be systematically different. For example, banks with higher exposure to real estate loans may be lending to firms that experience faster credit demand growth during the housing boom. If this were true, our bank level results would be spuriously driven by credit demand shocks, and could not be attributed to credit supply consequences of securitization. Therefore, are banks with more real-estate exposure different?

Table IV tests whether banks with high real estate exposure are systematically different. The top panel regresses various bank characteristics against banks' exposure to real estate assets and reports the coefficient on real estate exposure. Banks with more real estate exposure as of 2000Q1 are similar to other banks in terms of profitability (return on assets), risk (non-performing loans) and capital ratio. However for reasons already highlighted, banks with real estate exposure are more likely to be savings banks. This implies that in some regressions we will control for savings banks

in a non-parametric way (with firm*bank-type fixed effects) and, even in some robustness regressions, we will exclude savings banks from the regressions to show that the results are not driven by these banks (even without these banks there is enough variation across real estate and securitization).

The middle panel tests whether firms borrowing from banks with high real estate exposure are systematically different. Since a firm may borrow from multiple banks, we take the average of initial real estate exposure for banks lending to a given firm. We find that firms borrowing from banks with greater real estate exposure are smaller in size along all dimensions – total assets, bank credit and sales. These firms also have higher tangible assets to total assets ratio (more likely to be collateralized), and are less likely to borrow short term. In consequence, bank-level evidence is not enough to identify the bank lending channel, and loan-level data with firm fixed effects may be necessary (and even in some cases firm*bank-type fixed effects and some loan controls for robustness).

The bottom panel tests if loan level outcomes as of 2000 differ for banks with greater real estate exposure. While there is no difference in default rates, loans from banks with more real estate exposure are smaller on average, more likely to be collateralized and more likely to have longer maturities. The right-lower panel repeats these loan level tests, but includes firm fixed effects to focus only on within-firm variation. The loan size result goes away, showing that conditional on lending to the same firm, loan amount does not differ across banks with differential real estate exposure.

3. Estimating the Bank Lending Channel

Since firms borrowing from real estate exposed banks are somewhat different, there is a legitimate concern that the increase in credit by these banks between 2004 and 2007 is not driven by securitization, but by stronger credit demand from the type of firms borrowing from these banks. Even if the firms borrowing from real estate exposed banks were not different on observables, one could worry about differences along unobservable dimensions. However, as Section II explained, we can address such concern by using firms fixed effects to fully absorb changes in unobservable firm fundamentals (proxying the demand side).

3.1 Loan-Level Bank Lending Channel Estimates

We regress change in credit from 2004Q4 to 2007Q4 against a lender's initial exposure to real estate assets. We use real estate loan share as of 2000Q1 as our main proxy for banks' exposure to securitization – rather than a direct measure of securitized assets – for four reasons (though we do for robustness a two-stage instrumental variable regression where we instrument securitization with ex-ante real estate exposure, see Table VII).

First, data on securitized assets is not available for some banks whereas real estate exposure is available for all banks. Second, as we mentioned in the previous section, securitized assets are not always kept on banks' books. Therefore, it is difficult to keep an accurate count of securitized assets. However, we have already seen in Table II that banks with more real estate loans issue more covered bonds and ABS (to the extent observed). Third, and perhaps most importantly, what matters most for credit channel is the *ability* and *expectation* of access to liquidity.[23] Even for a bank that has not yet securitized many of its assets, the knowledge that the bank has securitizable assets and, hence, could access to liquidity can make it extend new credit.[24] Fourth, the objective of our paper is to analyze the real effects of the bank lending channel, thus identify the firm-level effects. Therefore, it is not so crucial for us that the origin of the shock, but the real effects and the potential different effects from loan-level versus firm-level estimations.

Column (1) of Table V estimates equation (1) without firm fixed effects. In line with the bank-level results of Figure 3 and Table II, there is a strong correlation between business loan growth and a bank's initial exposure to real estate assets. Can we attribute this correlation to a credit supply effect? Since we need firm-fixed effects to answer this question, we limit ourselves to firms with multiple banking relationships as for 2004Q4[25]. Column (2) restricts sample to such firms with results similar to column (1).

[23] Banks credit supply (at t=0 in a model à la Diamond and Rajan (2006) or Allen and Gale (2007)) depends on the expectation of accessing future liquidity (t=1 in these models); therefore it is the potential access to liquidity (in our case via securitization) that matters most for credit supply rather than actual liquidity (at t=1 via securitization activity).

[24] Nonetheless our results are robust to using securitized assets by 2007 as our main right hand side variable.

[25] Almost 75 percent of all firms borrow from at least two banks during our sample period.

Column (3) adds firm fixed effects. The coefficient on bank real estate exposure (0.386) implies that a one standard deviation increase in real estate exposure generates a 6.1 percentage points higher growth in credit supply. This is more than a doubling of the average loan-level credit growth rate of 5.7% between 2004Q4 and 2007Q4.[26] Since real estate exposed banks tend to grant longer term and more collateralized loans, there may be a residual concern that our results are driven by differences in the types of loans extended by real estate exposed banks. For example, perhaps credit boom was driven by greater demand for longer term loans which happen to be the specialization of real estate exposed banks. Column (5) therefore controls for a loan's collateralization rate and maturity as of 2004Q4 as well as changes in these variable between 2004Q4 and 2007Q4. There is no appreciable change in the coefficient of interest.

Finally, we know that savings banks are more likely to have high real estate exposure. Could our results thus far be described as a savings banks phenomenon? We address this issue in column (4) by excluding savings banks and in column (6) by including bank-type *interacted* with firm fixed effects, where bank-type is either "commercial" or "savings banks". The first regression directly excludes savings banks and the second one forces comparison across loans of the *same* firm within the *same* bank-type. As results show, our coefficient of interest is almost identical and even higher in column (6).

Columns (2) through (7) go through a strong battery of tests to isolate the supply side transmission channel driven by a bank's exposure to real estate.[27] Firm fixed effects, loan level controls, and bank-type interacted with firms fixed effects control for credit demand shocks in a nonparametric way. The strong power of controls can be gauged from the fact that R-square goes to 0.003 in column (2) to 0.7 in column (5) *without* any decrease in the coefficients' magnitude! As Altonji et al. (2005) point out, the persistence of a coefficient despite a substantial increase in regression R-

[26] This should not be confused with the overall growth in credit at the firm level, which is 21.4%. Loan-level credit growth is smaller as a firm can stop borrowing from a bank between 2004 and 2007, and start borrowing from a different bank.

[27] Other robustness tests we have run are: controlling for other key bank characteristics such as bank capital. NPLs, size, profits and liquidity; controlling for the average real estate exposure of other banks lending to the same firm, and, controlling for firm observable in firm level regressions where firm fixed effects are not possible (this only for the firm-level aggregate channel). Results are very similar. See Table VII for some of these robustness tests. In the main regressions at the loan level we also double cluster the standard errors at both firm and bank level.

square due to controls provides a strong support for exogeneity of the right hand side variable of interest. Moreover, there is not statistically difference between the OLS and fixed effect coefficient, as the real estate bank shock is uncorrelated with firms' fundamentals in *non real-estate* firms. Finally, there may be a remaining concern that our results are driven by some pre-existing trends in data. Column (8) tests for this by repeating our core specification over the period 2001Q4 to 2004Q4. The estimated coefficient turns out to be negative and is statistically indifferent from zero.

A downside of the dependent variable we have used thus far (the "intensive margin") is that we cannot compute change in loan amount for loans that are dropped (terminated) before 2007Q4. In order to take such "dropped loans" into account, we construct an indicator variable that is 1 if a loan exists in 2004Q4 but not in 2007Q4, and 0 if it exists in both quarters. Column (9) repeats our core specification using "loan dropped" as dependent variable (i.e. the "extensive margin of dropped loans"). The number of loans increases in column (7) from 32,647 to 51,397 because of the inclusion of *all* outstanding loans in 2004Q4 regardless of their status in 2007Q4. Consistent with our earlier results, banks with higher real estate exposure are *less* likely to drop (terminate) a loan. Column (10) uses a Tobit specification to combine the "intensive margin" effect of column (3) and the "extensive margin" result of column (9). The combined effect of the two margins, not surprisingly, makes the overall impact in the credit channel even stronger.

3.2 Firm-Level Aggregate Credit Estimates

The results thus far highlight a strong credit supply channel effect driven by exposure to real estate assets. However, as we emphasized in the Introduction and in Section 2, these results are incomplete as they do not incorporate firm-level adjustments in response to credit supply shocks from banks. This section addresses this limitation by implementing the empirical strategy highlighted in Section 2.

Column (11) presents the OLS (and potentially biased) estimate of firm-level credit channel coefficient. The coefficient is close to zero and statistically not different from zero. The unbiased estimate of firm level credit channel is given by equation (3), which adjusts the coefficient in column (9) to take into account endogenous matching of firms with banks. Since the adjustment term depends on the differences between loan level OLS and fixed effect estimate, it is going to have a

small effect in our case. The adjustment term is equal to (0.404-0.386)*0.025/0.0123, i.e. 0.037. The unbiased firm-level bank lending channel effect is thus equal to -0.020 (see also Table VIII). It turns out that despite a very strong credit supply channel effect at the bank level, the *net* firm-level impact is close to zero![28]

Our result thus highlights the importance of incorporating firm level adjustments in the analysis of the credit supply channel. A simple correlation – *or even causation* – between bank credit extension and bank liquidity shocks can be highly misleading at the loan (bank-firm) or bank level. The speed at which firm-level borrowing adjusts also points towards a dynamic banking system where borrowing relationships are created and destroyed at regular frequency. Consistent with this view, we find that about 45 percent of firms during our sample period break away an existing banking relationship *and* start a new banking relationship with a *different* bank afterwards.

3.3 Quarter by Quarter Estimates: Pre-trend, Boom and Crisis Periods

The regressions in Table V focused on the 2004Q4 to 2007Q4 period, which is the heart of credit boom in Spain. Since the underlying data are quarterly and span a much longer time horizon, we can replicate our estimates at a quarterly frequency over the entire period. We anchor 2004Q4 as our reference quarter, and use Δ log (*credit*) between quarter *t* from 2001Q4 to 2009Q4. We estimate the OLS and FE regressions corresponding to columns (2) and (3) of Table V respectively and plot the corresponding coefficients on bank exposure to real estate in the top panel of Figure 4. These coefficients capture the evolution of loan-level bank lending channel in Spain.

Both OLS and FE estimates are close to zero until 2004Q4 and statistically not different from zero.[29] Thus the credit channel documented in Table V is not driven by any pre-existing trend, as we found earlier for the overall pre-shock cross-section. That is, there is no differential growth in credit prior to 2004Q4 for loans granted by banks with greater real estate exposure. This finding also suggests that our earlier results are not driven by boom in house prices. As Figure 1 show, the growth in house prices were as strong during the 2001-2004 period as the 2004-2007 period. If the credit channel effect in Table V was driven by real estate exposed banks' loan assets

[28] Non-bank sources are unlikely to play a significant role in our analysis since the net impact is closet o zero with only bank sources alone. Moreover, here are also no real effects in firm outcomes.

[29] Standard errors are not reported for brevity, but are similar to those shown in corresponding tables.

appreciating in value, we should see a similar effect over 2001 to 2004. The fact that it does not suggests that the loan-level bank lending channel effects are driven by the boom in securitization that kicks into high gear between 2004 and 2007.

Our results indicate that once securitization market is strong enough in terms of volume and is sustained over a long enough period, banks begin to rely on the newly found source of liquidity and start lending against it. The bank lending channel effect of securitization builds gradually over time until 2008, when the private market for securitization shuts down. Once the global financial crisis begins in fall of 2008, the bank lending channel in Spain turns *negative:* Banks with greater ex-ante exposure to real estate assets start to contract credit at a faster pace than during the crisis.

The top panel uses log change in loan amount outstanding as dependent variable. The lower panel replicates the analysis but uses log change in total commitment amount as dependent variable. The coefficient estimates are similar to the top panel with one important difference. The post-2008 reversal in credit channel is stronger with loan commitment that loan outstanding. This difference reflects a stronger contraction in the *supply* of credit by real-estate exposed banks through loan commitments. The differential impact for outstanding loans is smaller because the drawn to commitment ratio rises faster for banks with more real estate exposure, i.e. firms draw more on existing credit lines.[30]

The post-2008 reversal in bank lending channel at the loan level takes place despite massive European Central Bank (ECB) intervention in the securitization market (banks massively borrowed in the ECB/Eurosystem against their collateral). As Figure 2 makes clear, the flow of asset-backed securities issued by Spanish banks in 2008 and beyond is almost entirely driven by the interest of the banks to build up a portfolio of securities that can be used as collateral for liquidity through the ECB. The private market for securitized assets had pretty much evaporated by then.[31] Our result thus illustrates that banks with greater dependence on securitization start to cut back credit drastically – a credit crunch – when private securitization market dries up. However, the net impact of this cut is not as strong., as Figure 5 shows, firm level adjustment reduces the overall impact of bank-specific cuts in credit during 2008-2009.

[30] This is similar to the finding in U.S. by Ivashina and Sharfstein (2010).
[31] Source: Dealogic, ECB and Banco de España.

The OLS and FE estimates track each other quite closely in Figure 4. Since the FE estimate absorbs credit demand shocks at the firm-level, the compliance between OLS and FE estimates show that firm (credit demand) shocks during our sample period are largely orthogonal to bank (credit supply) shocks driven by exposure to real estate assets.

Figure 5 replicates firm-level OLS estimate of column (9) in Table V, but replaces the dependent variable with log change in firm credit between quarter *t* and 2004Q4. As in Figure 4, we plot the OLS coefficient separately for each *t* from 2001Q4 to 2009Q4. The top panel uses log change in firm credit outstanding as dependent variable, while the lower panel uses log change in total loan commitment for a firm as dependent variable. The dotted line in Figure 5 plots firm-level OLS coefficients, while the solid line reflects corresponding bias-corrected coefficients implied by equation (3). Since loan-level OLS and FE estimates in Figure 4 are close to each other, OLS and bias-corrected coefficients do not differ significantly in Figure 5 either. The bias-corrected coefficients in Figure 5 reflect the net firm-level impact of bank lending channel over time. The net impact in 2004Q4-2007Q7 period is zero despite the strong the loan-level results.

3.4 Other Credit Terms and Conditions

The loan-level bank lending channel, i.e. loan-level impact of credit supply channel on credit quantity, is undone by firm level adjustments for firms with multiple borrowing relationships. But, what about other credit terms and conditions? Greater willingness by banks to extend credit supply could lead to greater competition, hence putting downward pressure on other credit terms.

While we do not observe interest rates, we know the fraction of loan commitment that is drawn down by a borrower as well as loan maturity and collateralization rate. Changes in loan draw-down rate (drawn credit over total commitment) during the credit boom give us useful information on the otherwise unobserved terms of credit (such as covenants and interest rates). This idea is based on a revealed preference argument. As banks compete more aggressively for a firm's business, the firm should prefer to draw down more aggressively from the bank with better loan terms.

Columns (1) through (3) in Table VI test if the draw-down ratio goes up faster during 2004Q4 to 2007Q4 for banks with greater exposure to real estate. Column (1)

runs our core specification on data restricted to multiple relationship firms as of 2004Q4. There is a strong effect of bank real estate exposure on growth in drawn-down rate. A one standard deviation increase in bank's real estate exposure increases the drawn-down ratio by 1.33 percentage points. The increase in drawn-down ratio could have resulted from declining loan commitments. However, as we have already seen in Figure 4, banks with greater real estate exposure are increasing their loan commitments at a faster pace during 2004-2007 period. The increase in draw-down ratio happens *despite* faster growth in loan commitments from real-estate-exposed banks; hence, it points towards better loan terms offered by these banks.[32]

Column (2) shows that the increase in drawn to commitment ratio is not driven by real estate exposed banks making different types of loans. For example, if real estate exposed banks granted shorter maturity loans during the time period, such loans are naturally going to have higher drawn to commitment ratio. Column (2) adds loan maturity and collateralization rate as of 2004Q4, as well as change in these variables between 2004Q4 and 2007Q4 as controls. There is no change in our coefficient of interest. Column (3) further adds firm fixed effects, thus absorbing shocks at the firm level and isolating credit-supply-driven changes in loan terms. Our coefficient of interest increases slightly.

A direct measure of credit terms in our data is the fraction of loans that are collateralized. If credit terms are relaxed over 2004-2007 by banks with more real estate exposure, then we would expect rates of collateralization to go down more for these banks. Columns (4) to (6) show that this is the case, although statistical significance depends on the specification chosen. However, once we control for loan maturity in 2004Q4 and change in loan maturity between 2004Q4 and 2007Q4, the drop in collateralization rate is stronger and significant for banks with more real estate exposure. This is consistent with our earlier interpretation that securitization leads to more favourable credit terms for borrowers.

The inclusion of controls for loan maturity is necessary when testing for differences in collateralization change for two reasons. First, as we saw in Table IV, real estate exposed banks are more likely to have longer maturity loans which naturally have higher rates of collateralization. Second, and more importantly, the

[32] During crisis period, firms could draw more also depending on bank health.

change in propensity to make longer term loans is also stronger for banks with real estate exposure. This is shown in columns (7) though (9) of Table VI. Hence, as done in column (5), it is important to control for loan maturity and changes in loan maturity when comparing differences in collateralization rates.

Figure 6 plot the quarter-by-quarter OLS and FE coefficients for drawn-to commitment and collateralization rate. The sharp increase in drawn to commitment ratio for real estate exposed banks kicks in around 2005. Before 2005 there is no differential effect. Similarly, though a bit weaker, results hold for collateralization rate as well. All in all, results suggest that securitization implies softer lending conditions in both collateral, overall price and maturity.

3.5 Two Stage Instrumental Variable Regression

As explained above we prefer to directly use ex-ante real estate asset exposure than a two stage IV analysis as we do not observe all the securitization done by each bank (total off-balance sheet ABS) and also as it may matter for credit supply more the capacity and expectation to securitize assets rather than the actual securitization level. However, we also present in Table VII the results instrumenting actual securitization (both total securitization and ABS of mortgage assets, to the extend that we observe them) by the ex-ante real estate exposure in a two-stage IV regression. We analyze changes in the supply of credit for credit volume and credit terms.

The first stage shows that ex-ante real estate exposure is highly correlated with actual securitization. The F of the excluded instrument is higher than 16 (Staiger and Stock (1997)), i.e. the t-stat of real estate exposure is always higher than 4, and other related tests (Stock and Yogo (2005)) also point out that the setting does not suffer from weak instrument problems. In these regressions we also control in some columns for the main observable bank characteristics like bank capital, profits, liquidity, risk and size, for other loan controls, and for firm fixed effects. The results are also robust to not including savings banks (see column (2)) and, in fact, in this case, the first stage regression gets even stronger.

The second stage regression is also highly statistically significant where we regress change in credit volume (columns (1) to (7)) or credit terms (column (8) to (13)) on the predicted variation of securitization by ex-ante real estate exposure. All in all, results indicate that the predicted part of actual securitization by the ex-ante pre-boom

real estate assets affects credit supply, both credit volume and other terms and conditions. Moreover, economic significance is similar to Tables V and VI. Finally, the coefficients of ABS in general double the ones from total securitization (ABS and covered bonds), especially for credit terms.

3.6 Firm-level Aggregate Lending Channel and Real Effects

We also estimate the net firm-level impact of bank lending channel for draw-to-commitment ratio, maturity and collateralization. Columns (1) though (3) in Table VIII show that changes in all three of these outcomes are significant at firm level. Thus, while loan level impact in credit quantity is undone by firm-level adjustments, the same is not true for other credit terms and conditions! As banks with real estate exposure become more willing to extend credit, there is greater competition for a given firm's overall debt capacity. The competition results in borrowing firms receiving softer, more favourable credit terms.[33]

Therefore, despite the zero firm-level impact of securitization-induced credit supply channel on the *quantity* of credit, there could be positive firm-level real effects through the induced lower price of credit. However, columns (4) through (6) of Table VIII show that firms borrowing from banks with greater real estate exposure *do not* experience any differential change in propensity to default, sales or number of employees. There is thus no evidence of any appreciable impact on real firm outcomes over the period 2004 to 2007 due to securitization. Hence, despite of large effects at the bank-firm level, the crowding-out completely mitigates these effects for firm real outcomes.

3.7 Extending Credit to New Clients

So far our core analysis was based on loans outstanding in 2004Q4, which were followed forward in time. Banks with greater exposure to real estate assets increased their credit supply for existing loans as securitization kicked in. While this credit channel is counter-balanced by crowding out adjustments at firm level, the question remains whether securitization led to a net increase in credit for new borrowers. A shift in the supply of bank credit should make banks more willing to lend to riskier firms on the extensive margin (see e.g. Shin (2009)). These firms may have been

[33]All these results of Table VII and IX are robust to the other tests we have done for Table V and VI.

denied credit in the past, but with securitization expanding the supply of credit, they have a better chance of getting a loan.

Table IX tests whether banks with greater real estate exposure lend more to new clients on the extensive margin. We define "new credit" as credit given to first-time clients between 2004Q4 and 2007Q4 and regress the log of total new credit against a bank's initial exposure to real estate assets. We hypothesize that banks more exposed ex-ante to real estate are significantly more likely to make loans to new clients on the extensive margin. Column (1) tests this assertion and Column (2) replaces new credit drawn with new total credit commitments and gets similar results.

Column (3) normalizes new credit outstanding by total assets of the bank. The estimated coefficient implies that a one standard deviation increase in real estate exposure is associated with an increase of bank lending by 10.4 percent more of its assets to new clients. New bank clients can be of two types: firms that never borrowed from any bank in the past, and firms that start borrowing from the given bank for the first time after 2004Q4. Column (4) splits these two types by only focusing on lending to firms that never borrowed from any bank in the past. The coefficient drop to 0.38 from 0.665, showing that more than half of our extensive margin result is driven by lending to firms that did not borrow from any bank in the past.

Column (5) shows that new credit driven by exposure to real estate assets is significantly more likely to default by the end of 2009. We regress the 2009Q4 default rate of new credit against initial bank exposure to real estate. The estimated coefficient is statistically significant and economically large in magnitude. A one standard deviation increase in bank exposure to real estate is associated with 1.03 percentage point increase in default rate for new credit.[34]

Figure 7 plots the quarter-by-quarter estimates of columns (3) and (4). The dependent variable is new credit granted between 2004Q4 and quarter *t,* with *t* going from 2005Q1 to 2009Q4. The differential growth in new credit continues until 2008, before collapsing as the financial crisis kicks in. The extensive margin regressions are run at bank level and hence suffer from the usual criticism that unobserved credit demand shocks might contaminate our coefficients. We cannot use our firm fixed

[34] The power gets weaker if we try to split defaults by borrowers that did not borrow from any bank in the past, and borrowers that are first-time borrowers with the said bank. However, the coefficient on bank RE exposure is positive for both these groups.

effects approach to tease out the supply-driven effect here. However, our earlier results are useful for interpreting causality of our extensive margin results.

The estimated covariance between firm (credit demand) and bank (credit supply) shocks for firms borrowing from multiple banks in 2004Q4 was close to zero. It is reasonable to assume that similar correlation holds on the extensive margin as well. For instance, given the estimated covariance term for existing borrowers, it is unlikely that credit demand from future potential clients will go up disproportionately more for firms that tend to apply for loans with real-estate-exposed banks. We thus feel confident to interpreting the coefficients in Table IX as being driven by supply-side shocks as well.

4. Conclusions

As the securitization market threatened to dry up and banks suffered major losses, governments all over the world fretted about the possibility of banks transmitting their adverse shocks to the rest of the economy through a credit crunch. Many governments and central banks (including the U.S. and Europe) intervened in the banking sector with large sums of money to try to prevent any amplification of the downturn through the banking system. Such fears are common in almost all instances of financial downturns. Moreover, these financial crises are not exogenous events, but importantly come after periods of strong bank credit growth.

However, despite the importance attached to bank transmission channels in real life, the literature on the real effects of the bank lending channel is scant. A key hurdle is access to exhaustive credit registers matched with precise firm- (and bank-) level information. Another hurdle is that most researchers use nowadays the KM loan-level methodology to identify credit supply, but real effects are at the firm-level, not at the loan-level, as firms can substitute the reduction in credit supply by some banks with credit from other banks or market debt. In this paper we overcome these hurdles by using the credit register of Spain (matched with firm- and bank-level balance-sheet data) and generalize the Khwaja and Mian (2008)'s loan-level estimator to firm-level in order to identify the real and credit aggregate effects of the bank lending channel.

The robust results suggest a strong impact on credit supply to non real-estate firms of banks' ability to securitize real estate related assets (i.e. loans collateralized by real

estate, such as mortgages and loans to construction and real estate developer firms). However, this strong loan-level credit channel is neutralized by firm-level equilibrium dynamics in good times, i.e. we find close to zero effects for credit availability at the firm-level for firms with established credit relationships. In consequence, we find *no* real effects at the firm-level. Importantly, securitization implies higher bank risk-taking, both by relaxing lending standards of existing borrowers – cheaper and less collateralized credit with longer maturity – and by a credit expansion on the extensive margin to first-time bank borrowers that substantially default more. Finally, our results show a restriction of credit supply during the crisis due to dry-up in the (private) market for securitization.

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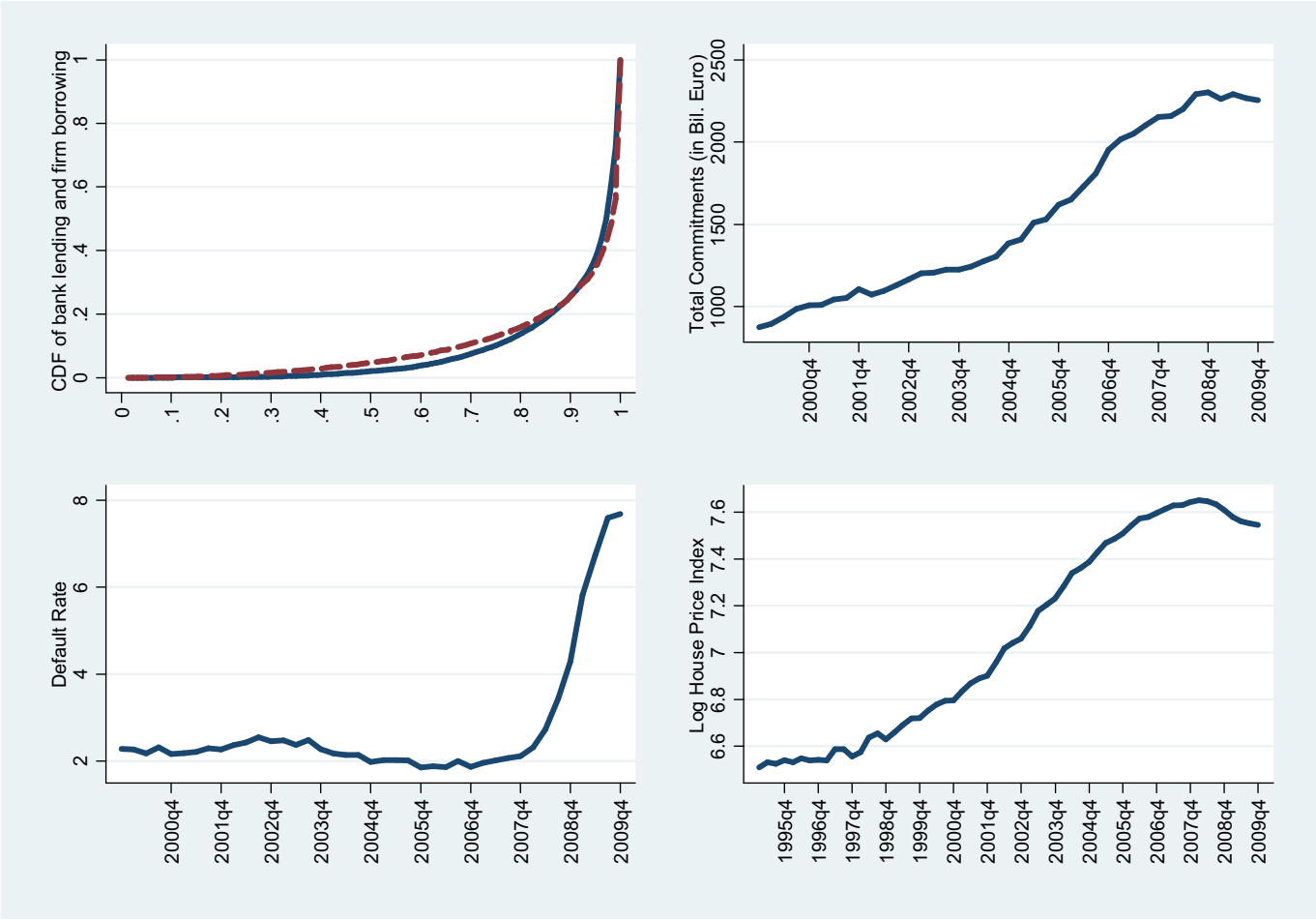
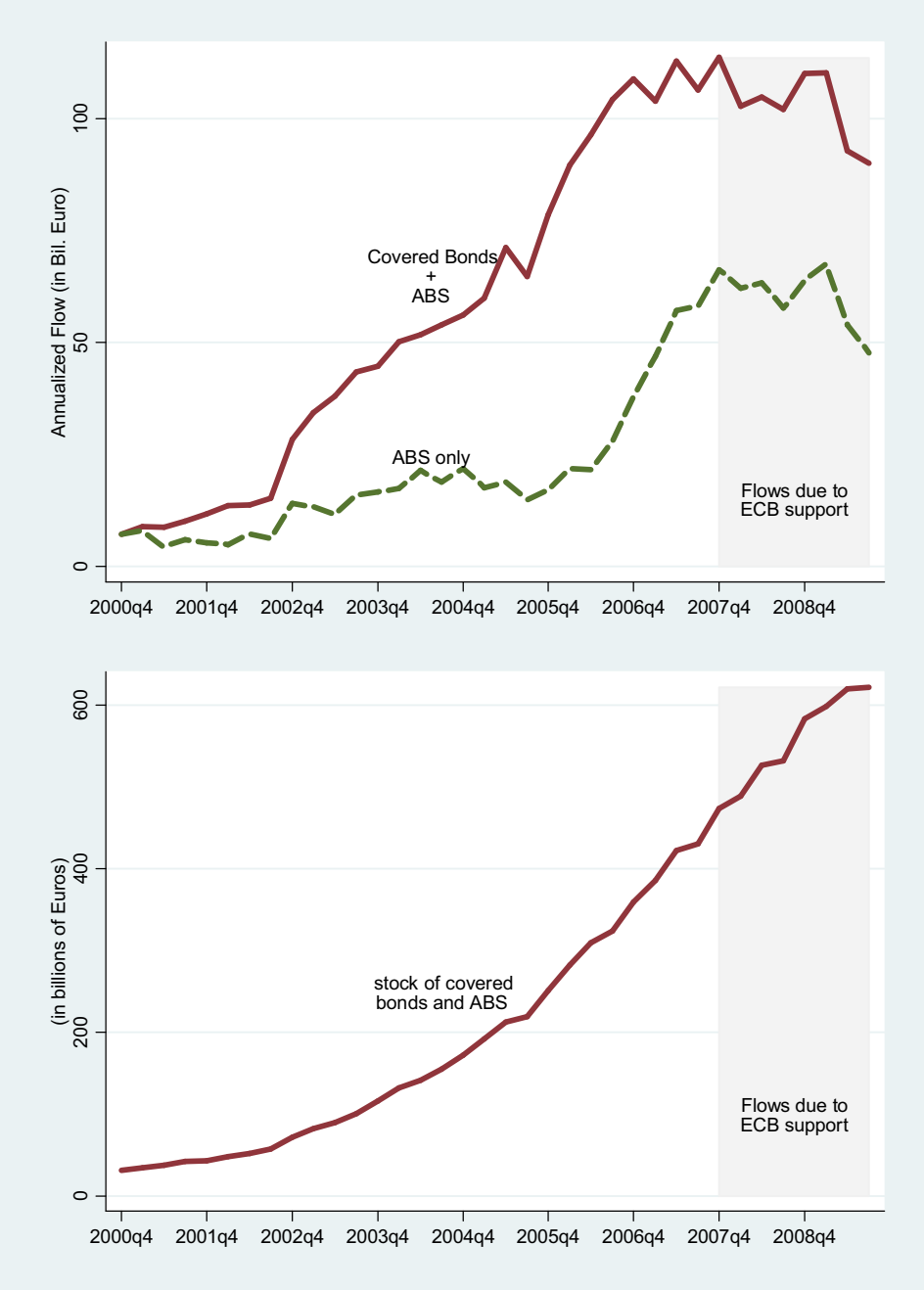
Figure 1
Credit and Housing Market in Spain



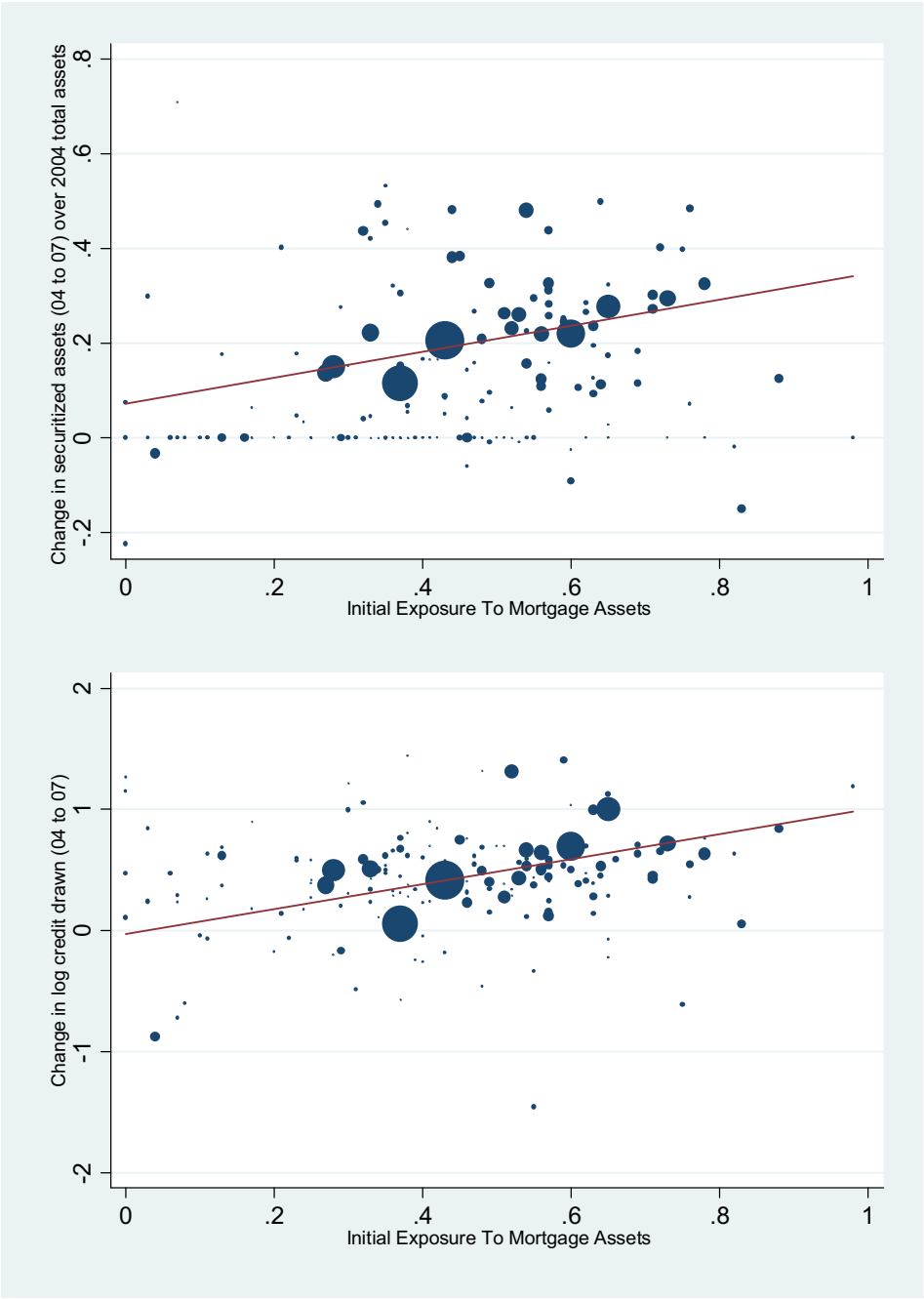
The top-left panel plots the cumulative distribution function for firm-level bank debt (solid line), and bank-level total lending (dashed line). The top-right panel plots total bank loan commitments to the non-real estate and non-financial sector in Spain. The bottom-left panel plots default rate for Spanish firms over time (limited to non-real estate and non-financial sector). The bottom-right panel plots the log of residential house price index in Spain.

Figure 2
ABS And Covered Bond Issuance In Spain



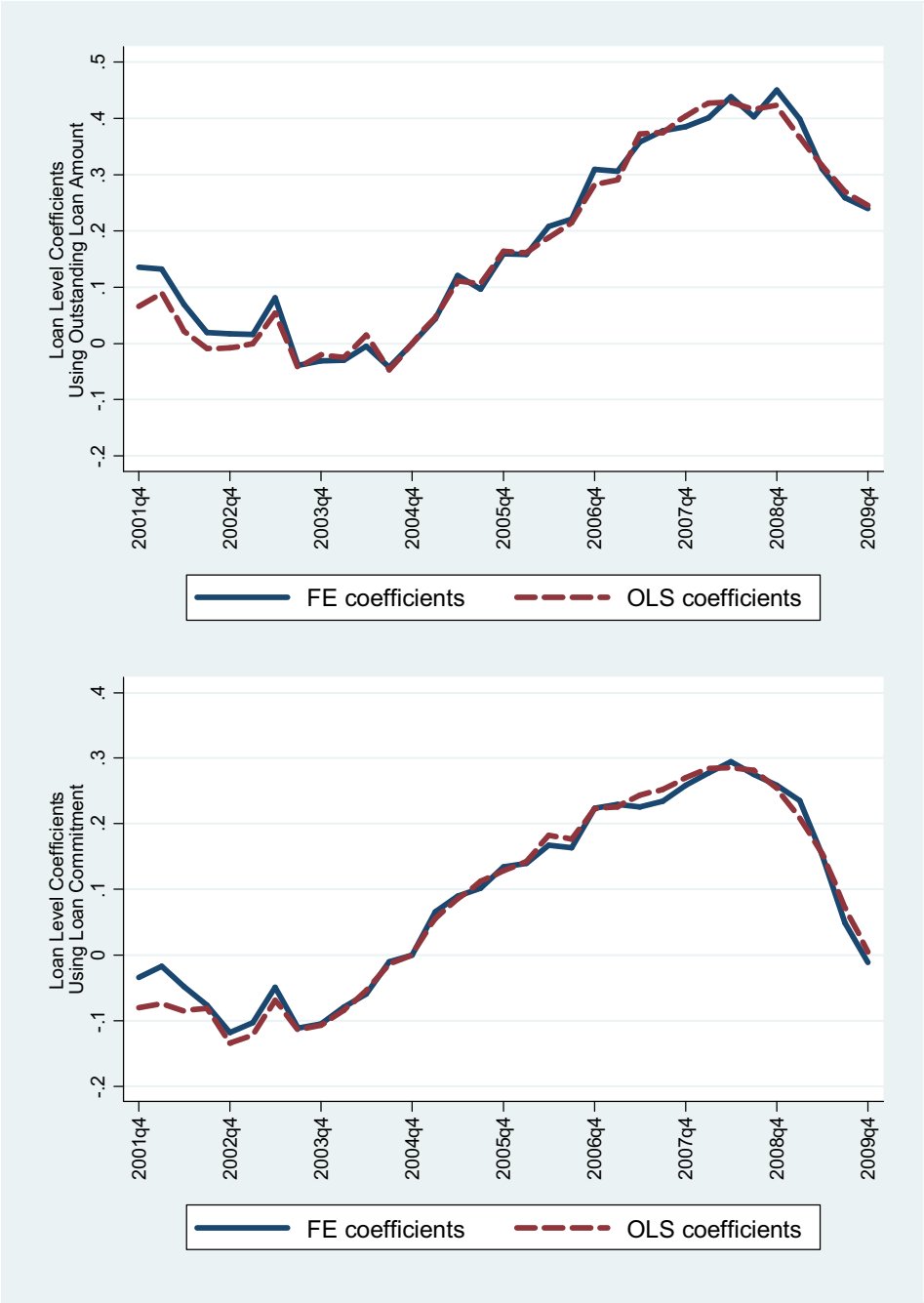
The top panel plots the annual flow of asset-backed securities issued in Spain. The solid line includes both ABS and covered bond issuance, while the dotted line only includes ABS issuance. The shaded area post 2007 represents ABS issuance that was put as collateral with the ECB for liquidity support. The bottom panel plots the stock of ABS and covered bonds over time in Spain.

Figure 3
Securitization, Bank Credit and Banks' Exposure to Real Estate



The top panel plots change in securitized assets (covered bonds and ABS) at the bank-level between 2004 and 2007 (normalized by bank total assets in 2004) against initial exposure to mortgage assets in 2000. Exposure to mortgage assets is defined as the share of total bank loans that go to the real estate sector. The size of each bank-level observation in the plot is proportional to bank size. The bottom panel plots the 2004 to 2007 change in log bank credit to non-real estate and non-financial sector against banks initial exposure to mortgage assets.

Figure 4
Loan-Level Credit Channel Coefficients By Quarter

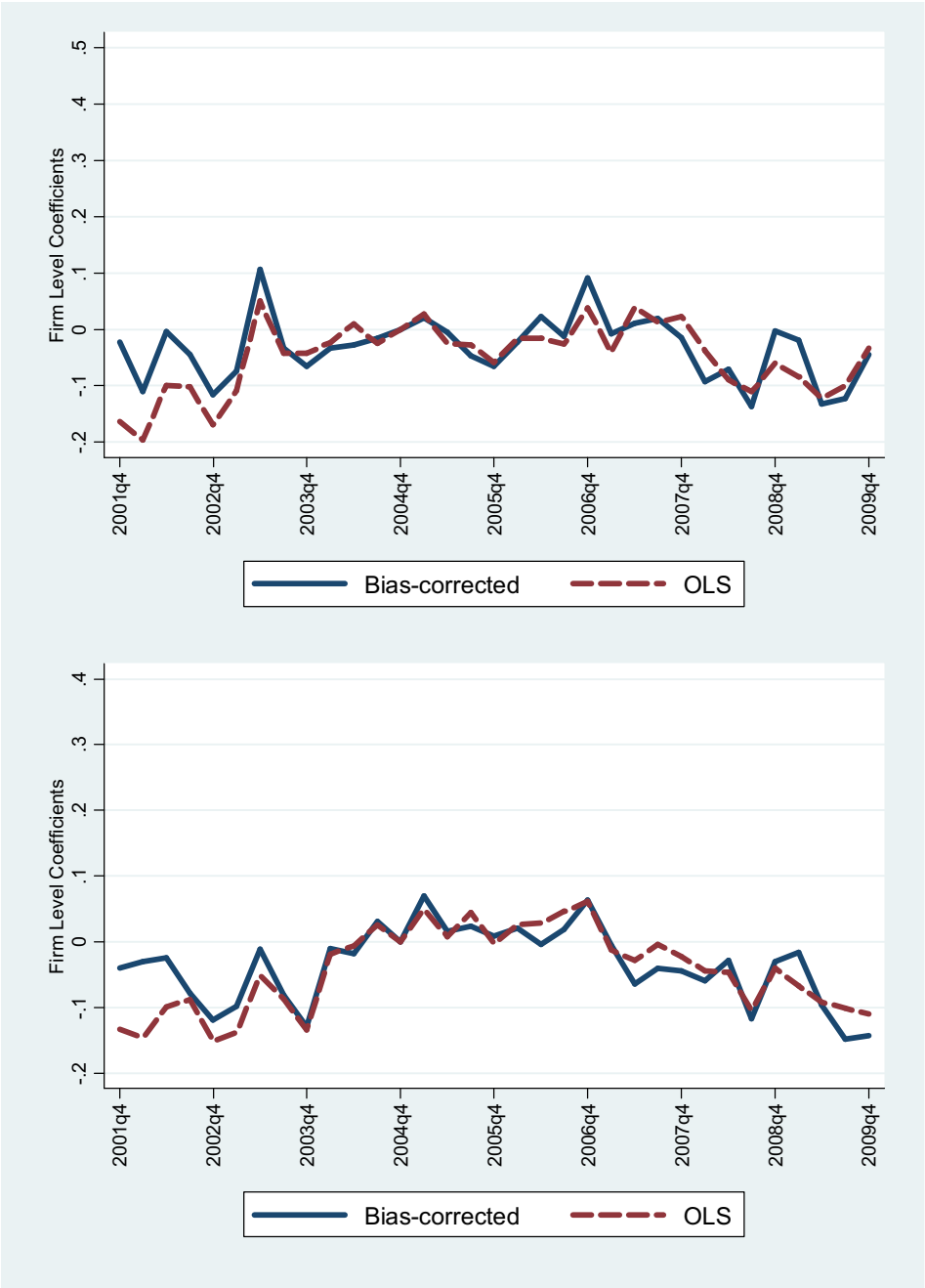


The top panel plots the coefficient estimates for $\boldsymbol{\beta}^t$ for the following specification for each quarter t:

$$\boldsymbol{y}_{ijt} - \boldsymbol{y}_{ij,04q4} = \boldsymbol{\alpha}^t + \boldsymbol{\beta}^t * \boldsymbol{REexposure}_{i,2000} + \boldsymbol{\eta}_{jt} + \boldsymbol{\varepsilon}_{ijt}$$

where $\boldsymbol{y}$ is the natural logarithm of loan amount outstanding for firm j from bank i. $\boldsymbol{REexposure}_{i,2000}$ is the share of loan portfolio exposed to real estate for bank i in 2000. The OLS coefficient estimates do not include the firm fixed effects term, $\boldsymbol{\eta}_{jt}$. The bottom panel repeats the same exercise after replacing $\boldsymbol{y}$ with the natural logarithm of loan commitment for firm j from bank i.

Figure 5
Firm-Level Credit Channel Coefficients By Quarter



The top panel plots the coefficient estimates for $\overline{\boldsymbol{\beta}}^t$ *for the following specification for each quarter t:*

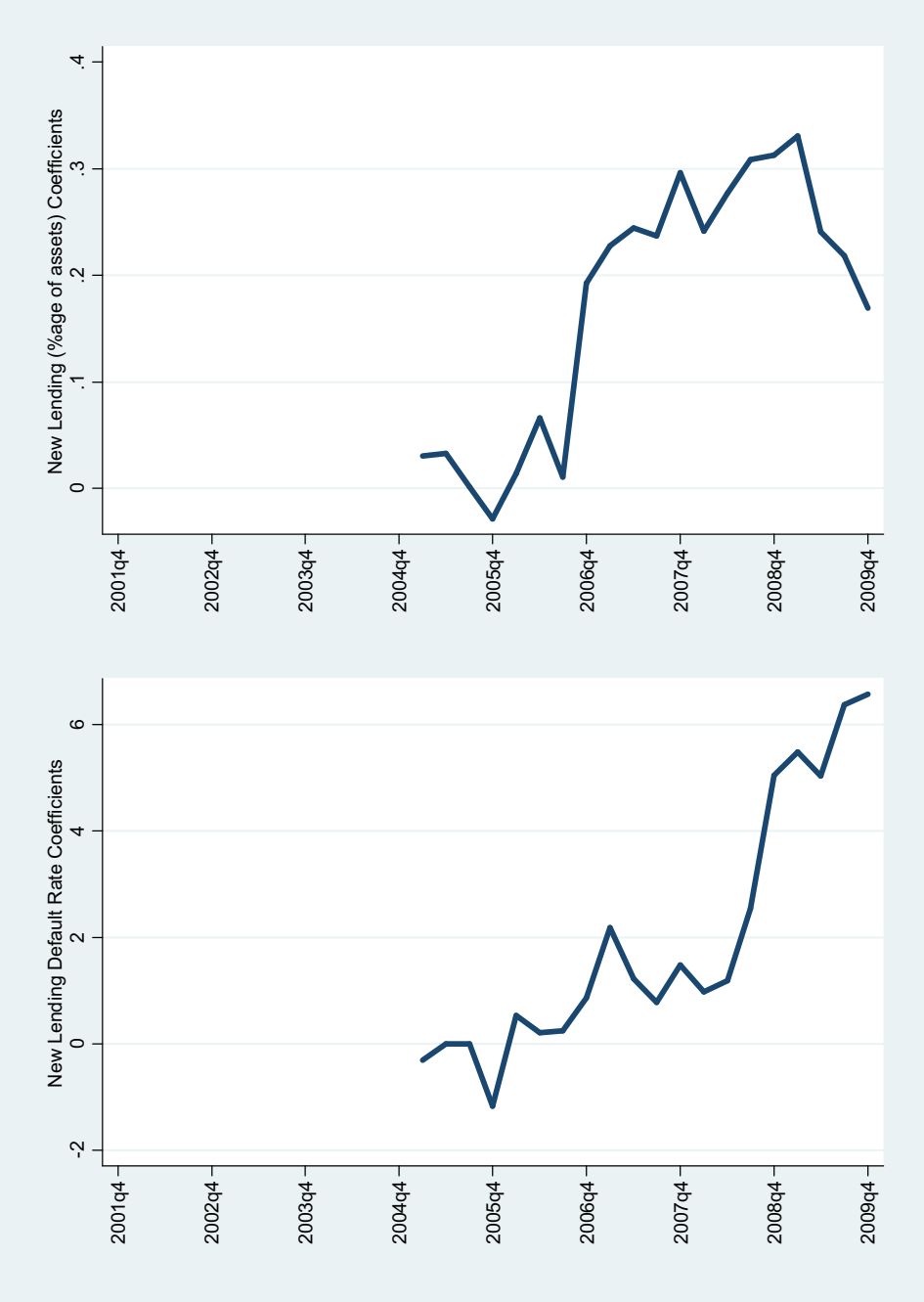
$$\overline{\boldsymbol{y}}_{jt} - \overline{\boldsymbol{y}}_{j,04q4} = \overline{\boldsymbol{\alpha}}^t + \overline{\boldsymbol{\beta}}^t * \overline{\boldsymbol{REexposure}}_{j,2000} + \overline{\boldsymbol{\varepsilon}}_{jt}$$

where $\overline{\boldsymbol{y}}$ *is the natural logarithm of total credit outstanding for firm j.* $\overline{\boldsymbol{REexposure}}_{j,2000}$ *is the average real estate exposure in 2000 of banks lending to firm j at time t. The solid line in top panel "bias corrects" the coefficient estimate according to equation (3) in the paper. The bottom panel repeats the same exercise after replacing* $\overline{\boldsymbol{y}}$ *with the natural logarithm of total commitment for firm j.*

Figure 6
Loan Terms Credit Channel Coefficients By Quarter

The top panel plots the coefficient estimates for $\boldsymbol{\beta}^t$ for the following specification for each quarter t:
$\boldsymbol{y}_{ijt} - \boldsymbol{y}_{ij,04q4} = \boldsymbol{\alpha}^t + \boldsymbol{\beta}^t * \boldsymbol{REexposure}_{i,2000} + \boldsymbol{\eta}_{jt} + \varepsilon_{ijt}$
where $\boldsymbol{y}$ is the drawn to commitment ratio for firm j from bank i. $\boldsymbol{REexposure_{i,2000}}$ is the share of loan portfolio exposed to real estate for bank i in 2000. The OLS coefficient estimates do not include the firm fixed effects term, $\boldsymbol{\eta}_{jt}$. The bottom panel repeats the same exercise after replacing $\boldsymbol{y}$ with collateralization rate of loan for firm j from bank i.

Figure 7
Extensive Margin Bank Credit Channel Coefficients



The top panel plots the coefficient estimates for $\boldsymbol{\beta}^t$ for the following specification for each quarter t:
$\boldsymbol{y}_{it} = \boldsymbol{\alpha}^t + \boldsymbol{\beta}^t * \boldsymbol{REexposure}_{i,2000} + \boldsymbol{\varepsilon}_{ijt}$
where $\boldsymbol{y}$ is the ratio of credit given to new clients since 2004q4 and total outstanding loans of bank i. $\boldsymbol{REexposure}_{i,2000}$ is the share of loan portfolio exposed to real estate for bank i in 2000. The bottom panel repeats the same exercise after replacing $\boldsymbol{y}$ with the default rate for new credit.

Table I
Simulation Of The Lending Channel – $\boldsymbol{\beta}$= 0.5

Panel A

	$\Lambda = 0\%$			$\Lambda = 50\%$			$\Lambda = 100\%$		
ρ	-0.50	0.00	0.50	-0.50	0.00	0.50	-0.50	0.00	0.50
$\widehat{\beta}_{OLS}$	0.0619	0.5036	0.9514	0.0522	0.4966	0.9425	0.0627	0.5016	0.9395
$\widehat{\beta}_{FE}$	0.5000	0.4998	0.4999	0.4994	0.4997	0.4997	0.4995	0.5009	0.4999
$\widehat{\overline{\beta}}_{OLS}$	-0.2497	0.5025	1.2709	-0.5057	0.2432	1.0109	-0.7446	0.0009	0.7536
$\overline{\beta}$	0.4941	0.4942	0.5008	0.2510	0.2496	0.2599	-0.0058	-0.0009	0.0098

Panel B

	$\Lambda = 0\%$			$\Lambda = 50\%$			$\Lambda = 100\%$		
ρ	-0.50	0.00	0.50	-0.50	0.00	0.50	-0.50	0.00	0.50
$\widehat{\beta}_{OLS}$	0.0551	0.4904	0.9195	0.0567	0.4915	0.9130	0.0625	0.4951	0.9260
$\widehat{\beta}_{FE}$	0.4999	0.5003	0.4996	0.4988	0.5002	0.4991	0.5007	0.5006	0.4999
$\widehat{\overline{\beta}}_{OLS}$	-0.1005	0.4921	1.0854	-0.3265	0.2537	0.8365	-0.5917	-0.0050	0.5903
$\overline{\beta}$	0.4854	0.5066	0.5295	0.2555	0.2667	0.2894	-0.0098	0.0030	0.0250
dropped	0.3811	0.3725	0.3685	0.3790	0.3743	0.3671	0.3799	0.3743	0.3702

This table reports the mean of 100 OLS and FE parameter estimates of the lending channel at the loan level ($\widehat{\boldsymbol{\beta}}_{OLS}$ and $\widehat{\boldsymbol{\beta}}_{FE}$), OLS estimates at the firm level ($\widehat{\overline{\boldsymbol{\beta}}}_{OLS}$), as well as "bias corrected" estimates ($\overline{\boldsymbol{\beta}}$). We report parameter estimates for different correlation values between the firm- and bank-speficic shocks at the loan level ranging from $\boldsymbol{\rho} = -0.50$ to $\boldsymbol{\rho} = 0.50$ for different substitution levels $\boldsymbol{\Lambda}$ assuming normally distributed shocks with a mean 0 of and a standard deviation of 1. In Panel B we allow for the possibility that loans are dropped.

Table II
Summary Statistics

	All Firms			*Multiple Relationship Firms*		
Loan Level Variables	N	Mean	Std Dev	N	Mean	Std Dev
Banks' initial exposure to real estate assets	67,838	0.466	0.156	51,397	0.460	0.158
Loan amount outstanding (2004Q4)	67,838	288,000	3191.9	51,397	295,899	1637.3
Log loan amount – within firm (2004Q4)	63,941	0.000	0.852	49,787	0.000	0.966
Loan amount committed (2004Q4)	67,838	367.0	3608.2	51,397	376.4	2169.2
Default Rate (2004Q4)	63,941	0.019	0.134	49,787	0.017	0.129
Loan drawn to commitment ratio (2004Q4)	67,838	81.066	30.752	51,397	83.2	27.9
Collateralization rate (2004Q4)	67,838	0.195	0.371	51,397	0.148	0.330
Maturity greater than 5 years (2004Q4)	67,838	0.230	0.390	51,397	0.185	0.356
Δ log loan amount, 01Q4 to 04Q4	33,274	-0.004	1.146	26,262	0.013	1.145
Δ default rate, 01Q4 to 04Q4	33,274	0.020	0.151	26,262	0.019	0.146
Δ log loan amount, 04Q4 to 07Q4	42,609	0.057	1.223	32,647	0.059	1.217
Δ log loan amount, 04Q4 to 07Q4 (within firm)	42,609	0.000	0.754	32,647	0.000	0.861
Δ default rate, 04Q4 to 07Q4	42,609	0.019	0.140	32,647	0.021	0.147
Δ log loan amount, 07Q4 to 09Q4	31,298	-0.250	1.016	23,322	-0.252	1.034
Δ default rate, 07Q4 to 09Q4	31,298	0.061	0.241	23,322	0.074	0.263
Firm Level Variables						
Banks' initial exposure to real estate assets	29,848	0.471	0.131	15,697	0.463	0.111
Number of banking relationships (2004Q4)	29,848	2.250	1.848	15,697	3.302	2.017
Loan amount outstanding (2004Q4)	29,848	662	6720.6	15,697	982.507	7101.2
Commitment amount (2004Q4)	29,848	836.5	7833.6	15,697	1249.2	8681.9
Default Rate (2004Q4)	29,848	0.021	0.135	15,697	0.017	0.119
Total Assets (2004Q4)	14,984	4547.1	52221	9,093	6238.4	66362.5
Total Sales (2004Q4)	14,984	5155.4	67860	9,093	7028.0	86285.2
Total Employees	12,672	28.951	278.7	7,850	37.263	351.6
Δ log loan amount, 01Q4 to 04Q4	20,998	0.146	1.193	12,627	0.384	1.019
Δ default rate, 01Q4 to 04Q4	20,998	0.017	0.142	12,627	0.015	0.125
Δ log sales, 01Q4 to 04Q4	8,606	0.213	0.627	5,837	0.230	0.587
Δ log loan amount, 04Q4 to 07Q4	25,154	0.214	1.263	14,074	0.048	1.098
Δ default rate, 04Q4 to 07Q4	25,154	0.018	0.137	14,074	0.023	0.154
Δ log sales, 04Q4 to 07Q4	11,088	0.232	0.680	7,019	0.221	0.626
Δ log loan amount, 07Q4 to 09Q4	22,120	-0.204	0.942	12,681	-0.232	0.923
Δ default rate, 07Q4 to 09Q4	22,120	0.050	0.209	12,681	0.063	0.230
Δ log sales, 07Q4 to 09Q4	11,191	0.058	0.392	6,932	0.049	0.363
Bank Level Variables						
Securitized asset (2007)	191	0.098	0.110			
ABS Mortgages (2007)	191	0.0341	0.061			
Initial exposure to real estate assets (2000Q1)	191	0.440	0.157			
Total Assets (2004Q4)	191	7.8E+6	2.5E+7			
Capital ratio (2004Q4)	191	6.686	3.922			
Return on assets (2004Q4)	191	0.945	0.483			
Interbank ratio (2004Q4)	191	-0.893	28.93			

This table presents summary statistics for loans outstanding as of 2004Q4. The underlying data represents a 10% random sample of all loans in Spain, with sampling done at firm level. A "loan" is defined as a firm-bank pair, i.e. separate loans from a bank to the same firm are aggregated at the firm level. "Multiple Relationship" firms have at least two banking relationships as of the fourth quarter of 2004.

Table III
Securitization And Initial Real Estate Exposure

	Δ Securitized Assets Over Total Assets ('04 to '07)		Securitized Assets Over Total Assets (2007)	Δ Log Bank Credit ('04 to '07)	
	(1)	(2)	(3)	(4)	(5)
Bank RE Exposure	0.197***	0.274***	0.156***	1.01***	
	(0.064)	(0.075)	(0.034)	(0.32)	
Δ Securitized Assets Over Total Assets (2004 to 2007)					1.12***
					(0.415)
	OLS	WLS	WLS	WLS	WLS
N	179	179	179	178	178
R^2	0.063	0.14	0.15	0.18	0.12

This table presents bank-level regressions relating the change in securitized assets and change in bank credit between 2004Q4 and 2007Q4 to a bank's initial exposure to real estate assets. Bank's initial exposure to real estate is defined as the fraction of total loans that is given out to the real estate sector (residential, commercial, and construction) as of 2000:Q1. All specifications report robust standard errors. ***,**,* imply that coefficient estimates are significant at 1%, 5% and 10% level, respectively.

Table IV

Correlation Between Banks Exposure To Real Estate And Initial Characteristics

	Coeff	s.e.	Coeff	s.e.
Bank Level Variables				
Return on asets (2000Q1)	1.896	(1.569)		
Total Default Rate (2000Q1)	0.0009	(0.005)		
Capital Ratio (2000Q1)	-0.705	(2.642)		
Interbank loans to assets (2000Q1)	40.117***	(13.505)		
Saving Banks	0.935***	(0.120)		
Firm Level Variables (2005Q4)				
Default rate	0.0104	(0.0114)		
Total assets	-7549.001***	(1739.050)		
Log total assets	-0.846***	(0.147)		
Total credit	-469.860**	(253.369)		
Log total credit	-0.802**	(0.379)		
Total sales	-8349.19***	(1836.714)		
Log total sales	-1.225***	(0.173)		
Number of banking relationships	-0.004	(0.343)		
Tangible assets ratio	19.109***	(2.912)		
Short term debt ratio	-27.557***	(3.213)		
Loan Level Variables (2005Q4)			*With firm fixed effects*	
Default Rate	0.013	(0.008)	0.007	(0.004)
Loan amount	-300.276***	(126.888)	-68.160	(83.267)
Log loan amount	-0.123	(0.312)	0.147	(0.285)
Collateralization rate	0.266***	(0.048)	0.150***	(0.034)
Maturity greater than 5 years	0.204***	(0.092)	0.106	(0.069)

This table regresses various bank, firm and loan characteristics on banks exposure to real estate assets in 2000, and reports the coefficient and standard error on bank exposure variable. Bank's initial exposure to real estate is defined as the fraction of total loans that is given out to the real estate sector (residential, commercial, and construction) as of 2000:Q1. ***,**,* imply that coefficient estimates are significant at 1%, 5% and 10% level, respectively.

Table V
Securitization And The Credit Channel

	Δ Log Drawn (04Q4 to 07Q4)							Δ Log Drawn (01Q4 to 04Q4)	Loan Dropped?	Tobit	Δ Firm-Level Log Drawn (04Q4 to 07Q4)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bank RE Exposure	0.366***	0.406***	0.386***	0.374**	0.382***	0.419***	0.424***	-0.135	-0.245***	0.882***	0.023
	(0.098)	(0.161)	(0.091)	(0.145)	(0.089)	(0.149)	(0.143)	(0.112)	(0.059)	(0.285)	(0.100)
Data restricted to firms with multiple relationships	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	Yes	Yes	Yes	-	-	Yes	Yes	No	No
Firm-BankType fixed effects	No	No	No	No	No	Yes	Yes	No	No	No	-
Excluding saving banks	No	No	No	Yes	No	No	Yes	No	No	No	No
Loan controls	No	No	No	No	Yes	No	No	No	No	No	-
Bank controls	No	No	No	No	No	No	Yes	No	No	No	No
N	42,609	28,640	28,640	14,063	28,640	28,640	28,640	21,733	51,397	51,397	14,074
R^2	0.00	0.00	0.41	0.55	0.42	0.64	0.64	0.42	0.46		0.00

This table presents coefficient estimates from specifications at the loan (firm-bank) level relating the growth in bank credit from 2004:Q4 to 2007:Q4 to lending bank's initial exposure to real estate. Column (9) runs a tobit specification, taking into account that change in lending is censored for firms dropped by banks (or log loan amount dropping by more than -1.82, i.e. the bottom 5th percentile). Bank's initial exposure to real estate is the fraction of total loans that is given to mortgages and construction/ real estate as of 2000:Q1. Bank controls are (log) total assets, capital ratio, interbank ratio, return on assets ratio and bank type are commercial, saving and cooperative banks. Loan controls include collateral and maturity. A firm is defined to have multiple relationships if it borrows from at least two banks of 2004Q4. All specifications include a constant (not reported) and errors are cluster at the firm and at the bank level except Model 10, which is cluster at the bank level, and Model 11, which is cluster at the lead-bank level. ***,**,* Coefficient estimated statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

Table VI
Securitization And Loan Terms

	Change in Loan conditions from 2004:Q4 to 2007:Q4								
	Drawn to Committed Ratio			Collateralization Rate			Long-term Maturity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank RE Exposure	8.28***	8.33***	8.51***	-0.016	-0.065**	-0.048**	0.134	0.140**	0.128**
	(2.68)	(2.65)	(2.61)	(0.011)	(0.033)	(0.023)	(0.083)	(0.069)	(0.047)
Data restricted to firms with multiple relationships	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
N	28,640	28,640	28,640	28,640	28,640	28,640	28,640	28,640	28,640
R^2	0.00	0.04	0.50	0.00	0.25	0.62	0.01	0.40	0.68

This table presents coefficient estimates from specifications at the loan (firm-bank) level relating the change in loan conditions from 2004:Q4 to 2007:Q4 to lending bank's exposure to real estate. We use three different loan conditions: change in drawn to committed credit in column 1 to 3, change in collateralization rate in column 4 to 6 and change in long term maturity (over 5 years) in column 7 to 9. Loan controls in (2) and (3) include maturity and collateralization rate as of 2004Q4 as well as changes in these two variables during 2004-07. Loan controls in (5) and (6) have maturity as of 2004Q4 as well as change in this variable during 2004-07. Loan controls in (8) and (9) have collateralization rate as of 2004Q4 as well as change in this variable during 2004-07. All specifications include a constant (not reported) and errors are cluster at the firm and at the bank level. Bank's initial exposure to real estate is defined as the fraction of total loans that is given out to the real estate sector (residential, commercial, and construction) as of 2000:Q1. ***,**,* imply that coefficient estimates are significant at 1%, 5% and 10% level, respectively.

Table VII

Securitization And The Credit Channel: Two-Stage Instrumental Variable Regression

								Loan Terms					
Second Stage	Δ Log Drawn (04Q4 to 07Q4)							Drawn to Committed Ratio	Collateraliz. Rate	Long-term Maturity (>5y.)	Drawn to Committed Ratio	Collateraliz. Rate	Long-term Maturity (>5y.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Securitized Assets Over Total	2.966**	2.211**		2.908**	2.182**	1.833**		64.295**	-0.366**	0.976***			
	(1.198)	(1.111)		(1.174)	(0.994)	(0.724)		(25.251)	(0.149)	(0.298)			
ABS Over Total Assets			5.038**				1.378**				110.942*	-0.637	1.669**
			(2.538)				(0.590)				(62.504)	(0.394)	(0.833)
First Stage	Total Securitized Assets Over Total Assets		ABS Over Total Assets	Total Securitized Assets Over Total Assets			ABS Over Total Assets	Total Securitized Assets Over Total Assets			ABS Over Total Assets		
Bank RE Exposure	0.130***	0.169***	0.077**	0.131***	0.191***	0.231***	0.307***	0.132***	0.132***	0.131***	0.077**	.0757**	0.077**
	(0.032)	(0.054)	(0.030)	(0.032)	(0.054)	(0.051)	(0.071)	(0.311)	(0.031)	(0.032)	(0.030)	(.030)	(0.031)
Firms with multiple relationships	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	-	-	-	Yes	No	No	Yes	No	No
Firm-BankType fixed effects	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No
Excluidng saving banks	No	Yes	No	No	No	No	No	No	No	No	No	No	No
Loan controls	No	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No
N	28,640	14,063	28,640	28,640	28,640	28,640	28,640	N	N	N	28,640	28,640	28,640

This table presents IV estimates from specifications at the loan (firm-bank) level relating the growth in bank credit from 2004:Q4 to 2007:Q4 to the securitized assets during the time period instrumented by the lending bank's initial exposure to real estate. Bank's initial exposure to real estate is the fraction of total loans that is given to mortgages and construction/ real estate as of 2000:Q1. ABS over total assets is the amount of ABS on mortgages over total assets in 2007. Loan controls include collateral and maturity. A firm is defined to have multiple relationships if it borrows from at least two banks as of 2004Q4. Bank controls are (log) total assets, capital ratio, interbank ratio, return on assets ratio and bank type are commercial, saving and cooperative banks. Loan controls in (8) and (11) include maturity and collateralization rate as of 2004Q4 as well as changes in these two variables during 2004-07. Loan controls in (9) and (12) have maturity as of 2004Q4 as well as change in this variable during 2004-07. Loan controls in (10) and (13) have collateralization rate as of 2004Q4 as well as change in this variable during 2004-07. All specifications include a constant (not reported) and errors are cluster at the firm and at the bank level. ***,**,* Coefficient estimated statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

Table VIII
Firm Outcomes

	Δ(drawn to commit)	Δ(%long-term)	Δ(collateral rate)	Δ(default rate)	Δ(log sales)	Δ(employees)
		(1)	(3)	(4)	(5)	(6)
Firm Banks' RE Exposure	6.860***	0.054**	-0.100***	0.001	-0.003	0.045
	(1.260)	(0.026)	(0.019)	(0.022)	(0.059)	(0.081)
Bias-Corrected Coefficient	**7.38**	**0.066**	**-0.074**			
Data restricted to firms with multiple relationships	Yes	Yes	Yes	Yes	Yes	Yes
N	14,277	14,277	14,277	14,277	7,019	5,964

This table presents coefficient estimates from specifications at the firm level relating the growth in firm level outcomes to a firm's banks' initial exposure to real estate assets. Bank's initial exposure to real estate is defined as the fraction of total loans that is given out to the real estate sector (residential, commercial, and construction) as of 2000:Q1. Firm banks' real estate exposure is the weighted average of a firm's lending banks' exposure to real estate as of 2000:Q1. Bias-corrected coefficients are calculated using the methodology outline in equation (3) of the paper. The calculations are as follows: Column (1), 7.38 = 6.86 + (8.54-8.28)*(0.157^2/0.111^2). Column (2), 0.066= 0.054+ (0.14-0.134))*(0.157^2/0.111^2). Column (3), -0.074=-0.10+ (-0.0030+0.016)*(0.157^2/0.111^2). All specifications include a constant (not reported) and errors are cluster at the lead-bank level. ***,**,* imply that coefficient estimates are significant at 1%, 5% and 10% level, respectively.

Table IX
Extensive Margin – Extension of Credit to New Clients

	Log Drawn	Log Commitment	Drawn Normalized	Defaults
	(1)	(2)	(3)	(4)
Bank RE Exposure	1.97**	1.69**	0.67***	0.07**
	(0.79)	(0.73)	(0.22)	(0.03)
Constant	7.99***	8.37***	0.193*	0.01
	(0.39)	(0.37)	(0.11)	(0.01)
N	175	177	179	163
R^2	0.025	0.019	0.064	0.068

This table presents coefficient estimates from specifications at the bank level relating lending given out to new clients by banks between 2004Q4 and 2007Q4 to a bank's initial real estate exposure. Bank's initial exposure to real estate is defined as the fraction of total loans that is given out to the real estate sector (residential, commercial, and construction) as of 2000:Q1. ***,**,* imply that coefficient estimates are significant at 1%, 5% and 10% level, respectively. All specifications report robust standard errors.