Credit Supply versus Demand:

Bank and Firm Balance-Sheet Channels in Good and Crisis Times

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Abstract

Banking crises involve periods of persistently low credit and economic growth. Banks' balance sheets are then weak but so are those of non-financial corporate borrowers. Hence, a crucial question is whether credit growth is low due to supply or to demand factors. However convincing identification has been elusive due to a lack of detailed loan application-, bank-, and firm-level data. Access to a dataset of loan applications in Spain that is matched with complete bank and firm balance-sheet data covering the period from 2002 to 2010 allows us to identify bank and firm balance-sheet channels. We find robust evidence showing that bank balance-sheet strength determines the success of loan applications and the granting of loans in crisis times. The heterogeneity in firm balance-sheet strength determines loan granting in both good and crisis times, although the potency of this firm balance-sheet channel is the largest in the latter period. Our findings therefore hold important implications for both theory and policy.

Keywords: bank lending channel, credit supply, business cycle, credit crunch, capital, liquidity.

JEL: E32, E44, E5, G21, G28.

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1. Introduction

Since 2007 Western Europe and the United States have experienced a severe banking crisis, followed by weak credit growth and a strong economic recession. These recent events are not unique. Banking crises are recurrent phenomena, which trigger deep and long-lasting recessions, with depressed credit growth (Reinhart and Rogoff (2009); Schularick and Taylor (2011)).

The main channel by which banks' balance-sheet weaknesses affect the economy at large is through a reduction of credit supply (Bernanke (1983)). But balance sheets of non-financial corporate borrowers may also be weak and credit demand may be low owing to bad economic prospects (Bernanke, Gertler and Gilchrist (1996)). Moreover, banking crises are not exogenous phenomena, but often follow a period of strong credit growth (Kindleberger (1978); Schularick and Taylor (2011)).

A crucial question, therefore, is whether credit growth depends on supply or on demand factors, both in good and in crisis times. Credit supply is affected by the banks' balance-sheet strength, the so-called bank lending channel (see e.g. Bernanke and Gertler (1987); Bernanke and Gertler (1995); Holmstrom and Tirole (1997); Bernanke (2007); Adrian and Shin (2010); Adrian and Shin (2011); Gertler and Kiyotaki (2011)). Demand is affected by the firm balance-sheet strength, the so-called firm balance-sheet channel (Bernanke and Gertler (1989); Bernanke and Gertler (1995); Bernanke, Gertler and Gilchrist (1996); Bernanke, Gertler and Gilchrist (1999)). Bank and firm net worth vary over the business cycle, but bank net worth and balance-sheet strength may especially matter in financial crisis times (Gertler and Kiyotaki (2011)).

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However, fully-convincing identification of the bank and firm balance-sheet channels has remained elusive due to unavailability of detailed micro data (Bernanke and Gertler (1995)). Spain, however, offers an ideal setting for identification: (i) As far as we are aware, Spain is the only country where loan applications are available for all banks and, moreover, include also an identifier for the borrower lodging the application. Hence both bank and borrower identity are known, which is crucial to identify credit availability; (ii) The credit application data can be matched with comprehensive bank balance-sheet data (collected by the supervisor) and complete firm balance-sheet data, which can proxy for the strength of bank and firm balance-sheets. This information is essential to distinguish between the bank and the firm balance-sheet channels.

We analyze the bank and firm balance-sheet channels using loan applications from Spain which are matched with complete bank and firm balance-sheet data (for example identity, size, capital ratio, liquidity ratio, credit history and defaults). The data which is available at a monthly frequency covers the period from 2002 to 2010, which allows us to analyze the period before the start of the financial crisis in August 2007 which was characterized by good economic conditions (henceforth "good times"), and the banking crisis period which started in August 2007 and we study this period until June 2010 (henceforth "crisis times").

Analyzing first only bank balance sheet strength and loan application granting, we find robust evidence that heterogeneity in bank balance-sheet strength does not determine loan granting in good times. However, it does determine loan granting in crisis times, in particular bank size, capital, liquidity, and the doubtful loan ratio. In consequence, the estimates suggest that credit supply factors only matter in crisis times.

In contrast, when analyzing the effect of firm balance-sheet strength on loan granting, we find evidence that firm heterogeneity in balance-sheet strength determines the probability a loan is granted to the applying firm both in good and in crisis times. Firm balance-sheet strength, nevertheless, matters even more in crisis times than in good times, with for example the impact of firm leverage on loan application granting more than doubling in crisis times as compared to in good times.

The key contribution of our paper is the identification strategy we employ and the estimates we obtain. The identification of the bank versus the firm balance-sheet channel is important both for testing theoretical models and for policy (see the last part of the paper). There is a large empirical literature on the balance-sheet channels that started with a macro approach and that, to achieve better identification, moved to micro level data (Bernanke and Gertler (1995)): At the bank level to identify the bank balance-sheet (or lending) channel (Kashyap and Stein (2000)) and at the firm level to identify the firm balance-sheet channel (Bernanke, Gertler and Gilchrist (1996)).[1] The papers in the literature so far – and due to data unavailability – do not use loan applications to analyze credit granting. In addition, as banks with different size, net worth and risk tend to lend to firms with different size, net worth and risk an analysis either at the bank level or at the firm level may be biased. Therefore, the identification of the bank and firm balance-sheet channels can only be done with loan applications matched with bank and firm identity and complete balance-sheet

[1] A large empirical literature has investigated the bank- and firm-balance sheet channels independently, with the analysis done at either the bank or the firm level. On the bank side see Bernanke and Blinder (1992), Kashyap and Stein (2000), Kishan and Opiela (2000), Jayaratne and Morgan (2000), Ashcraft (2006), Gan (2007), Khwaja and Mian (2008), Black, Hancock and Passmore (2009), and Chaney, Sraer and Thesmar (2009), among others. On the firm side, see Gertler and Gilchrist (1994) and Bernanke, Gertler and Gilchrist (1996), for example.

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data for both. As far as we are aware, this paper is the first in the literature to do so, hereby relying on data from Spain.

This data moreover allows us, as we explain in detail in Section 2, to use firm*time fixed effects (which control comprehensively for the firm channel) to identify the bank balance-sheet channel;[2] and to use bank*time fixed effects (which controls comprehensively for the bank channel) to identify the firm balance-sheet channel. Importantly, our analysis suggests that not controlling adequately for either the firm or bank channel results in biased results that are not robust to including either firm*time or bank*time fixed effects – i.e., not controlling for the firm or bank balance-sheet channel biases the estimates on the potency of the bank or firm balance-sheet channel.

Another intended contribution of our paper to the literature – one we deem to be very important – is that we analyze loan application granting both during the last credit boom and also during the 2007-2010 crisis itself. We therefore contribute to historical studies by Kindleberger (1978), Bernanke (1983), Reinhart and Rogoff (2009), and Schularick and Taylor (2011) by analyzing the recent credit boom and bust cycle with a comprehensive and unique micro data-set that allows for a better identification of the fundamental determinants of credit during a boom and ensuing bust.

We have used a part of the data set also in another paper. In Jiménez, Ongena, Peydró and Saurina (2011a) we analyze the bank lending channel of monetary policy until 2008 using the loan applications. Our innovation in this paper is two-fold: first,

[2] Puri, Rocholl and Steffen (2011) analyze household loan applications to German saving banks before and during the recent crisis and find that banks with exposure to US subprime assets grant less loan applications during the crisis. However, different to our paper, they cannot control for non-financial-borrowers*time fixed effects, which exhaustively control for time-varying unobserved and observed heterogeneity in non-financial borrower fundamentals and, as we show in this paper, are crucial not to bias the estimates of the potency of the balance-sheet channel.

we analyze the (non-financial borrower) firm balance-sheet channel and compare it to the bank balance-sheet channel, and (ii) we analyze the crisis period and compare it to the preceding boom years. These two innovations are crucial for testing models and for public policy analysis, and substantially differentiate our two papers.

The paper proceeds as follows. Section 2 discusses the data and the empirical strategy. Section 3 presents and discusses the results. Section 4 concludes by highlighting the relevant implications for theory and for public policy analysis.

2. Data and Empirical Strategy

In this Section we first discuss the data we employ in our empirical work, second we present and discuss the empirical strategy highlighting the testable predictions emanating from theory. Finally, we provide the definition of the dependent and independent variables and the main econometric specification.

A. *Data*

We have access to The *Credit Register* of the *Banco de España* (CIR), which contains confidential information on <u>all</u> business loans granted by <u>all</u> banks operating in Spain (see Jiménez, Salas and Saurina (2006) for a detailed description of the CIR).

To analyze credit demand, we focus on loan applications for commercial and industrial (C&I) loans (82 percent of total loans) by non-financial publicly-limited and limited-liability companies (that account for around 95 percent of all firms) to commercial banks, savings banks and credit cooperatives (that account for more than 95 percent of the entire Spanish financial system).[3] The dataset contains loan applications from potential borrowers to banks that they are not currently borrowing

[3] Delgado, Salas and Saurina (2007) explain the main features of the Spanish banking system.

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from (i.e., the extensive margin of new lending). Loan applications are available since 2002:01. Though the applications can be made at any time, they are collated monthly and uniquely link borrowers with banks (Jiménez et al. (2011a) provides a detailed description of this dataset).

We analyse the loan applications until 2010:06, the time of the start of the sovereign debt crisis in the Euro area. For each loan application between 2002:02 and 2010:06, we also observe whether the loan is accepted and granted, or not, by matching the loan application database with the CIR database, which contains the stock of all the loans granted. Therefore, if multiple banks request information on a particular borrower, we can infer the bank that granted the loan and the banks that did not. In case there is a loan application but the bank does not grant the loan, either the bank denied the firm credit or the firm perceived the offered conditions by the bank to be less attractive than those of the loan it eventually took. Hence, we can link loan granting for the same firm within each month to bank balance-sheet strength, and we can also analyse the success of a loan application depending on the firm balance-sheet strength.

We therefore match the application dataset with bank and firm datasets, so that we have balance-sheet information for each bank that receives a loan application and for the firm that applies for a loan. The banks' dataset, at a monthly frequency starting in 1984, is owned by the *Banco de España* in its role as banking supervisor. The firms' dataset is available from the Spanish Mercantile Register at a yearly frequency, starts in 1992 and covers the large majority of firms. We can match 427,364 loan applications to bank balance-sheet data and 198,350 loan applications

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to both bank and firm balance-sheet data, which constitute our two samples of loan applications that we analyze.[4]

B. *Empirical Strategy*

The theory of the bank and firm balance-sheet channels that we discuss in the Introduction has the following testable predictions. Bank and firm variables that proxy for the strength of balance sheets determine loan application granting, and the impact is stronger in crisis than in good times. Given that the main problem in the literature is to identify the channels, we emphasize more the empirical strategy and the data that is needed to test the predictions emanating from the theoretical literature.

As we have access to loan applications plus the bank and firm balance-sheet characteristics that determine balance-sheet strength, we are able to better disentangle the supply from the demand for loans. Through the loan applications, loan demand for each bank is in a sense given and observed, and each bank has to decide only on the granting of each loan knowing the firm. As far as we are aware, ours is the first paper that analyzes the impact of the bank versus the firm balance-sheet channel relying on the probability loans are granted following applications from firms.

To analyze the bank and firm balance-sheet channels we exploit the cross-sectional implications of the sensitivity of credit availability in good and crisis times according to the strength of the balance sheets (see e.g. Kashyap and Stein (2000) for

[4] In case there is no balance-sheet information for a firm, there is nevertheless the firm identity, which is crucial to identify credit supply as we discuss below. The loan applications which are not matched to the firm balance-sheet data are from very small firms since CIR collects all business loans from all the firms in Spain, including the very small ones.

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the bank balance-sheet (or lending) channel and Bernanke, Gertler and Gilchrist (1996) for the firm balance-sheet channel).

Following the theoretical literature (Holmstrom and Tirole (1997), Bernanke, Gertler and Gilchrist (1999), and Gertler and Kiyotaki (2011)) we focus on bank and firm capital ratios.[5] Since risk also affects net worth, we also feature for banks a non-performing ("doubtful") loan ratio and a Herfindahl-Hirschman index of the bank's credit portfolio by industry that proxies for bank diversification. For firms we feature a measure of previous bad credit history and the age of the firm. Following Kashyap and Stein (2000) and Bernanke, Gertler and Gilchrist (1996) we also feature the bank and firm liquidity ratios and size.

We control with bank and firm fixed effects for time-invariant characteristics of banks and firms respectively, such as for example bank type (i.e., commercial, savings or cooperative) and firm legal structure, industry and location. Moreover, given that banks of different net worth may be approached by borrowers with different net worth and risk, our benchmark regressions have the largest set of possible controls: Firm*month fixed effects to identify the bank balance-sheet channel and bank*month fixed effects to identify the firm balance-sheet channel.

Firm*month fixed effects are a complete set of monthly dummies (from 2002:02 to 2010:06) for *each* firm, which therefore control exhaustively for all time-varying observed and unobserved firm heterogeneity. This set of effects is key to control for the demand side, and hence, to identify the bank balance-sheet channel. Bank*month fixed effects are a complete set of monthly dummies (from 2002:02 to 2010:06) for

[5] Off-balance sheet volumes are very small in Spain. Hence, total bank assets cover most of the banks' businesses. Banks did not develop conduits and/or Structured Investment Vehicles (SIVs) because the prevailing accounting rules made banks consolidate these vehicles and set aside sufficient capital, eliminating the incentives of banks for developing such structures.

each bank, which therefore control exhaustively for all time-varying observed and unobserved bank heterogeneity. Similarly this set of effects is key to control for the supply side, and hence, to identify the firm balance-sheet channel.

Given that these comprehensive sets of fixed effects does not allow including concurrently respectively both firm or bank balance sheet variables, we also analyze specifications without these sets of fixed effects. In these cases, i.e., when there are no time fixed effects included, we control for macro factors with real GDP growth, the change in the interbank 3-month interest rate, and inflation (using the Consumer Price Index).

C. *Dependent Variable, Independent Variables and Specifications*

In this subsection we provide the definition of the main dependent variable, the independent variables, and the estimated specifications.

1. Main Dependent Variable: LOAN APPLICATION IS GRANTED

Table 1 defines the dependent and independent variables employed in the first set of empirical specifications where we only analyze the bank balance-sheet channel, and Table 4 defines the second set, where we analyze both the bank and the firm balance-sheet channels. Tables 1 and 4 also present their descriptive statistics for the whole period (2002:02-2010:06), for the good times (2002:02-2007:07), and for the crisis times (2007:08-2010:06).

The dependent variable we feature throughout the paper is LOAN APPLICATION IS GRANTED (we recurrently shorthand this as "loan granting"), which equals one if the loan application by firm i at time t is approved by bank b and the loan is granted in month t to $t+3$, and equals zero otherwise. The average value

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of loan granting equals 39 percent in both Tables 1 and 4 in good times and 30 percent in crisis times.[6]

We match each loan application with its relevant bank and firm characteristics, in particular firm identity. The inclusion of firm (or firm-month) fixed effects in a logit (or probit) model naturally restricts the sample to those firms that filed at least one application that did result in a loan granted and one application that did not during the sample period (or in a month). To avoid this selection problem we employ linear probability models in the regressions.

2. Independent Variables

As independent variables we include an array of bank and firm characteristics that proxy for bank and firm balance-sheet strength. The summary statistics of Table 1 are based on the observations used in the first three Tables that include only bank characteristics (and possibly firm fixed effects or firm*time fixed effects). Bank balance-sheet data is taken at the end of the previous month *t-1*.

The bank balance-sheet variables we are foremost interested in are bank size, capital, liquidity and risk. Bank size is the log of the total assets of the bank, BANK LN(TOTAL ASSETS), its average is 17.27 in good times and 17.71 in crisis times (31 and 49 billion Euros, respectively). The BANK CAPITAL RATIO as a measure of the bank's net worth which is defined as the ratio of core capital over total assets of the bank (as in Bernanke and Lown (1991) for example). Core capital is defined as total equity plus retained earnings. As we use the book value of equity and assets are not risk adjusted, our measure is equivalent to a pure leverage ratio. Thus defined it has an average value of 5.47 percent in good times and 5.39 percent in crisis times.

[6] As we explained above, there is no firm balance-sheet data for some loan applications but firm identity is always known and so is complete bank balance-sheet data.

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We also use a measure of banks' liquidity position. The BANK LIQUIDITY RATIO is the ratio of liquid assets held by the bank (i.e., cash and deposits with central banks and other credit institutions, and public debt with a maturity up to one year) and the total assets of the bank. Banks on average held 17.14 percent of their balance-sheet in liquid assets in good times but only 12.51 percent in crisis times.

We proxy bank risk by the doubtful loan ratio of the BANK DOUBTFUL LOANS RATIO which has an average value of 0.73 percent in good times and 2.71 in crisis times, and by the BANK HERFINDAHL BY INDUSTRY, the Herfindahl-Hirschman index of the bank's credit portfolio by industry, which has an average value of 27.26 in good times and 28.58 in crisis times.

As a bank-firm relationship variable we include LN(1+NUMBER OF MONTHS WITH THE BANK), which is the log of one plus the number of months that the bank had a working relationship with the firm.

To analyze the firm balance-sheet channel we include a broad set of firm characteristics that proxy for the strength of firm balance sheets (see Table 4 for the summary statistics). Parallel to the bank variables, as firm variables we feature: FIRM LN(TOTAL ASSETS), the log of the total assets, which has a value of 7.65 in good times and 7.74 in crisis times (2 and 2.2 million Euros, respectively); FIRM CAPITAL RATIO, which is the log of the ratio of own funds over total assets of the firm, which has an average value of 2.57 in good times and 2.84 in crisis times; the FIRM LIQUIDITY RATIO, the current assets over total assets of the firm, which has an average value of 6.71 in good times and 7.09 in crisis times.

For firm risk we use FIRM SUBPRIME, a dummy variable that equals one if the firm had delinquent loans before the loan was requested, and equals zero otherwise.

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Its average value equals 10 percent in good times and 12 percent in crisis times; and FIRM LN(1+AGE), the log of one plus the age of the firm in years that has an average value of 1.96 in good times and 2.26 in crisis times (7 and 9 years, respectively).

3. Specifications

The specifications we estimate are at the loan application-level and we match the loan application outcomes (whether the loan is granted or not) with the associated bank and firm balance-sheet variables. We analyze first good times (2002:02-2007:07) and then we analyze the whole period (2002:02-2010:06) introducing a crisis dummy variable that takes the value of one after 2007:07 and its interactions with the bank and firm balance sheet variables. We provide in the next Section the exact empirical specification we discuss in each Table, but the most general empirical specification assessing the probability a loan application is granted is structured as follows:

$$\text{LOAN APPLICATION IS GRANTED}_{bit} = \\ bank_{bt-1} + firm_{it-1} + \text{CRISIS}_{t-1} + \text{CRISIS}_{t-1} * bank_{bt-1} + \text{CRISIS}_{t-1} * firm_{it-1} + fixed\ effects + \varepsilon_{bit}, \tag{1}$$

where *bank* and *firm* are respectively the bank and the firm balance-sheet variables presented above, CRISIS is the crisis dummy that takes the value of one in the sample months after 2007:07 and equals zero otherwise, CRISIS * *bank* and CRISIS * *firm* are the interactions between the dummy crisis and the firm and bank balance-sheet variables, *fixed effects* are the different specifications of bank, time

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and firm fixed effects we presented above, in particular bank, time, firm, firm*time, and bank*time fixed effects. The theory of the bank and firm balance-sheet channels predict that bank and firm variables proxying for balance-sheet strength matter, and especially in crisis times (i.e., when CRISIS = 1).

3. Results

We first analyze the bank balance-sheet channel with the sample composed by all loan applications (see Tables 1 to 3), and then we analyze the bank and the firm balance-sheet channels with the sample of loan applications matched to both bank and firm balance-sheet data (see Tables 4 to 6).

A. *The Bank Balance-Sheet Channel*

Table 1, as explained in the previous Section, provides in addition to the variable definitions also the summary statistics. Table 2 provides the results for the bank balance-sheet channel for the period of good times and Table 3 for the whole period. The specifications we estimate are as follows:

$$\text{LOAN APPLICATION IS GRANTED}_{bit} = \\ bank_{bt-1} + controls_{bit} + fixed\ effects + \varepsilon_{bit}, \qquad (2)$$

where *bank* includes BANK LN(TOTAL ASSETS), BANK CAPITAL RATIO, BANK LIQUIDITY RATIO, BANK DOUBTFUL LOANS RATIO, and BANK HERFINDAHL BY INDUSTRY; and *controls* include LN(1+NUMBER OF MONTHS WITH THE BANK), GDP GROWTH, CHANGE IN 3-MONTH

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INTEREST RATE, and INFLATION. The latter three variables drop out when we include time effects starting in Model 2.

In Table 2, when we do not control for time or firm fixed effects yet, but only include bank fixed effects (Model 1), we find that smaller banks grant loans with a higher probability than larger banks. The estimated coefficient equals -3.61***.[7] Given that we estimate linear probability models and given that the estimated coefficients are expressed in percent, the economic magnitude of the effect can be readily approximated. A decrease in bank asset size of one standard deviation (i.e., 1.47), increases the probability a loan application is granted by 5.2 percentage points (= 1.45 times 3.61***). This is a sizeable effect given that the probability that a loan application is accepted in good times equals 39 percent, implying a semi-elasticity of 13 percent.

Banks with a more diverse loan portfolio also grant loans with a higher probability, but the economic magnitude of the effect is somewhat smaller: A one standard deviation lower concentration results in a 1.3 percentage points increase (9.40 times -0.14**) in granting loans. This finding implies that in good times banks that are diversified across industries are more likely to grant loans.

Finally, we find that banks are more likely to grant loans to firms with a longer previous relationship (but the economic relevancy is also modest) and that a one percentage point higher GDP growth implies a 2.9 percentage points higher probability of loan granting (= 1 times 2.92***).

Model 2 adds time fixed effects. The estimated coefficient on bank size turns statistically insignificant. In Model 3 we add firm fixed effects and bank liquidity

[7] As in the Tables, ***, **, and * indicates statistical significant at the 1, 5, and 10 percent level, respectively.

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becomes marginally statistically significant. Time and firm fixed effects control partially for loan demand net worth and risk and, as the change of results suggest, they are necessary as for example banks with different size and liquidity likely have different type of borrowers.

Yet to fully control for credit demand we need to control for both time-varying observed and unobserved heterogeneity in firm balance-sheet strength (since the business and monetary cycle affect credit demand). We do this in Model 4 where we add firm*time fixed effects in addition to bank fixed effects. Now only the estimated coefficients on bank concentration and the bank-firm relationship variables are now statistically significant, but as calculated earlier in Model 1 their economic relevancy is rather modest.

In sum, analyzing the effect of bank balance sheet strength on the probability a loan is granted following applications, the evidence suggests that the heterogeneity in bank balance-sheet strength (i.e., bank size, capital, liquidity, and risk) does not determine loan granting in good times.

In Table 3 we use loan applications from the whole period and through interactions of the crisis dummy with bank balance-sheet variables aim to differentiate the impact of bank balance-sheet strength on lending in normal versus crisis times. As the crisis shock was unexpected, it is difficult to believe that banks already adjusted their balance sheets anticipating the crisis.[8]

The specifications we now estimate are:

[8] Our results are similar if during the crisis period we use the relevant values for bank and firm characteristics immediately prior to 2007:08.

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LOAN APPLICATION IS GRANTED$_{bit}$ =

$$bank_{bt-1} + \text{CRISIS}_{t-1} + \text{CRISIS}_{t-1} * bank_{bt-1} + controls_{bit} + fixed\ effects + \varepsilon_{bit}, \quad (3)$$

where *bank* and *controls* include the same set of variables as in (2).

The crisis drastically decreases the probability a loan application is successful. Likely concurrent lower GDP growth, a higher short-term interest rate, and higher inflation also result in a lower probability of loan granting.

When analyzing the "strongest" specification, our benchmark Model 4, which is saturated with comprehensive sets of bank and firm*time fixed effects, we find that bank balance-sheet variables do not matter in normal times, but do matter in crisis times. In particular, banks that are smaller, with lower capital ratios, or with more doubtful loans are less likely to grant loans in crisis times. Banks also tend to grant more loan applications to firms which they had lent in the past, but this effect is not different between crisis and good times.

The economic relevancy of the estimated effects of the bank balance sheet strength is sizable. For example for a one standard deviation commensurate change in crisis times in bank size (decrease), capital (decrease), or doubtful loan ratio (increase) the probability a bank loan application is granted decreases by 1.0, 1.8 and 2.3 percentage points, respectively (-1.46 times 0.66***; -1.84 times 0.95***; 2.27 times -1.03**).[9] As the probability a loan application is granted in crisis times equals 30 percent, the semi-elasticities amount to 3.3, 6 and 7 percent, respectively.

[9] Rochet and Vives (2004) and Vives (2011b) show that low bank net worth (capital and doubtful ratio) negatively affect bank liquidity, especially during crisis times (leading, therefore, to a reduction in bank assets, in particular new credit). See also Gale and Yorulmazer (2011).

In sum, analyzing multiple loan applications from the same borrower in the same month (firm*time fixed effects), and accounting for all time-invariant bank characteristics, banks with stronger balance-sheets grant loan applications more readily than banks with weaker balance-sheets in crisis times, but not in good times. Hence the results suggest that credit supply factors only matter in crisis times. Not controlling exhaustively for the firm balance-sheet channel biases the estimates of the potency of the bank lending channel.

B. *The Bank and Firm Balance-Sheet Channels*

Table 4, as explained in Section 2, provides the summary statistics for the loan applications that are also matched with firm balance sheets. Table 5 provides the results for the period of good times for the bank and firm balance-sheet channels and Table 6 for the whole period.

The specifications we now estimate take the form:

$$\text{LOAN APPLICATION IS GRANTED}_{bit} = \textit{bank}_{bt-1} + \textit{firm}_{it-1} + \textit{controls}_{bit} + \textit{fixed effects} + \varepsilon_{bit}, \quad (4)$$

where *bank* and *controls* include the same set of variables as in (2) and (3), while *firm* includes: FIRM LN(TOTAL ASSETS), FIRM CAPITAL RATIO, FIRM LIQUIDITY RATIO, FIRM SUBPRIME, and FIRM LN(1+AGE).

In Tables 5 and 6 we follow the structure of the previous Tables and progressively saturate the specification with comprehensive sets of fixed effects, i.e., we introduce comprehensive sets of bank, time, firm and/o bank*time effects.

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In Models 1 and 2, without controlling for firm fixed effects, we find similar results for the bank variables as in Table 2 and we also find that smaller firms, with a lower capital ratio or that are younger have higher probability of being successful in their loan application.

In Model 3 we control for firm fixed effects (in addition to bank and time fixed effects that were introduced in Models 1 and 2, respectively). We now find that firms with a higher capital ratio and with a better credit history have higher loan granting probability, and we still find that smaller firms obtain higher credit granting. We also find similar results for bank variables as in Model 3 of Table 2.

In Models 4 and 5 we introduce bank*time fixed effects in addition to the firm fixed effects to control for time-varying observed and unobserved heterogeneity in bank balance-sheet strength. Given the large set of fixed effects we cannot double cluster: Model 4 therefore provides the results with firm clustering and Model 5 with bank clustering. We find that in good times firms with higher capital ratio and with a better credit history have a higher probability their application will be resulting in a loan being granted.

The estimated effects are also economically relevant. A one standard deviation increase in the firm capital ratio results in a 3 percentage points increase in the probability (1.16 times 2.56***), a semi-elasticity of 8 percent (3 divided by 39). Firms that are prime have a 7 percentage points higher probability of getting a loan upon applying than subprime firms.

Importantly as well, as in Tables 2 and 3 for the bank channel, the results imply that not controlling for firm fixed effects or bank*time fixed effects biases the estimates of the potency of the firm balance-sheet channel, in particular the elasticity

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of firm capital and subprime without firm fixed effects, and of firm size without bank*time fixed effects.

Next in Table 6 we estimate specifications of the form:

$$\text{LOAN APPLICATION IS GRANTED}_{bit} = \\ bank_{bt-1} + firm_{it-1} + \text{CRISIS}_{t-1} + \text{CRISIS}_{t-1} * bank_{bt-1} + \text{CRISIS}_{t-1} * firm_{it-1} + \\ controls_{bit} + fixed\ effects + \varepsilon_{bit}, \quad (5)$$

where *bank*, *firm* and *controls* include the same set of variables as were introduced in (2) and (3), and (5), respectively.

In the benchmark regressions including firm fixed effects in conjunction with bank*time fixed effects (columns 4 and 5), we find that firms with a lower capital ratio are less likely to obtain credit in general, but that the effects are stronger in crisis times. A one standard deviation decrease in the firm capital ratio in good times lowers the probability by 2 percentage points (-1.11 times 1.51***), and a similar decrease in the capital ratio in crisis times lowers the probability by an *additional* 3 percentage points (-1.16 times 2.40***), implying a total semi-elasticity of 17 percent (5 divided by 30).

Younger firms are also less likely to obtain credit following an application in the crisis times with a similarly sized economic effect. Interestingly, subprime firms are penalized equally in crisis versus good times. Finally, and similarly as in Table 3 but

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differently to the firm balance-sheet channel, the bank balance-sheet strength does not matter in good times, but it does in crisis times (see Models 1 to 3).[10]

In sum, results suggest that heterogeneity in bank balance-sheet strength does not determine loan granting in good times. However, it does determine loan granting in the crisis. In consequence, the results suggest that credit supply factors only matter in crisis times.

When analyzing firm balance-sheet strength, we instead find evidence that firm heterogeneity in balance-sheet strength determines loan application granting both in good and crisis times. Firm balance-sheet strength, nevertheless, matters more in crisis than in good times, with key elasticities as firm leverage to loan application granting more than doubling in crisis times as compared to good times.

Finally, the results imply unequivocally that not controlling exhaustively for the firm balance-sheet channel biases the estimates of the potency of the bank balance-sheet channel, and that similarly not controlling exhaustively for the bank balance-sheet channel biases the estimates of the potency of the firm balance-sheet channel.

4. Conclusions and Implications for Theory and Policy

The recent crisis has resulted in massive transfers from governments and central banks to banks, through government bail-outs, recapitalizations and liquidity assistance and various central bank lender-of-last-resort actions to help banks in repairing their capital and liquidity positions. Our evidence shows that weaknesses in bank balance sheets reduces the supply of bank credit in crisis times (credit crunch) and, therefore, our estimates lend support to theories that emphasize the role of

[10] Notice that we do not control for firm*time fixed effects in Table 6 and that the coefficient on the bank doubtful loan ratio is not significant, see Table 3 Model 3 versus 4 where this coefficient was only statistically significant when we introduce firm*time fixed effects and the coefficient increases from to Model 3 to 4 by a factor of almost ten.

banks for the business cycle and crises (see e.g. Holmstrom and Tirole (1997); Allen and Gale (2007); Matsuyama (2007); Shleifer and Vishny (2010b); Shleifer and Vishny (2010a); Adrian and Shin (2011); Gertler and Kiyotaki (2011); Diamond and Rajan (2011), Vives (2011b)).

Firm balance-sheet strength matters in general but effects are stronger in crisis times as highlighted by our estimates of the potency of the firm-balance sheet channel (Bernanke, Gertler and Gilchrist (1996); Bernanke, Gertler and Gilchrist (1999); Kiyotaki and Moore (1997); Lorenzoni (2008); Jeanne and Korinek (2010)). A crucial firm balance sheet characteristic that matters in the crisis is firm leverage, in particular high leverage, which lends support to the theories of firm debt overhang and deleveraging (see e.g. Myers (1977)). This implies that even if the government support to banks helps bank credit availability, firms' balance-sheet strength and access to finance is also important. Therefore, our results support some of the policies by the Federal Reserve targeted to non-financial borrowers' access to finance.

Though our results indicate that heterogeneity in bank balance-sheet do not determine loan application granting in good times, it does not mean that banks are irrelevant for credit built-up in good times. Risk-taking incentives captured by changes in *composition* in credit supply could be more important in good times (Jiménez, Ongena, Peydró and Saurina (2011b), Allen and Rogoff (2011)). Finally, our findings that bank strength does significantly matter in crisis times for lending policies supports current work by regulators to strengthen capital and liquidity levels at each individual bank, so that when the next crisis arrives banks are in a better

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position to cope with it and, thus, the crisis will have a attenuated impact on credit granting (i.e., a "softer" credit crunch) and, therefore, on the real economy.[11]

[11] Support in the literature for stronger regulatory requirements can be found in Admati, DeMarzo, Hellwig and Pleiderer (2010), Hellwig (2010), Repullo, Saurina and Trucharte (2010) and Hanson, Kashyap and Stein (2011), among others. Insurance contracts contingent on average bank capital as a way to insure against systemic crises are discussed in Gersbach (2011). For a discussion on competition and the limits to regulation see Vives (2011a).

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Table 1

Variable definitions and descriptive statistics for all loan applications

Variable Names	Variable Definition
LOAN APPLICATION IS GRANTED	A dummy variable which equals one if the loan application by firm *i* at time (i.e., month) *t* is approved by bank *b* and the loan is granted in month *t* to *t+3*, and equals zero otherwise
BANK LN(TOTAL ASSETS)	The log of total assets of the bank, in thousands of Euros
BANK CAPITAL RATIO	The ratio of bank equity over total assets of the bank, in percent
BANK LIQUIDITY RATIO	The ratio of liquid assets (cash and balance with central banks, and loans and advances to governments and credit institutions) held by the bank over the total assets of the bank, in percent
BANK DOUBTFUL LOANS RATIO	The doubtful loan ratio of the bank, in percent
BANK HERFINDAHL BY INDUSTRY	The Herfindahl-Hirschman index of the bank's credit portfolio by industry
LN(1+NUMBER OF MONTHS WITH THE BANK)	The log of one plus the duration of the relationship between bank and firm, in months
CRISIS	A dummy variable which equals one in months after 2007:07 and equals zero otherwise
GDP GROWTH	Annual change of Spanish gross domestic product in real terms, in percent
CHANGE IN 3-MONTH INTEREST RATE	Annual change of Spanish 3-month interbank interest rates, in percent
INFLATION	Annual change of Spanish Consumer Price Index, in percent

Descriptive Statistics	Mean	St. Dev.	Minimum	Median	Maximum
Whole Period (2002:02-2010:06)	Number of Observations = 427,364				
LOAN APPLICATION IS GRANTED	0.35	0.48	0	0	1
BANK LN(TOTAL ASSETS)	17.49	1.47	9.60	17.66	19.94
BANK CAPITAL RATIO	5.43	2.03	0.00	4.91	87.17
BANK LIQUIDITY RATIO	14.90	7.53	0.03	14.00	92.07
BANK DOUBTFUL LOANS RATIO	1.69	1.93	0	0.82	58.61
BANK HERFINDAHL BY INDUSTRY	27.90	8.84	13.20	25.62	100
LN(1+NUMBER OF MONTHS WITH THE BANK)	0.38	1.11	0	0	5.67
CRISIS	0.48	0.50	0	0	1
GDP GROWTH	1.71	2.71	-4.45	3.02	4.11
CHANGE IN 3-MONTH INTEREST RATE	-0.28	1.53	-4.38	0.09	1.41
INFLATION	2.68	1.56	-1.37	2.92	5.27
Good Times (2002:02-2007:07)	Number of Observations = 220,275				
LOAN APPLICATION IS GRANTED	0.39	0.49	0	0	1
BANK LN(TOTAL ASSETS)	17.27	1.45	9.60	17.40	19.71
BANK CAPITAL RATIO	5.47	2.20	0.00	4.91	63.10
BANK LIQUIDITY RATIO	17.14	8.10	0.03	15.40	92.07
BANK DOUBTFUL LOANS RATIO	0.73	0.66	0	0.54	28.33
BANK HERFINDAHL BY INDUSTRY	27.26	9.40	13.20	24.01	87.94
LN(1+NUMBER OF MONTHS WITH THE BANK)	0.32	1.01	0	0	5.56
GDP GROWTH	3.56	0.42	2.57	3.65	4.11
CHANGE IN 3-MONTH INTEREST RATE	0.28	0.81	-1.40	0.19	1.31
INFLATION	3.11	0.62	2.13	3.15	4.19
Crisis Times (2007:08-2010:06)	Number of Observations = 207,089				
LOAN APPLICATION IS GRANTED	0.30	0.46	0	0	1
BANK LN(TOTAL ASSETS)	17.71	1.46	9.94	17.87	19.94
BANK CAPITAL RATIO	5.39	1.84	0.00	4.91	87.17
BANK LIQUIDITY RATIO	12.51	6.02	0.53	11.74	90.76
BANK DOUBTFUL LOANS RATIO	2.71	2.27	0	2.23	58.61
BANK HERFINDAHL BY INDUSTRY	28.58	8.15	13.65	26.89	100
LN(1+NUMBER OF MONTHS WITH THE BANK)	0.44	1.21	0	0	5.67
GDP GROWTH	-0.27	2.73	-4.45	-0.49	3.58
CHANGE IN 3-MONTH INTEREST RATE	-0.87	1.86	-4.38	-0.50	1.41
INFLATION	2.22	2.05	-1.37	1.77	5.27

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Table 2
The bank balance-sheet channel during good times (2002:02-2007:07) using all loan applications

	(1)	(2)	(3)	(4)
BANK LN(TOTAL ASSETS)	-3.61 ***	-1.74	-0.60	-0.27
	(1.38)	(1.76)	(1.85)	(1.74)
BANK CAPITAL RATIO	-0.10	-0.06	0.07	0.30
	(0.30)	(0.33)	(0.27)	(0.27)
BANK LIQUIDITY RATIO	-0.11	-0.15	-0.17 *	-0.13
	(0.13)	(0.13)	(0.10)	(0.08)
BANK DOUBTFUL LOANS RATIO	-0.22	-0.20	0.18	0.24
	(0.68)	(0.68)	(0.61)	(0.54)
BANK HERFINDAHL BY INDUSTRY	-0.14 **	-0.13 *	-0.14 **	-0.15 ***
	(0.07)	(0.08)	(0.06)	(0.06)
LN(1+NUMBER OF MONTHS WITH THE BANK)	1.21 ***	1.22 ***	0.99 ***	1.10 ***
	(0.16)	(0.16)	(0.20)	(0.19)
GDP GROWTH	2.92 ***			
	(1.05)			
CHANGE IN 3-MONTH INTEREST RATE	-0.13			
	(0.55)			
INFLATION	0.25			
	(0.21)			
Fixed Effects				
Bank	*Yes*	*Yes*	*Yes*	*Yes*
Time	*No*	*Yes*	*Yes*	-
Firm	*No*	*No*	*Yes*	-
*Firm*Time*	*No*	*No*	*No*	*Yes*
Number of Observations	220,275	220,275	220,275	220,275

Notes: The table reports the estimated coefficients and robust standard errors (S.E.) in percent clustered at the bank and firm level from linear probability models estimated using least squares. The dependent variable is LOAN APPLICATION IS GRANTED. Fixed effects are included ("Yes"), not included ("No"), or comprised by the included set of fixed effects ("-"). The set of time fixed effects includes a fixed effect for every (but one) year:month during the sample period. The variable definitions and summary statistics are in Table 1. ***, **, and * indicates statistical significant at the 1, 5, and 10 percent level, respectively.

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Table 3
The bank balance-sheet channel during good (2002:02-2007:07) and crisis times (2007:08-2010:06) using all loan applications

	(1)	(2)	(3)	(4)
BANK LN(TOTAL ASSETS)	0.23	0.04	-0.11	-0.10
	(2.20)	(3.49)	(2.85)	(2.19)
BANK CAPITAL RATIO	-0.30	-0.44	0.15	-0.02
	(0.38)	(0.41)	(0.34)	(0.31)
BANK LIQUIDITY RATIO	-0.08	-0.08	-0.02	-0.04
	(0.11)	(0.11)	(0.08)	(0.07)
BANK DOUBTFUL LOANS RATIO	0.26	0.15	-0.73 ***	0.35
	(0.72)	(0.73)	(0.22)	(0.46)
BANK HERFINDAHL BY INDUSTRY	-0.09	-0.11	-0.08	-0.09
	(0.08)	(0.09)	(0.07)	(0.05)
LN(1+NUMBER OF MONTHS WITH THE BANK)	1.22 ***	1.23 ***	0.86 ***	1.11 ***
	(0.18)	(0.17)	(0.15)	(0.19)
CRISIS	-22.23 ***			
	(7.64)			
CRISIS * BANK LN(TOTAL ASSETS)	0.75 **	0.70 **	0.01	0.66 ***
	(0.32)	(0.31)	(0.07)	(0.24)
CRISIS * BANK CAPITAL RATIO	0.99 ***	0.95 ***	0.32 ***	0.95 ***
	(0.24)	(0.26)	(0.10)	(0.17)
CRISIS * BANK LIQUIDITY RATIO	0.13	0.10	0.05	0.06
	(0.12)	(0.12)	(0.06)	(0.07)
CRISIS * BANK DOUBTFUL LOANS RATIO	-0.60	-0.76	-0.12	-1.03 **
	(0.75)	(0.78)	(0.12)	(0.47)
CRISIS * BANK HERFINDAHL BY INDUSTRY	-0.07	-0.07	-0.08 **	-0.07
	(0.08)	(0.08)	(0.03)	(0.05)
CRISIS * LN(1+NUMBER OF MONTHS WITH THE BANK)	0.14	0.13	0.07	-0.16
	(0.16)	(0.16)	(0.13)	(0.22)
GDP GROWTH	1.84 ***			
	(0.37)			
CHANGE IN 3-MONTH INTEREST RATE	-1.18 **			
	(0.51)			
INFLATION	-0.46 **			
	(0.20)			
Fixed Effects				
Bank	*Yes*	*Yes*	*Yes*	*Yes*
Time	*No*	*Yes*	*Yes*	-
Firm	*No*	*No*	*Yes*	-
*Firm*Time*	*No*	*No*	*No*	*Yes*
Number of Observations	427,364	427,364	427,364	427,179

Notes: The table reports the estimated coefficients and robust standard errors (S.E.) in percent clustered at the bank and firm level from linear probability models estimated using least squares. The dependent variable is LOAN APPLICATION IS GRANTED. Fixed effects are included ("Yes"), not included ("No"), or comprised by the included set of fixed effects ("-"). The set of time fixed effects includes a fixed effect for every (but one) year:month during the sample period. The variable definitions and summary statistics are in Table 1. ***, **, and * indicates statistical significant at the 1, 5, and 10 percent level, respectively.

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Table 4

Variable definitions and descriptive statistics for the loan applications that are also matched with firm balance sheet data

Firm Variable Names	Variable Definition
FIRM LN(TOTAL ASSETS)	The log of total assets of the firm, in thousands of Euros
FIRM CAPITAL RATIO	The log ratio of firm own funds over total assets of the firm
FIRM LIQUIDITY RATIO	The ratio of current assets over the total assets of the firm, in percent
FIRM SUBPRIME	A dummy variable which equals one if the firm was delinquent on a loan before and equals zero otherwise
FIRM LN(1+AGE)	The log of one plus the duration of the age of the firm, in years

Descriptive Statistics	Mean	St. Dev.	Minimum	Median	Maximum
Whole Period (2002:02-2010:06)	Number of Observations = 198,350				
LOAN APPLICATION IS GRANTED	0.35	0.48	0	0	1
BANK LN(TOTAL ASSETS)	17.49	1.47	9.60	17.66	19.94
BANK CAPITAL RATIO	5.43	2.03	0.00	4.91	87.17
BANK LIQUIDITY RATIO	14.90	7.53	0.03	14.00	92.07
BANK DOUBTFUL LOANS RATIO	1.69	1.93	0	0.82	58.61
BANK HERFINDAHL BY INDUSTRY	27.90	8.84	13.20	25.62	100
LN(1+NUMBER OF MONTHS WITH THE BANK)	0.38	1.11	0	0	5.67
FIRM LN(TOTAL ASSETS)	7.70	1.68	1.45	7.65	15.82
FIRM CAPITAL RATIO	2.70	1.11	-5.12	2.88	4.61
FIRM LIQUIDITY RATIO	6.90	11.01	0	2.81	100
FIRM SUBPRIME	0.09	0.29	0	0	1
FIRM LN(1+AGE)	2.11	0.91	0	2.20	4.92
CRISIS	0.48	0.50	0	0	1
GDP GROWTH	1.71	2.71	-4.45	3.02	4.11
CHANGE IN 3-MONTH INTEREST RATE	-0.28	1.53	-4.38	0.09	1.41
INFLATION	2.68	1.56	-1.37	2.92	5.27
Good Times (2002:02-2007:07)	Number of Observations = 100,110				
LOAN APPLICATION IS GRANTED	0.39	0.49	0	0	1
BANK LN(TOTAL ASSETS)	17.26	1.42	9.60	17.39	19.71
BANK CAPITAL RATIO	5.44	2.28	0.00	4.90	63.10
BANK LIQUIDITY RATIO	17.68	8.30	0.03	15.82	92.07
BANK DOUBTFUL LOANS RATIO	0.72	0.64	0	0.54	28.33
BANK HERFINDAHL BY INDUSTRY	26.92	9.34	13.74	23.43	87.94
LN(1+NUMBER OF MONTHS WITH THE BANK)	0.46	1.19	0	0	5.56
FIRM LN(TOTAL ASSETS)	7.65	1.72	1.48	7.59	15.06
FIRM CAPITAL RATIO	2.57	1.16	-5.12	2.75	4.61
FIRM LIQUIDITY RATIO	6.71	11.09	0	2.62	100
FIRM SUBPRIME	0.10	0.31	0	0	1
FIRM LN(1+AGE)	1.96	0.92	0	2.08	4.82
GDP GROWTH	3.54	0.43	2.57	3.64	4.11
CHANGE IN 3-MONTH INTEREST RATE	0.24	0.82	-1.40	0.11	1.31
INFLATION	3.12	0.62	2.13	3.15	4.19
Crisis Times (2007:08-2010:06)	Number of Observations = 98,240				
LOAN APPLICATION IS GRANTED	0.30	0.46	0	0	1
BANK LN(TOTAL ASSETS)	17.68	1.42	10.31	17.84	19.94
BANK CAPITAL RATIO	5.33	1.81	0.00	4.85	62.44
BANK LIQUIDITY RATIO	12.54	6.09	0.53	11.74	87.64
BANK DOUBTFUL LOANS RATIO	2.80	2.27	0	2.41	21.93
BANK HERFINDAHL BY INDUSTRY	28.55	8.26	13.65	27.00	100
LN(1+NUMBER OF MONTHS WITH THE BANK)	0.63	1.42	0	0	5.67
FIRM LN(TOTAL ASSETS)	7.74	1.63	1.45	7.70	15.82
FIRM CAPITAL RATIO	2.84	1.04	-4.26	3.01	4.60
FIRM LIQUIDITY RATIO	7.09	10.92	0	3.02	100
FIRM SUBPRIME	0.12	0.33	0	0	1
FIRM LN(1+AGE)	2.26	0.88	0	2.40	4.92
GDP GROWTH	-0.42	2.70	-4.45	-0.86	3.58
CHANGE IN 3-MONTH INTEREST RATE	-0.95	1.85	-4.38	-0.60	1.41
INFLATION	2.14	2.05	-1.37	1.77	5.27

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Table 5

The bank and firm balance-sheet channels during good times (2002:02-2007:07) using the loan applications that are also matched with firm balance sheet data

	(1)	(2)	(3)	(4)	(5)
BANK LN(TOTAL ASSETS)	-4.45 ***	-2.12	-1.31		
	(1.60)	(2.19)	(2.58)		
BANK CAPITAL RATIO	-0.21	-0.24	-0.20		
	(0.27)	(0.28)	(0.35)		
BANK LIQUIDITY RATIO	-0.09	-0.14	-0.18 *		
	(0.14)	(0.14)	(0.10)		
BANK DOUBTFUL LOANS RATIO	0.13	0.32	0.82		
	(0.81)	(0.85)	(0.85)		
BANK HERFINDAHL BY INDUSTRY	-0.07	-0.07	-0.10		
	(0.08)	(0.09)	(0.09)		
LN(1+NUMBER OF MONTHS WITH THE BANK)	1.93 ***	1.95 ***	0.80 ***	0.78 ***	0.78 ***
	(0.17)	(0.17)	(0.20)	(0.23)	(0.20)
FIRM LN(TOTAL ASSETS)	-1.32 ***	-1.33 ***	-1.68 *	-1.69	-1.69
	(0.31)	(0.31)	(0.95)	(1.14)	(1.09)
FIRM CAPITAL RATIO	-0.96 ***	-0.94 ***	2.65 ***	2.56 ***	2.56 ***
	(0.22)	(0.22)	(0.62)	(0.87)	(0.71)
FIRM LIQUIDITY RATIO	-0.01	-0.01	0.02	0.03	0.03
	(0.02)	(0.02)	(0.06)	(0.08)	(0.05)
FIRM SUBPRIME	-0.47	-0.41	-7.28 *	-6.93 *	-6.93 *
	(0.59)	(0.59)	(3.75)	(4.01)	(4.08)
FIRM LN(1+AGE)	-1.10 ***	-1.09 ***	-3.67 *	-2.64	-2.64
	(0.35)	(0.36)	(2.22)	(3.02)	(2.44)
GDP GROWTH	3.46 **				
	(1.35)				
CHANGE IN 3-MONTH INTEREST RATE	-0.35				
	(0.68)				
INFLATION	0.02				
	(0.31)				
Fixed Effects					
Bank	*Yes*	*Yes*	*Yes*	-	-
Time	*No*	*Yes*	*Yes*	-	-
Firm	*No*	*No*	*Yes*	*Yes*	*Yes*
*Bank*Time*	*No*	*No*	*No*	*Yes*	*Yes*
Number of Observations	100,110	100,110	100,110	100,110	100,110

Notes: The table reports the estimated coefficients and robust standard errors (S.E.) in percent clustered at the bank and firm level in models 1-3, at the firm level in model 4, and at the bank level in model 5 from linear probability models estimated using least squares. The dependent variable is LOAN APPLICATION IS GRANTED. Fixed effects are included ("Yes"), not included ("No"), or comprised by the included set of fixed effects ("-"). The set of time fixed effects includes a fixed effect for every (but one) year:month during the sample period. The variable definitions and summary statistics are in Table 1. ***, **, and * indicates statistical significant at the 1, 5, and 10 percent level, respectively.

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Table 6

The bank and firm balance-sheet channels during good (2002:02-2007:07) and crisis times (2007:08-2010:06) using the loan applications that are also matched with firm balance sheet data

	(1)	(2)	(3)	(4)	(5)
BANK LN(TOTAL ASSETS)	-0.10	0.02	-0.26		
	(2.15)	(3.58)	(3.02)		
BANK CAPITAL RATIO	-0.42	-0.55	-0.52		
	(0.42)	(0.42)	(0.40)		
BANK LIQUIDITY RATIO	-0.05	-0.06	-0.07		
	(0.11)	(0.11)	(0.08)		
BANK DOUBTFUL LOANS RATIO	0.33	0.42	0.38		
	(0.69)	(0.70)	(0.62)		
BANK HERFINDAHL BY INDUSTRY	-0.05	-0.08	-0.03		
	(0.09)	(0.10)	(0.08)		
LN(1+NUMBER OF MONTHS WITH THE BANK)	1.92 ***	1.94 ***	0.84 ***	0.86 ***	0.86 ***
	(0.18)	(0.17)	(0.22)	(0.21)	(0.22)
FIRM LN(TOTAL ASSETS)	-1.35 ***	-1.35 ***	-2.65 ***	-2.79 ***	-2.79 ***
	(0.31)	(0.31)	(0.67)	(0.86)	(0.70)
FIRM CAPITAL RATIO	-0.98 ***	-0.95 ***	1.47 ***	1.51 **	1.51 ***
	(0.22)	(0.22)	(0.51)	(0.66)	(0.50)
FIRM LIQUIDITY RATIO	-0.01	-0.01	-0.03	-0.03	-0.03
	(0.02)	(0.02)	(0.04)	(0.06)	(0.04)
FIRM SUBPRIME	-0.45	-0.38	-4.88 **	-4.56 **	-4.56 **
	(0.58)	(0.58)	(1.95)	(2.27)	(2.05)
FIRM LN(1+AGE)	-1.05 ***	-1.04 ***	-0.94	0.23	0.23
	(0.36)	(0.36)	(1.81)	(2.26)	(1.82)
CRISIS	-37.01 ***				
	(8.81)				
CRISIS * BANK LN(TOTAL ASSETS)	1.15 ***	1.10 ***	1.13 ***		
	(0.38)	(0.38)	(0.34)		
CRISIS * BANK CAPITAL RATIO	1.21 ***	1.20 ***	1.14 ***		
	(0.29)	(0.31)	(0.23)		
CRISIS * BANK LIQUIDITY RATIO	0.17	0.15	0.17 *		
	(0.13)	(0.13)	(0.09)		
CRISIS * BANK DOUBTFUL LOANS RATIO	-0.72	-0.94	-0.91		
	(0.70)	(0.73)	(0.61)		
CRISIS * BANK HERFINDAHL BY INDUSTRY	-0.06	-0.06	-0.10 *		
	(0.09)	(0.08)	(0.06)		
CRISIS * LN(1+NUMBER OF MONTHS WITH THE BANK)	-0.19	-0.21	-0.06	-0.13	-0.13
	(0.20)	(0.19)	(0.25)	(0.27)	(0.25)
CRISIS * FIRM LN(TOTAL ASSETS)	-0.11	-0.11	-0.50	-0.38	-0.38
	(0.32)	(0.32)	(0.41)	(0.41)	(0.45)
CRISIS * FIRM CAPITAL RATIO	0.97 ***	0.95 ***	2.60 ***	2.40 ***	2.40 ***
	(0.33)	(0.32)	(0.49)	(0.60)	(0.49)
CRISIS * FIRM LIQUIDITY RATIO	0.00	0.00	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.06)	(0.07)	(0.07)
CRISIS * FIRM SUBPRIME	-0.49	-0.65	0.23	0.08	0.08
	(0.68)	(0.68)	(1.32)	(1.62)	(1.42)
CRISIS * FIRM LN(1+AGE)	2.20 ***	2.21 ***	1.69 **	1.86 **	1.86 **
	(0.37)	(0.37)	(0.71)	(0.85)	(0.79)
GDP GROWTH	1.74 ***				
	(0.48)				
CHANGE IN 3-MONTH INTEREST RATE	-1.04 *				
	(0.56)				
INFLATION	-0.39				
	(0.27)				
Fixed Effects					
Bank	*Yes*	*Yes*	*Yes*	-	-
Time	*No*	*Yes*	*Yes*	-	-
Firm	*No*	*No*	*Yes*	*Yes*	*Yes*
*Bank*Time*	*No*	*No*	*No*	*Yes*	*Yes*
Number of Observations	198,350	198,350	198,350	198,350	198,350

Notes: The table reports the estimated coefficients and robust standard errors (S.E.) in percent clustered at the bank and firm level in models 1-3, at the firm level in model 4, and at the bank level in model 5 from linear probability models estimated using least squares. The dependent variable is LOAN APPLICATION IS GRANTED. Fixed effects are included ("Yes"), not included ("No"), or comprised by the included set of fixed effects ("-"). The set of time fixed effects includes a fixed effect for every (but one) year:month during the sample period. The variable definitions and summary statistics are in Table 1. ***, **, and * indicates statistical significant at the 1, 5, and 10 percent level, respectively.

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