The Real Side of the Financial Crisis: Banks' Exposure, Flight to Quality and Firms' Investment Rate

Emanuele Brancati*

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ABSTRACT

This paper takes advantage of the Italian experience during the Lehman crisis to test the effects of banking shocks on the real decisions of client firms. The financial crisis represented an unexpected event that was largely exogenous to the financial position of both Italian banks and firms, resulting into a quasi-natural experiment to study the impact of supply shocks. The analysis exploits the information on the lender-borrower relationship from a newly available survey on a representative sample of small and medium enterprises in Italy. The magnitude of the shock is modeled with bank pre-crisis exposures to Dollar-denominated assets and liabilities, then interacted with time-varying market measures on the riskiness of the US system (CDS spreads). After controlling for demand conditions I find robust evidence that banks' exposures to Dollar-denominated items affect the investment rate, the amount of borrowing, and the probability of financial constraints of their client firms. The mechanism of transmission is characterized by a flight to quality, with a redistribution of loans away from risky borrowers. Furthermore, the effects are stronger for firms borrowing from undercapitalized and illiquid banks or financial institutions that depend more upon bank-based sources of finance.

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* Emanuele Brancati: University of Rome, Tor Vergata, via Columbia 2, 00133 Rome (Italy), and MET, via Sabotino 2A, 00195 Rome (Italy) (e-mail: emanuele.brancati@uniroma2.it; e.brancati@met-economia.it). I am grateful to Susanto Basu, Kit Baum, Mikhail Dmitriev, Petra Gay, Filippo De Marco, Marco Macchiavelli, seminar participants at Boston College, and two anonymous referees for helpful comments. A special thank to Pierluigi Balduzzi and Fabio Schiantarelli for their constant suggestions. All errors are my own responsibility.

1 Introduction

The financial crisis of the Fall of 2008 threw economies all over the world into a severe recession. The main cause of this panic is considered to be the US credit boom that skyrocketed up to 2007, followed by the meltdown of sub-prime mortgages and asset-backed securities triggered by the burst of the US housing bubble. This in turn induced a widespread panic that soon impacted the worldwide banking sector. The following sharp contraction in credit supply damaged firms' capability to fund their investment projects. Indeed, the companies that lacked sufficient financial slack, because of a deterioration of their liquidity buffers, were not able to fund all potentially profitable investments internally and were forced to cut back expansion plans.

This paper tests the effects of banks' vulnerability toward the financial crisis by analyzing the behavior of client firms. I explore this bank-lending channel linking firms' borrowing and investment decisions with the exposure of their lender banks to Dollar-denominated assets and liabilities.

The experimental framework of the paper is the Italian system, which provides an ideal laboratory to test the presence of a lending channel. The nature of the financial crisis allows me to identify a supply shock that is independent by the quality of the loan-domestic portfolio of Italian banks. Historically, deterioration in lenders' financial solidity has generally coincided with shocks to the condition of their corporate borrowers. Differently, the Lehman crisis exploded in the US housing market and was totally unrelated to the business fundamentals of Italian companies. In other words, the crisis of 2008–2009 represents, for Italy, a quasi-natural experiment that allows for studying the transmission of supply shocks onto the real economy. The Italian experience is particularly interesting also because of the peculiar structure of the industrial and financial systems. The great diffusion of Small and Medium Enterprises (hereinafter SMEs), together with underdeveloped stock markets, ensures that firms that are constrained by banks also lack access to alternative sources of financing. Ruling out any substitution effect, the impossibility of resorting to capital markets is likely to magnify the impact of bank supply shocks.[1] Furthermore, the broad diffusion of short-term-debt contracts makes the transmission mechanism more immediate because of firms' need of rolling-over.

Although the overall direct exposure of the Italian banking system to toxic assets was negligible, several

[1] For instance, Adrian, Colla, and Shin (2012) and Becker and Ivashina (2011) document the substitution of bank debt with bond issuance during the crisis. This in turn can mitigate the effects of adverse banking supply shocks.

banks held sizable amounts of assets and liabilities denominated in US Dollars (hereinafter $). At the same time, the rate of growth of loans (between 2007 and 2010) of more exposed banks was substantially lower than that of less internationalized institutions (9.6% v.s. 19.6%).[2] It is then natural to ask whether there is a causal nexus linking bank $-exposure and the borrowing conditions of client firms. This in turn is likely to be reflected in the investment activity of Italian companies.

Several features of the analysis are worth mentioning. First, I exploit a newly available survey covering a representative sample of Italian firms. The dataset allows to identify the bank-firm relationship and considers a large number of small companies with no access to capital markets. Second, I exploit the Lehman crisis as a quasi-natural experiment to explore the effects of exogenous supply shocks. I identify banks' vulnerability to the financial turmoil with their pre-crisis (as of 2006) exposure to the US economy. I then interact this measure with time-varying market valuations on the riskiness of the American system (CDS spreads). This identification strategy addresses potential problems of endogeneity due to banks' anticipatory behavior in determining their asset portfolio. Third, even though the emphasis of the paper is on firms' investment rate, I show the effects to operate through a lending channel that in turn affects firm probability of being financially constrained. Fourth, I explicitly take into account both exposures to $-denominated assets and to $-liabilities. Two possible channels are tested. On the one hand, exposures to $-assets are linked to the deterioration of the quality of bank asset portfolio (due to the raise in credit risk and potential losses). On the other hand, relevant $-liabilities are associated with higher instability of the bank $-sources of funding during the crisis. Finally, I highlight several dimensions of heterogeneity of this effect, both along firm and bank characteristics.

The empirical analysis provides clear results. The shock that hit Italian banks in the aftermath of the Lehman collapse was transmitted onto client firms with an intensity that depended upon banks' pre-crisis exposure to the US economy. The findings highlight a "flight-to-quality" effect suggesting a reallocation of loans away from riskier (young and small) borrowers. As a consequence, firms' investment moved proportionally. A one-standard deviation increase in bank exposure led to a reduction in the investment rate of

[2]Data refers to variations in gross loans between 2007 and 2010. Statistics are performed on the pool of banks within the sample. They are grouped into banks with "High" and "Low" exposure depending on the median value of the 2006 distribution of the $-denominated assets to total assets ratio. The overall rate of growth of loans in the sample is 11.5% and is in line with aggregated data on the Italian banking system.

a 3-year-old firm (5^{th} percentile of the age distribution) of -0.17 standard deviations, and an increase of +0.11 standard deviations for a 48-year-old company (95^{th} percentile). The heterogeneity of the effect is not limited to the characteristics of the borrower firm. I find results to be strong and significant only for clients of undercapitalized and illiquid banks or financial institutions that depended more upon interbank finance.

Firms' investment rate was deeply affected by bank exposure to both $-denominated assets (total $-assets, $-credits to banks, and $-credits to customers) *and* $-liabilities (total $-liabilities, $-deposits from banks, and $-deposits from customers). This is true even when these measures are simultaneously considered. Furthermore, I document similar effects on the amount firms were able to borrow and on their probability of financial constraints.

Finally, while the econometric analysis is performed at the firm level, I also derive some aggregate implications. I find that banks' exposure led to a reduction in the aggregate capital accumulation of the Italian economy of -5%, with a significant reallocation of resources across firms (11% of the total stock of capital).

This paper is related to several works. One strand of the literature focuses on the presence of a lending channel of monetary policy building on the theoretical contributions of Kashyap, Stein, and Wilcox (1993) and Kashyap and Stein (2000). Peek and Rosengren (1997, 2000) offer compelling bank-level evidence that shocks to financial institutions matter for loan supply. By exploiting the 1989-drop of the Japanese stock market, they isolate a supply shock in US tanks to the diffusion of American branches of Japanese banks. Their results show the fall in loans granted by Japanese branches to depend upon their parents' capital positions. Several papers that followed, explore the presence of a banking channel, especially during the financial and sovereign-debt crises. The common key ingredient is to find a suitable identification strategy that allows to isolate a supply shock. Ivashina and Scharfstein (2010) exploit banks' exposures to unexpected credit-line drawdowns to analyze lending in United States. Puri, Rocholl, and Steffen (2011) identify the magnitude of the shock with the degree of vulnerability to the subprime crisis of German financial institutions. On Spanish data Carbó-Valverde, Degryse, and Rodriguo-Fernandez (2011) take advantage of asset backed securities and covered bonds to characterize sound and unsound banks. They find more vulnerable banks to cut their lending by more, increase the number of rejected loan-applications or worsen firms' financial

problems in times of crisis. In the same spirit, Santos (2011) finds a positive relationship between the interest rates charged on corporate loans and the amount of bank losses during the subprime crisis. Finally, Balduzzi, Brancati, and Schiantarelli (2013) focus on the role of banks' financial market valuations in affecting investment, hiring and borrowing decisions of client firms.

Several papers analyze the transmission mechanism as a function of bank-specific characteristics. Cornett, McNutt, Strahan, and Tehranian (2011) focus on the composition of financing and show the drop in loans is lower for banks that are more liquid or rely on stable sources of financing (deposit and equity capital). Jiménez, Ongena, Peydró, and Saurina (2012) study the beneficial role of liquidity and capitalization in alleviating the effects of tight monetary policies and low GDP growth. Finally, Iyer, Lopes, Peydro, and Schoar (2010) find a sharp decrease in loan supply for banks that were more dependent on interbank finance before the crisis. This credit contraction is stronger for small firms with "weak" banking relationships.

The literature on the Italian system is extremely rich, mainly focused on the Credit Register dataset "Centrale dei Rischi" (CdR). Matching bank-firm data at loan-level, a pool of papers from the Bank of Italy investigates the banking channel during the financial and sovereign debt crises.[3] Albertazzi and Marchetti (2010) and Gambacorta and Mistrulli (2011), document contractions in credit supply and increases in the interest rates for undercapitalized and illiquid banks. These effects are associated with a reallocation of loans toward safer borrowers. Bonaccorsi and Sette (2012) focus on illiquid banks and institutions that are more reliant on bank-sources of funding. These banks are characterized by sharper contractions in the lending volume and stronger increases in the interests charged.

My paper is also related to the literature on firm investment during the crisis. Amiti and Weinstein (2013) work on a matched lender-borrower dataset covering loans to listed Japanese firms. After decomposing loan movements into bank, firm, industry, and common shocks they conclude supply-side contractions have a large effect on corporate investment. Finally, Campello, Graham, and Harvey (2010) and Campello, Giambona, Graham, and Harvey (2011) document higher reductions in capital spending for financially constrained firms. They also find evidence of a substitution between credit-lines and internal liquidity in times

[3]The only paper on Italy that doesn't use the CdR dataset is Presbitero, Udell, and Zazzaro (2012). Not being able to match firm-bank information they exploit survey data on loan applications. They find the credit crunch to be harsher in provinces with a large share of branches owned by distantly-managed banks. They also find an effect of "reversed flight to quality" in which large and healthy firms were more intensely hit by the credit tightening. These results are in contrast with the findings of this work and of other papers on the Italian system (for instance, Albertazzi and Marchetti, 2010).

of credit shortage.[4]

The contributions of this work to the existing literature are multiple. This is the first paper identifying the magnitude of the shock with banks' exposure to the financial crisis and documenting at the same time the transmission channel on firms' investment and borrowing decisions. The analysis tests a detailed set of $-denominated items, and uncovers a complementary effect of both the exposure to $-assets and the dependence on $-sources of funding. The work provides robust evidence that, even in countries with a low direct exposure to toxic assets, the financial crisis had a sizable impact on the real economy. The flight to quality that characterizes this transmission mechanism doesn't only depend on firm's size and capability to pledge collateral. Firm age, as a proxy for bank accumulation of soft information, is capable to explain most of the heterogeneity. The work also builds up on the literature on bank characteristics by showing the indirect effect of capitalization and liquidity in mitigating the transmission of adverse shocks.
Finally, another contribution is the specific focus on small firms. International literature worked either on syndicated loans or listed firms. An industrial system made up by privately-held firms purges the issue of substitutions among different sources of finance, making the effects of the banking channel clearer. Moreover, the great diffusion of single-bank relationships, also ensures the difficulty of substitutions among banks, a feature that may strengthen supply-side effects (see for example Degryse, Masschelein, and Mitchell, 2011).

The remainder of the paper is organized as follows. Section 2 discusses the empirical strategy, Section 3 gives details on the dataset and describes the assumptions of the paper, Section 4 presents the results, and Section 5 concludes.

2 The Empirical Strategy

A correct identification of the shock and the inclusion of proper controls for credit demand are crucial issues to investigate the effects of the lending channel.

This section presents the empirical methodology employed throughout the paper. First, I describe the

[4]Similarly, Almeida Heitor and Weisbenner (2009) prove firms with larger fractions of long-term debt maturing in times of crisis, experience more pronounced reductions in the investment rate compared to otherwise similar firms that don't need to refinance their debt.

identification strategy and discuss about endogeneity issues. I then illustrate the econometric methodology and the controls adopted to rule-out demand effects.

2.1 Banks' exposure to the Lehman crisis

Italy is an ideal case study to analyze the real effects of a financial shock. The 2008–2009 crisis represented an unanticipated and unexpected event that was largely exogenous to the financial position of the Italian banks and to the quality of their domestic loan portfolio. As a result, the Lehman collapse provides a quasi-natural experiment to study the transmission of exogenous supply shocks to the real economy.

Although the direct exposure to toxic assets was almost negligible, several Italian banks had sizable relationships with the US economy. Table 1 reports descriptive statistics on $-denominated balance-sheet items, most of which were directly related to US clients. As of 2006, the shares of assets and liabilities denominated in US Dollars were very heterogeneous across types of banks. The exposure was considerable for large and internationalized institutions (up to 6% and 12% of total assets, respectively) and almost inexistent for small and cooperative banks. This high cross-sectional heterogeneity is exploited to identify banks' degree of vulnerability to the financial crisis.[5]

Several $-denominated items are taken into account. In addition to general exposures to total $-assets and liabilities I explicitly consider loans and deposits to/from American banks or customers. Dollar exposures are then interacted with (common) time-varying market valuations of risk that are specific to the US system. CDS indices are employed to weight the different $-items and to account for variations in the severity of the crisis across times. The ($-item-specific) exposure (*Expo*) of the lender bank of firm i at time t is defined as:

$$\text{Expo}_{i,t} = \frac{\text{Bank \$-item}_{i,2006}}{\text{Bank total assets}_{i,2006}} \times \text{CDS index(USA)}_t \tag{1}$$

The choice of CDS index(USA)$_t$ varies together with the type of $-denominated item. When dealing with $-exposures toward banks ($-credits to banks and $-deposits from banks) I employ the *US bank sector CDS*

[5] Although annual reports would suggest that most of the $-denominated exposure is towards US clients, they do not provide a breakdown per country. It is worth noticing that, even if some of the $-exposure was not related to US economy, $-denominated items could still proxy for the degree of internationalization of the lender bank. Given the relative stability of the domestic banking system, more internationalized banks experienced larger shocks with respect to domestic, local institutions. As a result, my measure of exposure should still be capable of identifying more vulnerable institutions.

index 5Y, a CDS index summarizing the riskiness of the US banking sector. For measures based on $-exposures to customers ($-credits to customers and $-deposits from customers), CDS index(USA)$_t$ is the *CDX.NA.IG index 5Y*, a synthetic risk measure for US corporate credit.[6] Finally, when dealing with total $-assets and liabilities, I use a weighted average of *US banks sector CDS index 5Y*, *CDX.NA.IG index 5Y*, and *US treasury CDS 5Y*.[7]

The timing of *Expo* is particularly relevant. Employing pre-crisis exposures allows to have an indicator of bank fragility in the onset of the turmoil, that is independent of the financial position of banks' clients. Since the shock was unexpected by Italian institutions, their amount of $-denominated assets and liabilities in 2006 is largely exogenous with respect to the quality of banks' domestic loan portfolios (during the financial crisis). On the contrary, the use of contemporaneous measures may lead confounding results and endogeneity issues. Bank-accounting practices *via* restructuring of the balance-sheet composition may hide or soften the "true" magnitude of the shock. Instead, the exposure in 2006 captures bank activity in "normal times" and is not affected by balance-sheet recompositions driven by the crisis. Moreover, contemporaneous amounts may be affected by problems of reversed causality, since they are correlated with the current financial position of client firms through their effect on bank investment opportunities.[8] *Vice versa* if the financial shock was unanticipated in 2006 (as it is reasonable to assume), the measure I employ is immune to endogeneity problems. At the same time, the interaction with time-varying market valuations allows to "weight" the same exposure differently across the various stages of the crisis and along the degree of instability of the international markets.

Figure 1 shows the dynamics of the main CDS indices used in the analysis. As it is apparent from the plot, the overall riskiness of the banking and corporate sectors experienced a dramatic increase during 2008 and 2009. As a result, all the different definitions of *Expo* move together with the magnitude and the severity

[6] *CDX.NA.IG index 5Y* is an index, provided by Markit, based on a basket of (125) representative North American corporate credits and proxies for the overall riskiness of the US customers.

[7] The choice of the 5-years CDS spreads on senior debt is motivated by the higher liquidity of these markets. This should ensure a better precision of the market measures.

[8] A practical example may clarify the point. Suppose there is a self-selection of a certain type of firms (e.g. young, small, in a specific sector or geographical region, etc.) towards certain types of banks (e.g. local, small, etc.). In pre-crisis times, when the internal demand is still "normal", every bank deals with standard portfolio management practices. When the crisis hits the economy and leads to a generalized recession, the deterioration of firms' creditworthiness may not be homogeneous across types of companies (i.e. firms may be hit by correlated shocks). If a financial institution has a client portfolio skewed toward more fragile firms, both bank $-funding and bank investment decisions during the crisis may be strongly influenced by its clients' demand conditions (either because of borrowers' increased riskiness or because of a decline in loan applications). Even though sign and magnitude of these variations are unclear, the dependence of banks' decisions upon their clients' demand shocks may invalidate the results of the paper.

of the financial shock without suffering, however, from the aforementioned problems related to the actual values.

2.2 The econometric model

Although the paper provides results also on firms' borrowing and probability of financial constraints, most of the analysis focuses on firms' investment rate. The latter is modeled with a standard reduced-form equation of excess sensitivity augmented with the exposure of the lender-bank to Dollar-denominated items.

$$\begin{aligned}\frac{I_{i,t}}{K_{i,t-1}} =&\alpha + \beta_1 \text{Expo}_{i,t} + \beta_2 \left(\text{Expo}_{i,t} \times \text{Interacting variable}_{i,t}\right) + \beta_3 \left(\text{Expo}_{i,t} \times \text{Crisis}\right) + \\ &+ \beta_4 \left(\text{Expo}_{i,t} \times \text{Interacting variable}_{i,t} \times \text{Crisis}\right) + \gamma^\top X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \end{aligned} \tag{2}$$

$\frac{I_{i,t}}{K_{i,t-1}}$ is the ratio between gross investment at time t and the capital stock in $t-1$, $Expo_{i,t}$ is bank exposure as defined in equation 1, and $Interacting\ variable_{i,t}$ is either firm's age ($\ln(age_{i,t})$) or size ($\ln(assets_{i,t-1})$). The interaction term allows the effect of *Expo* to vary according to the riskiness of the borrowing firm.[9] In the case of $\beta_1 < 0$ and $\beta_2 > 0$, the lending channel would transmit the negative shock to client firms ($\beta_1 < 0$), with a redistribution of bank portfolios toward safer borrowers ($\beta_2 > 0$). *Crisis* is a dummy variable that identifies the 2008–2009 period.[10] Its purpose is to highlight an additional partial effect in times of crisis.[11] $X_{i,t}$ is a vector of controls including the output-to-capital ratio, cash flow-to-capital ratio, firm age and size.[12] Finally, μ_i and η_t represent firm-specific and time fixed effects.

Equation 2 is estimated with two-step system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) with Windmeijer (2005) finite-sample correction of standard errors. The model combines the original equation (in level) with its transformed version in first difference. It allows for a dynamic estimation

[9] Both large and old firms are considered safer clients because of their lower probability of default in the short-term. Typically, bigger firms are better diversified across customers, suppliers, and regions, and have a greater capability of pledging collaterals. Similarly, older companies are better established and thus considered less risky by banks.

[10] The choice of 2008 as the starting year of the crisis in Italy, is consistent with Schularick and Taylor (2011).

[11] As a result, an increase in *Expo* has an effect on firms' investment rate equal to $\beta_1 + (\beta_2 \times \text{Interacting variable}_{i,t})$ in normal periods and to $(\beta_1 + \beta_3) + [(\beta_2 + \beta_4) \times \text{Interacting variable}_{i,t}]$ in times of crisis.

[12] Equation 2 can be derived in a model with imperfectly competitive companies in presence of quadratic adjustment costs of capital. Within this framework, investment can be rearranged as a function of the expected sum of discounted marginal revenue of capital which in turn can be approximated with a fixed-common discount rate, the present value of the firm, and time-specific discount factors that embed all the financial frictions faced by the company. Assuming a Cobb-Douglas production function and a log-linear demand function, the marginal revenue product of capital is proportional to the output-capital ratio (Gilchrist and Himmelberg, 1998). Supposing expectations are formed with a VAR(1) process, one can recover a simplified version of Equation 2.

of a small-T, large-N unbalanced panel, taking into account heteroskedasticity and autocorrelation within firms. Endogenous variables are instrumented with appropriately-lagged levels in the differenced equation and with first difference in the level equation. Once tested for the order of the auto-regressive process of $\Delta\varepsilon_{i,t}$, values lagged twice or more are legitimate (internal) instruments for the endogenous regressors.[13]

A crucial issue is how to discriminate between demand and supply effects. The identification strategy removes unobservable firm characteristics and controls for several time-varying common and company-specific demand shocks. All firm-unobservable factors that are constant over time or demand shocks that are common across all companies, are captured by firm and time fixed effects. Moreover, contemporaneous cash flow and output control for most of the time-varying firm investment opportunities and financial needs. Thus, the baseline specification should be capable of controlling for most of the demand factors.

In order to rule-out any possible residual component of demand for credit, several robustness are performed. To control for firms' creditworthiness, the baseline specification is augmented either with an Altman score or with the principal component of several measures of firm's structural solidity. Moreover, to prove results are not driven by heterogeneous demand shocks, the model is enriched with a set of time fixed effects that are specific to types of firms and banks.[14] The robustness of the results reassures about the identification of a supply channel.

The other estimations within the paper are variations upon the baseline specification in Equation 2 and are discussed when presenting the results (Section 3).

3 Data

The empirical analysis exploits a large number of information. The dataset used for the estimations combines the identification of the borrower-lender relationship with firm balance sheet data, bank characteristics, bank exposures to $-denominated items, and CDS spreads that are specific to the US system.

[13] The order of the AR process of $\Delta\varepsilon_{i,t}$ is tested with the Arellano-Bond test for autocorrelation. If the test detected the presence of AR(2) (or more) residuals, then values lagged twice would no longer be suitable instruments since they would be, by construction, correlated with the variation in the error term.

[14] To this purpose, I include firm-size-specific (small and large), firm-age-specific (young and old), firm-creditworthiness-specific (High and Low creditworthiness) firm-region-specific (North and South), firm-industry-specific (2-Digit), or bank-size-specific (small and large) time-fixed effects.

3.1 Sources

There are several sources of data. The crucial information about the lender-borrower relationship comes from the MET dataset on Italian firms, a three-waves survey performed in 2008, 2009 and 2011.[15] The sample numerosity is about 25,000 observations per wave, with a bayesian sampling scheme representative at size, region and industry levels. As a result, the sample is skewed toward small companies, and contains also partnerships and family firms with less than 10 employees. In addition to a large number of information on firm characteristics and growth strategies, the 2011-wave provides details on the bank each company borrows from. For this reason, the present work only focuses on the 2011-cross-sectional sample and the panel structure is obtained supposing constancy over time of the lender-borrower relationship (see Section 2.3 for further details). In the (rare) case of multiple banking relationships, *Expo* is defined as the equally-weighted average across banks' measures.[16]

The universe of Italian-firm balance sheets comes from CRIBIS D&B, while bank data are from Bankscope Bureau van Dijk. Bank exposures to the $-denominated assets and liabilities are hand-collected from banks' consolidated annual reports (with a cross-section of 21 banking groups in the sample). Finally, CDS spreads are either from Markit (*US bank sector CDS index 5Y* and *US treasury CDS 5Y*) or Bloomberg (*CDX.NA.IG index 5Y*). They are computed as the average over the year of the daily spreads.

All quantitative variables have been scaled by their own standard deviation and winsorized at 1% level in order to reduce the influence of outliers. Overall, the dataset includes roughly 20,000 to 25,000 observations (depending on the specification), for a total number of 4,000 to 5,000 firms belonging to manufacturing (60%) and service industries (40%).

3.2 Summary statistics

Tables 2 and 3 present summary statistics for the main variables. The top panel of Table 2, documents the strong decline in firms' investment and borrowing during the financial (and sovereign-debt) crisis. Similar patterns are found for sales and cash flow.

[15] http://www.met-economia.it.

[16] Since I have no information on the relative importance of the different lenders, in the case of firms with multiple relationships I suppose companies to borrow from an "artificial bank" obtained by averaging all the lenders they borrow from.

The bottom panel of Table 2 shows the dynamics of the different definitions of *Expo* in 2006–2011. In line with the evolution of the American CDS indices in Figure 1, *Expo* is always increasing with the severity of the financial crisis and reaches its maximum in 2008.

Table 3 provides details on the borrower-lender identification. The vast majority of Italian firms has connections with just one bank (roughly 80% of firms), even though the number of multiple-bank relationships is strictly increasing with firm's age and size. Although these data may seem to contradict other papers on the Italian system, the share of single-bank relationships is in line with the Credit Register dataset if one considers SMEs with less than 20 employees (see for instance Mistrulli and Vacca, 2011).[17]

3.3 Stability of the firm-bank relationships

Since the information about the lender-borrower connections is available only for the 2011-wave, the panel is created by assuming stable firm-bank relationships over time.

Economic literature provides compelling evidence on the importance of prolonged-bank connections in reducing asymmetric-informational problems for SMEs. Long-term commitments allow to reduce firm cost of credit (Diamond 1991 and D'Auria, Foglia, and Reedtz 1999) and the amount of collateral requested by the bank (Berger and Udell, 1995; Harhoff and Körting, 1998; Degryse and VanCayseele, 2000).[18] This in turn lowers firm's likelihood of facing financial constraints (Petersen, 1994; Bianco, 1997), reducing bank willingness to support borrowers over the short-run in the expectation of future earnings.

[17] Several papers on the banking channel in Italy (exploiting the Italian Credit Register, "Centrale dei Rischi" –CdR) emphasize the "widespread Italian practice of multiple borrowing" (see for instance Albertazzi and Marchetti, 2010; Gambacorta and Mistrulli, 2011; Bofondi, Carpinelli, and Sette, 2012, among others). Since the great discrepancy with the MET survey cannot be justified with the negligible threshold on borrowing amounts for the inclusion in the CdR dataset, a different explanation must be provided (a minimum requirement of €30,000 –€75,000 before 2009– doesn't seem sufficiently high to justify a strong selection bias). The main difference between the two datasets is due to the average firm size in the sample. Indeed, their focus on multiple lending is mainly driven by a neat econometric strategy that includes firm*time fixed effects to remove all unobservable demand factors. To the purpose of being representative of the overall amount of credit in the system, the resulting sample selection is marginal and does not jeopardize the general validity of their results. With a different aim, the MET dataset wants to be representative of the structure of the industrial system and is mainly composed by SMEs with less than 20 employees (the sample median is six). This different sample-composition explains most of the diffusion of single firm-bank relationships. Indeed, the MET data on the lender-borrower relationships are totally in line with the CdR dataset if one focuses on firms with less than 20 employees. Mistrulli and Vacca (2011) document, with little regional variations, 80% of companies with single relationship, 15% with double relationship, and 5% of relationships with more than two banks, exactly as in Table 3.

[18] They all find a positive effect that dominates the so called hold-up problem. "Hold-up" is defined as a situation in which banks can exploit their monopolistic condition charging higher interest rates on "captive firms". On the contrary, their findings would suggest that, adding a credit relationship with a new bank, can result in a coordination problem of monitoring and bargaining costs in bankruptcy. The raise in bank costs would then be translated into higher interest rates charged to the firm.

In a system dominated by SMEs, firms do not usually have the reputation needed to get credit from a new financial institution and they have to rely on prolonged relationships (Diamond, 1991; Houston and James, 1996). This issue is even more relevant in times of crisis characterized by increased opaqueness of less structured companies. Thus, for most firms, bank accumulation of soft information achieved through stability of the credit relationship was the only way to overcome increasing problems of asymmetric information.

Although previous argumentations support the assumption of stability of the firm-bank relationship, it is crucial to discuss the relevance of this hypothesis for the results of the paper. Indeed, if the phenomenon of "switcher firms" is large enough, it may even affect the conclusions of this work. In a world where only creditworthy firms are capable to create new relationships with unknown banks, the observation of credit connections at the end of a crisis may be characterized by the polarization good-banks/good-firms and bad-banks/bad-firms as a result of the switches.[19] If more creditworthy firms invest more than others, then my results may come from a self-selection of sounder firms towards less exposed banks.

Several evidence and robustness checks reassure on this point. First, descriptive statistics in Table 4 do not detect any sign of firm polarization and document a great homogeneity of client creditworthiness across banks.[20] Second, the small average size of the sampled firms makes the possibility to switch extremely hard. Third, evidence from Italy indicates that firms attempted to broaden the range of financial sources rather than substitute one bank with another (D'Auria, Foglia, and Reedtz, 1999). Hence, the relevance of the problem would be limited to companies that borrow from more than one bank, a small share of the overall sample. Indeed, results are extremely robust if one restricts the analysis to the the subsample of firms with single-bank connections. Finally, unobserved bank switches generate measurement errors in the econometric estimation that lead to persistent residuals and induce a negative correlation between the set of instruments and the variation of the error term ($\Delta\varepsilon_{i,t}$).[21] Tests for the autocorrelation of $\Delta\varepsilon_{i,t}$ (Arellano–Bond AR test)

[19] In practice, if the presence of switching companies was a relevant problem, there would be a concentration of most creditworthy firms toward less exposed banks.

[20] The table reports the average Altman score among firms belonging to banks with different exposures towards the US economy. The distribution of client firms' creditworthiness is very homogeneous among groups of banks. For each year in the sample, the difference between the means of the two subsamples, is never significantly different from zero.

[21] Consider a simple "true" model of the type: $y_{i,t} = \alpha + \beta \text{Expo}_{i(j_t),t} + \varepsilon_{i,t}$, where $y_{i,t}$ is the outcome variable of firm i and $\text{Expo}_{i(j_t),t}$ is the exposure of the actual bank (j_t) with whom firm i has a relationship in time t. If firm i switched bank between t and T (2011), then a measurement error occurs. In practice, one would estimate $y_{i,t} = \alpha + \gamma \text{Expo}_{i(j_T),t} + \nu_{i,t}$, where the new error term contains the difference between the exposure of the actual bank in time t and the one of the imputed bank (i.e. the actual bank in T): $\nu_{i,t} = \beta \text{Expo}_{i(j_t),t} - \gamma \text{Expo}_{i(j_T),t} + \varepsilon_{i,t}$. Since *Expo* are computed from bank \$-items in 2006 (then multiplied by a common factor), the sign of $\text{Expo}_{i(j_t),t} - \text{Expo}_{i(j_T),t}$ is the same across all periods. This would produce a process of the error term $\Delta\nu_{i,t}$ that is extremely persistent. Moreover, the negative correlation between lagged values of

and for the exogeneity of the instrumenting matrix (Hansen test of overidentifying restrictions) always reject this possibility, suggesting that switcher firms are not a relevant issue.

4 Results

4.1 Baseline specification

Results of the baseline specification are summarized in Tables 5 and 6. Together with the increased riskiness of the US system, the investment rate of Italian firms moved proportionally to the exposure of their lender banks. Interestingly, this negative impact is not limited to the effect of bank $-denominated assets. Banks' liabilities in US dollars seem to play an equally-important role.

Table 5 provides regression results for the whole set of exposures: columns 1—3 and 4—6 refer, respectively, to $-denominated assets (total $-assets, $-credits to banks, and $-credits to customers) and $-liabilities (total $-liabilities, $-deposits from banks, and $-deposits from customers). The economic and statistical significance of *Expo* highlight a transmission channel from bank exposure to the investment rate of client firms that goes beyond bank exposure to toxic assets. Even in a system where the bank-direct involvement in subprime mortgages and ABS was negligible, the financial crisis had real effects through banks' degree of internationalization.

Since the magnitude of *Expo* follows, by construction, the severity of the crisis (see Table 2), the impact of bank exposure on firms' investment is particularly relevant in 2008 and 2009.[22] Moreover, the inclusion of an interaction term with the crisis indicator (*Expo* $\times$ *Crisis*) highlights an additional marginal effect that goes in the same direction. The overall coefficient in times of crisis is given by $\beta_1 + \beta_3$ and it is about twice as big as the effect in normal times (β_1).[23] Overall, a one-standard-deviation increase in *Expo* during the crisis leads to a contraction of firms' investment rate of about -0.28 standard deviations.

The effect is not homogeneous across companies. The sign and significance of the interaction term with age (or size) indicate a contraction of the investment rate that is much stronger for young (small) firms than

$\text{Expo}_{i(j_T),t}$ and $\Delta\nu_{i,t}$ would violate the null hypothesis of exogeneity of the instrumenting set.

[22] Since the US CDS spreads skyrocketed in 2008–2009 (Figure 1), the magnitude of *Expo* during the crisis is about four-times as big as the value in the pre-crisis period.

[23] The additional partial marginal effect is not significant in Table 6 (size interaction).

for old (big) companies. The sign of the coefficient is even reversed for firms in the right tail of the age (size) distribution.[24]

Figures 2 and 3 plot the marginal effects of bank exposure in normal and crisis times as a function of firms' age. In normal periods, a one-standard-deviation increase in *Expo* leads to a drop in the investment rate of -0.1 standard deviations for firms at the 5^{th} percentile of the age distribution (3-year-old firms) and a rise of +0.06 standard deviations for companies at the 95^{th} percentile (48-year-old firms). In times of crisis the plot becomes steeper and the marginal effects go, respectively, to -0.17 and +0.11 standard deviations.[25] This evidence is compatible with the effect of "flight to quality" documented by Khwaja and Mian (2008) and Albertazzi and Marchetti (2010): more exposed banks seem to reallocate loans away from riskier firms. On the one hand, by worsening access to credit for young and small firms with higher opaqueness and short-term probability of default, and lower capability of pledging collaterals. On the other hand, by easing credit for safer and more established firms (big and old). With this regard, firm age may also proxy for the length of the bank-firm relationship and thus for the amount of soft information accumulated with prolonged connections. This interpretation is consistent with the positive role of firm-bank relationships in mitigating supply shocks, presented by Puri, Rocholl, and Steffen (2011).

As already discussed, the comparison of the top and bottom plots in Figure 2 and 3 does not fully describe the size of the shock. To this aim, Figure 4 takes into account variations in the magnitude of the exposures multiplying the marginal effects by the average value of *Expo* in normal and crisis times. The vertical distance between the black and the blue lines clearly shows the strong negative impact of the financial shock.

It is however possible that the effects documented on *Expo* are driven by a spurious correlation between the amount of $-items and some other bank characteristics. To address this issue, Table 7 includes a set of controls for banks' fundamentals. Even after controlling for capitalization, liquidity, profitability and dependence upon the bank-sources of funding results are unchanged.

A crucial issue is whether these findings are due to supply or demand effects. The baseline specification allows to control for most of the latter. First of all, heterogeneous demand conditions that are persistent over

[24] Apart from the baseline specification, the rest of the paper only refers to the interaction with firms' age. Results for the size interactions are however shown in "Additional tables: size interaction".

[25] Variations reported within the text refer to Figure 3, corresponding to Column 4 of Table 5. The effects associated to the other definitions of *Expo* are comparable in both magnitude and significance.

time and common shocks that hit the whole economy (both from the supply and demand side) are purged by the inclusion of firm-specific and time fixed effects. Moreover, contemporaneous cash flow and output allow to control for most of the time-varying firm-specific demand factors and financial needs. Coherently with *a priori* expectations, they are both positive and significant.

Results are also robust to a rich set of controls including firm's creditworthiness (Altman score or the principal component of several measures of firm's structural solidity) and a set of time fixed effects that are specific to classes of firms and banks. Even including firm-size-specific (small and large), firm-age-specific (young and old), firm-creditworthiness-specific (high and low creditworthiness), firm-region-specific (North and South), firm-industry-specific (2-Digit), or bank-size-specific (small and large) time fixed effects, the findings are unchanged.[26] Every specification provides the same result: the shock of the Lehman crisis to Italian banks' balance sheets was transmitted onto their client firms with an intensity that depended upon bank $-exposure. This in turn was systematically reflected in firms' real investment, but unequally across companies. The financial shock led to a sizable reduction of the investment rate of small and young firms with a reduced or reversed effect for large and old companies.

4.2 Heterogeneity among banks

The present section investigates a different source of heterogeneity by testing whether the transmission to client firms is homogeneous across financial institutions (with similar exposures) or instead depends upon the structural solidity of the lender bank. In principle, bank capitalization, liquidity and dependence upon the interbank finance may influence the way banks reacted to the shock. On the one hand, consistent liquidity buffers allow to face temporary periods of shortage and to alleviate the short-term consequences of a financial crisis (Cornett, McNutt, Strahan, and Tehranian, 2011). On the other, low capitalization may exacerbate the effect of the financial crisis once tighter prudential regulation on capital requirements is introduced.[27] Finally, because of the freeze of the interbank market in 2008, banks that depended more on interbank

[26] The common rationale of these checks is to control for possible self-selection (of certain type of firms towards specific banks) that, combined with heterogeneous demand shocks, may drive the results. To this purpose, I allow for different classifications of firms on the basis of their age, size, geographical region, industry or the size of the lending bank. The inclusion of specific-time fixed effects removes all the (time-varying) components of heterogeneity among firm classes.

[27] Difficulties that followed the financial shock were worsened by the need of increasing bank stock of capital in times when raising equity at market conditions was particularly hard (Jiménez, Ongena, Peydró, and Saurina, 2012; Albertazzi and Marchetti, 2010; Gambacorta and Mistrulli, 2011).

finance experienced sizable raises in the cost of funding and transmitted their difficulties onto client firms.[28]

In order to allow for heterogeneous effects, the partial coefficients in times of crisis are imposed to be bank-class-specific. Banks are grouped into institutions with "High" and "Low" levels of Tier 1 capital ratio, liquid to total assets ratio and dependence upon interbank finance, depending on the median value of each distribution in 2006.[29]

Tables 8, 9, and 10 provide clear results. The effect on firms' investment rate doesn't only depend on the lender's exposure to the US economy. A crucial role is played by the bank ability to counteract negative shocks.

The marginal effect in times of crisis is now specific to the class each lender bank belongs to. On average the baseline coefficient is negative and significant for every firm (apart from Table 8). On the contrary, the partial effect in 2008–2009 is very significant only for firms borrowing from undercapitalized and illiquid banks. Similarly, the effect is much stronger for financial institutions relying more on interbank funding rather than stable sources of finance. Conditional on the lender exposure to $-denominated assets and liabilities, the effect on the investment rate is three-to-four times bigger for firms that are clients of "less solid" banks. As in the baseline regression, the transmission mechanism heavily damages young and small firms, with a redistribution towards larger and older companies.

This heterogeneity is clear in Figures 5, 6, and 7. Taking into account variations in the magnitude of *Expo*, the figures plot changes in the investment rate in pre-crisis (common to all types of banks) and crisis times (specific to the class the lender belongs to).

Although these results are consistent with the finding in Albertazzi and Marchetti (2010), Gambacorta and Mistrulli (2011), Cornett, McNutt, Strahan, and Tehranian (2011), and Puri, Rocholl, and Steffen (2011), the emphasis is different. My analysis does not provide any conclusive evidence about the direct impact of bank characteristics. The findings only highlight their indirect role in alleviating the effect of the financial shock.[30]

[28] The illiquidity of the interbank market during the crisis is linked to the sharp increase in the spread on unsecured interbank transactions. As a consequence, banks that relied less on stable sources of finance (deposits) and depended more upon the interbank market, experienced sharp increases in their cost of borrowing and cut their lending by more (Bonaccorsi and Sette, 2012).

[29] Dependence on interbank finance is defined as the ratio between net bank debt (difference between debts and credits to banks) and total funding.

[30] Bank classes are constructed from the pre-crisis values as of 2006. As a result, "High" and "Low" are constant over time and the direct effects of capitalization, liquidity and dependence on bank debt are absorbed by the firm fixed effects.

As a robustness check, each specification is then performed admitting a direct effect of capitalization, liquidity and interbank debt (see Table 11 as an example). Interestingly, while the main results continue to hold, no direct impact is found for any of these measures.[31] Liquidity, capitalization and dependence upon bank-based sources of finance don't seem to play a crucial role *per se* but through their beneficial effect once the shock occurs.

4.3 The channels

This section provides some insights about two possible channels driving the results of the paper.

The increased uncertainty on the international markets that followed the explosion of the financial crisis hit both the quality of bank $-asset portfolios and the stability of the $-sources of funding. On the one side, the raise in credit risk led to a reduction in the expected value of $-denominated assets because of increasing losses (potential and actual). These adjustments, in turn, induced a reallocation of loans toward safer borrowers to reduce the overall amount of risk accumulated by the bank.[32] On the liability side, higher pre-crisis dependence upon $-items led to a greater instability of banks' sources of finance enhancing their overall cost of funding (then transmitted onto firms' borrowing conditions).

Table 13 tests the first channel. In absence of information about the real charge-offs on $-assets, I multiply the beginning-of-period $-item with the variation in the (appropriate) CDS spread within the same horizon.[33] This measure takes into account the increase in credit risk and proxies for the magnitude of potential losses if valuations were done through marking-to-market.[34] I then use the correspondent pre-crisis measure of *Expo* as external instrument to uncover the transmission mechanism and to avoid endogeneity issues. Similarly, Table 14 tests for the instability of $-denominated funding by instrumenting the variability of the specific $-liability with the correspondent measure of *Expo*.[35]

[31] Table 11 shows the estimation obtained by directly including bank tier-1 capital ratio. Results of the other specifications are coherent.

[32] Notice that, the effect on $-assets is also compatible with an increase in bank managers' risk aversion. Independently by the presence of actual losses, the great uncertainty on the international markets may have hit the risk aversion of bank managers leading to a reallocation of loans directed to reduce the overall riskiness of bank assets.

[33] In Column 1 potential losses are computed as ($\Delta CDS_{W\_USA,i,t}\times$ $-assets) and are instrumented with *Expo(Tot. assets)*. In Column 2 they are computed as ($\Delta CDS_{B_USA,t}\times$ $-credits to banks) and are instrumented with *Expo(Bank credit)*. In Column 3 they are computed as ($\Delta CDS_{C_USA,t}\times$ $-credits to customers) and are instrumented with *Expo(Cust. credit)*.

[34] Notice that the potential losses are specific to the type of $-asset considered.

[35] In Column 1 Δ\$-item$_t$ is the variation within the year of total $-liabilities (instrumented with *Expo(Tot. liab.)*), in Column 2 Δ\$-item$_t$ is the change of $-deposits from banks (instrumented with *Expo(Bank dep.)*), in Column 3 Δ\$-item$_t$ is the variation of $-deposits from customers (instrumented with *Expo(Cust. dep.)*).

Correlations of *Expo*, potential losses and instability of $-funding are presented in Table 12. Tables 13 and 14 document the strong negative effects of both channels on the investment rate of client firms.[36]

4.4 What exposure matters the most?

Although every measure employed in the previous sections is statistically and economically significant, their individual relevance is not enough to conclude the presence of a joint effect of both $-assets and $-liabilities. To this purpose, it is crucial to purge the possible spurious correlation among the different definitions of *Expo* and to test their simultaneous relevance in the model.[37]

Given the great amount of variables and interaction terms, I proceed in two stages. A first step analyzes the simultaneous significance of both $-assets and $-liabilities.[38] I then perform a "horse race" among the different definitions of *Expo* to establish which are the most relevant for the transmission of the shock.[39]

Table 15 shows the first results. Apart from customer $-deposits, all variables keep being very negative and significant. Not only the impact of $-liabilities doesn't blow over once controlling for $-asset measures, but also the magnitude of their effect is not even reduced with respect to the baseline specification (Table 5).

Table 16 compares aggregate, bank and customer-based measures. The results document a dominant role for exposures towards international banks and for $-credits to customers. On the contrary, no significant effect is found for $-customer deposits.[40] Also extremely sensible are the results on total $-assets and liabilities. Once controlled for bank and customer measures, the residual component doesn't seem to have any additional effect on banks' decisions. This finding is the natural consequence of the negligible direct exposure of the Italian banking system to toxic derivative assets.[41]

[36] Notice that the positive effect of $\Delta\$\text{-item}_t$ in Table 14 is in line with a negative impact of instability of $-funding for banks that were more exposed in normal times. This interpretation can be inferred from the negative correlation between *Expo* and $\Delta\$\text{-item}_t$ in Table 12.

[37] Suppose the only type of exposure having a relevant effect was the total amount of $-assets. Since banks tend to balance the two sides of their balance sheet, more internationalized institutions are characterized by a higher exposure to both $-assets and $-liabilities. Results from a separate estimation (as in Table 5) may lead to incorrectly attribute a role to all variables, simply because of their correlation with the only variable that really matters (in the example, total $-assets).

[38] To this aim, exposures are grouped into "Total", "Bank" and "Customer" *Expo.* "Total", considers *Expo(Tot. assets)* and *Expo(Tot. liab.)*, "Bank" considers *Expo(Bank credit)* and *Expo(Bank dep.)*, "Customer" considers *Expo(Cust. credit)* and *Expo(Cust. dep.)*.

[39] To limit the number of covariates (and to avoid an explosive size of the instrumenting matrix) I temporary leave aside the additional partial effect in times of crisis.

[40] This last evidence suggests that the negative effect arose mainly from the increased riskiness (and potential losses) of bank credits towards international customers, rather than through a shock on banks' customer funding.

[41] Indeed, exposures to asset backed securities and covered bonds, together with investment in US sovereign bonds, would

4.5 Bank debt and financial constraints

Previous findings document the effects of bank financial shocks on the investment decisions of client firms. The purpose of this section is to investigate the missing link by analyzing the effect bank $-exposures on the amount client firms were able to borrow and on their probability of being financially constrained.

Table 17, presents the results on firms' growth of bank debt. In line with previous findings, the $-exposures of the lender bank strongly reduced the amount young and small client firms were able to borrow in 2008–2009.

Even though this finding is coherent with prior analysis, the effect of the lending channel is likely to be strongly underestimated. On the one hand, focusing on the amount of bank debt neglects part of the impact of changes in firm cost of funding (that perhaps is the most important channel of transmission of a shock). On the other hand, the drop in the sample numerosity produces a relevant selection bias towards older and bigger firms which in turn attenuates the magnitude of the estimated coefficients.[42]

One way to synthesize both the amount and the cost of bank debt is to look at firms' probability of facing financial constraints. To this purpose, Table 18 shows the results of a conditional (fixed-effect) logit model on a direct indicator from the MET survey.[43] Even with a very reduced sample, the exposure to the $-denominated assets and liabilities is found to significantly explain the change in firms' financial constraint status in times of crisis.[44] Moreover, a standard analysis of excess sensitivity (Fazzari, Hubbard, and Petersen, 1988) provides further confirmations on this point. An additional interaction term between *Expo* and firm cash flow (Table 19) highlights a greater investment-to-cash flow sensitivity in times of crisis for firms that are clients of more exposed banks. This is compatible with the presence of financing constraints and with the attempt of these firms to substitutete bank debt with internal funding. Although this approach

appear as a residual in total $-asset measure.

[42] National accounting rules require only certain types of firms to fill in balance sheets in a complete form. Typically, smaller companies write up only a "simplified version" of the balance sheet that does not contain any detail on the type of outstanding debt. As a result, the drop in the numerosity is almost 10,000 observations with a sample that is very biased towards bigger firms (the median of the distribution of the number of employees in the investment equation was six, while in the bank debt equation is 46. Similarly, the median age passes from 17 to 24 years).

[43] The dependent variable is a dichotomous measure inferred directly from the following question: "Have there been potentially profitable projects not carried-on by the firm due to a lack of financial sources?". In other words firms are considered financially constrained if their overall investments would have been higher in absence of financial frictions (i.e. there were projects with positive net present-value, non undertaken for scarce financial means).

[44] Also in this case the reduction in sample numerosity is very relevant. First of all, I have to focus on the subsample of firms interviewed in all three waves (about 7,800 companies). Second, and most importantly, in order to control for time and firm fixed effects I have to focus only on the subsample of companies that switched their financial status during the 2008, 2009 or 2011. The great persistence of financial constraints, leads to a final estimation sample that is strongly reduced in numerosity (about 2,500 observations).

is subject to several critiques (Poterba, 1988; Kaplan and Zingales, 1997, 2000, among others), it is still worth emphasizing the coherence of the results.

Taken together, although these results suffer from issues of selection bias and from problems of interpretability, they all seem to confirm the presence of a lending channel during the Lehman crisis. Banks that were most exposed to the US economy in the pre-crisis period cut their corporate lending more relative to less vulnerable banks. As a consequence, their domestic client-firms faced higher probability to be financially constrained and reduced their investment in physical capital by more.

4.6 Implied aggregate effects

So far, the analysis documented a negative effect of *Expo* on the investment rate of young and small firms and a reverse impact for old and large companies. This flight to quality implies a redistribution of resources toward safer borrowers but doesn't provide any information about the relative magnitude of the aggregate effect. In order to do so, I can compare the actual investment rate with a "counterfactual investment" obtained by imposing *Expo* at their $t-1$ levels $\left(Expo_{i,t-1} = \frac{\text{Bank \$-item}_{i,2006}}{\text{Bank total assets}_{i,2006}} \times \text{CDS index(USA)}_{t-1}\right)$.

First, notice that Equation 2 can be rewritten as:

$$\begin{aligned}\frac{I_{i,t}}{K_{i,t-1}} =& \alpha + \beta_1 \text{Expo}_{i,t} + \beta_2 \left(\text{Expo}_{i,t} \times \text{Interacting variable}_{i,t}\right) + \beta_3 \left(\text{Expo}_{i,t} \times \text{Crisis}\right) + \\ &+ \beta_4 \left(\text{Expo}_{i,t} \times \text{Interacting variable}_{i,t} \times \text{Crisis}\right) + \gamma^\top X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \\ =& \alpha + \beta_{i,t} \text{Expo}_{i,t} + \gamma^\top X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t}\end{aligned} \tag{3}$$

with a coefficient β that is both time and firm specific. I can define $\hat{I}_{i,t}$ as the investment rate of firm i if $Expo_{i,t}$ had stayed at their $t-1$ levels $Expo_{i,t-1}$:

$$\frac{\hat{I}_{i,t}}{K_{i,t-1}} = \alpha + \beta_{i,t} \text{Expo}_{i,t-1} + \gamma^\top X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \tag{4}$$

that, combined with 3 gives:

$$I_{i,t} - \hat{I}_{i,t} = K_{i,t-1} \left[\beta_{i,t} \left(\text{Expo}_{i,t} - \text{Expo}_{i,t-1} \right) \right] \tag{5}$$

which measures the difference between the firm's actual and counterfactual investment.

I can then aggregate $I_{i,t} - \hat{I}_{i,t}$ across firms for which this measure is positive, to obtain:

$$\text{POS}_t = \frac{\sum_{i, I_{it} - \hat{I}_{it} \geq 0} w_i (I_{i,t} - \hat{I}_{it})}{\sum_{i=1}^{N_t} w_i K_{it-1}} \tag{6}$$

where w_i is the firm-specific sampling weight employed to reproduce the population aggregates (calibrated in the post-stratification stage of the survey procedure).

Similarly, I can aggregate the difference between actual and hypothetical investment across firms with negative $I_{it} - \hat{I}_{it}$, to obtain:

$$\text{NEG}_t = \frac{\sum_{i, I_{it} - \hat{I}_{it} < 0} w_i |I_{i,t} - \hat{I}_{it}|}{\sum_{i=1}^{N_t} w_i K_{it-1}}. \tag{7}$$

The net effect of changes in Expo_{it} on the aggregate rate of capital accumulation at time t is:

$$\text{NET}_t = \text{POS}_t - \text{NEG}_t \tag{8}$$

with a total effect given by:

$$\text{SUM}_t = \text{POS}_t + \text{NEG}_t \tag{9}$$

which provides a measure of the overall redistribution.[45]

Results are presented in Table 20. Banks' exposure to $-denominated items led to a significant reduction in the aggregate investment during the Lehman crisis, with a net effect of about -5% of total capital. Not only

[45] The exercise is similar in spirit to Chodorow-Reich (2013), who computes a counter-factual measure of firm-level employment based on the assumption that the health of the firm's syndicate, as measured by its lending to other firms, was the same as that of the healthiest syndicate.

the number of old and big firms with positive effects is lower than the count of small and young companies. But also the cumulated positive effect (3%) isn't large enough to compensate the aggregate negative impact of *Expo* (-8%). Finally, this negative effect comes together with a substantial redistribution of resources across firms that is quantifiable around 11% of the total stock of capital.

Robustness

The main results are robust to:

1. The exclusion of firms with multiple-banking relationships from the estimation sample.

2. The inclusion of further controls for firm creditworthiness: either an Altman score or the principal component of several measures of firm solidity.[46]

3. Controls for firm or bank-specific demand shocks: time-fixed effects that are (2-digit) industry specific, region specific (North and South), specific to firm size (small and large), firm age (young and old), firm creditworthiness (high and low creditworthiness), and to bank size (small and large).[47]

4. The employ of different econometric models: OLS (with time and firm fixed effects) and difference-GMM.[48]

5. A different threshold to identify low levels of capitalization, liquidity and dependence upon bank-based sources of funding (75^{th} percentile).

6. A different definition of firm size: ln(employees).

[46] The most suitable version of the Altman score for the Italian economy is the specification in Altman, Hartzell, and Peck (1995). The Z" score is computed as $Z''_{it} = 6.56X_{1,it} + 3.26X_{2,it} + 6.72X_{3,it} + 1.05X_{4,it}$ where $X_{1,it}$ to $X_{4,it}$ are (in order): working capital to total assets, retained earnings to total assets, EBIT to total assets, and book value of equity to total liabilities. The principal component analysis is performed on a rich set of measures of structural solidity, traditionally used in the literature on bank-firm relationship. It includes the following ratios: tangible to total assets, output growth, floating capital to total assets, liquid to total assets, earnings to total assets, working capital to total assets, long-term debt to total debt, total debt to total assets, ROE, labor cost to value added and value added to turnover.

[47] Braun and Larrain (2005) prove those sector that depend more upon external finance are more cyclical than others. Similarly, the demand shock may be particularly severe for more fragile firms (small and old) or companies in regions with higher probability of financial constraints (typically, southern regions). Finally, the inclusion of bank-size-time fixed effects allows to control for specific demand shocks in case of self selection of more vulnerable firms towards smaller banks.

[48] Note however that the OLS is not a suitable model given the clear endogeneity of (at least) firm output, cash flow and size.

5 Conclusions

The paper documents the real effects of the Lehman collapse in systems with low-direct exposure to toxic assets. The study focuses on the Italian economy and exploits the pre-crisis positions on $-denominated items to characterize banks' vulnerability to the financial crisis. The empirical analysis takes advantage of an exogenous supply shock and investigates its real effects on domestic-client companies.

I find robust evidence that firms' real decisions were strongly affected by the degree of vulnerability of their lender bank. In particular, client firms of more exposed banks invested and borrowed less and had a higher probability to face financial constraints. These effects followed several dimensions of heterogeneity, both along firm and bank characteristics. On the one hand, the presence of a recomposition of loans toward safer firms led to a strong negative impact on small and young companies with softened and even reversed effects for old and big firms. On the other, the transmission channel was deeper for undercapitalized and illiquid banks, or financial institutions that relied more upon bank-based sources of funding.

Interestingly, the channel was not only related to bank holding of risky assets; the share of $-liabilities played an equally-important role. The two effects are proven to be complementary and to operate both through the increment in actual and potential losses on the asset side, and through the increased instability of the $-funding (liability side). Moreover, most of the overall effect is explained by international interbank connections and corporate credits. Once controlled for exposures toward banks and customers, the residual components of the aggregate measures don't seem to have any additional effect on banks' decisions.

Finally, while the econometric analysis is performed at the firm level, I also derive some aggregate implications. I find that banks' exposure to the Lehman crisis led to a reduction in the aggregate capital accumulation in the Italian economy (-5%) with a significant reallocation of resources across firms (11% of the total stock of capital).

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Appendix: variable definitions

Firm variables	
Variable name	Definition
Investment rate	$\Delta \text{GK}_t/\text{K}_{t-1}$.
GK_t	tangible fixed assets$_t$ + accumulated depreciation$_t$.
K_{t-1}	tangible fixed assets$_{t-1}$.
Output	Sales$_t$/K_{t-1}.
Cash flow	(EBIT$_t$– interest payments$_t$ – non-operating income$_t$ – extraordinary items$_t$)/K_{t-1}.
Age	$\ln(1 + \text{age}_t)$.
Size	ln(total assets$_{t-1}$).
Crisis	Indicator variable for 2008–2009 period.
Output / TA	Sales$_t$/Total assets$_{t-1}$.
Cash flow / TA	Cash flow$_t$/Total assets$_{t-1}$.
Bank debt growth	$\Delta \ln(\text{Bank debt})_t$.
Financial constraint	Dummy variable identifying financially constrained firms.[a]
Altman score	Altman score as computed in Altman, Hartzell, and Peck (1995).[b]

[a] It is a dichotomous measure extracted directly from the following question in the MET survey: "Have there been potentially profitable projects not carried-on by the firm due to a lack of financial sources?".

[b] $Z''_{i,t} = 6.56X_{1,i,t-1} + 3.26X_{2,i,t-1} + 6.72X_{3,i,t-1} + 1.05X_{4,i,t-1}$ where $X_{1,i,t-1}$ to $X_{4,i,t-1}$ are (in order): working capital to total assets, retained earnings to total assets, EBIT to total assets, and book value of equity to total liabilities.

Bank variables

Variable name	Definition
Expo(Tot. assets)	($-assets$_{i,2006}$/Total assets$_{i,2006}$) × CDS$_{W_USA,\,i,t}$.
Expo(Bank credit)	($-credits to banks$_{i,2006}$/Total assets$_{i,2006}$) × CDS$_{B_USA,\,t}$.
Expo(Cust. credit)	($-credits to customers$_{i,2006}$/Total assets$_{i,2006}$) × CDS$_{C_USA,\,t}$.
Expo(Tot. liab.)	($-liabilities$_{i,2006}$/Total assets$_{i,2006}$) × CDS$_{W_USA,\,i,t}$.
Expo(Bank dep.)	($-deposits from banks$_{i,2006}$/Total assets$_{i,2006}$) × CDS$_{B_USA,\,t}$.
Expo(Cust. dep.)	($-deposits from customers$_{i,2006}$/Total assets$_{i,2006}$) × CDS$_{C_USA,\,t}$.
CDS$_{B_USA,\,t}$	Average of daily *US banks sector CDS indices 5Y* over the year (senior debt).
CDS$_{C_USA,\,t}$	Average of daily *CDX.NA.IG indices 5Y* over the year (senior debt).
CDS$_{W_USA,\,i,t}$	Bank-specific weighted average of CDS$_{B_USA,\,t}$, CDS$_{C_USA,\,t}$ and the 5-year CDS on US treasury bonds (senior debt).[a]
Capitalization	Tier 1 capital ratio$_{t-1}$.
Liquidity	Liquid assets$_{t-1}$/Total assets$_{t-1}$.
ROE	Return on equity$_{t-1}$.
Interbank dependence	(Debts toward banks$_{t-1}$ – Credit to banks$_{t-1}$)/Total funding$_{t-1}$.
Low tier-1 K	Dummy variable for low capitalized banks (below median of Capitalization$_{2006}$).
High tier-1 K	1 - Low tier-1 K.
Low liquidity	Dummy variable for more illiquid banks (below median of Liquidity$_{2006}$).
High liquidity	1 - Low liquidity.
Low dependence	Dummy variable for banks more dependent on bank-based sources of finance (below median of Interbank dependence$_{2006}$).
High dependence	1 - Low dependence.

[a] For total $-assets, the weights are, respectively, w_1 = $-credits to banks$_{i,2006}$/$-assets$_{i,2006}$, w_2 = $-credits to customers$_{i,2006}$/$-assets$_{i,2006}$ and $w_3 = 1 - (w_1 + w_2)$. For total $-liabilities the weights are, w_4 = $-deposits from banks$_{i,2006}$/$-liabilities$_{i,2006}$, w_5 = $-deposits from customers$_{i,2006}$/$-liabilities$_{i,2006}$ and $w_6 = 1 - (w_4 + w_5)$. CDS$_{W_USA,\,i,t}$=$w_{1(4)}$CDS$_{B_USA,\,t}$+$w_{2(5)}$CDS$_{C_USA,\,t}$+w$_{3(6)}$5Y US treasury CDS.

Main Tables

Table 1: Exposure of Italian banks to Dollar-denominated assets and liabilities.

2006:	Mean	Max	Min	Std. dev.
$-assets / total assets	2.14%	6.32%	0.31%	2.03%
$-credits to banks / total assets	0.58%	1.81%	0.06%	0.55%
$-credits to customers / total assets	0.82%	3.42%	0.11%	0.96%
$-liabilities / total assets	3.29%	11.6%	0.4%	3.69%
$-deposits from banks / total assets	1.33%	3.62%	0.01%	1.13%
$-deposits from customers / total assets	0.85%	2.39%	0.33%	0.63%

Notes: Banks' exposure to Dollar-denominated assets and liabilities as of 2006, descriptive statistics. Values refer to the pool of banks within the sample and are expressed as a percentage of total assets.

Table 2: Summary statistics.

	2006	2007	2008	2009	2010	2011
Firms:						
Investment rate	8.55%	8.81%	13.1%	3.58%	3.43%	3.19%
Cash flow	25.9%	27.6%	23.5%	15.9%	18.4%	17.7%
Output	771%	795%	760%	551%	576%	578%
Bank debt growth	3.52%	6.53%	0.94%	-7.78%	0.06%	0.00%
Total assets (1m euro)	2.23	2.40	2.57	2.53	2.70	2.84
Age	15	16	17	18	19	20
Banks:						
Expo (Tot. assets)	0.14	0.41	1.98	1.74	1.16	1.43
Expo (Bank credit)	0.14	0.41	1.93	1.71	1.14	1.40
Expo (Cust. credit)	0.12	0.39	1.86	1.64	1.10	1.35
Expo (Tot. liab.)	0.15	0.44	2.09	1.84	1.23	1.51
Expo (Bank dep.)	0.17	0.49	2.33	2.06	1.37	1.69
Expo (Cust. dep.)	0.14	0.42	2.03	1.79	1.19	1.47
Capitalization	6.93%	6.76%	6.68%	7.72%	8.90%	9.39%
Liquidity	10.7%	11.4%	9.71%	9.70%	7.45%	7.50%
ROE	11.7%	13.5%	6.67%	3.36%	5.12%	-15.2%
Interbank dependence	3.90%	2.75%	4.35%	3.40%	6.65%	10.1%

Notes: Summary statistics for firms and banks in the sample between 2006 and 2011. Data refer to median values within the year. Bank exposures are expressed in units of standard deviations. All variables are defined in "Appendix: Variable definitions".

Table 3: Firm-bank relationships.

	Type of banking relationship		
	Single	Double	Multiple
Age - Q1	87.5%	10.7%	1.79%
Age - Q2	84.3%	12.5%	3.13%
Age - Q3	83.6%	12.4%	4.03%
Age - Q4	80.5%	15.1%	4.46%
Size - Q1	86.4%	11.4%	2.27%
Size - Q2	87.2%	11.0%	1.75%
Size - Q3	82.2%	13.4%	4.49%
Size - Q4	76.7%	17.0%	6.32%
Total	83.0%	13.3%	3.77%

Notes: Type of bank relationships for firms belonging to different quartiles of the age and size distributions. Companies are grouped into: *Single*, *Double*, and *Multiple* defining, respectively, firms that borrow from one, two, or more than two banks. Values refer to the percentage of firms within each class. Q1, Q2, Q3 and Q4 refer to the quartile of the specific distribution.

Table 4: Firms' creditworthiness and banks' exposure.

	$-assets		$-liabilities	
Time	High	Low	High	Low
2006	2.3	2.3	2.3	2.3
2007	2.3	2.3	2.3	2.3
2008	2.2	2.2	2.3	2.3
2009	2.1	2.1	2.1	2.2
2010	1.9	1.9	1.9	2.0
2011	2.0	2.0	2.0	2.1

Notes: Firms' average creditworthiness by degree of exposure of the lender bank. The measure of creditworthiness is the Altman score as defined in "Appendix: Variable definitions". Banks are classified into financial institutions with *High* and *Low* exposures depending on the median value of *Expo*. The corresponding $-items are listed in the top row.

Table 5: Baseline specification: firms' investment and banks' exposures to the US financial crisis (age interaction).

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.153***	-0.140***	-0.179***	-0.177***	-0.192***	-0.165***
	[0.0522]	[0.0522]	[0.0541]	[0.0542]	[0.0553]	[0.0542]
Expo($-item) × Age	0.0556***	0.0551***	0.0567***	0.0545***	0.0633***	0.0507***
	[0.0138]	[0.0139]	[0.0145]	[0.0145]	[0.0145]	[0.0146]
Expo($-item) × Crisis	-0.119**	-0.129***	-0.115**	-0.109**	-0.0980*	-0.122**
	[0.0490]	[0.0489]	[0.0532]	[0.0534]	[0.0526]	[0.0540]
Expo($-item) × Age × Crisis	0.0331***	0.0344***	0.0352***	0.0358***	0.0316**	0.0373***
	[0.0128]	[0.0129]	[0.0137]	[0.0139]	[0.0131]	[0.0140]
Output	0.142**	0.142**	0.132**	0.151**	0.131**	0.133**
	[0.0612]	[0.0615]	[0.0622]	[0.0635]	[0.0621]	[0.0622]
Cash flow	0.147***	0.147***	0.122**	0.115**	0.122**	0.124**
	[0.0515]	[0.0517]	[0.0524]	[0.0502]	[0.0524]	[0.0520]
Age	-0.140***	-0.139***	-0.149***	-0.145***	-0.161***	-0.141***
	[0.0147]	[0.0145]	[0.0169]	[0.0169]	[0.0174]	[0.0165]
Constant	0.475***	0.457***	0.543***	0.533***	0.565***	0.529***
	[0.0705]	[0.0685]	[0.0794]	[0.0802]	[0.0841]	[0.0781]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25409	25409	20773	20519	20773	20773
# firms	4866	4866	3989	3942	3989	3989
Hansen p-value	0.306	0.301	0.446	0.368	0.462	0.435
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.585	0.584	0.255	0.285	0.259	0.252

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 6: Baseline specification: firms' investment and banks' exposures to the US financial crisis (size interaction).

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.617***	-0.500***	-0.682***	-0.739***	-0.713***	-0.706***
	[0.139]	[0.140]	[0.133]	[0.134]	[0.136]	[0.134]
Expo($-item) × Size	0.0698***	0.0584***	0.0741***	0.0797***	0.0789***	0.0759***
	[0.0143]	[0.0144]	[0.0135]	[0.0136]	[0.0138]	[0.0136]
Expo($-item) × Crisis	-0.101	-0.136	-0.0930	-0.0769	-0.0546	-0.0980
	[0.123]	[0.125]	[0.125]	[0.126]	[0.122]	[0.127]
Expo($-item) × Size × Crisis	0.00867	0.0121	0.00856	0.00764	0.00465	0.00909
	[0.0125]	[0.0127]	[0.0126]	[0.0127]	[0.0121]	[0.0128]
Output	0.145**	0.146**	0.138**	0.156**	0.137**	0.138**
	[0.0628]	[0.0632]	[0.0630]	[0.0639]	[0.0630]	[0.0628]
Cash flow	0.139**	0.139***	0.122**	0.112**	0.123**	0.120**
	[0.0541]	[0.0541]	[0.0562]	[0.0539]	[0.0564]	[0.0561]
Size	-0.176***	-0.164***	-0.189***	-0.192***	-0.201***	-0.188***
	[0.0153]	[0.0151]	[0.0169]	[0.0168]	[0.0177]	[0.0166]
Constant	1.645***	1.526***	1.813***	1.839***	1.894***	1.814***
	[0.155]	[0.153]	[0.172]	[0.171]	[0.180]	[0.170]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25476	25476	20832	20578	20832	20832
# firms	4880	4880	4002	3955	4002	4002
Hansen p-value	0.179	0.170	0.335	0.281	0.337	0.341
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.698	0.697	0.332	0.373	0.348	0.327

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for columns 1 and 3, CDS$_{B_USA,t}$ for columns 2 and 5, and CDS$_{C_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 7: Firms' investment and banks' exposures to the US financial crisis (age interaction). Controlling for bank balance sheet variables.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.277***	-0.304***	-0.255***	-0.247***	-0.270***	-0.242***
	[0.0539]	[0.0560]	[0.0679]	[0.0613]	[0.0662]	[0.0633]
Expo($-item) × Age	0.0867***	0.0912***	0.0758***	0.0759***	0.0854***	0.0720***
	[0.0145]	[0.0155]	[0.0158]	[0.0147]	[0.0154]	[0.0149]
Capitalization	-0.0375	-0.0562	-0.0276	-0.0207	-0.00930	-0.0242
	[0.0738]	[0.0709]	[0.0475]	[0.0477]	[0.0490]	[0.0473]
Capitalization × Age	-0.00710	-0.00474	-0.00435	-0.00669	-0.0109	-0.00554
	[0.0251]	[0.0250]	[0.0184]	[0.0184]	[0.0185]	[0.0184]
Liquidity	-0.0653	-0.0739	-0.0258	-0.0238	-0.0262	-0.0247
	[0.0477]	[0.0526]	[0.0365]	[0.0359]	[0.0355]	[0.0360]
Liquidity × Age	0.00230	0.00514	-0.0000117	-0.00176	-0.00212	-0.000461
	[0.00783]	[0.00922]	[0.00722]	[0.00750]	[0.00741]	[0.00739]
ROE	0.124	0.111	0.151	0.165	0.175	0.152
	[0.135]	[0.137]	[0.128]	[0.128]	[0.128]	[0.128]
ROE × Age	-0.0437	-0.0405	-0.0400	-0.0419	-0.0442	-0.0397
	[0.0396]	[0.0400]	[0.0373]	[0.0379]	[0.0384]	[0.0376]
Interbank dependence	-0.105	-0.115	-0.0291	-0.0331	-0.0444	-0.0283
	[0.0649]	[0.0712]	[0.0563]	[0.0562]	[0.0563]	[0.0565]
Interbank dependence × Age	-0.0129	-0.0134	-0.0162	-0.0222	-0.0289	-0.0178
	[0.0238]	[0.0260]	[0.0206]	[0.0192]	[0.0177]	[0.0207]
Output	0.121***	0.120***	0.129***	0.128***	0.128***	0.128***
	[0.0354]	[0.0354]	[0.0406]	[0.0407]	[0.0406]	[0.0407]
Cash flow	0.189***	0.189***	0.175***	0.174***	0.175***	0.174***
	[0.0485]	[0.0485]	[0.0411]	[0.0409]	[0.0408]	[0.0410]
Age	0.267	0.221	0.251	0.287	0.303	0.265
	[0.352]	[0.343]	[0.338]	[0.340]	[0.348]	[0.338]
Constant	-0.156	0.0993	-0.502	-0.633	-0.667	-0.551
	[1.305]	[1.324]	[1.222]	[1.223]	[1.257]	[1.213]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	16101	16101	13360	13339	13360	13360
# firms	4334	4334	3615	3609	3615	3615
Hansen p-value	0.557	0.575	0.337	0.331	0.389	0.357
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.898	0.969	0.764	0.713	0.721	0.736

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 8: Firms' investment and banks' exposures to the US financial crisis (age interaction). Heterogeneous effects for less capitalized banks.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.0619	-0.0624	-0.0584	-0.0513	-0.0670	-0.0407
	[0.0492]	[0.0489]	[0.0527]	[0.0528]	[0.0540]	[0.0528]
Expo($-item) × Age	0.0291**	0.0322**	0.0243*	0.0202	0.0299**	0.0170
	[0.0128]	[0.0128]	[0.0140]	[0.0140]	[0.0140]	[0.0140]
Expo($-item) × Crisis × High tier–1 K	-0.0233	-0.0461	0.0197	0.0295	0.0253	0.0233
	[0.0512]	[0.0507]	[0.0571]	[0.0581]	[0.0556]	[0.0587]
Expo($-item) × Age × Crisis × High tier–1 K	0.00225	0.00705	-0.00161	-0.00361	-0.00195	-0.00284
	[0.0133]	[0.0133]	[0.0146]	[0.0148]	[0.0139]	[0.0150]
Expo($-item) × Crisis × Low tier–1 K	-0.260***	-0.254***	-0.311***	-0.304***	-0.289***	-0.322***
	[0.0606]	[0.0612]	[0.0636]	[0.0638]	[0.0634]	[0.0641]
Expo($-item) × Age × Crisis × Low tier–1 K	0.0759***	0.0737***	0.0871***	0.0893***	0.0819***	0.0903***
	[0.0169]	[0.0173]	[0.0172]	[0.0173]	[0.0166]	[0.0175]
Output	0.142**	0.142**	0.135**	0.153**	0.134**	0.135**
	[0.0619]	[0.0620]	[0.0632]	[0.0645]	[0.0633]	[0.0631]
Cash flow	0.153***	0.152***	0.127**	0.120**	0.128**	0.128**
	[0.0512]	[0.0513]	[0.0520]	[0.0499]	[0.0519]	[0.0519]
Age	-0.123***	-0.125***	-0.125***	-0.120***	-0.134***	-0.117***
	[0.0143]	[0.0141]	[0.0167]	[0.0166]	[0.0171]	[0.0163]
Constant	0.414***	0.408***	0.445***	0.435***	0.455***	0.433***
	[0.0703]	[0.0680]	[0.0796]	[0.0805]	[0.0845]	[0.0784]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25409	25409	20773	20519	20773	20773
# firms	4866	4866	3989	3942	3989	3989
Hansen p-value	0.253	0.255	0.368	0.304	0.376	0.362
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.595	0.586	0.245	0.279	0.255	0.246

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High tier–1 K* and *Low tier–1 K* are dummy variables identifying banks with high and low levels of capitalization. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 9: Firms' investment and banks' exposures to the US financial crisis (age interaction). Heterogeneous effects for less liquid banks.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.122**	-0.106**	-0.167***	-0.162***	-0.172***	-0.153***
	[0.0500]	[0.0498]	[0.0541]	[0.0541]	[0.0547]	[0.0544]
Expo($-item) × Age	0.0461***	0.0445***	0.0531***	0.0504***	0.0578***	0.0472***
	[0.0131]	[0.0131]	[0.0145]	[0.0145]	[0.0143]	[0.0146]
Expo($-item) × Crisis × High liquidity	-0.0147	-0.0268	0.0391	0.0485	0.0406	0.0433
	[0.0589]	[0.0578]	[0.105]	[0.100]	[0.0811]	[0.110]
Expo($-item) × Age × Crisis × High liquidity	0.0000148	0.00209	-0.0131	-0.0132	-0.00982	-0.0159
	[0.0157]	[0.0154]	[0.0297]	[0.0284]	[0.0224]	[0.0312]
Expo($-item) × Crisis × Low liquidity	-0.172***	-0.190***	-0.130**	-0.126**	-0.121**	-0.137**
	[0.0545]	[0.0555]	[0.0550]	[0.0555]	[0.0552]	[0.0558]
Expo($-item) × Age × Crisis × Low liquidity	0.0507***	0.0554***	0.0393***	0.0406***	0.0383***	0.0413***
	[0.0148]	[0.0153]	[0.0142]	[0.0145]	[0.0139]	[0.0145]
Output	0.141**	0.141**	0.132**	0.151**	0.131**	0.133**
	[0.0615]	[0.0617]	[0.0624]	[0.0638]	[0.0624]	[0.0624]
Cash flow	0.150***	0.149***	0.123**	0.116**	0.123**	0.124**
	[0.0512]	[0.0514]	[0.0522]	[0.0499]	[0.0521]	[0.0518]
Age	-0.135***	-0.134***	-0.145***	-0.141***	-0.156***	-0.138***
	[0.0144]	[0.0143]	[0.0171]	[0.0171]	[0.0174]	[0.0168]
Constant	0.461***	0.445***	0.530***	0.517***	0.546***	0.516***
	[0.0703]	[0.0683]	[0.0802]	[0.0809]	[0.0843]	[0.0790]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25409	25409	20773	20519	20773	20773
# firms	4866	4866	3989	3942	3989	3989
Hansen p-value	0.280	0.274	0.429	0.352	0.440	0.418
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.606	0.613	0.257	0.287	0.262	0.254

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High liquidity* and *Low liquidity* are dummy variables identifying banks with high and low liquidity. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 10: Firms' investment and banks' exposures to the US financial crisis (age interaction). Heterogeneous effects for banks that are more dependent on interbank financing.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.128**	-0.135***	-0.116**	-0.111**	-0.137**	-0.0964*
	[0.0520]	[0.0521]	[0.0536]	[0.0536]	[0.0553]	[0.0535]
Expo($-item) × Age	0.0487***	0.0535***	0.0399***	0.0370***	0.0490***	0.0322**
	[0.0138]	[0.0138]	[0.0143]	[0.0143]	[0.0145]	[0.0143]
Expo($-item) × Crisis × Low dependence	-0.0581	-0.0663	-0.0207	-0.0111	-0.0185	-0.0179
	[0.0504]	[0.0504]	[0.0575]	[0.0582]	[0.0556]	[0.0591]
Expo($-item) × Age × Crisis × Low dependence	0.0148	0.0153	0.0129	0.0114	0.0141	0.0106
	[0.0133]	[0.0134]	[0.0149]	[0.0151]	[0.0141]	[0.0152]
Expo($-item) × Crisis × High dependence	-0.332***	-0.404***	-0.217***	-0.216***	-0.200***	-0.231***
	[0.0722]	[0.0814]	[0.0643]	[0.0645]	[0.0647]	[0.0646]
Expo($-item) × Age × Crisis × High dependence	0.0919***	0.113***	0.0631***	0.0654***	0.0594***	0.0672***
	[0.0205]	[0.0235]	[0.0174]	[0.0176]	[0.0172]	[0.0176]
Output	0.141**	0.141**	0.133**	0.152**	0.132**	0.134**
	[0.0614]	[0.0616]	[0.0627]	[0.0639]	[0.0625]	[0.0626]
Cash flow	0.152***	0.151***	0.125**	0.118**	0.125**	0.127**
	[0.0513]	[0.0515]	[0.0520]	[0.0498]	[0.0520]	[0.0518]
Age	-0.138***	-0.143***	-0.134***	-0.130***	-0.148***	-0.126***
	[0.0147]	[0.0146]	[0.0168]	[0.0167]	[0.0173]	[0.0163]
Constant	0.467***	0.472***	0.483***	0.471***	0.509***	0.467***
	[0.0705]	[0.0686]	[0.0794]	[0.0800]	[0.0841]	[0.0779]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25409	25409	20773	20519	20773	20773
# firms	4866	4866	3989	3942	3989	3989
Hansen p-value	0.284	0.286	0.389	0.323	0.406	0.380
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.588	0.586	0.254	0.286	0.262	0.250

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High dependence* and *Low dependence* are dummy variables identifying banks with high and low dependence upon bank-based sources of funding. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 11: Firms' investment and banks' exposures to the US financial crisis (age interaction). Heterogeneous effects for less capitalized banks. Controlling for capitalization.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.119**	-0.122**	-0.0961*	-0.0981*	-0.155***	-0.0674
	[0.0532]	[0.0526]	[0.0562]	[0.0566]	[0.0578]	[0.0561]
Expo($-item) × Age	0.0304**	0.0347**	0.0194	0.0172	0.0346**	0.0105
	[0.0141]	[0.0140]	[0.0152]	[0.0153]	[0.0155]	[0.0152]
Expo($-item) × Crisis × High tier–1 K	-0.000155	-0.0225	0.0383	0.0559	0.0683	0.0379
	[0.0523]	[0.0523]	[0.0568]	[0.0575]	[0.0550]	[0.0582]
Expo($-item) × Age × Crisis × High tier–1 K	0.00390	0.00927	0.000171	-0.00311	-0.00467	-0.000500
	[0.0136]	[0.0136]	[0.0147]	[0.0148]	[0.0139]	[0.0150]
Expo($-item) × Crisis × Low tier–1 K	-0.242***	-0.249***	-0.261***	-0.246***	-0.212***	-0.276***
	[0.0628]	[0.0646]	[0.0624]	[0.0630]	[0.0620]	[0.0632]
Expo($-item) × Age × Crisis × Low tier–1 K	0.0830***	0.0849***	0.0847***	0.0858***	0.0754***	0.0884***
	[0.0172]	[0.0178]	[0.0171]	[0.0173]	[0.0165]	[0.0174]
Capitalization	0.00782	0.00769	0.00164	0.000384	0.00633	0.00118
	[0.0178]	[0.0180]	[0.0200]	[0.0201]	[0.0197]	[0.0199]
Capitalization × Age	-0.00413	-0.00384	-0.000805	-0.000646	-0.000941	-0.00105
	[0.00543]	[0.00548]	[0.00628]	[0.00631]	[0.00639]	[0.00624]
Output	0.105*	0.104*	0.127*	0.159*	0.127*	0.127*
	[0.0612]	[0.0611]	[0.0767]	[0.0826]	[0.0768]	[0.0767]
Cash flow	0.152***	0.151***	0.139**	0.116**	0.140**	0.139**
	[0.0510]	[0.0510]	[0.0566]	[0.0559]	[0.0566]	[0.0566]
Age	-0.110***	-0.115***	-0.111***	-0.106***	-0.130***	-0.0992***
	[0.0274]	[0.0275]	[0.0339]	[0.0335]	[0.0349]	[0.0329]
Constant	0.512***	0.511***	0.527***	0.525***	0.587***	0.494***
	[0.111]	[0.109]	[0.137]	[0.136]	[0.136]	[0.134]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	19485	19485	15890	15669	15890	15890
# firms	4610	4610	3792	3746	3792	3792
Hansen p-value	0.149	0.155	0.236	0.130	0.220	0.232
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.594	0.597	0.491	0.501	0.500	0.492

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High tier1 K* and *Low tier1 K* are dummy variables identifying banks with high and low levels of capitalization. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 12: Potential losses on $-assets and instability of $-liabilities. Correlation matrix with *Expo*.

Pearson correlation coefficients

$-item:	(1) Tot Asset	(2) Bank Cred	(3) Cust. Cred	(4) Tot Liab	(5) Bank Dep	(6) Cust. Dep
$-item$_{t-1}$ × ΔCDS$_t$	0.309***	0.355***	0.171***	–	–	–
Δ$-item$_t$	–	–	–	-0.455***	-0.537***	-0.181***

Notes: Pairwise correlations between *Expo*, potential losses on $-assets or instability of $-liabilities. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for columns 1 and 3, CDS$_{B_USA,t}$ for columns 2 and 5, and CDS$_{C_USA,t}$ for columns 3 and 6.

Table 13: Firms' investment and banks' potential losses on $-denominated assets (age interaction).

Dependent variable: investment rate

$-item:	(1) Tot. assets	(2) Bank credit	(3) Cust. credit
$-item$_{t-1}$ × ΔCDS$_t$	0.0833	0.000373	-0.177*
	[0.123]	[0.0874]	[0.103]
$-item$_{t-1}$ × ΔCDS$_t$ × Age	-0.0337	0.000666	0.0517**
	[0.0337]	[0.0230]	[0.0261]
$-item$_{t-1}$ × ΔCDS$_t$ × Crisis	-0.539***	-0.503***	-0.355***
	[0.204]	[0.147]	[0.106]
$-item$_{t-1}$ × ΔCDS$_t$ × Age × Crisis	0.177***	0.159***	0.112***
	[0.0602]	[0.0434]	[0.0284]
Output	0.183**	0.184***	0.134**
	[0.0715]	[0.0713]	[0.0637]
Cash flow	0.206***	0.207***	0.189***
	[0.0571]	[0.0573]	[0.0564]
Age	-0.793**	-0.848**	-0.714**
	[0.373]	[0.380]	[0.312]
Constant	2.872**	3.058**	2.600**
	[1.313]	[1.334]	[1.101]
Fixed effects			
Time	yes	yes	yes
Firm	yes	yes	yes
# obs.	25809	25809	22347
# firms	5065	5065	4778
Hansen p-value	0.329	0.352	0.412
AR(1) p-value	0.000	0.000	0.000
AR(2) p-value	0.376	0.405	0.208

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The product between the variation in the CDS spread (within the year) and the beginning-of-period $-item (listed in the top row), is a proxy for the expected losses on the specific $-denominated assets (with marking to market). All measures are defined in "Appendix: variable definitions". Set of instruments: Output, Cash flow and Age are lagged twice or more. Instead of considering lagged values of $-item$_{t-1}$ × ΔCDS$_t$, the instrumenting matrix is enriched with *Expo* (and its interactions) as external instruments. *Expo* varies across specifications. It is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for column 1, CDS$_{B_USA,t}$ for column 2, and CDS$_{C_USA,t}$ for column 3. Also *Expo* is lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 14: Firms' investment and instability of $-denominated liabilities (age interaction).

Dependent variable: investment rate			
	(1)	(2)	(3)
$-item:	Tot. liab.	Bank dep.	Cust. dep.
Δ\$-item$_t$	0.417	0.250	0.220
	[0.313]	[0.158]	[0.157]
Δ\$-item$_t$ × Age	-0.133	-0.0800	-0.0706
	[0.100]	[0.0503]	[0.0498]
Δ\$-item$_t$ × Crisis	1.437***	1.360***	1.354***
	[0.259]	[0.294]	[0.188]
Δ\$-item$_t$ × Age × Crisis	-0.410***	-0.419***	-0.400***
	[0.0771]	[0.0832]	[0.0552]
Output	0.163**	0.139**	0.148**
	[0.0678]	[0.0695]	[0.0703]
Cash flow	0.147**	0.153**	0.159**
	[0.0609]	[0.0615]	[0.0629]
Age	-0.595*	-0.704**	-0.644**
	[0.312]	[0.316]	[0.317]
Constant	2.170**	2.557**	2.350**
	[1.095]	[1.107]	[1.115]
Fixed effects			
Time	yes	yes	yes
Firm	yes	yes	yes
# obs.	21812	21920	21920
# firms	4682	4717	4717
Hansen p-value	0.189	0.209	0.182
AR(1) p-value	0.000	0.000	0.000
AR(2) p-value	0.254	0.239	0.300

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. Δ\$-item$_t$ is the variation of \$-denominated liabilities within the year. The type of \$-liability varies across columns and is listed in the top row. All measures are defined in "Appendix: variable definitions". Set of instruments: Output, Cash flow and Age are lagged twice or more. Instead of considering lagged values of \$-item$_{t-1} \times \Delta$CDS$_t$, the instrumenting matrix is enriched with *Expo* (and its interactions) as external instruments. *Expo* varies across specifications. It is consistently defined as in equation 1 and both \$-item and CDS(USA)$_t$ are column-specific. \$-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for column 1, CDS$_{B_USA,t}$ for column 2, and CDS$_{C_USA,t}$ for column 3. Also *Expo* is lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 15: Firms' investment and banks' exposures to the US financial crisis (age interaction). Asset vs. liability measures.

Dependent variable: investment rate			
	(1)	(2)	(3)
Class:	Total	Bank	Customers
Expo($-asset(class))	-0.223***	-0.151***	-0.612***
	[0.0496]	[0.0495]	[0.209]
Expo($-asset(class)) × Age	0.0679***	0.0509***	0.209***
	[0.0150]	[0.0149]	[0.0659]
Expo($-liability(class))	-0.159***	-0.217***	0.342
	[0.0493]	[0.0487]	[0.209]
Expo($-liability(class)) × Age	0.0428***	0.0622***	-0.124*
	[0.0146]	[0.0143]	[0.0660]
Output	0.175**	0.139**	0.168***
	[0.0724]	[0.0648]	[0.0580]
Cash flow	0.107*	0.133**	0.158**
	[0.0560]	[0.0522]	[0.0677]
Age	-0.194***	-0.198***	-0.158***
	[0.0185]	[0.0177]	[0.0164]
Constant	0.761***	0.735***	0.520***
	[0.0789]	[0.0721]	[0.0715]
Fixed effects			
Time	yes	yes	yes
Firm	yes	yes	yes
# obs.	20519	20773	20773
# firms	3942	3989	3989
Hansen p-value	0.162	0.355	0.330
AR(1) p-value	0.000	0.000	0.000
AR(2) p-value	0.329	0.282	0.303

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. Each column compares asset and liability measures within each class of $-item (listed in the top row). Column 1, compares *Expo(Tot. assets)* and *Expo(Tot. liab.)*, Column 2 *Expo(Bank credit)* and *Expo(Bank dep.)*, Column 3 *Expo(Cust. credit)* and *Expo(Cust. dep.)*. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 16: Firms' investment and banks' exposures to the US financial crisis (age interaction). Total, bank and customer exposures.

Dependent variable: investment rate		
	(1)	(2)
Side:	Assets	Liabilities
Expo(Total)	0.218	0.00155
	[0.193]	[0.0181]
Expo(Total) × Age	-0.0857	0.00801
	[0.0592]	[0.0198]
Expo(Bank)	-0.382**	-0.497***
	[0.174]	[0.111]
Expo(Bank) × Age	0.138***	0.158***
	[0.0532]	[0.0346]
Expo(Customer)	-0.248***	0.179
	[0.0584]	[0.111]
Expo(Customer) × Age	0.0757***	-0.0734**
	[0.0176]	[0.0353]
Output	0.141**	0.173**
	[0.0647]	[0.0674]
Cash flow	0.131**	0.124**
	[0.0529]	[0.0508]
Age	-0.201***	-0.188***
	[0.0179]	[0.0179]
Constant	0.745***	0.714***
	[0.0731]	[0.0729]
Fixed effects		
Time	yes	yes
Firm	yes	yes
# obs.	20773	20147
# firms	3989	3924
Hansen p-value	0.353	0.217
AR(1) p-value	0.000	0.000
AR(2) p-value	0.290	0.336

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. Each column compares all the type of measures within each side of bank balance sheet (asset or liability). Column 1 compares *Expo(Tot. assets)*, *Expo(Bank credit)*, and *Expo(Cust. credit)*. Column 2 compares *Expo(Tot. liab.)*, *Expo(Bank dep.)*, and *Expo(Cust. dep.)*. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 17: Firms' bank-debt growth and banks' exposures to US financial crisis (age interaction).

Dependent Variable: bank debt growth						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	0.0471	0.0277	0.0458	0.0399	0.0396	0.0425
	[0.0491]	[0.0500]	[0.0493]	[0.0504]	[0.0494]	[0.0492]
Expo($-item) × Age	-0.0129	-0.00718	-0.0142	-0.0132	-0.0124	-0.0133
	[0.0128]	[0.0129]	[0.0134]	[0.0137]	[0.0133]	[0.0134]
Expo($-item) × Crisis	-0.0953*	-0.0958*	-0.244***	-0.248***	-0.220***	-0.234***
	[0.0511]	[0.0555]	[0.0751]	[0.0765]	[0.0742]	[0.0744]
Expo($-item) × Age × Crisis	0.0371***	0.0381***	0.0578***	0.0600***	0.0590***	0.0586***
	[0.0127]	[0.0138]	[0.0185]	[0.0189]	[0.0181]	[0.0183]
Output / TA	0.0664	0.0671	0.0686	0.0794	0.0685	0.0690
	[0.0553]	[0.0553]	[0.0627]	[0.0676]	[0.0629]	[0.0627]
Cash flow / TA	-0.0174	-0.0205	-0.0127	-0.0260	-0.0135	-0.0137
	[0.0839]	[0.0840]	[0.0712]	[0.0748]	[0.0713]	[0.0711]
Age	-0.0399*	-0.0502**	-0.0413**	-0.0429**	-0.0431**	-0.0421**
	[0.0239]	[0.0237]	[0.0200]	[0.0201]	[0.0216]	[0.0207]
Constant	0.253***	0.289***	0.252***	0.263***	0.259***	0.256***
	[0.0916]	[0.0912]	[0.0807]	[0.0821]	[0.0876]	[0.0837]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	16504	16504	14113	13966	14113	14113
# firms	3148	3148	2688	2657	2688	2688
Hansen p-value	0.249	0.254	0.219	0.245	0.214	0.217
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.423	0.418	0.285	0.290	0.284	0.284

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the firms' rate of growth of bank debt between time t and $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more. Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 18: Firms' financial constraints status and banks' exposures to the US financial crisis (age and size interactions).

Dependent Variable: financial constraint $(0, 1)$						
	(1)	(2)	(3)	(4)	(5)	(6)
\$-item	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo(\$-item) × Crisis	0.459***	0.459***	0.453***	0.459***	0.455***	0.461***
	[0.121]	[0.125]	[0.129]	[0.129]	[0.122]	[0.131]
Expo(\$-item) × Age × Crisis	-0.0813**	-0.0790**	-0.0900**	-0.0923**	-0.0892**	-0.0929**
	[0.0351]	[0.0362]	[0.0374]	[0.0373]	[0.0354]	[0.0380]
Age	-0.672***	-0.675***	-0.913***	-0.858***	-0.917***	-0.915***
	[0.236]	[0.236]	[0.270]	[0.271]	[0.271]	[0.270]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	2707	2707	2290	2253	2290	2290
# firms	1053	1053	893	878	893	893
Log lik.	-943.1	-942.6	-799.9	-787.5	-797.0	-800.5
Expo(\$-item) × Crisis	1.021***	1.060***	1.139***	1.105***	1.147***	1.100***
	[0.318]	[0.330]	[0.324]	[0.323]	[0.308]	[0.328]
Expo(\$-item) × Size × Crisis	-0.0854***	-0.0886***	-0.1000***	-0.0967***	-0.100***	-0.0961***
	[0.0325]	[0.0337]	[0.0326]	[0.0325]	[0.0310]	[0.0330]
Size	-0.641***	-0.640***	-0.864***	-0.814***	-0.864***	-0.872***
	[0.237]	[0.237]	[0.270]	[0.271]	[0.272]	[0.270]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	2709	2709	2290	2253	2290	2290
# firms	1054	1054	893	878	893	893
Log lik.	-942.9	-942.1	-798.0	-786.1	-794.9	-799.2

Notes: Conditional logistic regression with time and firm-specific fixed effects. The dependent variable is a direct measure of financial constraints. It takes value 1 if firm investment activity has been limited by the presence of financial frictions, and 0 otherwise. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both \$-item and CDS(USA)$_t$ are column-specific. \$-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for columns 1 and 3, CDS$_{B_USA,t}$ for columns 2 and 5, and CDS$_{C_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions".
Robust standard errors in brakets. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 19: Firms' investment and banks' exposures to US financial crisis (age interaction). Heterogeneous investment to cash flow sensitivity during the crisis.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.166***	-0.150***	-0.188***	-0.188***	-0.204***	-0.176***
	[0.0515]	[0.0513]	[0.0536]	[0.0538]	[0.0550]	[0.0538]
Expo($-item) × Age	0.0577***	0.0569***	0.0582***	0.0565***	0.0658***	0.0526***
	[0.0137]	[0.0137]	[0.0143]	[0.0144]	[0.0145]	[0.0144]
Expo($-item) × Crisis	-0.203***	-0.224***	-0.170***	-0.158***	-0.161***	-0.166***
	[0.0563]	[0.0574]	[0.0591]	[0.0590]	[0.0568]	[0.0599]
Expo($-item) × Age × Crisis	0.0567***	0.0605***	0.0509***	0.0516***	0.0507***	0.0506***
	[0.0146]	[0.0151]	[0.0153]	[0.0154]	[0.0143]	[0.0156]
Output	0.106***	0.105***	0.0987***	0.104***	0.0957***	0.101***
	[0.0286]	[0.0291]	[0.0371]	[0.0364]	[0.0350]	[0.0367]
Cash flow	0.147***	0.151***	0.122**	0.0996**	0.120**	0.113**
	[0.0327]	[0.0321]	[0.0534]	[0.0495]	[0.0535]	[0.0521]
Cash flow × Crisis	-0.0655	-0.0743	-0.0231	0.00592	0.00201	-0.00617
	[0.0472]	[0.0485]	[0.0689]	[0.0695]	[0.0729]	[0.0656]
Expo × Cash flow × Crisis	0.425***	0.418***	0.267**	0.265**	0.287***	0.248*
	[0.113]	[0.103]	[0.127]	[0.130]	[0.106]	[0.132]
Expo × Age × Cash flow × Crisis	-0.123***	-0.119***	-0.0792**	-0.0831**	-0.0884***	-0.0766**
	[0.0319]	[0.0292]	[0.0358]	[0.0366]	[0.0314]	[0.0375]
Age	-0.147***	-0.147***	-0.153***	-0.153***	-0.168***	-0.146***
	[0.0133]	[0.0130]	[0.0153]	[0.0151]	[0.0159]	[0.0149]
Constant	0.518***	0.501***	0.576***	0.584***	0.611***	0.565***
	[0.0590]	[0.0570]	[0.0665]	[0.0661]	[0.0724]	[0.0648]
Fixed–effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25409	25409	20773	20519	20773	20773
# firms	4866	4866	3989	3942	3989	3989
Hansen p-value	0.254	0.277	0.266	0.268	0.440	0.265
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.528	0.550	0.203	0.211	0.202	0.194

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 20: Aggregate effects on capital accumulation.

	(1) NEG	(2) POS	(3) NET	(4) SUM
$(\text{Expo}_{i,t} - \text{Expo}_{i,t-1})$				
2008	7.14%	3.12%	-4.02%	10.3%
2009 (cumulated)	7.95%	3.38%	-4.57%	11.3%

Notes: Aggregate effects of ΔExpo_{it} on firms' capital accumulation in times of crisis. The table refers to the difference between the actual investment and the counterfactual investment if banks' $Expo_{i,t}$ (in this example *Expo(Tot. assets)*) had stayed at their $t-1$ values. NEG is the ratio between the aggregate negative difference and the pre-crisis total capital (defined in equation (7)). POS is the ratio between the aggregate positive difference and the pre-crisis total capital (defined in equation (6)). NET is the net effect as defined in equation (8). SUM is the measure of reallocation in equation (9).

Figures

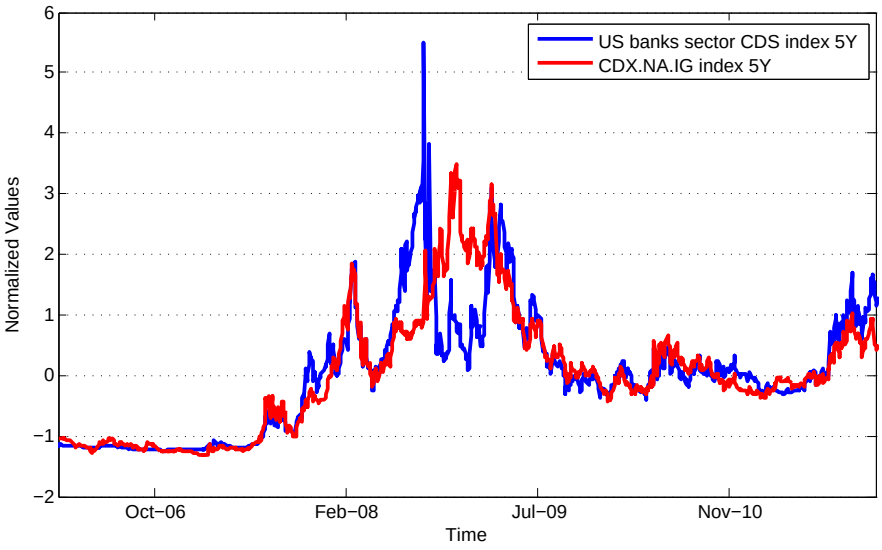

Figure 1: US CDS spread indices in 2006–2011.
Daily CDS spreads indices for US banking and corporate sectors between January 2006 and December 2011. The two series have been demeaned and standardized.

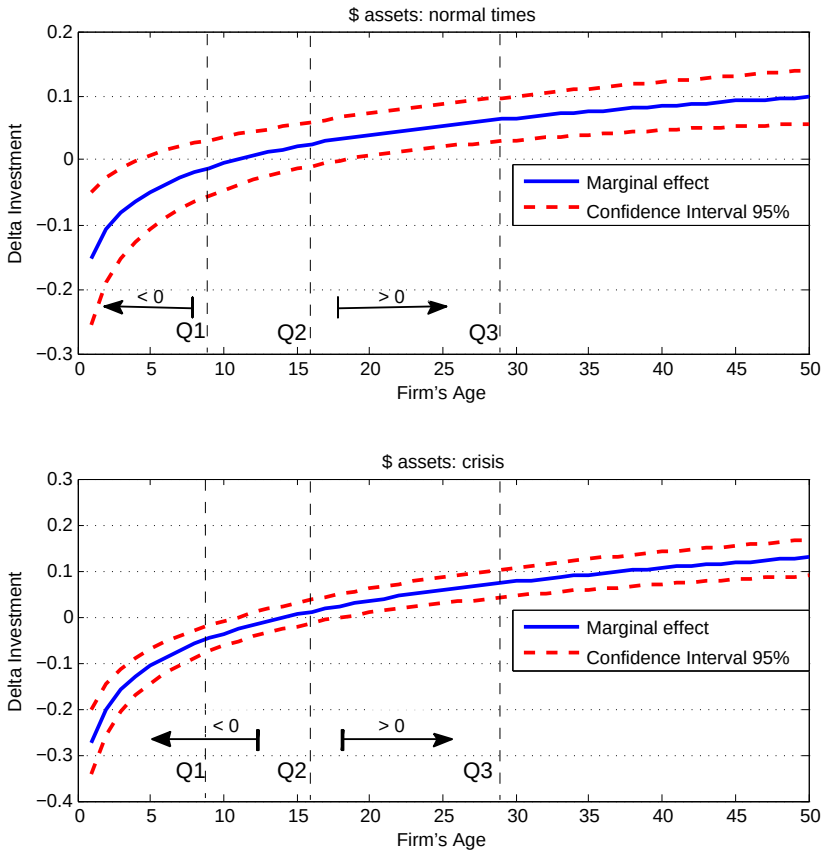

Figure 2: Flight to quality across firm age: marginal effects of $-assets.

Marginal effect of a unitary increase in bank exposure on the investment rate of client firms. The coefficient varies across different levels of firm age. The top and bottom plots report, respectively, the marginal effects for pre-crisis and crisis times. The black arrows highlight the regions of significance of the specific coefficient. Q1, Q2 and Q3 represent the 1^{st}, 2^{nd} and 3^{rd} quartiles of the firms' age distribution in the sample. Both investment and *Expo* are expressed in units of standard deviations. *Expo=Expo(Tot. assets)*.

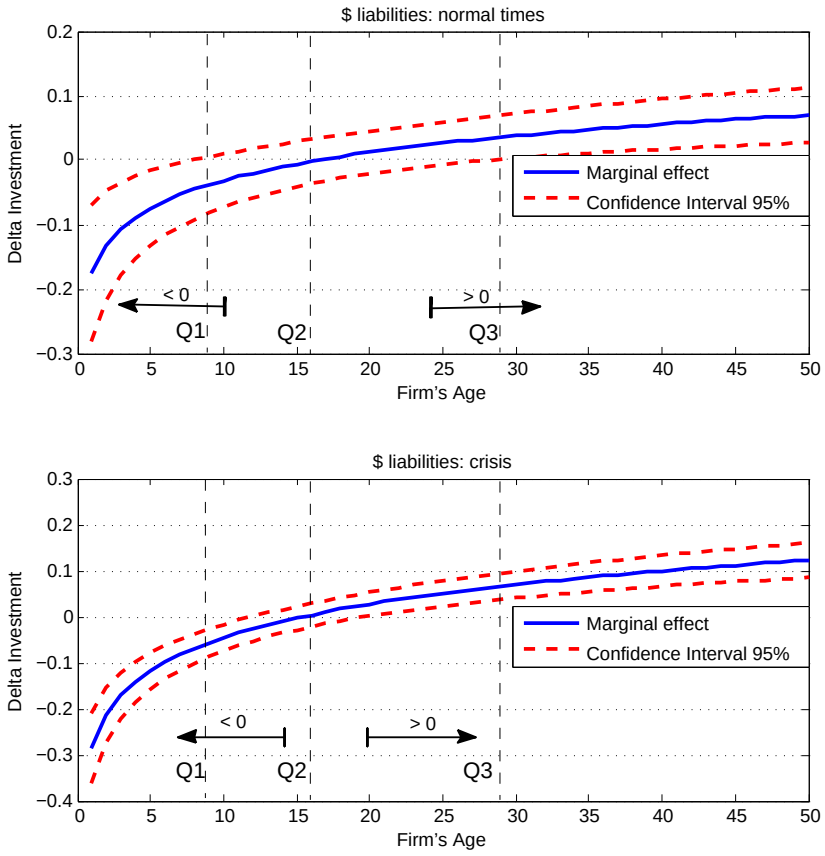

Figure 3: Flight to quality across firm age: marginal effects of $-liabilities.

Marginal effect of a unitary increase in bank exposure on the investment rate of client firms. The coefficient varies across different levels of firm age. The top and bottom plots report, respectively, the marginal effects for pre-crisis and crisis times. The black arrows highlight the regions of significance of the specific coefficient. Q1, Q2 and Q3 represent the 1^{st}, 2^{nd} and 3^{rd} quartiles of the firms' age distribution in the sample. Both investment and *Expo* are expressed in units of standard deviations. *Expo=Expo(Tot. liab.)*.

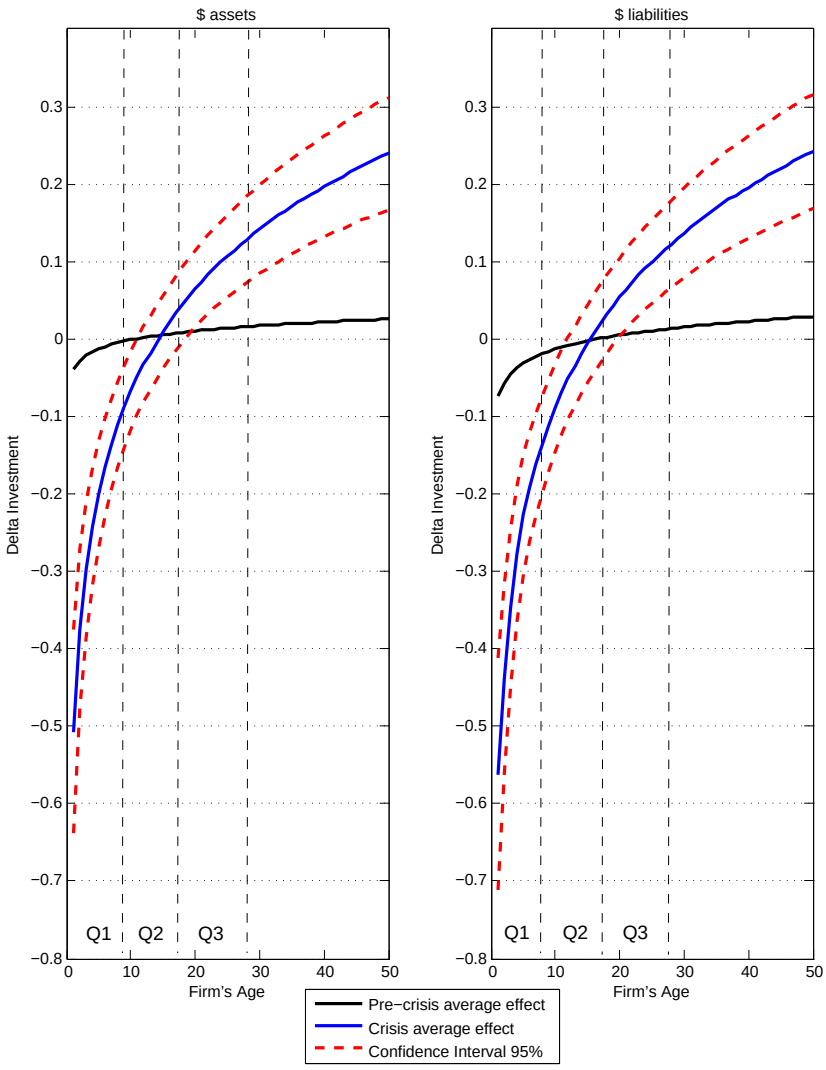

Figure 4: Flight to quality across firm age: average effects.

Average effect of bank exposure on investment as a function of firm's age. The left and right plots are associated, respectively, to *Expo(Tot. assets)* and *Expo(Tot. liab.)*. The black lines show the effect in the pre-crisis period, the blue lines report the coefficients in times of crisis, and the dotted red lines their 95% confidence interval. Q1, Q2 and Q3 represent the 1^{st}, 2^{nd} and 3^{rd} quartiles of the firms' age distribution in the sample. All variables are expressed in units of standard deviations.

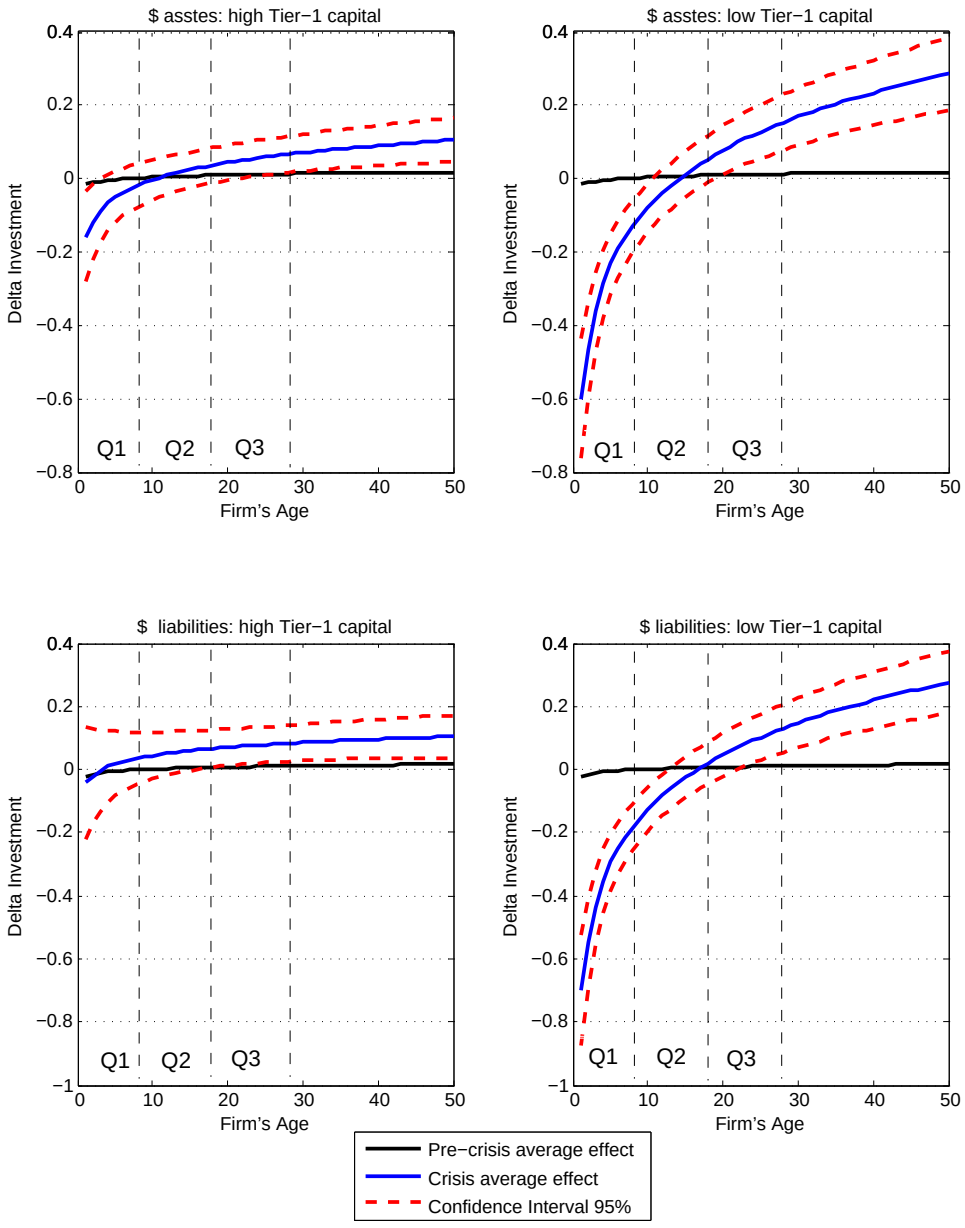

Figure 5: Flight to quality across firm age: average effects by bank capitalization.

Average effect of bank exposure on firm investment as a function of firm age and bank capitalization. The left and right plots are associated, respectively, to high and low levels of bank capitalization as defined in "Appendix: variable definitions". Top plots are associated to variations in *Expo(Tot. assets)* while the bottom plots show the effect of changes in *Expo(Tot. liab.)*. The black lines show the effect in the pre-crisis period, the blue lines report the coefficients in times of crisis, and the dotted red lines their 95% confidence interval. Q1, Q2 and Q3 represent the 1^{st}, 2^{nd} and 3^{rd} quartiles of the firms' age distribution in the sample. All variables are expressed in units of standard deviations.

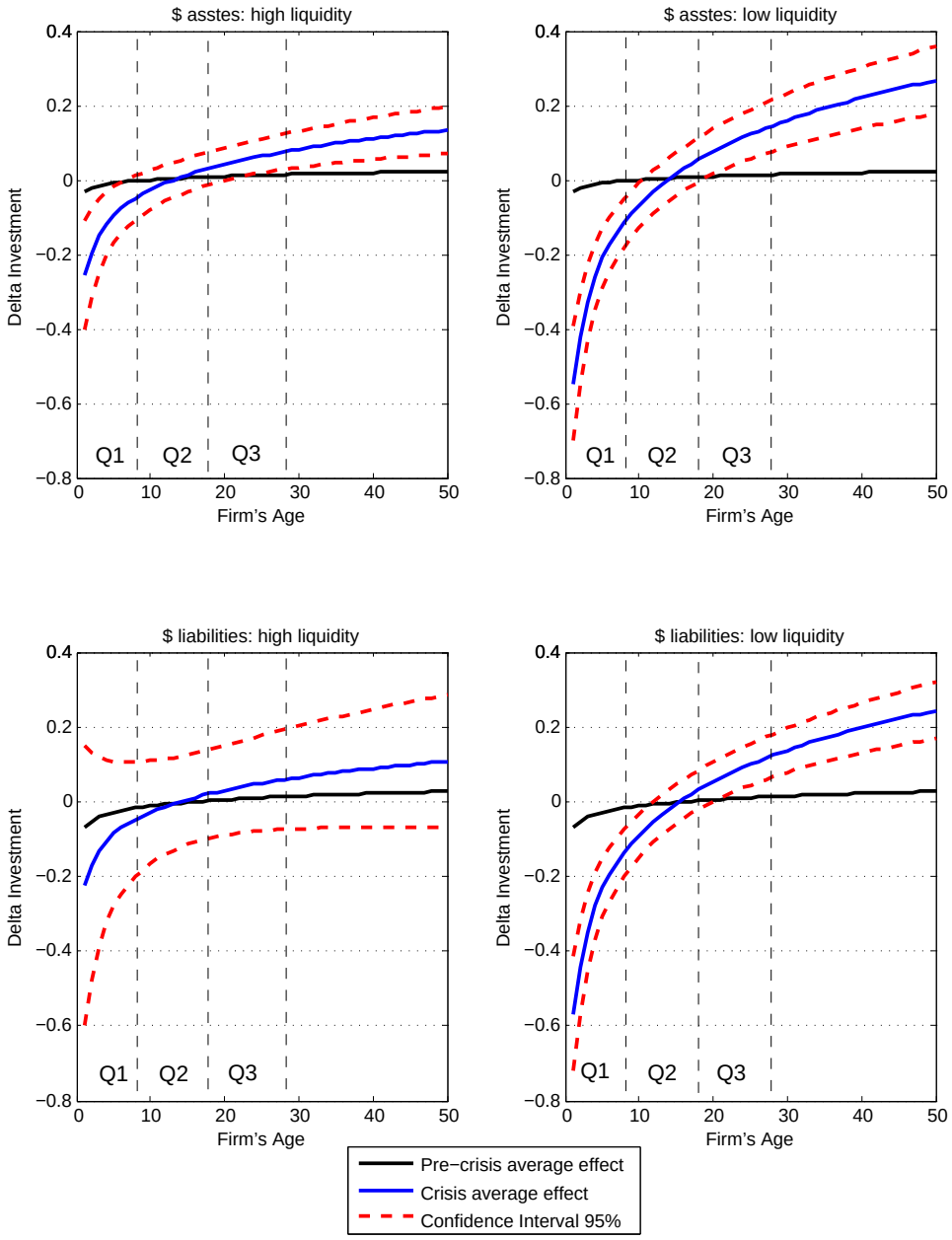

Figure 6: Flight to quality across firm age: average effects by bank liquidity.

Average effect of bank exposure on firm investment as a function of firm age and bank liquidity. The left and right plots are associated, respectively, to high and low levels of bank liquidity as defined in "Appendix: variable definitions". Top plots are associated to variations in *Expo(Tot. assets)* while the bottom plots show the effect of changes in *Expo(Tot. liab.)*. The black lines show the effect in the pre-crisis period, the blue lines report the coefficients in times of crisis, and the dotted red lines their 95% confidence interval. Q1, Q2 and Q3 represent the 1^{st}, 2^{nd} and 3^{rd} quartiles of the firms' age distribution in the sample. All variables are expressed in units of standard deviations.

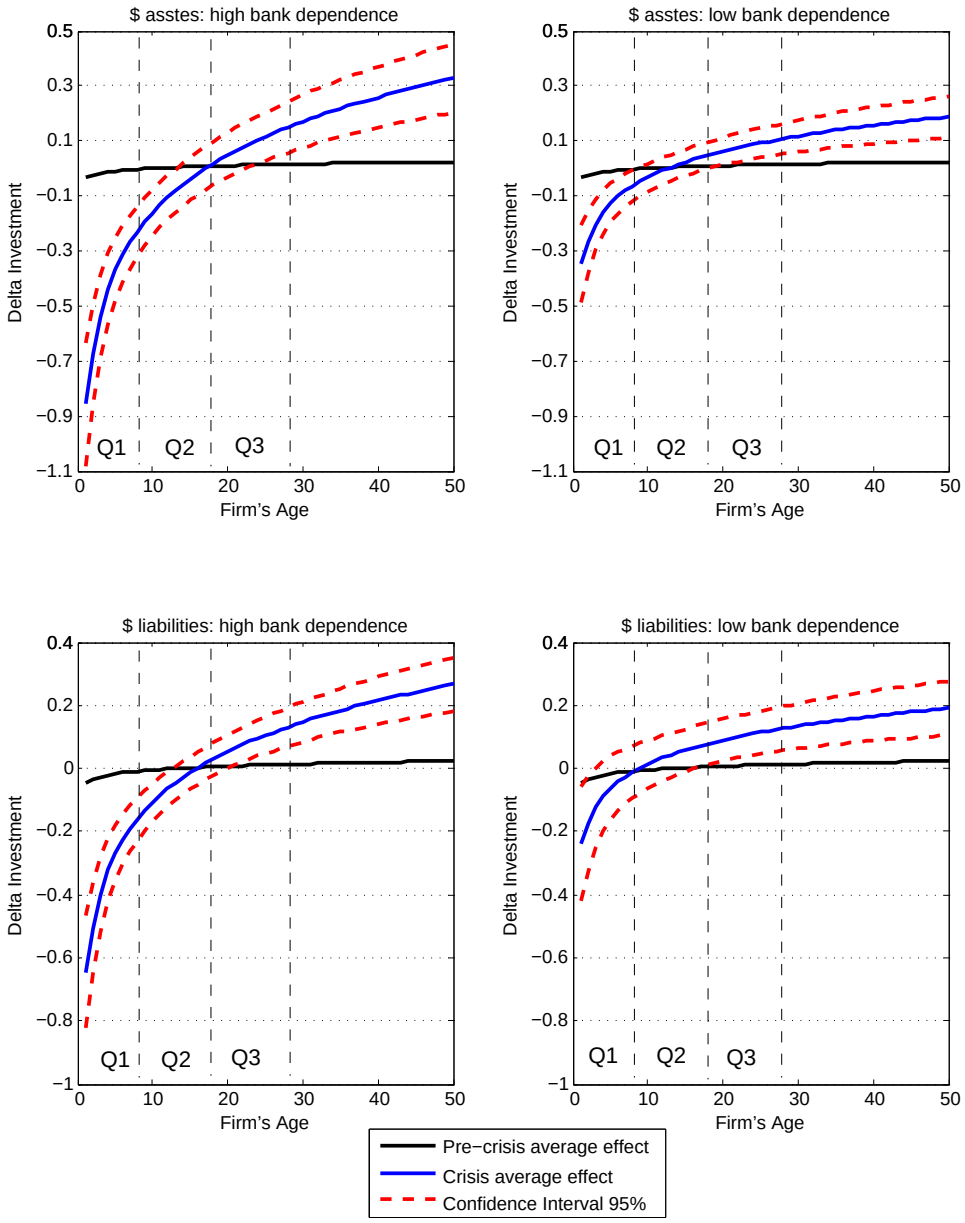

Figure 7: Flight to quality across firm age: average effects by bank interbank dependence.
Average effect of bank exposure on firm investment as a function of firm age and bank interbank dependence. The left and right plots are associated, respectively, to high and low levels of bank interbank dependence as defined in "Appendix: variable definitions". Top plots are associated to variations in *Expo(Tot. assets)* while the bottom plots show the effect of changes in *Expo(Tot. liab.)*. The black lines show the effect in the pre-crisis period, the blue lines report the coefficients in times of crisis, and the dotted red lines their 95% confidence interval. Q1, Q2 and Q3 represent the 1^{st}, 2^{nd} and 3^{rd} quartiles of the firms' age distribution in the sample. All variables are expressed in units of standard deviations.

Additional tables: size interaction

Table 21: Firms' investment and banks' exposures to the US financial crisis (size interaction). Controlling for bank balance sheet variables.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.649***	-0.548***	-0.725***	-0.753***	-0.743***	-0.749***
	[0.148]	[0.141]	[0.138]	[0.139]	[0.145]	[0.138]
Expo($-item) × Size	0.0697***	0.0589***	0.0735***	0.0775***	0.0774***	0.0760***
	[0.0155]	[0.0152]	[0.0130]	[0.0135]	[0.0141]	[0.0132]
Capitalization	-0.0816	-0.0750	-0.0609	-0.0615	-0.0523	-0.0587
	[0.0752]	[0.0697]	[0.0486]	[0.0487]	[0.0506]	[0.0482]
Capitalization × Size	0.00186	0.000449	0.000704	0.000720	-0.000831	0.000705
	[0.00908]	[0.00867]	[0.00624]	[0.00626]	[0.00637]	[0.00625]
Liquidity	-0.0590	-0.0712	-0.0372	-0.0308	-0.0316	-0.0346
	[0.0449]	[0.0491]	[0.0345]	[0.0338]	[0.0338]	[0.0340]
Liquidity × Size	0.00170	0.00258	0.00142	0.00113	0.000960	0.00148
	[0.00286]	[0.00333]	[0.00259]	[0.00264]	[0.00262]	[0.00262]
ROE	0.0324	0.0178	0.289	0.282	0.280	0.293
	[0.388]	[0.384]	[0.377]	[0.383]	[0.387]	[0.378]
ROE × Size	-0.00593	-0.00451	-0.0303	-0.0282	-0.0274	-0.0304
	[0.0412]	[0.0406]	[0.0404]	[0.0409]	[0.0412]	[0.0405]
Interbank dependence	-0.105	-0.100	-0.000926	-0.00505	-0.0131	0.000757
	[0.0648]	[0.0726]	[0.0531]	[0.0528]	[0.0528]	[0.0534]
Interbank dependence × Size	-0.00130	-0.00307	-0.00195	-0.00393	-0.00691	-0.00222
	[0.00795]	[0.00847]	[0.00724]	[0.00666]	[0.00607]	[0.00725]
Output	0.115***	0.114***	0.125***	0.125***	0.125***	0.125***
	[0.0359]	[0.0360]	[0.0405]	[0.0405]	[0.0405]	[0.0405]
Cash flow	0.180***	0.181***	0.173***	0.173***	0.173***	0.172***
	[0.0480]	[0.0479]	[0.0405]	[0.0404]	[0.0404]	[0.0405]
Size	-0.125	-0.112	0.0597	0.0434	0.0314	0.0609
	[0.300]	[0.299]	[0.310]	[0.310]	[0.312]	[0.308]
Constant	1.946	1.870	-0.109	0.00245	0.142	-0.154
	[2.920]	[2.964]	[2.944]	[2.953]	[2.972]	[2.928]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	16138	16138	13395	13374	13395	13395
# firms	4346	4346	3627	3621	3627	3627
Hansen p-value	0.297	0.315	0.264	0.222	0.239	0.275
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.745	0.746	0.780	0.759	0.751	0.771

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 22: Firms' investment and banks' exposures to the US financial crisis (size interaction). Heterogeneous effects for less capitalized banks.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.357***	-0.249*	-0.415***	-0.468***	-0.428***	-0.449***
	[0.132]	[0.134]	[0.127]	[0.127]	[0.130]	[0.128]
Expo($-item) × Size	0.0425***	0.0319**	0.0471***	0.0520***	0.0500***	0.0499***
	[0.0135]	[0.0136]	[0.0129]	[0.0128]	[0.0130]	[0.0129]
Expo($-item) × Crisis × High tier–1 K	0.235*	0.207	0.231	0.254*	0.259*	0.227
	[0.135]	[0.134]	[0.145]	[0.147]	[0.139]	[0.148]
Expo($-item) × Size × Crisis × High tier–1 K	-0.0273**	-0.0249*	-0.0236	-0.0256*	-0.0263*	-0.0231
	[0.0138]	[0.0137]	[0.0146]	[0.0148]	[0.0139]	[0.0150]
Expo($-item) × Crisis × Low tier–1 K	-0.578***	-0.628***	-0.586***	-0.558***	-0.549***	-0.566***
	[0.154]	[0.160]	[0.147]	[0.148]	[0.145]	[0.148]
Expo($-item) × Size × Crisis × Low tier–1 K	0.0593***	0.0646***	0.0579***	0.0564***	0.0539***	0.0560***
	[0.0159]	[0.0165]	[0.0150]	[0.0150]	[0.0146]	[0.0152]
Output	0.145**	0.147**	0.137**	0.154**	0.137**	0.136**
	[0.0638]	[0.0642]	[0.0640]	[0.0650]	[0.0643]	[0.0637]
Cash flow	0.143***	0.142***	0.123**	0.115**	0.125**	0.123**
	[0.0542]	[0.0541]	[0.0565]	[0.0540]	[0.0565]	[0.0564]
Size	-0.155***	-0.145***	-0.167***	-0.169***	-0.175***	-0.168***
	[0.0148]	[0.0145]	[0.0166]	[0.0164]	[0.0173]	[0.0164]
Constant	1.445***	1.340***	1.585***	1.609***	1.630***	1.602***
	[0.151]	[0.148]	[0.170]	[0.168]	[0.177]	[0.168]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25476	25476	20832	20578	20832	20832
# firms	4880	4880	4002	3955	4002	4002
Hansen p-value	0.155	0.149	0.310	0.257	0.304	0.318
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.601	0.596	0.259	0.298	0.275	0.257

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High tier1 K* and *Low tier1 K* are dummy variables identifying banks with high and low levels of capitalization. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 23: Firms' investment and banks' exposures to the US financial crisis (size interaction). Heterogeneous effects for less liquid banks.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.522***	-0.404***	-0.606***	-0.670***	-0.634***	-0.644***
	[0.135]	[0.136]	[0.133]	[0.134]	[0.136]	[0.135]
Expo($-item) × Size	0.0598***	0.0482***	0.0660***	0.0725***	0.0707***	0.0694***
	[0.0139]	[0.0139]	[0.0135]	[0.0136]	[0.0137]	[0.0137]
Expo($-item) × Crisis × High liquidity	0.349**	0.255*	-0.00506	0.866***	0.654***	0.971***
	[0.154]	[0.150]	[0.129]	[0.292]	[0.223]	[0.342]
Expo($-item) × Size × Crisis × High liquidity	-0.0395**	-0.0299*	-0.00126	-0.0924***	-0.0701***	-0.104***
	[0.0158]	[0.0153]	[0.0130]	[0.0302]	[0.0231]	[0.0351]
Expo($-item) × Crisis × Low liquidity	-0.316**	-0.367**	-0.566***	-0.161	-0.160	-0.172
	[0.139]	[0.144]	[0.194]	[0.130]	[0.128]	[0.131]
Expo($-item) × Size × Crisis × Low liquidity	0.0319**	0.0373**	0.0595***	0.0164	0.0156	0.0168
	[0.0143]	[0.0148]	[0.0201]	[0.0131]	[0.0128]	[0.0132]
Output	0.145**	0.146**	0.140**	0.157**	0.139**	0.139**
	[0.0634]	[0.0639]	[0.0633]	[0.0644]	[0.0635]	[0.0632]
Cash flow	0.143***	0.143***	0.122**	0.116**	0.127**	0.124**
	[0.0541]	[0.0541]	[0.0561]	[0.0538]	[0.0563]	[0.0559]
Size	-0.170***	-0.160***	-0.183***	-0.183***	-0.192***	-0.180***
	[0.0151]	[0.0149]	[0.0169]	[0.0170]	[0.0178]	[0.0169]
Constant	1.594***	1.484***	1.748***	1.754***	1.802***	1.735***
	[0.154]	[0.151]	[0.172]	[0.173]	[0.181]	[0.172]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25476	25476	20832	20578	20832	20832
# firms	4880	4880	4002	3955	4002	4002
Hansen p-value	0.162	0.152	0.332	0.273	0.325	0.336
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.659	0.672	0.308	0.327	0.307	0.286

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High liquidity* and *Low liquidity* are dummy variables identifying banks with high and low liquidity. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 24: Firms' investment and banks' exposures to the US financial crisis (size interaction). Heterogeneous effects for banks that are more dependent on interbank financing.

Dependent variable: investment rate						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	-0.550***	-0.503***	-0.479***	-0.553***	-0.532***	-0.513***
	[0.138]	[0.140]	[0.128]	[0.128]	[0.132]	[0.128]
Expo($-item) × Size	0.0629***	0.0588***	0.0535***	0.0607***	0.0605***	0.0563***
	[0.0141]	[0.0144]	[0.0129]	[0.0129]	[0.0133]	[0.0129]
Expo($-item) × Crisis × Low dependence	0.130	0.101	0.221	0.221	0.211	0.217
	[0.131]	[0.131]	[0.153]	[0.155]	[0.143]	[0.158]
Expo($-item) × Size × Crisis × Low dependence	-0.0159	-0.0135	-0.0221	-0.0216	-0.0208	-0.0221
	[0.0135]	[0.0134]	[0.0155]	[0.0157]	[0.0144]	[0.0160]
Expo($-item) × Crisis × High dependence	-0.855***	-1.142***	-0.459***	-0.413***	-0.429***	-0.436***
	[0.187]	[0.223]	[0.143]	[0.143]	[0.144]	[0.143]
Expo($-item) × Size × Crisis × High dependence	0.0858***	0.115***	0.0463***	0.0422***	0.0431***	0.0439***
	[0.0192]	[0.0227]	[0.0145]	[0.0145]	[0.0144]	[0.0146]
Output	0.147**	0.147**	0.139**	0.156**	0.138**	0.138**
	[0.0631]	[0.0634]	[0.0634]	[0.0642]	[0.0633]	[0.0632]
Cash flow	0.141***	0.141***	0.121**	0.113**	0.123**	0.121**
	[0.0539]	[0.0539]	[0.0559]	[0.0535]	[0.0560]	[0.0559]
Size	-0.174***	-0.172***	-0.169***	-0.173***	-0.182***	-0.169***
	[0.0153]	[0.0152]	[0.0168]	[0.0166]	[0.0176]	[0.0165]
Constant	1.627***	1.593***	1.607***	1.653***	1.700***	1.625***
	[0.155]	[0.154]	[0.172]	[0.170]	[0.180]	[0.169]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	25476	25476	20832	20578	20832	20832
# firms	4880	4880	4002	3955	4002	4002
Hansen p-value	0.164	0.158	0.309	0.260	0.307	0.317
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.636	0.628	0.287	0.330	0.306	0.284

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $CDS_{W\_USA,it}$ for columns 1 and 3, $CDS_{B\_USA,t}$ for columns 2 and 5, and $CDS_{C\_USA,t}$ for columns 3 and 6. *High dependence* and *Low dependence* are dummy variables identifying banks with high and low dependence upon the interbank market. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 25: Firms' investment and banks' potential losses on $-denominated assets (size interaction).

Dependent variable: investment rate			
	(1)	(2)	(3)
$-item:	Tot. assets	Bank credit	Cust. credit
$-item$_{t-1}$ × ΔCDS$_t$	0.366	0.347	0.139
	[0.250]	[0.230]	[0.212]
$-item$_{t-1}$ × ΔCDS$_t$ × Size	-0.0402	-0.0355	-0.0148
	[0.0254]	[0.0235]	[0.0212]
$-item$_{t-1}$ × ΔCDS$_t$ × Crisis	-0.827***	-0.876***	-0.941***
	[0.272]	[0.251]	[0.235]
$-item$_{t-1}$ × ΔCDS$_t$ × Size × Crisis	0.0922***	0.0953***	0.101***
	[0.0278]	[0.0259]	[0.0235]
Output	0.127*	0.127*	0.107*
	[0.0650]	[0.0650]	[0.0635]
Cash flow	0.169***	0.169***	0.148***
	[0.0553]	[0.0554]	[0.0556]
Size	-0.109***	-0.112***	-0.121***
	[0.0114]	[0.0115]	[0.0117]
Constant	1.093***	1.111***	1.208***
	[0.122]	[0.122]	[0.124]
Fixed effects			
Time	yes	yes	yes
Firm	yes	yes	yes
# obs.	25872	25872	22402
# firms	5080	5080	4791
Hansen p-value	0.245	0.238	0.255
AR(1) p-value	0.000	0.000	0.000
AR(2) p-value	0.316	0.335	0.211

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. The product between the variation in the CDS spread (within the year) and the beginning-of-period $-item, is a proxy for the expected losses on the specific $-denominated assets (with marking to market). All measures are defined in "Appendix: variable definitions". Set of instruments: Output, Cash flow and Age are lagged twice or more. Instead of considering lagged values of $-item$_{t-1}$ × ΔCDS$_t$, the instrumenting matrix is enriched with *Expo* (and its interactions) as external instrument. *Expo* varies across specifications. It is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for column 1, CDS$_{B_USA,t}$ for column 2, and CDS$_{C_USA,t}$ for column 3. Also *Expo* is lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 26: Firms' investment and instability of $-denominated liabilities (size interaction).

Dependent variable: investment rate			
	(1)	(2)	(3)
$-item:	Tot. liab.	Bank dep.	Cust. dep.
Δ\$-item$_t$	0.0231	0.000979	-0.0214
	[0.173]	[0.0863]	[0.0897]
Δ\$-item$_t$ × Size	-0.000292	0.000962	0.00330
	[0.0179]	[0.00894]	[0.00929]
Δ\$-item$_t$ × Crisis	2.782***	2.013***	2.512***
	[0.587]	[0.326]	[0.439]
Δ\$-item$_t$ × Size × Crisis	-0.290***	-0.221***	-0.263***
	[0.0617]	[0.0334]	[0.0455]
Output	0.125*	0.113	0.115*
	[0.0660]	[0.0687]	[0.0688]
Cash flow	0.117*	0.118*	0.121*
	[0.0623]	[0.0638]	[0.0640]
Size	-0.110***	-0.133***	-0.107***
	[0.0124]	[0.0130]	[0.0122]
Constant	1.107***	1.320***	1.080***
	[0.131]	[0.136]	[0.130]
Fixed effects			
Time	yes	yes	yes
Firm	yes	yes	yes
# obs.	21871	21979	21979
# firms	4695	4730	4730
Hansen p-value	0.174	0.138	0.157
AR(1) p-value	0.000	0.000	0.000
AR(2) p-value	0.326	0.399	0.301

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. Δ\$-item$_t$ is the variation of \$-denominated liabilities within the year. The type of \$-liability varies across columns and is listed in the top row.. All measures are defined in "Appendix: variable definitions". Set of instruments: Output, Cash flow and Age are lagged twice or more. Instead of considering lagged values of \$-item$_{t-1}$ × ΔCDS$_t$, the instrumenting matrix is enriched with *Expo* (and its interactions) as external instrument. *Expo* varies across specifications. It is consistently defined as in equation 1 and both \$-item and CDS(USA)$_t$ are column-specific. \$-items are listed in the top row, while the CDS spread is: CDS$_{W_USA,it}$ for column 1, CDS$_{B_USA,t}$ for column 2, and CDS$_{C_USA,t}$ for column 3. Also *Expo* is lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 27: Firms' investment and banks' exposures to the US financial crisis (size interaction). Asset vs. liability measures.

Dependent variable: investment rate			
	(1)	(2)	(3)
Class:	Total	Bank	Customers
Expo($-asset(class))	-0.346***	-0.247*	-1.054
	[0.134]	[0.128]	[0.799]
Expo($-asset(class)) × Size	0.0421***	0.0277**	0.121
	[0.0139]	[0.0134]	[0.0824]
Expo($-liability(class))	-0.553***	-0.617***	-0.342
	[0.114]	[0.112]	[0.727]
Expo($-liability(class)) × Size	0.0596***	0.0647***	0.0279
	[0.0119]	[0.0116]	[0.0747]
Output	0.165**	0.268***	0.167***
	[0.0698]	[0.0661]	[0.0588]
Cash flow	0.0815	0.157***	0.173***
	[0.0616]	[0.0493]	[0.0666]
Size	-0.213***	-0.194***	-0.373***
	[0.0185]	[0.0183]	[0.0606]
Constant	1.958***	1.863***	3.533***
	[0.186]	[0.184]	[0.588]
Fixed effects			
Time	yes	yes	yes
Firm	yes	yes	yes
# obs.	20578	20832	20773
# firms	3955	4002	3989
Hansen p-value	0.233	0.114	0.249
AR(1) p-value	0.000	0.000	0.000
AR(2) p-value	0.448	0.499	0.363

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. Each column compares asset and liability measures within each class of $-item (listed in the top row). Column 1, compares *Expo(Tot. assets)* and *Expo(Tot. liab.)*, Column 2 *Expo(Bank credit)* and *Expo(Bank dep.)*, Column 3 *Expo(Cust. credit)* and *Expo(Cust. dep.)*. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 28: Firms' investment and banks' exposures to the US financial crisis (size interaction). Total, bank and customer exposures.

Dependent variable: investment rate		
	(1)	(2)
Side:	Assets	Liabilities
Expo(Total)	4.583	0.0192
	[3.742]	[0.0184]
Expo(Total) × Size	-0.485	0.000604
	[0.393]	[0.00688]
Expo(Bank)	-5.803*	-1.493***
	[3.335]	[0.452]
Expo(Bank) × Size	0.620*	0.167***
	[0.350]	[0.0470]
Expo(Customer)	-2.524***	0.0632
	[0.895]	[0.355]
Expo(Customer) × Size	0.268***	-0.0149
	[0.0932]	[0.0379]
Output	0.134*	0.182***
	[0.0687]	[0.0488]
Cash flow	0.121**	0.148***
	[0.0597]	[0.0447]
Size	-0.599***	-0.385***
	[0.0605]	[0.0585]
Constant	5.599***	3.614***
	[0.585]	[0.566]
Fixed effects		
Time	yes	yes
Firm	yes	yes
# obs.	20773	20147
# firms	3989	3924
Hansen p-value	0.346	0.140
AR(1) p-value	0.000	0.000
AR(2) p-value	0.216	0.447

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the ratio between firm gross investment at time t and the stock of capital in $t-1$. Each column compares all the type of measures within each side of bank balance sheet (asset or liability). Column 1 compares *Expo(Tot. assets)*, *Expo(Bank credit)*, and *Expo(Cust. credit)*. Column 2 compares *Expo(Tot. liab.)*, *Expo(Bank dep.)*, and *Expo(Cust. dep.)*. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 29: Firms' bank-debt growth and banks' exposures to US financial crisis (size interaction).

Dependent Variable: bank debt growth						
	(1)	(2)	(3)	(4)	(5)	(6)
$-item:	Tot. assets	Bank credit	Cust. credit	Tot. liab.	Bank dep.	Cust. dep.
Expo($-item)	0.126	0.0351	-0.0290	0.0551	-0.0759	-0.0392
	[0.177]	[0.187]	[0.332]	[0.320]	[0.329]	[0.328]
Expo($-item) × Size	-0.0121	-0.00383	0.00220	-0.00584	0.00678	0.00325
	[0.0167]	[0.0176]	[0.0310]	[0.0298]	[0.0307]	[0.0306]
Expo($-item) × Crisis	-0.321**	-0.278**	-0.814***	-0.776***	-0.764***	-0.770***
	[0.131]	[0.131]	[0.279]	[0.278]	[0.262]	[0.271]
Expo($-item) × Size × Crisis	0.0348***	0.0319**	0.0733***	0.0697***	0.0712***	0.0703***
	[0.0124]	[0.0126]	[0.0253]	[0.0252]	[0.0236]	[0.0244]
Output / TA	0.0587***	0.0583***	0.0287	0.0445**	0.0284	0.0286
	[0.0223]	[0.0222]	[0.0237]	[0.0218]	[0.0238]	[0.0237]
Cash flow / TA	0.0400	0.0409	0.0715**	0.0480	0.0722**	0.0716**
	[0.0275]	[0.0274]	[0.0343]	[0.0308]	[0.0343]	[0.0343]
Size	-0.0662**	-0.0755**	-0.0826***	-0.0753***	-0.0899***	-0.0840***
	[0.0283]	[0.0314]	[0.0289]	[0.0279]	[0.0317]	[0.0299]
Constant	0.782***	0.885***	0.954***	0.876***	1.030***	0.969***
	[0.303]	[0.336]	[0.313]	[0.303]	[0.344]	[0.324]
Fixed effects						
Time	yes	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes	yes
# obs.	13154	13154	11268	11153	11268	11268
# firms	2799	2799	2396	2368	2396	2396
Hansen p-value	0.579	0.596	0.602	0.579	0.594	0.599
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.269	0.235	0.180	0.221	0.176	0.178

Notes: Two-step system-GMM with time and firm-specific fixed effects. The dependent variable is the firms' bank debt growth between time t and $t-1$. The exposure of the lender-bank to the US economy varies across specifications. *Expo* is consistently defined as in equation 1 and both $-item and CDS(USA)$_t$ are column-specific. $-items are listed in the top row, while the CDS spread is: $\text{CDS}_{W\_USA,it}$ for columns 1 and 3, $\text{CDS}_{B\_USA,t}$ for columns 2 and 5, and $\text{CDS}_{C\_USA,t}$ for columns 3 and 6. All measures are defined in "Appendix: variable definitions". Set of instruments: all variables are lagged twice or more.
Robust standard errors in brakets (Windmeijer correction). ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.