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SOVEREIGN DEBT EXPOSURE AND THE BANK LENDING CHANNEL: IMPACT ON CREDIT SUPPLY AND THE REAL ECONOMY

by Margherita Bottero*, Simone Lenzu** and Filippo Mezzanotti***

Abstract

We study the impact of sovereign market tensions on the real economy through the bank lending channel. Using a large matched bank-firm panel data set that tracks credit relations in Italy over the period 2009-2011, we show that the Greek bailout in the spring of 2010 had a negative impact on the riskiness of government securities held in the portfolio of financial intermediaries, which in turn led to a tightening in credit supply to firms. Firms, especially riskier ones, were unable to smooth out the credit shortage. We estimate that the shock to sovereign bonds led, via the lending channel, to a drop in aggregate bank lending to corporations of almost 2 per cent over the subsequent year, which translated into a reduction in investment by smaller firms.

JEL Classification: E51, G21.
Keywords: sovereign debt, bank lending channel, lending supply, real effects, firm investment.

Contents

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1 Introduction

Financial intermediaries play a fundamental role in fostering growth (Schumpeter 1934; King and Levine 1993), by lending to firms and households and reallocating capital to the highest value use. But loans are not the only assets held in banks' portfolio: a large fraction of it is composed by securities, real properties, and equity holdings. While there are complementarities between the different type of investments, swings in the prices and riskiness of some assets, arising from unexpected financial tensions, may lead banks to adjust their credit supply, with potential adverse effects on the real economy.

When in December 2009 Greece acknowledged fiscal misreporting and, a few months later, requested a bailout, investors' sensitivity to the macroeconomic fundamentals of a number of other European countries suddenly increased, with the effect, among the others, to pushing upwards the expected risk profile of government securities ("wake-up call contagion"; Goldstein 1998, Giordano et al. 2013).[1] This shock had a direct negative effect on the balance sheet of banks holding these assets, in particular following the increase in government bond yields and the widening of the spread with the German Bund. This paper looks at the case of Italy to investigate how the stress that affected sovereign markets in 2010 altered the credit supply of financial intermediaries via their exposure to government securities, and what have been the consequences for firms' investments.

The key event for our study is the bailout request advanced by Greece in April 2010, as it can be considered the first, unprecedented and unanticipated episode that challenged the notion of riskless sovereign securities in the euro area since the adoption of the single currency. In the case of Italy, this initial change in sovereign risk perception was exogenous to the country's structural and cyclical position, and was transmitted to the intermediaries to the extent that they were exposed to the risk of losses on such assets, namely depending on their sovereign bonds' portfolio. Subsequently, the crisis progressively extended from Greece to other euro-area countries with structural weaknesses and in the summer of 2011, after the announcement of the involvement of private-sector investors in the restructuring of the Greek public debt, it became systemic, spreading to Italy and Spain. Italy suffered because of its high public debt and the loss of competitiveness and growth capability.[2] As the situation escalated, country risk became the key factor underlying banks'

[1] The literature distinguishes between three types of international transmission of area-specific shocks: "wake-up call contagion", "pure contagion", and "shift contagion". See Pericoli and Sbracia (2003) for a review. Giordano et al. 2013 show that the Greek crisis was a wake-up call for investors who largely ignored macroeconomic fundamental for peripheral EMU countries before the end of 2009. By contrast they find no evidence of other forms of contagion.

[2] See also "The exit from the sovereign debt crisis: national policies, European reforms and monetary policy", Ignazio Visco, Governor of the Bank of Italy, Almo Collegio Borromeo - Pavia Lectio magistralis; http://www.bancaditalia.it/pubblicazioni/interventi-governatore/integov2014/Visco-Pavia250314_en.pdf?language_id=1

financial distress, as their creditworthiness was considered the same as that of the respective government.

We exploit a novel matched firm-bank panel data to provide empirical evidence that banks reduced lending to offset the increase in their balance sheets' overall riskiness, brought about by the 2010 financial turbulence. Then, we document the extent to which firms' investment policies were hampered by such contraction. The present paper extends to the case of sovereign bonds the bank lending channel literature, which documents the transmission of shocks to the risk of banks' balance sheet to credit supply (Bernanke and Gertler 1989; Gan 2007a; Khwaja and Mian 2008; Chodorow-Reich 2014; Jiménez et al. 2014). Further, it sheds more light on the link between credit restrictions and the real economy, which is instead less settled.[3]

Our data include all Italian financial intermediaries and a large, representative sample of firms borrowing from them (315,864 firms) between 2009:Q2 and 2011:Q1, for a total of over 500 thousand bank-firm credit relationships.[4] To isolate the impact of the tensions in sovereign markets on credit supply, and then on real outcomes, we compare the credit supplied in the four quarters *before* April 2010 (Greek bailout request, 2009:Q2 to 2010:Q1) to that in the four quarter *after* it (2010:Q2 to 2011:Q1), across banks differentially exposed to sovereign securities.

The choice of the estimation window reflects three considerations. First, the Greek events fundamentally and unexpectedly affected the notion of risk for sovereign assets, even for countries otherwise considered sound. As argued by Giordano et al. (2013), the sequence of events which culminated into Greece's request for a bailout was a "wake up call" for investors that prompted them to discriminate among sovereigns based on the quality of their fundamentals, which were until then largely ignored in the pricing. This change in attitude resulted in an increase in sovereign spreads vis-a-vis the German Bund and in the volatility of these securities. As we discuss in Section (2), this narrative is in line with a large body of evidence (Augustin et al. (2014); Acharya and Steffen (2013); Abbassi et al. (2014)), which finds that the Greek bailout represented a shock to sovereign bonds' risk. Second, our estimation window allows us to tackle endogeneity concerns related to banks' portfolio adjustments. Once the tensions grew, intermediaries (endogenously) reacted to them and adjusted their exposure to government securities as the situation began to deteriorate (Acharya et al. 2011). Finally, our event window permit us to exclude the effects of the unconventional measures adopted by the ECB to counteract the dysfunctions in the sovereign markets that directly involved Italian government bonds or in any case took place after the crisis started to hit Italy severely, and to safeguard the functioning of the monetary policy transmission mechanism. Most likely, in fact, these actions have

[3]With some exceptions (Cingano et al. 2014; Greenstone et al. 2014), most of the available empirical evidence is concentrated on a subset of larger banks and larger firms (Chodorow-Reich 2014), making it hard to draw precise conclusions on how a tightening in credit supply may differentially affect firms with heterogeneous sensitivity to bank credit. This last issue is considered by Gaiotti (2013).

[4]In our database, one observation corresponds to the difference between the average log credit granted by bank b to firm j during the period 2010:Q2-2011:Q1 and the average log credit granted by the same bank to the same firm during the period 2009:Q1-2010:Q1. This results in a total of almost 5 million observations in the quarterly firm-bank panel data set.

attenuated the impact of the shock under study. In particular, we stop our analysis before August 2011 when the ECB reactivated its Securities Markets Programme, operated through outright secondary market purchases of government bonds and initially targeted to Greece, Ireland and Portugal, and extended it to Italian and Spanish government securities.[5]

Having taken these considerations into account, we construct a bank-level proxy of the exposure of each financial institution to the sovereign shock exploiting the heterogeneity in banks' holdings of Italian sovereigns *before* the Greek bailout. We argue that, in the pre-bailout period, sovereign holdings are a function of a set of bank-specific characteristics and asset management strategies, and are orthogonal to the post-bailout events. Finally, we take advantage of the widespread presence of firms that established simultaneous lending relationships with different financial institutions (Gan 2007b; Khwaja and Mian 2008) to control for changes in observable and unobservable firm's characteristics, such as credit demand and creditworthiness, which may impact credit dynamics irrespective of the credit supply. In practice, we run a within-firm difference-in-difference regression which compares changes in the credit supply to the same borrower from lenders that differed in their relative pre-bailout exposure to Italian government debt.

In line with the findings of the literature on the bank lending channel, we document that the negative shock to the sovereign bond market had a negative, causal effect on lending. When we compare lending to the same firm by two banks which are one standard deviation (0.36) apart in terms of pre-shock sovereign exposure, we find that the more exposed financial intermediary diminished credit supply about 7% more relative to the other. Not only banks more exposed to the shock reduced lending more intensely, but they were also 2% more likely to terminate an existing credit relationship. Results are robust to alternative measures of sovereign exposure, potential confounding factors, econometric assumptions on the variance-covariance structure of the errors, and are not driven by non-parallel trends in lending growth before the shock. Furthermore, we show, using a placebo test, that this effect cannot be replicated during normal times, that is, in the absence of shocks to the risk of sovereigns. We also exclude any systematic sorting of firms experiencing high negative demand-side shocks with banks (ex ante) more exposed to sovereigns.

Taken together, these results confirm that the deterioration in the perception of sovereign bonds' riskiness triggered by the Greek events activated the bank lending channel and led the intermediaries more exposed to the shock to reduce credit supply, in an effort to curb the overall risk in the balance sheet. Interestingly, banks did not respond to the shock by substituting the riskier Italian securities with safer bonds, such as German

[5]The program was first announced in May 2010, and then reactivated in August 2011 (see the press releases "ECB decides on measures to address severe tensions in financial markets", of 10 May 2010, and "Statement by the President of the ECB" of 7 August 2011; https://www.ecb.europa.eu/press/pr/date/2010/html/pr100510.en.html and https://www.ecb.europa.eu/press/pr/date/2011/html/pr110807.en.html). The reactivation of the SMP was followed by two other measures, two longer-term refinancing operations (LTROs) with an extended maturity of 3 years announced in December 2011, and the OMT, announced in July 2012 (see Casiraghi et al. 2013).

bund. Possibly, this is because such substitution, while reducing the economic risk in their balance sheet, would not have decreased the capital ratios relevant for regulatory purposes, while shedding loans permits to do so.[6] In line with this conjecture, we find that the adverse impact on lending is larger for banks with lower capitalization, consistent also with the idea that financial shocks are amplified when banks are close to the capital requirements threshold (Gambacorta and Mistrulli 2004; Albertazzi et al. 2014). Moreover, this effect is highly non-linear and it is concentrated on banks that are closer to the regulatory capital threshold imposed by Basel II. On the other hand, we find that the effect on lending does not vary with the intermediaries' reliance on retail deposits or wholesale funding.

Looking at the real economy, we show that the supply shock had an impact on firms' activity, by impairing their access to bank credit. We find that the lenders' average pre-shock exposure correlates strongly with the change in a firm's total bank credit before-to-after the burst of the tensions. On average, one standard deviation (0.23) increase in lenders' average holdings of Italian sovereign securities corresponds to a reduction of 4.7% in the firm's total bank borrowing, suggesting that credit market imperfections prevented firms from offsetting the shock by obtaining funds from less exposed intermediaries. Through a simple counterfactual exercise, our estimates suggest that tensions on the sovereign markets had a statistically significant negative impact on bank lending, which however amounted to a little less than 2% on the aggregate.

Finally, we turn to estimate the effects on investment. Comparing investment before to after the Greek bailout, we find that firms whose lenders were more exposed to the shock cut investments more than those less exposed to it. This effect is however entirely driven by smaller firms. For a percentage point increase in lenders' exposure to Italian sovereigns before the sovereign shock, smaller firms decreased investments by 0.3 percent over the period studied, while the investment rate of larger firms is unaffected. Looking at employment, the effect of the sovereign shock is concentrated among small firms that are highly reliant on external finance (Rajan and Zingales 1998).[7] Small firms operating in industries which heavily rely in external financing also display a sharper contraction of investments. We show that this result is robust to pre-trending and is most likely due to the greater sensitivity of smaller firms to shocks to the supply of bank credit, as we do not find that banks cut lending to small firms more aggressively. This sensitivity may reflect both the difficulties encountered by smaller corporations in establishing new credit relationships or their inability to issue debt (Bank of Italy Financial Stability Report, n.1, 2014).

This paper contributes to the literature on the bank lending channel (Kashyap et al. 1992; Khwaja and Mian 2008; Gan 2007b; Chodorow-Reich 2014; Greenstone et al. 2014; Jiménez et al. 2014) by providing new

[6] See Angelini et al. (2014) for a discussion of the prudential treatment of sovereign securities.

[7] These findings are in line with those in Duygan-Bump et al. (2015), who find that workers in small firms were more likely to become unemployed during the 2007–2009 recession than comparable workers in large firms, but for firms operating in industries highly dependent on external finance.

evidence on the role of sovereign securities. Further, it assesses at the micro level the real effects of fluctuations in prices and expected risk of financial assets held in the balance sheet of financial intermediaries.

In addition, this work relates to the strand of literature that attempts to investigate the nexus between financial intermediation and the real economy during the sovereign debt crisis which unfolded over 2011-2012. Among these works, a group of papers tries to explain how the sovereign debt crisis lead to an increase in sovereign holdings in banks' balance sheets (Acharya and Steffen 2013; Battistini et al. 2013; Angelini et al. 2014), while a second strand investigates whether this behavior crowded out private debt and with what economic effects (Becker and Ivashina 2014; Ahtik and Albertazzi 2014). Other works, more similar to ours, investigate the economic costs of the sovereign debt crisis via its effect on credit supply (Popov and Van Horen (2013); Bofondi et al. (2013); Correa et al. (2014); De Marco (2014); Acharya et al. (2014)). Popov and Van Horen (2013) show that in 2011 European banks resident in countries not exposed to the crisis but with a higher exposure to the debt of Greece, Ireland, Portugal, Spain and Italy, decreased the volume of syndicated loans at the country–borrower level more than less exposed banks. Using Italian data, Albertazzi et al. (2014) show that sovereign debt market tensions, proxied by the 10-year BTP-Bund spread, had a sizable effect on banks' funding costs, significantly affected the cost of credit for firms and households and exerted a negative effect on loan growth. Bofondi et al. (2013) exploit the presence of foreign banks in the Italian market to identify financial intermediaries which were "more" and "less" exposed to the sovereign crisis in 2011. In particular, in order to assess how the rise in sovereign spreads affected credit supply decisions, they use banks headquartered in countries where the sovereign risk increased significantly less - mainly German and French groups - as a control group for Italian banks. According to their results, following the tensions in sovereign debt markets, Italian banks decreased lending more than foreign intermediaries and charged higher lending rates. Moreover, they find that over that period banks' holdings of Italian sovereign bonds were unrelated to lending supply dynamics. This suggests that the creditworthiness of Italian intermediaries was mostly determined by that of the Italian government, while their holdings of sovereign assets did not further amplify the financial distress.[8] Correa et al. (2014) show that the negative economic consequences of the sovereign crisis were perceived also outside Europe. Following the burst of the debt crisis, U.S. branches of euro-area banks suffered a liquidity shock due to a reduced access to large time deposits. This event induced them to cut lending along the extensive margin, thus affecting investments of their borrowers located in the United States. De Marco (2014) uses bank-level panel data from the European Banking Authority to quantify the presence and extent of the bank lending channel. Using syndicated loan data, Acharya et al.

[8]Interestingly, the authors also find some evidence that during that phase of the crisis, which was characterized by an unprecented increase in the cost of uncollateralized transactions, higher holdings of sovereign bonds contributed to dampen the transmission of the shock, as they retained their nature of eligible collateral for interbank transactions and for transactions with the central bank as well.

(2014) show that intermediaries headquartered in countries more exposed to the tensions significantly reduce lending volume during the sovereign debt crisis compared to the pre-crisis peak in 2007. Moreover, they document that firms with higher dependence on banks in stressed countries have lower levels of investment, lower sales growth and lower employment growth compared to firms less dependent on them.

Methodologically, our paper relates to a number of other works that take advantage of Credit Register data, and the presence of multiple lending relationships (Gan 2007a; Khwaja and Mian 2008; Jiménez and Ongena 2012; Jiménez et al. 2014). In particular, using Italian data Albertazzi and Bottero (2013) investigate the cyclical behavior of lending following the failure of Lehman in 2008. Cingano et al. (2014) study the effect of the 2008 credit crunch on lending and firm policies.

The remainder of the paper is organized as follows. In Section 2, we review some background information about the sovereign market in the period 2009-2011 and we discuss the importance of timing in our identification. In Section 3, we describe the data used in the paper. In Section 4, we present a simple model of lending that helps developing the intuition behind our identification strategy and provide evidence on the presence of the bank lending channel. In Section 5 and 6, we show that the sovereign tensions had a real impact on the ability of firms to borrow, consequently affecting their investments. Section 7 concludes.

2 The 2010 tensions in sovereign markets

Until late 2009 neither financial markets nor the media appeared to be particularly concerned with the sustainability of sovereign debt. For over ten years since the introduction of the Euro, the yields of 10-year bonds issued by European countries have been low and stable.[9] However, after the parliamentary elections held in Greece in October 2009, the newly elected government acknowledged accounting budget misreporting in previous years and a larger-than-expected fiscal deficit in the coming year, generating concerns about the health of the Greek economy and the solvency of its sovereign debt.[10] The situation became even more dramatic in the spring 2010. On April 23, the Greek government requested an EU/IMF bailout package to cover its financial needs for the remaining part of the year. A few days later, on April 27, Standard & Poor's downgraded Greece's sovereign debt rating to BB+ ("junk bond"). In response to these events, yields on Greek government bonds rose sharply, barring the country's access to capital market.

Shortly afterwards, financial markets began to be concerned with the solvency and liquidity of the public

[9]The convergence began right after the institution of the European monetary union and was interrupted only by a short-lived increase of the interest rates of peripheral countries in the second half of 2008 driven by banks bailouts in Ireland and Greece (Acharya et al. 2011).

[10]In this occasion, the newly elected government recognized that fiscal deficit in the coming year was going to be larger than expected and acknowledged account budget misreporting in previous years. After a series of upward deficit revisions, the Greek government estimated to deficit at 12.7 percent of GDP for 2009, up from the 7.7 percent in 2008. See [Lane2012] for a detailed description of the European sovereign crisis.

debt issued by Ireland and Portugal, in the former case owing to the real-estate bubble and consequent banking crisis, and in the latter as a result of its macroeconomic imbalances. Only in the summer of 2011, following the announcement of the involvement of private-sector investors in the restructuring of the Greek public debt, the tensions became systemic, spreading to Spain and to Italy, and eventually spiraling into the well-known negative feedback loop between banks and sovereigns (Angelini et al. 2014).

The key event for our study is the bailout request advanced by Greece in April 2010 which prompted a reassessment of the default risk of a number of countries of the Economic and Monetary Union and can be considered the first, unprecedented and unanticipated episode that challenged the notion of riskless sovereign debt in the euro area since the adoption of the single currency.[11] This shock was transmitted to Italian intermediaries solely to the extent that these were exposed to such risk, namely depending on their portfolio of sovereign assets. On the contrary, when the crisis became systemic in the summer of 2011 the creditworthiness of Italian intermediaries was for the most part determined by that of the Italian government, largely independently of the composition of their asset side.

A number of studies indeed confirm that the Greek crisis can be regarded as a *wake-up call* on sovereign risk, which increased investors' sensitivity to country-specific macroeconomic fundamentals and prompted them to re-assess the default risk of other euro-area countries. The shift in sovereign riskiness implied by the "wake-up call" is confirmed by a number of other indicators. For instance, the correlation between the Italian and Greek spread, that was essentially one before the October 2009, reflecting the fact that the spreads with Germany were negligible for all euro area countries, dropped substantially in the months immediately before the bailout, driven by the rising yields on the Greek bond, and then increased again, as tensions spilled-over to other European countries driving upwards the yields on their sovereign securities (Table 17).[12] The CDS on Italy, with 5 years maturity, which averaged at about 90 bps in our pre-bailout window (2009:Q2-2010Q1), doubled to 180bp in the post period (2010Q2-2011Q1). Developments in the interbank market provide further evidence in favor of this hypothesis and our timing. A recent paper by Abbassi et al. (2014) documents that Italian banks paid a higher cost in the interbank market lending after the Greek bailout, although volumes were not significantly different from the previous periods.

The sudden change in the expected risk profile of government securities had a direct negative effect on the balance sheet of banks holding these assets. In Italy, the spread between the BTP and the German Bund (henceforth BTP-Bund spread) increased from 85 bps at the end of the first quarter of 2010 to almost 160 bps in the third quarter of the same year (Figure 1a). To put the economic magnitude of this event into

[11] Benzoni et al. (2014) present a theoretical model that shows that unexpected events as the Greek bailout may trigger a widespread increase in uncertainty with negative repercussions for other countries.

[12] After this, the correlation remains extremely stable for the following two years. Nevertheless, note that, in line with the "wake-up call hypothesis", the correlation did not reach the pre-2009 levels as investors started to price the differences between the country-specific risks associated with the two sovereign securities.

perspective, this jump corresponds to an increase of about 1.7 standard deviation of the series since 2005. From the first quarter of 2010 to the first quarter of 2011, the yield of 10-year Italian bonds increased by 95 basis points (from 3.87 to 4.82%, an increase of 25%). Figure 1b shows the average CDS spreads of the five biggest Italian banks from beginning of 2009 to the end of 2011. Between the first and the second quarter of 2010, the average spread of the top-five Italian banks rose by 78 percent, over 2.3 times its standard deviation. In September 2010, participants to the European Bank and Insurance CEO conference envisaged fears originating from sovereign markets to be the biggest threat to bank share prices (Figure 2a).[13] The same survey reveals that investors were ranking Italian banks among the financial institutions with the lowest expected performance (Figure 2b). Only Greek and Portuguese banks were expected to do worse.

3 Data

The building block of our database is Bank of Italy's Credit Register, which contains detailed information on the credit relationships entertained by intermediaries operating in Italy.[14] Using Bank of Italy Supervisory records, we collect quarterly accounting information for each bank appearing in the Credit Register. These data provide full information on banks' assets, liabilities and income flows, including a detailed picture on sovereign bond holdings. To account for the fact that portfolio management decisions are often determined at the banking-group level, we use consolidated balance sheet and income statement information.

We restrict our analysis to a two-year window around the downgrade of Greek debt, which we split into a pre-shock period - from 2009:Q2 to 2010:Q1 - and and a post-shock period - from 2010:Q2 to 2011:Q1. The stock of Italian government bonds at the end of 2010:Q1 scaled by risk-weighted assets (henceforth RWA) - our treatment variable ($Sovereign_{2010Q1}$) -, provides a measure of financial institutions' exposure to the sovereign shock.[15] Our main dependent variable is the percentage change in average outstanding term loans between the pre- and post-shock period for every firm-bank credit relation in our data set. More precisely, we collapse the quarterly amount of credit granted to firm j from bank b to two observations, the pre-shock average (2009:Q2-2010:Q1) and the post-shock average (2010:Q2-2011:Q1), and we calculate the percentage change as the log-difference between the two averages.

Our empirical models include the following set of bank-level controls: bank profitability (ROA_{2010Q1}), size

[13] "Competing in the age of austerity", Bank of America Merrill Lynch Banking & Insurance CEO Conference, London, 29 September 2010.
Source: http://ftalphaville.ft.com/2010/10/04/359726/european-bank-watch-past-present-and-future/

[14] For a credit relationship *in bonis* the reporting is mandatory only if it exceeds the threshold of 30,000 euro. Positions in default need to be reported irrespective of their amount.

[15] In a robustness exercise, we use alternative measures of exposure to the (like total sovereign holdings, and sovereign holdings of "peripheral" European countries) and a different scaling variable (Tier1 rather than risk-weighted assets). We show that our conclusions are unchanged.

($Size_{2010Q1}$), capitalization ($Tier1_{2010Q1}$), funding structure measured by the share of deposits ($Deposits_{2010Q1}$) and wholesale funding ($Net\,Interbank\,Debt_{2010Q1}$), liquidity ($Liquidity_{2010Q1}$), quality of lending portfolio, looking at bad loans ($Bad\,Loans_{2010Q1}$) and status of the bank as a cooperative bank (BCC).[16] Moreover, we control for the length of the lending relationship between a borrower and each of its lenders, and for the contribution of each lender to the total bank debt of the borrower.[17] All bank-specific and relationship-specific controls are measured at the end of the first quarter of 2010, i.e. the last quarter in the pre-period. Information on firm's industry, geographical location, and credit rating of the borrower (Altman's z-score) are drawn from the Cerved database, a proprietary firm-level panel database owned by Cerved Group S.p.A.. We obtain information on firms' fixed assets, revenues, and investment policy for a subset of firms using the CEBI database owned by Cerved Group S.p.A..

After applying standard filters, which are described in Appendix 10.1, our final database includes 539 different banks, 274,070 firms, and 538,348 unique firm-bank credit relationships, for a total of more than 4.5 million observations between 2009:Q2 and 2011:Q1.[18] However, since we run our regression on the collapsed version of the dataset, the estimation sample effectively shrinks to about 420,000 thousands observations. In our sample, 159,913 firms established simultaneous multiple lending relationships.[19] Overall, this sample is fully representative of the universe of Italian banks and firms.

Table 1 displays the summary statistics of the variables of interest.[20] On average, the volume of credit granted displayed a weakly positive growth rate between the post- and pre-shock period, although with a high variation across and within (i.e. among different banks exposed to the same) firm. On the extensive margin, about 95% of credit relationships that existed before the shock were still ongoing afterwords. Moving to our main explanatory variable, in 2010:Q1 the average exposure of Italian banks to the shock ($Sovereign_{2010Q1}$), was 25 percent of RWA with a standard deviation of about 36 percent.[21] This is indicative of a high variation of the exposure to the sovereigns in the cross-section of the financial intermediaries in our sample. Italian

[16] ROA is earning over assets, size is measured in log points, Tier 1 ratio is Tier1 capital over RWA, deposits are scaled by RWA, net interbank debt is calculated as the difference between interbank debt and interbank credits scaled by RWA, liquidity is cash over RWA, and the quality of the lending portfolio is measured as bad loans over RWA. BCC is a dummy equal 1 if the bank is a Cooperative bank. Cooperative banks are quite common in Italy and they are characterized by a different statutory objective than other banks and potentially a different lending policy. The presence of Cooperative is not an Italian *unicum*, but they are widely found across Europe.

[17] We measure the length of a credit relationship as the number of quarters it exists continuously since 2006:Q1.

[18] We exclude borrowers which operate in the financial and insurance sector, utilities and government-related industries, as well as borrowers that do not have complete information for our analysis. We exclude credit provided by special purpose vehicles, non-bank financial intermediaries, and branches of foreign banks. Also, our sample does include defaulted loans as well as new credit granted to borrowers who already have some other relations in default, and loans for which no information about the lender was available. In Appendix 10.1, we discuss the data construction in great details.

[19] In the multiple relationship sample, the median firm has 2 banking relationship and the average one has slightly less than 3. The presence of multiple lender firms is not a peculiarity of Italy. Collecting data from the National Survey of Small Business Finances, Detragiache et al. (2000) show that in the United States the median number of credit relationships established by small and medium firms is two, and 55.5 percent of them have more than one bank. Moreover, the same authors highlight that the number of lending relationships grows with firm's size.

[20] We present further details about the distribution of the most important variables in Appendix B.

[21] If scaled by total assets, the average bank presents an exposure to Italian sovereign bonds of about 12 percent.

sovereign debt amounts, on average, to almost 99 percent of banks' sovereign portfolio. This is true also when we look at the banking groups with the most diversified portfolio of sovereign bonds.[22] The high concentration of national debt in banks portfolios allows us to use the cross-sectional variation in Italian sovereign debt, rather than total sovereign debt, as a measure of exposure to the sovereign shock.

4 The bank lending channel

In order to argue that the tensions in the sovereign market had real effects on firms' activity due to the transmission of the sovereign shock via banks' balance sheets we need to establish two different facts. First, we have to document the presence of a *bank lending channel*, defined as the credit tightening caused by the inability of financial institutions to cushion their borrowers against bank-specific shocks (in this case, a shock on the sovereign portfolio). Second, we need to provide evidence that firms were not able to smooth out the supply shock by borrowing from alternative funding sources. That is, the *firm borrowing channel* should only partially offset the bank lending channel. This section outlines the challenges related to the empirical estimation of the bank lending channel and how our identification strategy tackles them, reserving Section 5 to the analysis of the firm borrowing channel.

To illustrate the estimation challenges, we begin introducing a simple extension of Khwaja and Mian (2008) model of lending with costly external finance. We then highlight the key features of our empirical strategy. First, we take advantage of the widespread presence of firms establishing multiple lending relationships to exploit within-firm variation in credit supply across different intermediaries. This allows us to effectively control for idiosyncratic changes in firms' demand or riskiness which might explain the variation in bank lending irrespective of credit demand shifts. Second, we use the detailed balance sheet information available in our data set to control for bank characteristics which can simultaneously explain a bank's sovereign holdings in the pre-period and its propensity to lend. Third, we exploit the impact of the Greek bailout on sovereign markets to set up a quasi-experimental framework for the investigation of the lending channel. After discussing and providing empirical support in favor of our identification strategy, we present the results of the estimation.

[22] Even a banking group located at the first percentile of the distribution still holds 58 percent his sovereign issued by the Italian government. While these numbers seem surprising, in Appendix A we show that the strong home-bias of financial institutions in our sample is not a peculiarity of the Italian banking system, but a feature of many banks operating in other European countries like Germany, France and Spain.

4.1 The identification of the bank lending channel

Isolating supply and demand shocks

Tensions in the sovereign markets are often accompanied by a decline in economic activity and a deterioration of investment opportunities. Since contractions in aggregate demand can be large (Bocola, 2013; Correa et al., 2014), estimating the impact of a shock to sovereigns on the supply of credit requires to disentangle supply-driven changes (the bank lending channel) from demand-driven changes (changes in credit demand or borrower characteristics).[23]

Building on Khwaja and Mian (2008) model of bank lending with costly external finance (Stein, 1998), we present a stylized, discrete-time model to gain intuition on this identification problem and to highlight how a within-firm estimation can isolate changes in credit supply from simultaneous and correlated changes in credit demand or borrowers' unobservable characteristics. The model is fully described in Appendix 8. Imagine a simplified setup in which a bank b can raise funds via short-term funding or bonds. Short-term funding bears no interest and can be considered risk-less as it is backed by the bank's holding of sovereign bonds which can always be liquidated for a fraction of their face value. External financing is costly because of asymmetric information. Therefore, the average cost of funding of bank b decreases with the amount of assets invested in sovereign securities (G_b) and increases with the level of asymmetric information (α_B). The bank can invest in loans and sovereign assets. The marginal return on a loan to firm j is decreasing in loan size and it depends on both firm-specific (θ_j) and economy-wide factors (θ). The demand for sovereign securities is assumed to be a function of exogenous bank-specific characteristics. We model a sovereign shock by allowing the liquidation value of sovereign assets to change overtime and move between two periods by a factor of $\tau \in [0, \infty]$.

The solution to the model is fully described by the following equilibrium condition (see Appendix 8):

$$\Delta L_{bj} = \frac{1}{\alpha_B + \alpha_L}(\Delta\theta_j + \Delta\theta + \alpha_B G_b \tau) \tag{1}$$

where α_L measures the concavity of the demand for loans with respect to loan size, $\Delta\theta$ and $\Delta\theta_j$ capture, respectively, aggregate and idiosyncratic changes in the marginal return on the loan granted by bank b to firm j. In equilibrium, then, the change in loans from $t = 0$ to $t = 1$ is a function of three factors: (i) an idiosyncratic firm-specific shock to the quality or productivity of the borrower ($\rho_j = \frac{1}{\alpha_B + \alpha_L}\Delta\theta_j$); (ii) an

[23] For example, even in the absence of a bank lending channel we might rationalize the contraction of bank credit as a drop in credit demand due to a downward adjustment of firms' production in response to lower consumer demand and/or deteriorated investment opportunities. Alternatively, it might be that some banks reduce lending due an increased riskiness of their borrowers. In these situations, if borrowers of the banks more exposed to the sovereign tensions experience higher negative demand-side shocks of the kind described above, a regression of bank's change in lending on its sovereign holdings would produce a biased estimator, even in the absence of credit supply contractions.

economy-wide shock ($\beta_0 = \frac{1}{\alpha_B+\alpha_L}\Delta\theta$); and (iii) the effect imputable to the change of the market value of the sovereign portfolio held by bank b ($\beta_1 = \frac{\alpha_B\tau}{\alpha_B+\alpha_L}$). While the tensions on the sovereign markets can directly affect the profitability of lending via β_0, $\beta_1 G_b$ captures the impact of the sovereign shock through a bank's balance sheet.

The presence of firms which establish multiple lending relationships allows us to bring Equation (1) to the data by estimating the following first-difference econometric model:

$$\Delta ln(Loans_{bj}) = \beta_0 + \beta_1 G_{b,2010Q1} + \rho_j + \epsilon_{bj} \tag{2}$$

where $\Delta ln(Loans_{bj})$ represents the change in log-average loans from before to after the shock granted by lender b to firm j, $G_{b,2010Q1}$ is a bank's holdings of sovereign bonds before the shock, and ρ_j is a firm fixed effect. A negative and statistically significant value of the coefficient $\hat{\beta}_1$ indicates the presence of the lending channel triggered by banks' sovereign holdings. This parameter measures the change in credit supply of one of the firm's lenders relative to the other(s), as a function of their holding of sovereign securities.[24] Equation (2) suggests that, if the matching between banks and firms is not related to banks' holdings of sovereigns ($corr(G_b, \Delta\theta_j) = 0$), a standard OLS estimator that does not control for changes in firm-specific factors would deliver consistent estimates of β_1. In this case, the unobservable firm specific θ_js would be captured by the error term, while economy-wide shocks would enter in the constant. However, if the correlation above is non-zero, $\hat{\beta}_1$ would be inconsistent. The bias would be upward if banks more exposed the sovereign shock (higher G_b) systematically lend to firms which are more likely to suffer negative shocks regarding their expected revenues or investment opportunities ($\Delta\theta_j < 0$). Since the firm-specific shocks are unobservable, it is generally impossible to control for them via firm observable characteristics. Following Gan (2007b) and Khwaja and Mian (2008) we circumvent the problem by focusing on firms with multiple lending relationships. Adding firm fixed effects (ρ_j) in the first-differences model allows us to control for observable and unobservable idiosyncratic changes in demand-side factors which might be systematically correlated with lenders' exposure to the shock.

The identification of β_1 also requires the distribution of sovereign securities to be orthogonal with respect to any factor which can simultaneously explain banks' sovereign holdings before the shock and affect their lending policy. In an ideal experiment, the stock of sovereign securities in banks' balance sheets would be randomly assigned before the shock materializes. Arguably, this is not the case, but rather such distribution is influenced by a host of bank-specific characteristics and the available investment opportunities. If these

[24] Notice that, differently from previous studies (Khwaja and Mian 2008), our estimates of β_1 should not be interpreted as the elasticity of credit supply with respect to the shock to market value or liquidity of sovereign holdings. Instead, β_1 measures the percentage change of a lender's credit supply which results from his exposure to sovereign securities.

characteristics also correlate with credit supply decisions, a bias would arise. Indeed, we find that bigger, less capitalized and less liquid banks tend to hold a smaller share of sovereigns (Table 2), and the same characteristics seems to correlate with banks' propensity to lend.[25] To tackle this, we use the balance sheet information described in Section 3 to control for a set bank-specific characteristics.[26] Moreover, our regressions include a measure of the length and strength of the lending relationship between bank b and firm i before the shock. These controls allow us to obtain more precise estimates by focusing only on the time-series variation in credit supply not imputable to the nature of the lender-borrower relation (Hoshi et al. 1990a,b, 1991).

Finally, we need sovereign securities' holdings to be exogenous to any anticipation of the tensions, before these materialize. In this respect, the choice of a proper estimation window is another crucial ingredient of our identification strategy. If the shock to Italian sovereigns had been anticipated before the downgrade of Greek debt, banks might have reacted (endogenously) adjusting their exposure to government securities in expectation of it. For example, more risk-taking banks might have increase their holdings of sovereign securities to benefit of the higher yields. Others, more risk averse, might have decided to sell these assets in advance. The stylized facts presented in Section (2) suggest that this is was not the case before April 2010. The orthogonality of sovereign holdings with respect to the sovereign shock is not clear any longer once the crisis unfolds.[27] These reasons motivate our choice to compare credit supply in the four quarters *before* April 2010, when tensions on the Italian sovereign debt grew unexpectedly, to credit supply in the four quarter *after* it. More specifically, we collapse the quarterly data into a pre-shock and a post-shock average, and calculate the before-to-after percentage change in loans granted from bank b to firm j as the log difference of the two averages. By collapsing the time dimension of our data set we obtain more conservative estimates of the standard errors, reducing concerns that the statistical significance of our estimates are mechanically driven by serial correlation of our variables (Bertrand et al. 2004). Similar concerns led us to opt for a conservative correction of standard errors, clustering them at the bank-level.[28]

[25] Comparing the bank-level change in total corporate loans between our pre- and post-shock period, unreported analysis shows that bigger and more profitable banks cut lending more than smaller and less profitable financial institutions. The same is true for banks with more stable source of funding, those that have higher liquidity holdings, and those that participate in the wholesale market as net borrowers. Contrarily, corporate lending increases in financial institutions which are more capitalized.

[26] In practice, we include in all regressions a full set of bank-specific characteristics measured at the end of the last quarter before the shock (2010:Q1): bank profitability (ROA_{2010Q1}), size ($Size_{2010Q1}$), capitalization ($Tier1_{2010Q1}$), share of deposits ($Deposits_{2010Q1}$), wholesale market activity ($Net\,Interbank\,Debt_{2010Q1}$), liquidity ($Liquidity_{2010Q1}$), quality of lending portfolio ($Bad\,Loans_{2010Q1}$) and status of the bank as a cooperative bank (BCC).

[27] Observing the large run up of sovereign risk in 2010 and 2011, it is tempting to focus on these periods in order to estimate the lending channel triggered by the sovereign crisis. However, by comparing quarter-to-quarter movements in bank lending after the outbreak of the crisis (De Marco 2014;Bofondi et al. 2013), researchers might be jointly estimating the lending channel transmitted via banks' balance sheets *as well as* changes in credit supply which are imputable to strategic portfolio adjustments, deterioration of lenders' liquidity and solvency, or induced by the sequence of unconventional monetary policy actions conducted by the ECB from the second half of 2011.

[28] The same bank b appears many times in our sample, as many as the number of firms with which it has established a lending relationship. For this reason, it is crucial to take into account that the effective sample size for estimation purposes is lower than the number of observations available in our sample. In Section (4.1) we show that, indeed, our choice to cluster standard

Taking into account all of the considerations above, we estimate the following within-firm regression model:

$$\Delta ln(Loans_{bj}) = \beta_0 + \beta_1 Sovereign_{b,2010Q1} + \Gamma \cdot X_{b,2010Q1} + \Lambda \cdot Z_{bj,2010Q1} + \rho_j + \epsilon_{bj} \quad (3)$$

where $Sovereign_{b,2010Q1}$ is bank b holding of Italian sovereign securities in 2010:Q1 scaled by RWA in 2010:Q1; $X_{b,2010Q1}$ and $Z_{bj,2010Q1}$ are respectively bank-specific and relationship-specific controls measured before the shock described in Section 3. Notice that this specification captures only the pure intensive margin of the bank lending channel, as the left-hand side variable measures the change in the stock of loans granted by lender b to borrower j focusing only on relationships existing in both the pre- and the post-shock period. To the extent that the probability of not appearing in the Credit Register in the quarters after the shock is higher for credit rationed firms, our estimates can be considered a lower bound of the intensive margin of the lending channel.

Identification assumptions

The empirical model presented in Equation (3) is equivalent to a Difference-in-Difference specification, where intermediaries with lower exposure to Italian debt are used as the control group for banks with higher exposure. The validity of this identification strategy relies on the parallel trend hypothesis, i.e. the assumption that - in the absence of the sovereign shock - financial institutions in the treated group would have displayed a credit supply trend comparable to banks in the control group. If this were not the case, the estimates could be capturing factors different from the bank lending channel. While the parallel trend assumption is fundamentally untestable due to the absence of an observable counterfactual, we can still provide some evidence in this direction.

We begin with a semi-parametric investigation of the lending patterns comparing banks with a different exposure to sovereigns.[29] First, we sort banks into a *"High Sovereign"* group and a *"Low Sovereign"* group based their (conditional) holdings of Italian sovereigns in the last quarter before the shock. Then, we aggregate by quarter all corporate loans in our sample granted by all banks belonging to the low-sovereign and to the high-sovereign group respectively. In Figure 3, we plot the two time series over time. The two series are normalized such that aggregate lending is zero in 2010:Q1. Note that, before the shock, the credit supply of banks with higher holdings of sovereigns, if anything, was growing faster than that of banks with lower holdings. Immediately after the shock there is a sharp reversal of the lending trend for the group with high sovereign holdings, while banks with lower holdings kept raising their credit supply for the first three quarters

errors at bank level produces more conservative estimates than clustering at firm level.

[29] Appendix 10.3 provides a detailed description of the construction of Figure 3 and Figure 4.

of the post-shock period. This evidence is at odds with the claim that a larger drop in lending observed after the outbreak of the tensions for more exposed banks reflects a long-term credit tightening from part of banks in this group with respect to those less exposed.

However, Figure 3 does not take into account that the heterogeneity in banks' characteristics also directly affects their lending propensity. In response to this concern, we restrict our attention to the variation of credit supply which is not explained by balance sheet characteristics of the lender. To do so, we first regress the growth in corporate loans on a set ot bank-specific characteristics, and then aggregate the residuals of the loans granted by "High sovereign" and those granted by "Low Sovereign" banks. In Figure 4 we plot them over time. This figure provides a strong empirical support against the pre-trending hypothesis. Controlling for observable bank characteristics and relationship specific components, we find that the lending patterns of the treatment and control group display very similar trends before the shock. Also, and importantly, the semi-parametric exercise presented in Figure 4 corroborates our assumption that selection into treatment takes place primarily along a host of observable bank-specific characteristics. Once these factors are taken into account, banks with lower sovereign holdings represent a valid control group for more exposed intermediaries. Note also that Figure 4 highlights a sharp divergence in trends after the shock, which represents a first empirical evidence of the bank lending channel triggered by the sovereign shock.

To provide further support against the pre-trending hypothesis we perform a fully parametric test. We estimate Model (3) using as left-hand side variable the difference in log of sovereign debt between 2010:Q1 (the last accounting period *before* the shock) and 2009:Q2. Results are reported in Table 3, Column (1). In line with the semi-parametric findings presented in Figure 4, we find a non-significant positive correlation between banks' lending and their exposure to Italian debt before the bailout date, which again points to rejecting the pre-trending hypothesis.

We conclude our analysis of the validity of the identification assumptions with a placebo test. Our goal is ruling out the possibility that the results presented in this paper reflect a "structural" negative correlation between holding of sovereigns in period t and lending in period $t+1$. If such relation was structural, it would also question our claim that the Greek bailout fundamentally changed the way sovereign bonds were perceived, and consequently the reasonableness of our research question. We test whether changes in credit supply between 2006:Q4-2007:Q3, and 2007:Q4-2008:Q3, the closest two-year window before the financial crisis, were correlated with banks' holdings of sovereigns in 2007:Q3. During this periods there were no tensions on the European sovereign markets. The results of this regression are presented in Column (2) of Table 3. Although not statistically significant, we find a positive correlation between sovereign holdings in $t-1$ and changes in credit supply in the absence of tensions on the sovereign markets.[30] This finding, which

[30]The positive relationships between sovereign holdings at 2007Q3 and the growth rate in average lending between 2006Q4-

is in line with the existing literature on the role of sovereign in banking (Gennaioli et al. 2013, 2014), suggests that, in normal times we expect a positive correlation between sovereign debt holdings and lending because financial institutions use government bonds as a storage of liquidity in expectation of future investments.[31]

The bank lending channel: main results and robustness

Figure 4 provides a first evidence of the bank lending channel. However, the semi-parametric estimation conducted in the previous section cannot isolate credit supply shocks from simultaneous, idiosyncratic demand-side shocks. In particular, it cannot isolate idiosyncratic demand shocks that are correlated with the lenders' exposure to sovereigns. To do so, we bring to the data the econometric model described by Equation (5). Results are reported in Table 4. According to our estimates, a higher exposure of a financial intermediary to Italian sovereign debt before the shock to sovereigns had a negative and statistically significant effect on its credit supply. This change in bank lending is a pure supply shock, and it is orthogonal to idiosyncratic demand-side shocks such as changes in credit demand or borrower's riskiness. On average, comparing the change in credit supply of two lenders whose exposure to the sovereign shock is one standard deviation apart (0.36), the lender with the higher holdings of sovereigns tightens its credit supply 7% more relative to the other. All the other coefficients in our regression are in line with the predictions of economic theory.[32] As a robustness, in Columns (3) and (4) we show that if we scale the exposure to Italian sovereign by Tier1 capital our results still statistically significant and similar in economic magnitudes.[33] In addition, we check that our results are not driven by a particular group of banks, such as cooperative banks or subsidiaries of foreign banks.

Our results are also robust to different assumptions regarding the variance-covariance structure of residuals. Columns (1) and (3) and Columns (2) and (4) estimate our baseline regression clustering standard errors at bank and firm level respectively. Since bank-specific variables are constant across all borrowers of a given financial institution, clustering errors at bank level produces standard errors that are substantially larger. Opting for the most conservative and conceptually correct choice, we maintain this clustering structure for the remaining within-firm analysis. We also verify that our results are not driven by the choice of focusing on Italian sovereign securities only. In an unreported table, we show that a tightening in lending is associated

2007Q3 and 2007Q4-2008Q3 is statistically significant if we cluster standard errors at firm level.

[31] For example, studying a large panel of banks around the globe, Gennaioli et al. (2013) find that higher levels of current holdings of sovereign predicts lower levels of contemporaneous lending but higher lending in the future.

[32] On top of our main variable, clustering standard errors at bank level, only size, Tier1, BCC, share of lending relationship and length of lending relationship remain statistically significant. We find a negative relationship between the time-length of a credit relationship and its percentage change before-to-after the sovereign shock. We believe that this coefficient is mainly capturing the effect of the firm-bank specific credit-cycle rather than the full history of the credit relationship. The older a credit relationship is, the more likely it is that the credit will be rolled-over or renegotiated in the post-shock period. Since firms experience a tightening of credit standards in the post-shock period, the amount of new credit will be likely reduced by all lenders.

[33] Our results are statistically significant and equivalent in economic magnitude if we scale our treatment variable by total assets rather than risk-weighted assets.

also with holdings of sovereign securities issued by Greece, Ireland, Portugal and Spain (GIPS). Conversely, no such effect is found for holdings of German securities or other unaffected countries.

Loans are not the only form of bank credit available to firms. Previous research has shown that revolving credit lines are another important source of financing used by corporation (Sufi 2009).[34] On the one hand, we expect a supply-side shock to affect not only the provision of loans by banks, but also other credit-like products, such as credit lines. On the other hand, recent research using data from the Italian Credit Register has shown that credit lines may display a particular sticky response to supply-side shocks because of "ever-greening" practices conducted by banks (Albertazzi and Marchetti 2010). If this is the case, credit lines may respond more sluggishly to the shifts to the credit supply. Our estimates are coherent with both results (Table 5, Column (1)). While the effect on credit lines appears smaller in magnitude, we find a statistically and economically significant reduction of the credit limit accorded by financial intermediaries more exposed to sovereigns. Also, as we might expect, we find a statistically and sizable reduction of total bank credit (revolving credit lines plus term loans) imputable to the bank lending channel (Column (2)). This effect, which considers both term loans and credit lines, lays in between the effect on the two individual components of credit.

Finally, we study if banks operated the tightening differently across different borrowers. To test for such heterogeneity, we estimate equation (3) adding an interaction between sovereign exposure and, in turn, a measure of firms' riskiness, $Risky\,Firm$, as well as two measures of firm size. These are a dummy equal to one if the firm revenues in 2009 are above the median of the cross sectional distribution of revenues at the time, $HighRevenue$, and a dummy equal to one if firm j's book value of assets in 2009 is above the median of assets at the time, $HighAsset$.[35] Results are presented in Table 6. While the direct effect of the shock is negative and significant, the interaction is non-significant and small, providing evidence that the credit tightening of more exposed financial intermediaries was operated homogeneously across firms of different size.

The bank lending channel - extensive margin

A financial institution refusing to roll-over its credit can severely impair the economic activity of its borrowers. On aggregate, such extensive-margin tightening would add to the above-mentioned intensive margin effect, exacerbating the consequences of the sovereign shock on the corporate sector. In this section, we test whether banks more exposed to the shock were also more likely to terminate a lending relationship after April 2010.

[34] Using data on a large sample of corporations from the United States, Sufi finds that almost 85% of firms obtained a line of credit between 1996 and 2003, which represents an average of 16% of book assets. The data from Italian Credit Register highlight a similar picture for Italian firms, as more than 90 percent of the firms in our same have at least one line of credit available.

[35] The definition of risky firm follows the definition adopted by the Italian banks, which is based on a threshold of the Altman's z-score of the firm. Note also that to compute these measures, we have to restrict our analysis to the sub-sample of firms appearing in the CEBI database.

We start by defining a new dependent variable, $CutCredit_{POST,bj}$, which is equal to 1 whenever the credit relation between bank b and firm j is terminated after our shock period. As before, we exploit the presence of firms with multiple lending relationships established in the pre-shock period and we implement the firm fixed effect estimation strategy previously described. We estimate the following econometric model:

$$CutCredit_{POST,bj} = \beta_0 + \beta_1 Sovereign_{b,2010Q1} + \Gamma \cdot X_{b,2010Q1} + \rho_j + \epsilon_{bj} \tag{4}$$

The coefficient β_1 captures the extensive margin of the bank lending channel triggered by shock. In other words, β_1 tests whether, after the sovereign shock, a lending relationship is more likely to be interrupted if it is entertained with lenders more exposed to government securities after the sovereign shock. Results are reported in Table 7. Column (1) shows that, comparing two lenders of the same firm, a difference of one standard deviation in the banks' holdings of Italian sovereign securities immediately before the outbreak of the sovereign tensions corresponds to a 2% higher the probability of not rolling over an existing loan. This is a sizable increase since the unconditional probability of not renewing in the post-shock period a loan existing in the pre-shock period is about 5% for our sample. Like the intensive margin effects exposed in the previous paragraph, results are robust to different assumptions about the variance-covariance structure of the errors and to an alternative measures of exposure to sovereigns (Columns (3) and (4)).

Heterogeneity of the effects

We argue that the shock to sovereigns led to a contraction in the supply of credit via unexpectedly increasing the riskiness of a large fraction of banks' assets that were considered safe until then. According to the literature on the bank lending channel, banks are hit by, and accordingly transmit, these shock differently depending on other balance sheet characteristics. While there is a number of dimensions that may be relevant (Panetta et al. (2011)), in this investigation we look at banks' capitalization and its dependence on wholesale markets for funding. Banks that are less capitalized are expected to react more intensively to shocks to the risk of any of their assets (Gambacorta and Mistrulli 2004), as de-leveraging risky assets such as loans is a fast way to rebalance key capital ratios after an increase in the perceived riskiness of other assets. As explained in Angelini et al. (2014) , while shocks to the riskiness of sovereign assets may not force an adjustment in capital ratios, it may still affect credit supply if management wants to adjust the overall economic risk of the bank.[36] A second important dimension of heterogeneity considers instead the use of sovereign bonds as collateral in interbank transactions. In this case, the shock to sovereigns' riskiness affects banks by lowering the the total collateral value available to them. Accordingly, banks that obtain a larger share of funding

[36]Note that if procyclical risk-weights for sovereign exposure had been in place, the required adjustment of the capital ratios that would have followed the shock would have presumably contributed to further amplify its negative effects.

through the interbank markets should be more affected by the sovereign shock and may react to this decrease in funding by tightening credit supply more than others.

We bring these two alternatives to the data. We test for heterogeneous responses to the shock across banks that are different in terms of capitalization and funding structure. In practice, we interact sovereign exposure with the following variables. To proxy the weakness of the balance sheet, we use the holdings of non performing loans ($Bad\,Loans_{2010Q1}$) and the bank's Tier1 ratio ($Equity_{2010Q1}$). To account for the non-linearity of the effect, we also test whether the impact of the shock was more severe for the subset of banks closer to the regulatory threshold defining a the dummy variable - $Low\,Capital\,Ratio_{2010Q1}$ - which takes value one when a bank's Tier1 ratio is below 10%.[37] To distinguish banks with different funding structure, we use the deposit ratio ($Deposits_{2010Q1}$) interbank borrowing ratio ($Net\,Interbank\,Borrowing_{2010Q1}$). The results, presented in Table 8, document no heterogeneity for banks differently reliant on the interbank market, but find an economic and statistically significant effect along the dimension of capital, especially for the subset of banks with Tier1 ratio closer to the regulatory boundary. For them, the effect is not only significant but also economically large, suggesting that the decrease in lending was more than twice as big for banks with binding capital requirements. Importantly, the comparison of columns (1) and (5) suggests that the capital channel is non-linear, as a financial intermediary's distance from the regulatory threshold matters more than capitalization per se.

Demand side shocks, fixed-effects and firm's heterogeneity

Our within-firm approach provides us with an estimate of the firm fixed effect ρ_j. While this parameter is typically regarded as a nuisance parameter from the point of view of the identification of the main effect (Gan 2007b; Khwaja and Mian 2008; Jiménez and Ongena 2012; Cingano et al. 2014; Jiménez et al. 2014), de facto it can be interpreted as a direct measure of the idiosyncratic demand shocks suffered by firms. In line with this idea, we find a strong, positive correlation between a firm's estimated shock and proxies of credit demand. For instance, we find a positive correlation between the estimated fixed effects ($\hat{\rho}_j$) and the firm credit score, its growth in revenues and assets in the pre-period, suggesting that indeed the parameter is capturing meaningful variation in firm demand for credit (Table 9). Exploiting this, in the next section we will use this parameter to improve our inference in the between firm analysis.

Before moving forward in the analysis, we explore more in depth the role of demand-side factors in our analysis. Two issues are of particular interest to us. First, we want to approximate the size of the bias arising from sorting between banks and firms. Second, we want to see the exportability of our results outside the sample of multiple-lender firms. To assess evidence of sorting between banks and firm, which is the main

[37] Banks should main a Tier1 ratio greater than or equal to 8% under Basel II.

concern motivating the within-firm estimation, we compare the estimates of our baseline Model (3) obtained with the within-firm fixed effect model and those delivered by estimating a standard pooled OLS. As for the exportability issue, we compare the results obtained estimating the model on the sample of firms with multiple lenders with those relative to the sample with one relationship only. Results are presented in Table 10.

When we do not control for the fixed effects, the magnitude of $\hat{\beta}_1$ increases from -0.285 to -0.347 (Columns 1 and 2), implying that firms' demand shocks are, on average, positively correlated with the lenders' exposure to the shock.[38] However, a t-test on the equality between the two coefficients above fails to reject the null hypothesis. This is suggestive that biases arising from correlated demand and supply shocks are of second order importance in our sample. Given this result, we move to our model on the sample of firms which established only one lending relationship (Column (3)).[39] By construction, we cannot include firm fixed effects in this specification. The sign and statistical significance of the coefficient capturing the bank lending channel is similar to the previous results. If anything, the magnitude increases even further (-0.367) compared to the estimate on the multi-lender firms of Columns (1) and (2), although this difference is not statistically significant.

In conclusion, we have shown that firm fixed-effects capture variation in bank credit which can be imputed to changes in firms' investment opportunities, riskiness, and credit demand taking place after the shock. Compared to other studies which assess the significance of the bank lending channel (Khwaja and Mian 2008; Jiménez and Ongena 2012; Jiménez et al. 2014), the results in Table 10 suggest that neglecting demand-side factors reduces the precision of the estimates but has not a significant effect on their magnitude or statistical significance of the estimated effect. In other words, the correlation between idiosyncratic firm shocks and banks' exposure to the sovereigns appears to be a second order concern in our analysis. Nevertheless demand-side factors play a major role in explaining the credit dynamics in the period under study.

5 The firm borrowing channel

The results presented so far confirm the presence of a sizable bank lending channel triggered by the transmission of tensions on sovereign markets to the balance sheet of financial institutions. However, firms might have been able to compensate a credit shortage from exposed lenders by borrowing from other financial intermedi-

[38] In unreported regressions we show that a reduction in absolute terms of about the same order of magnitude is observed when we scale sovereign holdings by Tier 1 rather than risk-weighted assets.

[39] For clarity, the sample of firms with one lending relationships is a random sample of 70% of firms appearing in the Bank of Italy's Credit Register which established only one lending relationship over the period of interest and satisfy the filters described in Section (3). We did so to obtain a sample with about the same number of firms present in the sample with multiple lending relationships.

aries or resorting to alternative sources of funding (*firm borrowing channel*). Doing so, they would effectively undo the bank lending channel and offset the impact of the credit supply shock on economic activity. In this section we show that firms have not been able to tap to funds from less exposed lenders to compensate the tightening suffered from the more exposed ones. As in Khwaja and Mian (2008), our results demonstrate that credit market frictions prevented firms to fully smooth out the bank lending channel through the recourse to bank credit only.[40]

To assess the importance of the firm borrowing channel, we construct a measure of a firm j's exposure to the sovereign shock by computing the average of its lenders' exposures, weighted by the size of the loans granted by each of these intermediaries (Khwaja and Mian 2008; Albertazzi and Bottero 2013). We calculate the weights (ω_{bj}) assigned to each lender b as the share of total bank loans of firm j in 2010:Q1 granted by bank b. That is, let $\mathcal{B}_j$ be the set of all lenders to firm j. Firm j's average exposure is given by $Sovereign^{WA}_{j,2010Q1} = \frac{1}{B}\sum_{b\in\mathcal{B}_j}\omega_{bj}Sovereign_{b,2010Q1}$, where $Sovereign_{b,2010}$ is the stock of Italian sovereign over risk weighted assets held by lender b in 2010:Q1.[41] We use this firm-level shock variable to explain the change in the total amount of bank debt before-to-after the contagion of the sovereign crisis to the Italian debt, which we construct as $\Delta ln(Total\,Loans_j) = \sum_{b\in\mathcal{B}_j} ln(Loans_{bj,Post}) - \sum_{b\in\mathcal{B}_j} ln(Loans_{bj,Pre})$.

The identification of the firm borrowing channel raises the same concerns discussed in Section (4). Unlike what we did in Model (3) we can no longer control for unobservable demand-side shocks using a within-firm estimation, since the unit of observation of this analysis is the firm rather than each of its lending relationships. If $Sovereign^{WA}_{j,2010Q1}$ were correlated with unobservable changes in firms' characteristics or demand-side shocks, the estimator capturing the effect of $Sovereign^{WA}_{j,2010Q1}$ on $\Delta ln(Total\,Loans_j)$ would be inconsistent. There are three ways we deal with this concern. First, in the previous Section, we have shown that the estimates from within-firm specification are not far from the OLS ones. This is suggestive that the bias we incur when we do not control for demand is second-order in this setting. Secondly, we rely on the findings of Section (4) and use the estimates of the firm fixed effects from Model (3) - $\hat{\rho}_j$ - as a proxy of changes in demand-side factors. Given the importance of demand-side factors in the context of the sovereign tensions, this conservative choice allows us to improve the precision of our estimators and reduce concerns regarding consistency. Thirdly, we also control for other sources of heterogeneity in demand by including province and industry fixed effects (respectively $\tau_{province}$ and $\tau_{industry}$). In the end, we control for a weighted average of lender-specific ($X^{WA}_{j,2010Q1}$) and relationship-specific characteristics ($Z^{WA}_{j,2010Q1}$) which

[40] Unfortunately we have no information on bond emission or trade credit. Anticipating the results of the next two sections, our evidence is compatible with the notion that firms more likely to tap into these non-banking funds (i.e. larger and less risky firms) have suffered comparatively less. However, even if the firms are able to completely undo the bank lending channel by borrowing from banks less exposed to the shock or resorting to other forms of financing, the sovereign tensions might still propagate to the real economy through other channels. See for example Bocola (2013) or Neri and Ropele (2013).

[41] In our data set, on average, the exposure of firms to the sovereign crisis is 22 percent (mean of $Sovereign^{WA}_{j,2010Q1j}$), with a standard deviation of 23 percent (standard deviation of $Sovereign^{WA}_{j,2010Q1j}$).

might simultaneously affect lenders' exposure to the shock and their credit supply decisions.[42] All in all, we estimate the following model:

$$\Delta ln(Total\ Loans_j) = \alpha_0 + \alpha_1 Sovereign^{WA}_{j,2010Q1} + \hat{\rho}_j + \Gamma \cdot X^{WA}_{j,2010Q1} + \Lambda \cdot Z^{WA}{}_{j,2010Q1} + \tau_{province} + \tau_{industry} + u_j \tag{5}$$

If firms were able to completely compensate a negative supply shock, we should find no effect of $Sovereign^{WA}_{j,2010Q1}$ on the change in aggregate bank debt of a firm ($\hat{\alpha}_1 = 0$) and corporate lending would respond only to the aggregate shock captured by the intercept α_0. If the opposite were true, we would expect a negative and statistically significant $\hat{\alpha}_1$.

Column (1) of Table 11 reports the estimates of Model (5) focusing on the sample of firms with multiple lending relationships.[43] The negative and statistically significant coefficient of $Sovereign^{WA}_{j,2010:Q1}$ ($\hat{\alpha}_1 = -0.206$) suggests that, on average, firms have been unable to fully undo the bank lending channel. Firms cannot easily compensate the reduction in credit supply from more exposed lenders by expanding existing or establishing new credit relationships with less exposed financial intermediaries. Indeed, we find that the average exposure across lenders before the shock is highly predictive of the change in total bank credit of a firm as tensions in the sovereign market unfold. On average, to a one standard deviation (0.23) increase in lenders' average holdings of Italian sovereign securities corresponds a reduction of 4.7% of total bank borrowing of a firm, with respect to its pre-shock amount.[44] Running the same regression without controlling for firm-specific demand shocks (Column 2) we find a significant coefficient for the firm borrowing channel of -0.216, but - as we expected - it is not statistically different from the coefficient of Column (1). However, confirming the results of Section 4, idiosyncratic demand shocks matter when it comes to explain the large drop in credit supply. Indeed, the adjusted R^2 increases once firm-fixed effects are taken into account. In unreported regressions we show that these results are confirmed when we measure firms' exposure to the sovereigns by looking only at the exposure of the major lender in 2010:Q1.

To put our analysis into perspective, we can conduct a counterfactual exercise to understand the economic magnitude of these effects. As discussed in Appendix 10.4, we estimate that the sovereign shock led to an aggregate decline in corporate lending of about 2% within the first year following the Greek bailout request.

In principle, one may expect a substantial heterogeneity across firms in their ability to respond to a credit shock: smaller, more opaque and riskier firms should have a harder time compensating a credit shortage by

[42] We weight these variables by the size of the loans granted by each intermediary, with the only exception of the dummy for cooperative bank which is equal to one if the major bank is a cooperative bank.

[43] We estimate Model (5) clustering standard errors at the level of the major bank.

[44] The coefficient is very similar ($\hat{\alpha}_1 = -0.213^{***}$) if we do not control for industry and province fixed effects.

borrowing more from other lenders. To test this hypothesis, we study whether, *ceteris paribus*, total credit declined more for small and riskier firms. To do so, we estimate Model (5) including an interaction between firm's exposure ($Sovereign^{WA}_{j,2010Q1}$) and its size and credit risk. We restrict our attention to the sub-sample of firms appearing in the CEBI database to obtain two alternative proxies of size. The first, $HighRevenue$, is a dummy equal to one if firm j's revenues in 2009 are above the median of the cross sectional distribution of revenues at the time. The second, $HighAsset$, is equal to one if firm j's book value of assets in 2009 is above the median of assets at the time. Our measure of credit risk, $Risky\,Firm$, is a binary variable equal to one if firm j is considered a risky borrower based on its credit rating.[45] The results, presented in Table 12, suggest that both large and small firms suffered in terms of lower credit, but, despite a weak statistical significance, the firm borrowing channel for smaller firms is larger, although the effect is not significant for the dummy $HighAsset$.

The empirical analysis presented in this Section has shown that firms could not fully compensate the credit shortage by rising more bank debt from intermediaries less exposed to the sovereign shock. This is particularly true for borrowers displaying a troublesome credit rating and, to some extent, for smaller firms. In the next Section 6 we turn to estimate the effect that such restriction, from which firms have not been able to shield themselves from, had on firms' real economic activity.

6 The real effects of the sovereign shock on investment

The sovereign shock has led banks to cut lending to corporations, which, in turn, were not able to perfectly smooth out the credit supply shock. As a result, firms faced a tightening of bank credit. In this Section, we move a step forward in the investigation of the economic costs of the sovereign shock transmitted via the lending channel. We do so documenting a sizable effects on firms investment rates.

We employ the specification in Equation (5) relating the average sovereigns exposure of a firm's lenders with changes in its investments:

$$I_j = \theta_0 + \theta_1 Sovereign^{WA}_{j,2010Q1\,j,2010Q1} + \hat{\rho}_j + \Gamma \cdot X^{WA}_{j,2010Q1} + \Lambda \cdot Z^{WA}_{j,2010Q1} + \tau_{province} + \tau_{industry} + u_j \quad (6)$$

We consider two measures of investments. The first is a dummy indicating an increase in firm's fixed assets between 2009 and 2011. The second is the log-difference of fixed assets between 2011 and 2009. While we

[45] The definition of risky firm follows the definition adopted by the Italian banks, which is based on a threshold of the Altman's z-score of the firm.

do not have access to direct measures of capital expenditure, the two variables just described the empirical corporate finance literature considers them proxies for it.[46] As in the previous section, we measure a firm's exposure to the lending channel as the loan-size weighted average of sovereign to RWA of all banks from which the firm borrowed in 2010:Q1. Due to data availability, we restrict our investigation to the sub-sample of multi-lender firms appearing in the CEBI database for which we have accounting information on assets and revenues (about $34,000$). In unreported regressions, we confirm that all previous results on the bank lending and firm borrowing channel remain stable in terms of economic magnitude and statistical significance on this sub-sample of firms.

In Table 13, we present the main results. We find that, on average, the sovereign shock had little or no effect on investments. In columns (1) and (2), the coefficient for sovereign is negative and, at best, barely significant. However, this small average effect is hiding a large heterogeneity across firms. In Columns (3)-(6) we interact sovereign exposure with two dummies for firm size, which are obtained splitting the sample above and below the median of the cross-sectional distribution of assets and revenues. Doing so, we find that the direct effect of sovereign becomes negative and highly significant, while the interaction is positive. Overall, the results suggest that the shock led smaller firms to cut their investments dis-proportionally more than bigger firms. This is true for changes of investments along the extensive margin, as well as along the intensive margin. This result is not driven by heterogeneity in local demand, unobservable industry factors or firm idiosyncratic credit demand shifts.[47] Taken together, the estimates in Table 13 suggest that the average effect of the sovereign shock transmitted via the lending channel is essentially zero for larger firms, but sizable and negative for smaller firms. For every percentage point increases in sovereign investment by the lender, smaller firms decrease investment by 0.3 percent more between 2009 and 2011, while we find that the investment rate of larger firms is unaffected. Table 14 shows that these results are robust to pre-trending tests. Comparing changes in investments between 2007 and 2009, firms borrowing from banks more exposed to sovereign securities in 2010:Q1 did not reduce investments more than firms borrowing from less exposed lenders.

We then turn to study how the shock affected employment decisions by firms. Again, we construct two measures of change in employment to investigate the spillover on labor demand: increase ($1\{\Delta\text{Emp} > 0\}$) and percentage change in employment ($\%\Delta\text{Empl}$).[48] In contrast to previous literature (Chodorow-Reich 2014),

[46] CEBI does not report capital expenditures. We construct out proxies of investment using changes in fixed assets, similar to Acharya et al. 2014.

[47] In unreported regressions we show that the same holds when looking at continuous measure of size, like the logarithm of asset and revenues. Regressions are available upon request.

[48] Information on the workforce is available only for a subsample of firms the firms in CADS. A comparison of the observable characteristics of firms with and without employment information reveals that the latter are smaller firms both in terms of total assets and revenues. Thus, our estimates our estimates are likely a lower bound of the true impact of the credit shock on employment.

we find no evidence of a transmission of the credit supply shock on labor demand of Italian firms. However, while there is not differential effect between large and small firms employment growth, the credit supply shock had a significant effect on labor demand of smaller firms that are highly dependent on external finance (Table 15). These findings are in line with those in Duygan-Bump et al. (2015), who finds that workers in small firms were more likely to become unemployed during the 2007–2009 recession than comparable workers in large firms, but only if they were employed in industries with high financing needs.

Having shown that the restriction in credit supply operated by banks was not directed specifically towards smaller or riskier firms (see Section 4), the heterogeneous response of investments along the size dimension can be explained by conjecturing that smaller firms are more sensitive than larger corporations to bank credit supply shocks of equal magnitude, possibly because they encounter more difficulties raising funding from less exposed lenders or because they cannot access alternative sources of funding. On the whole, this seems to suggest that while every firm was affected in their ability to borrow, smaller firms bore higher economic costs than bigger firms because of their higher sensitivity to bank credit.

Our results have shown that the investment policy of small firms was indeed negatively affected by the transmission of the sovereign tensions via the lending channel, while investments of larger firms were unaffected. This heterogeneous response along the size dimension does not appear to be supply driven, but rather demand driven. Small firms were less able to smooth bank credit shocks and, for this reason, they suffered more the outbreak of the sovereign tensions. On the contrary, despite the reduction of credit from more exposed lenders, large firms were better able to avoid a reduction in investments, by rising more credit from other (less exposed) lenders and, presumably, resorting to other forms of non-bank funding.

7 Conclusions

Using a detailed firm/bank panel data set extracted from the Italian Credit Registry, we document the propagation of sovereign tensions spurred by the Greek bailout to the real economy through a deterioration of banks' balance sheet. Comparing lending to the same firm by two banks differently exposed to the shock, we find that, within one year after the onset of the turbulence, financial intermediaries with a higher exposure reduced their credit supply by 7% more than the other banks, and terminated ongoing lending relationships with a 2% higher probability (bank lending channel). This effect is larger for banks that at the moment of the Greek bailout, which marked the beginning of the tensions, had a weak balance sheet (Tier1 capital close to the regulatory threshold). Furthermore, the supply shock led to a decline in total bank credit, suggesting that firms, in particular small and low rated firms, were not able to smooth out the bank lending

channel by borrowing more from the other financial intermediaries (firm borrowing channel). Conducting a simple counter-factual exercise, our estimates suggest that a drop of almost 2% in aggregate corporate lending is directly imputable to the transmission of the sovereign tensions via banks balance sheets. Finally, we document the real consequences triggered by this credit tightening. We find a negative and significant reduction of investments by small firms, both in the intensive and in the extensive margin. The investment rate of larger firms did not seem to be affected. We interpret this heterogeneous response as a higher sensitivity of investments to bank credit shocks for smaller firms, rather than attributing it to a selective credit rationing conducted by more exposed financial intermediaries. In this sense, our evidence is coherent with the hypothesis that the business activity of smaller firms is more sensitive to shocks hitting the banking sector, reflecting their difficulties in tapping in other sources of credit.

All in all, we find that shocks to the riskiness of sovereign bonds are propagated to lending supply via the bank lending channel, coherently with what happens when shocks hit other assets in the banks' portfolios. However, a closer look at our findings also suggests that the issue of the interaction between sovereign holdings and the amplification of financial crisis is multifaceted, and still open to investigation. Indeed, in unreported regressions we confirm the results by Bofondi et al. (2013), in that the estimated negative impact disappears when the sample period includes the summer of 2011, at the height of the sovereign crisis in Italy. At that time, the creditworthiness of Italian intermediaries was for the most part determined by that of the Italian government, largely independently of the composition of their asset side

References

Abbassi, P., F. Braeuning, F. Fecht, and J.-L. Peydro (2014). Cross-border liquidity, relationships, and monetary policy: Evidence from the euroarea interbank crisis. Technical report, mimeo. Deutsche Bundesbank.

Acharya, V., I. Drechsler, and P. Schnabl (2011). A pyrrhic victory? bank bailouts and sovereign credit risk. *NBER Working paper* (17136).

Acharya, V., T. Eisert, C. Eufinger, and C. Hirsch (2014). Real effects of the sovereign debt crises in europe: evidence from syndicated loans. *Working paper*.

Acharya, V. and S. Steffen (2013). The "greatest" carry trade ever? understanding eurozone bank risks. *NBER Working paper* (19039).

Ahtik, M. and U. Albertazzi (2014). The supply of credit to sovereigns and privates is there crowding out? *Mimeo ECB*.

Albertazzi, U. and M. Bottero (2013). The procyclicality of foreign bank lending: Evidence from the global financial crisis. *Journal of International Economics 92(S1), S22-S35*.

Albertazzi, U. and D. J. Marchetti (2010). Credit supply, flight to quality and evergreening: an analysis of bank-firm relationships after lehman. *Bank of Italy Working paper* (756).

Albertazzi, U., T. Ropele, and G. Sene (2014). The impact of the sovereign debt crisis on the activity of italian banks. *Journal of Banking & Finance 46*, 387–402.

Angelini, P., G. Grande, and F. Panetta (2014). The negative feedback loop between banks and sovereigns. *Bank of Italy Occasional Paper* (213).

Augustin, P., H. Boustanifar, J. H. Breckenfelder, and J. Schnitzler (2014). Sovereign credit risk and corporate borrowing costs. *Available at SSRN 2097391*.

Bank of Italy (2014). *Financial Stability Report, n.1.* Bank of Italy.

Battistini, N., M. Pagano, and S. Simonelli (2013). Systemic risk and home bias in the euro area. *European Commission Economic Papers* (494).

Becker, B. and V. Ivashina (2014). Financial repression in the european sovereign debt crisis. *Swedish House of Finance Research paper* (14/13).

Benzoni, L., P. Collin-Dufresne, R. S. Goldstein, and J. Helwege (2014). Modeling credit contagion via the updating of fragile beliefs.

Bernanke, B. and M. Gertler (1989). Agency costs, net worth, and business fluctuations. *The American Economic Review 79*, 14–31.

Bertrand, M., E. Duflo, and S. Mullainathan (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics 119*(1), pp. 249–275.

Bocola, L. (2013). The pass-through of sovereign risk. *Manuscript, University of Pennsylvania*.

Bofondi, M., L. Carpinelli, and E. Sette (2013). Credit supply during a sovereign debt crisis. *Bank of Italy Temi di Discussione (Working Paper) No 909*.

Casiraghi, M., E. Gaiotti, M. L. Rodano, and A. Secchi (2013). The impact of unconventional monetary policy on the italian economy during the sovereign debt crisis. *Bank of Italy Occasional Paper* (203).

Chodorow-Reich, G. (2014). The employment effects of credit market disruptions: Firm-level evidence from the 2008–9 financial crisis. *The Quarterly Journal of Economics 129*(1), 1–59.

Cingano, F., F. Manaresi, and E. Sette (2014). Does credit crunch investments down? new evidence on the real effects of the bank-lending channel. *MoFir Working paper* (91).

Correa, R., K.-h. Lee, H. Sapriza, and G. A. Suarez (2014). Sovereign credit risk, banks' government support, and bank stock returns around the world. *Journal of Money, Credit and Banking 46*(s1), 93–121.

De Marco, F. (2014). Bank lending and the sovereign debt crisis. *Manuscript, Boston College*.

Detragiache, E., P. Garella, and L. Guiso (2000). Multiple versus single banking relationships: Theory and evidence. *The Journal of Finance 55*(3), 1133–1161.

Duygan-Bump, B., A. Levkov, and J. Montoriol-Garriga (2015). Financing constraints and unemployment: evidence from the great recession. *Journal of Monetary Economics*.

Gaiotti, E. (2013). Credit availability and investment: Lessons from the "great recession". *European Economic Review 59*, 212–227.

Gambacorta, L. and P. E. Mistrulli (2004). Does bank capital affect lending behavior? *Journal of Financial intermediation 13*(4), 436–457.

Gan, J. (2007a). Collateral, debt capacity, and corporate investment: Evidence from a natural experiment. *Journal of Financial Economics 85*(3), 709–734.

Gan, J. (2007b). The real effects of asset market bubbles: Loan-and firm-level evidence of a lending channel. *Review of Financial Studies 20*(6), 1941–1973.

Gennaioli, N., A. Martin, and S. Rossi (2013). Banks, government bonds, and default: what do the data say? *IMF Working Paper* (120).

Gennaioli, N., A. Martin, and S. Rossi (2014). Sovereign default, domestic banks, and financial institutions. *The Journal of Finance 69*(2), 819–866.

Giordano, R., M. Pericoli, and P. Tommasino (2013). Pure or wake-up-call contagion? another look at the emu sovereign debt crisis. *International Finance 16*(2), 131–160.

Goldstein, M. (1998). *The Asian financial crisis: Causes, cures, and systemic implications*, Volume 55. Peterson Institute.

Greenstone, M., A. Mas, and H.-L. Nguyen (2014). Do credit market shocks affect the real economy? quasi-experimental evidence from the great recession and 'normal' economic times. *NBER Working paper*.

Hoshi, T., A. Kashyap, and D. Scharfstein (1990a). Bank monitoring and investment: Evidence from the changing structure of japanese corporate banking relationships. In *"Asymmetric information, corporate finance, and investment",* R. Glenn Hubbard, editor: University of Chicago Press.

Hoshi, T., A. Kashyap, and D. Scharfstein (1990b). The role of banks in reducing the costs of financial distress in japan. *Journal of financial economics 27*(1), 67–88.

Hoshi, T., A. Kashyap, and D. Scharfstein (1991). Corporate structure, liquidity, and investment: Evidence from japanese industrial groups. *The Quarterly Journal of Economics*, 33–60.

Jiménez, G. and S. Ongena (2012). Credit supply and monetary policy: Identifying the bank balance-sheet channel with loan applications. *The American Economic Review 102*(5), 2301–2326.

Jiménez, G., S. Ongena, J.-L. Peydró, and J. Saurina (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica 82*(2), 463–505.

Kashyap, A. K., J. C. Stein, and D. W. Wilcox (1992). Monetary policy and credit conditions: Evidence from the composition of external finance.

Khwaja, A. I. and A. Mian (2008). Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *The American Economic Review*, 1413–1442.

King, R. G. and R. Levine (1993). Finance and growth: Schumpeter might be right. *The quarterly journal of economics*, 717–737.

Merler, S. and J. Pisani-Ferry (2012). Who's afraid of sovereign bonds? (2012/12).

Neri, S. and T. Ropele (2013). The macroeconomic effects of the sovereign debt crisis in the euro area.

Panetta, F., R. Correa, M. Davies, A. Di Cesare, J.-M. Marques, F. Nadal de Simone, F. Signoretti, C. Vespro, S. Vildo, and M. Wieland (2011). The impact of sovereign credit risk on bank funding conditions. *CGFS Papers, No. 5*.

Pericoli, M. and M. Sbracia (2003). A primer on financial contagion. *Journal of Economic Surveys 17*(4), 571–608.

Popov, A. and N. Van Horen (2013). The impact of sovereign debt exposure on bank lending: Evidence from the european debt crisis. *Review of Finance,* forthcoming.

Rajan, R. G. and L. Zingales (1998). Financial dependence and growth. *The American Economic Review 88*(3), 559–586.

Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*, Volume 55. Transaction publishers.

Stein, J. C. (1998). An adverse-selection model of bank asset and liability management with implications for the transmission of monetary policy. *RAND Journal of Economics 29*(3), 466–486.

Sufi, A. (2009). Bank lines of credit in corporate finance: An empirical analysis. *Review of Financial Studies 22*(3), 1057–1088.

Panel (a): Relationship-specific Variables

	Obs.	Mean	SD	SD^{Within}	$SD^{Between}$	1^{st} percentile	99^{th} percentile
$\Delta ln(Loans)_{POST-PRE}$	424191	0.011	0.567	0.366	0.478	-1.771	1.702
$\Delta ln(Credit\ Lines)_{POST-PRE}$	424191	0.005	0.519	0.336	0.463	-1.704	1.546
$\Delta ln(Tot\ Credit)_{POST-PRE}$	424191	0.011	0.514	0.317	0.450	-1.572	1.564
$Cut\ Credit_{POST}$	464435	0.050	0.219	0.142	0.194	0.000	1.000
$Lenght\ Relatioship_{2010Q1}$	424191	10.372	5.555	3.258	4.780	1.000	17.000
$Share\ Relatioship_{2010Q1}$	424191	33.124	21.076	16.459	13.247	2.932	90.312

Sub-Sample: Firms with multiple lending relationships appearing in Italian Credit Register

Panel (b): Real Variables

	Obs.	Mean	SD	1^{st} percentile	99^{th} percentile
$1\{\Delta Ln(Asset) > 0\}$	34522	0.44	0.50	0.000	1.000
$\Delta Ln(Asset)$	34522	0.03	0.59	-1.95	2.37

Sub-Sample: Firms with multiple lending relationships appearing in CEBI

Panel (c): Bank-specific Variables

	Obs.	Mean	SD	1^{st} percentile	99^{th} percentile
$Sovereign_{b,2010Q1}$	539	0.251	0.364	0.000	0.892
$Sovereign^{TIER1}_{2010Q1}$	539	1.423	1.192	0.000	5.643
$Sovereign^{TotAssets}_{2010Q1}$	539	0.141	0.018	0.000	0.471
$Sovereign_{2010Q1}/Total\ Sovereign_{2010Q1}$	539	0.989	0.0571	0.068	1.000
ROA_{2010Q1}	539	0.004	0.002	-.0313	0.006
$Size_{2010Q1}$	539	5.160	1.623	2.768	11.194
$Tier1_{2010Q1}$	539	0.172	0.119	0.062	0.593
$Deposits_{2010Q1}$	539	0.812	0.465	0.096	1.995
$Liquidity_{2010Q1}$	539	0.014	0.019	0.001	0.035
$Net\ Interbank\ Debt_{2010Q1}$	539	-0.093	0.242	-0.672	0.258
$Bad\ Loans_{2010Q1}$	539	0.038	0.033	0.002	0.183
BCC	539	0.758	0.428	0.000	1.000

Sample: Lenders to firms with multiple lending relationships appearing in the Italian Credit Register

Table 1: **Summary Statistics - Borrowers' variables**

This table reports the summary statistics of the firm-level variables in our analysis analysis. In **Panel (a)** we present the distribution of relationship-specific variables. These include the change in log average loans ($\Delta lnLoans_{POST-PRE}$), credit lines ($\Delta lnCreditLine_{POST-PRE}$), and total credit ($\Delta lnTotal\ Debt_{POST-PRE}$) between the pre-shock and post-shock period, a dummy variable equal 1 whenever a term loan present in the pre-period was not renewed after the burst of the sovereign crisis ($Cut\ loan_{POST}$), the length of the lending relationship measured in quarters ($Lenght\ Relatioship_{2010Q1}$) and the faction of total bank credit provided by the lender ($Share\ Relatioship_{2010Q1}$). All relationship-specific variables variables come from the Italian Credit Register. **Panel (b)** reports the summary statistics of the investment variables used in Section (6) of this paper. $1\{\Delta Ln(Asset) > 0\}$ is a dummy variable equal to one if the firm increased its fixed assets between the end of 2009 and the end of 2011; $\Delta Ln(Asset)$ is the log-difference of tangible asset of the firm between 2011 and 2009. Investment variables come from the sub-sample of the firms in the Italian Credit Registry appearing in the CEBI database. **Panel (c)** reports the summary statistics of bank-level variables used in our analysis. All variables in Panel (c) are measured the last quarter before the contagion of the sovereign crisis to Italian debt (2010:Q1).

	$Below\ Median\ of$ $Sovereign_{2010Q1}$	$Above\ Median\ of$ $Sovereign_{2010Q1}$	$Difference$ $Below - Above$	$Pairwise\ Correlation\ with$ $Sovereign_{2010Q1}$
ROA_{2010Q1}	0.00	0.00	-0.00	0.04
	(0.00)	(0.00)	(0.00)	(0.36)
$Size_{2010Q1}$	6.19	5.03	1.16***	-0.26***
	(1.77)	(1.24)	(0.13)	(0.00)
$Tier1_{2010Q1}$	0.14	0.20	-0.06***	0.45***
	(0.12)	(0.16)	(0.01)	(0.00)
$Deposits_{2010Q1}$	0.61	0.99	-0.37***	0.75***
	(0.32)	(0.51)	(0.04)	(0.00)
$Liquidity_{2010Q1}$	0.00	0.01	-0.00***	0.26***
	(0.00)	(0.01)	(0.00)	(0.00)
$Net\ Interbank\ Debt_{2010Q1}$	-0.06	-0.11	0.05**	-0.11***
	(0.33)	(0.15)	(0.02)	(0.01)
$Bad\ Loans_{2010Q1}$	0.03	0.05	-.010***	0.1052**
	(0.03)	(0.04)	(0.00)	(0.01)
BCC	0.61	0.88	-0.27***	0.09***
	(0.48)	(0.32)	(0.03)	(0.04)

Sample: Firms with multiple lending relationships

Table 2: **Banks Characteristics and Sovereign Holdings**

This table shows the relation between the exposure of intermediaries to the sovereign crisis and a host of bank-specific characteristics, as previously defined in the paper. All variables are measured at the end of first quarter of 2010. The first and second column report, respectively, the mean and standard deviation (in parenthesis) of bank's characteristics sorting bank into two groups: above and below the median exposure. The third column shows the difference between the first and the second column and the standard errors of a two-sample t-test of the equality of the means (in parenthesis). The fourth column shows the pairwise correlation between $Sovereign_{2010Q1}$and banks characteristics and the p-value of this correlation (in parenthesis). *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	$Pre-trend$	$Placebo$
$Dep.Var:$	$\Delta ln(Loans)_{2010Q1-2009Q2}$	$\Delta ln(Loans)_{2008Q3-2006Q4}$
	(1)	(2)
$Sovereign_{2010Q1}$	0.028	
	(0.079)	
$Sovereign_{2007Q3}$		0.836
		(0.597)
$Bank\,Controls_{2010Q1}$	Y	Y
$Relationship\,Controls_{2010Q1}$	Y	Y
$Firm\,F.E.$	Y	Y
$Sample$	$Multiple$	$Multiple$
$Cluster$	$Bank$	$Bank$
$Adj.\,R^2$	0.417	0.554
$Observations$	249966	634633

Table 3: **Pre-Trend and Placebo Regressions**

This table reports the results of the pre-trend test and of the placebo test described in Section (4). We run the empirical model of equation (*3*) on two different samples. In Column (1) we test the no pre-trend assumption investigating the correlation between holdings of sovereigns of bank b and the percentage change in loans to firm j in the pre-shock period. The change is measured as delta log loans from b to j between 2010:Q1 and 2009:Q2. The main independent variable is the exposure of lender j to Italian sovereigns in 2010:Q1 scaled by RWA in 2010:Q1 ($Sovereign_{2010Q1}$). In Column (2) we run a placebo test investigating the correlation between the percentage credit supply of bank b to firm j between period $t-1$ (logarithm of average loans between 2006:Q4-2007:Q3) and period t (logarithm of average loans between 2007:Q4-2008:Q3) and the holdings of sovereign of the lender at the end of period t (2007:Q3). The main independent variable is the exposure of lender j to Italian sovereigns in 2007:Q3 scaled by RWA in 2007:Q3 ($Sovereign_{2007Q3}$). These regressions include a set of bank-specific controls, as in the main analysis - measured at the end of 2010:Q1 in Column (1), and at the end of 2007:Q3 in Column (2). The sample includes only firms with multiple lending relationships, and both empirical models include firm fixed effects. Standard Errors are clustered at bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

$Dep.Var: \Delta ln(Loans)_{POST-PRE}$				
	(1)	(2)	(3)	(4)
$Sovereign_{2010Q1}$	-0.285***	-0.285***		
	(0.105)	(0.022)		
$Sovereign^{TIER1}_{2010Q1}$			-0.030***	-0.030***
			(0.011)	(0.002)
ROA_{2010Q1}	0.055	0.055***	0.061*	0.061***
	(0.035)	(0.009)	(0.036)	(0.009)
$Size_{2010Q1}$	0.017***	0.017***	0.018***	0.018***
	(0.006)	(0.001)	(0.006)	(0.001)
$Tier1_{2010Q1}$	0.996***	0.996***	0.688***	0.688***
	(0.218)	(0.059)	(0.179)	(0.052)
$Deposits_{2010Q1}$	0.155***	0.155***	0.159***	0.159***
	(0.058)	(0.012)	(0.056)	(0.012)
$Liquidity_{2010Q1}$	2.696	2.696***	2.132	2.132***
	(3.812)	(0.632)	(3.831)	(0.640)
$Net\ Interbank\ Debt_{2010Q1}$	0.044	0.044**	0.046	0.046**
	(0.122)	(0.021)	(0.108)	(0.021)
$Bad\ Loans_{2010Q1}$	0.225	0.225***	0.315	0.315***
	(0.292)	(0.062)	(0.293)	(0.062)
BCC	0.106***	0.106***	0.105***	0.105***
	(0.028)	(0.006)	(0.027)	(0.006)
$Lenght\ Relatioship_{2010Q1}$	-0.023***	-0.023***	-0.024***	-0.024***
	(0.000)	(0.000)	(0.002)	(0.000)
$Share\ Relatioship_{2010Q1}$	-0.025***	-0.025***	0.001***	0.001***
	(0.002)	(0.002)	(0.015)	(0.015)
$BCC*Sovereign_{2010Q1}$				
$Firm\ F.E.$	Y	Y	Y	Y
$Sample$	$Multiple$	$Multiple$	$Multiple$	$Multiple$
$Cluster$	$Bank$	$Firm$	$Bank$	$Firm$
$Adj.\ R^2$	0.599	0.599	0.599	0.599
$Observations$	424191	424191	424191	424191

Table 4: **The Bank Lending Channel: Intensive Margin**

This table examines the bank lending channel. It reports the estimates obtained from Model (3) on the sample of firms with multiple lending relationships. The outcome variable is the log-difference in average loans granted by bank b to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. This information comes from the Italian Credit Register. The main independent variables is the stock of Italian sovereigns held by the lender right before the sovereign shock (end of 2010:Q1), scaled by RWA (Columns (1) and (2)) or Tier1 (Columns (3) and (4)). Every specification contains firm fixed effects. Standard Errors are clustered at firm or bank level depending on the specification. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	$\Delta ln(Credit\,Lines)$	$\Delta ln(Tot.\,Credit)$
	(1)	(2)
$Sovereign_{2010Q1}$	-0.240**	-0.270***
	(0.107)	(0.099)
$Bank\,Controls_{2010Q1}$	Y	Y
$Relationship\,Controls_{2010Q1}$	Y	Y
$Firm\,F.E.$	Y	Y
$Sample$	$Multiple$	$Multiple$
$Cluster$	$Bank$	$Bank$
$Adj.\,R^2$	0.596	0.642
Obs.	424191	424191

Table 5: **Bank Lending Channel: Total Credit and Credit Lines**

In this table we explore the bank lending channel for alternative measures of change in bank credit. The table reports the estimates obtained from Model (3) on the sample of firms with multiple lending relationships. We consider two alternative measures of bank credit. In Column (1) our left-hand side variable the total amount of bank credit, including credit lines and term loans. In Column (2) we focus only on credit lines. Both outcome variables are the log-difference in average credit t granted by bank b to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. All the bank level and relationship variables are measured at 2010:Q1. Every specification contains firm fixed effects. Standard Errors are clustered at bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)
$Dep.Var: \Delta ln(Loans)_{POST-PRE}$			
$Sovereign_{2010Q1}$	-0.321**	-0.341**	-0.312**
	(0.140)	(0.151)	(0.152)
$HighRevenue_j^{2009}$x$Sovereign_{2010Q1}$	-0.008		
	(0.052)		
$HighAsset_j^{2009}$x$Sovereign_{2010Q1}$		0.035	
		(0.039)	
$Risky\ Firm_j$x$Sovereign_{2010Q1}$			0.001
			(0.003)
$Firm\ F.E.$	Y	Y	Y
$Bank\ Controls_{2010Q1}^{AVE}$	Y	Y	Y
$Relationship\ Controls_{2010Q1}^{AVE}$	Y	Y	Y
$Province\ \&\ Industry.FE$	Y	Y	Y
$Sample$	$Multiple$	$Multiple$	$Multiple$
$Cluster$	$Average\ Bank$	$Average\ Bank$	$Average\ Bank$
$Adj.\ R^2$	0.413	0.412	0.570
$Observations$	140634	140470	148006

Table 6: **The Bank Lending Channel: Firms' Heterogeneity**

This table examines the heterogeneity of bank lending channel across different types of banks. It reports the estimates obtained from Model (3) on the sample of firms with multiple lending relationships which also appear in the CEBI database. We include in the baseline regression of Model (3) a set of interactions between bank b 's exposure to the shock and a host of bank-specific characteristics. The outcome variable is the log-difference in average loans granted by bank b to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. This information comes from the Italian Credit Register. The main independent variable is the exposure of the lender to Italian sovereign scaled by RWA, which we interact with proxies of size (Column (1) and Col um (2)) and credit risk (Column (3)). We employ two different measures of size. The first, $HighRevenue$ in Column (1), is a dummy equal to one if firm j's revenues in 2009 are above the median of the distribution of revenues across firms at the time. The second, $HighAsset$ in Column (2), is equal to one if firm j's book value of assets in 2009 are above the median of the distribution of assets across firms at the time. In Column (3) we interact our measure of sovereign exposure with a dummy for credit risk. This dummy, $Risky\ Firm$, is equal to one if firm j is considered a risky borrower based on its credit rating. The definition of risky firm follows the standard definition adopted by the Italian banks. The set of bank controls and relationship controls are the usual. All bank-level and relationship-variables are measured in 2010:Q1. Every specification contains firm fixed effects. Standard Errors are clustered at firm or bank level depending on the specification. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

$Dep.Var: Cut\,Credit_{POST}$				
	(1)	(2)	(3)	(4)
$Sovereign_{2010Q1}$	0.053***	0.053***		
	(0.025)	(0.007)		
$Sovereign^{TIER1}_{2010Q1}$			0.006*	0.006***
			(0.003)	(0.001)
ROA_{2010Q1}	-1.432	-1.432**	-1.827	-1.827***
	(1.466)	(0.609)	(1.530)	(0.617)
$Size_{2010Q1}$	0.001	0.001***	0.001	0.001***
	(0.002)	(0.000)	(0.002)	(0.000)
$Tier1_{2010Q1}$	-0.076*	-0.076***	-0.018	-0.018
	(0.042)	(0.018)	(0.033)	(0.016)
$Deposits_{2010Q1}$	-0.007	-0.007	-0.007	-0.007*
	(0.011)	(0.004)	(0.011)	(0.004)
$Liquidity_{2010Q1}$	-0.531	-0.531**	-0.428	-0.428*
	(0.843)	(0.226)	(0.885)	(0.227)
$Net\,Interbank\,Debt_{2010Q1}$	0.033	0.033***	0.032	0.032***
	(0.031)	(0.007)	(0.028)	(0.007)
$Bad\,Loans_{2010Q1}$	0.036	0.036	0.017	0.017
	(0.081)	(0.023)	(0.086)	(0.024)
BCC	-0.007	-0.007***	-0.007	-0.007***
	(0.006)	(0.002)	(0.006)	(0.002)
$Sample$	$Multiple$	$Multiple$	$Multiple$	$Multiple$
$Cluster$	$Bank$	$Firm$	$Bank$	$Firm$
$Adj.\,R^2$	0.585	0.585	0.585	0.585
$Observations$	464435	464435	464435	464435

Table 7: **The Bank Lending Channel: Extensive Margin**

This table examines the bank lending channel. It reports the estimates obtained from Model (3) on the sample of firms with multiple lending relationships. The outcome variable ($Credit\,Cut_{POST}$) is a dummy equal to one if bank b granted a loan to firm j before the onset of the sovereign crisis (2009:Q2-2010:Q1) but did not renew the loan to firm j after the crisis (2010:Q2-2011:Q1). This information comes from the Italian Credit Register. The main independent variables is the stock of Italian sovereign held by the lender right before the sovereign shock (end of 2010:Q1), scaled by RWA (Columns (1) and (2)) or Tier1 (Columns (3) and (4)). The set of bank-specific controls and relationship controls are the usual. All bank-level and relationship variables are measured at the end 2010:Q1. Every specification contains firm fixed effects. Standard Errors are clustered at firm or bank level depending on the specification. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

$Dep.Var: \Delta ln(Loans)_{POST-PRE}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Sovereign_{2010Q1}$	-0.174**	-0.227**	-0.304***	-0.392***	-0.347**	-0.275***	-0.275***
	(0.083)	(0.103)	(0.099)	(0.141)	(0.137)	(0.103)	(0.103)
$Sovereign_{2010Q1}$ interacted with:							
$Low\ Capital\ Ratio$	-0.235*					-0.507***	-0.507***
	(0.137)					(0.173)	(0.173)
$Bad\ Loans_{2010Q1}$		-1.541				-1.763	-1.763
		(1.131)				(1.123)	(1.123)
$Net\ Interbank\ Debt_{2010Q1}$			-0.139			0.128	0.128
			(0.156)			(0.155)	(0.155)
$Deposits_{2010Q1}$				0.101		0.156	0.156
				(0.069)		(0.117)	(0.117)
$Tier1_{2010Q1}$					0.349		-0.508
					(0.366)		(0.548)
$Top\ 5_{2010Q1}$						0.134	0.134
						(0.339)	(0.339)
$Sample$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$
$Bank\ Controls_{2010Q1}$	Y	Y	Y	Y	Y	Y	Y
$Relationship\ Controls_{2010Q1}$	Y	Y	Y	Y	Y	Y	Y
$Firm\ F.E.$	Y	Y	Y	Y	Y	Y	Y
$Cluster$	$Bank$	$Bank$	$Bank$	$Bank$	$Bank$	$Bank$	$Bank$
$Adj - R^2$	0.599	0.599	0.600	0.599	0.599	0.600	0.600
$Obs.$	424191	424191	424191	424191	424191	424191	424191

Table 8: **Transmission Mechanism of The Bank Lending Channel**

This table investigates the channels of transmission of the sovereign shock to through banks' balance sheet. It reports the estimates obtained from Model (3) on the sample of firms with multiple lending relationships, where we interact exposure to the sovereign shock with a set of bank characteristics which are proxies for alternative balance sheet channels of transmission. The outcome variable is the log-difference in average loans granted by bank b to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. This information comes from the Italian Credit Register. The set of bank-specific controls and relationship controls are the usual. All bank-level and relationship variables are measured at the end 2010:Q1.The interaction variables include: bad loans, a dummy equal one if the financial institution is a net borrower in interbank markets, Tier1 ratio, deposit, close capital (dummy equal 1 if Tier1 ratio of the bank is between 8 and 10 percent), Top 5 (a dummy equal 1 if the bank is one of the biggest five Italian banks). All bank-level and relationship-variables are measured in 2010:Q1. Every specification contains firm fixed effects. Standard Errors are clustered at bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

$Dep.Var$: $Estimate\ Firm\ FE\ (\rho_j)$	
	(1)
$Rating_{2009}$	0.055***
	(0.002)
$Revenues\ Growth\ (2009-2010)$	0.273***
	(0.006)
$Assets\ Growth\ (2009-2010)$	0.075***
	(0.004)
$Num\ Credit\ Relationship_{2010Q1}$	0.032***
	(0.001)
$Constant$	-0.051***
	(0.001)
$Sample$	$Multiple$
$Standard\ Errors$	$Robust\ SE$
$Adj.\ R^2$	0.065
$Observations$	164,875

Table 9: **Fixed Effects and Demand-Side Shocks**

This table investigates the correlation between the fixed effects estimated by Model (3) on the sample of firms with multiple lending relationships with proxies of firms demand, investment opportunities, and riskiness. The right-hand side variables in include credit rating at the end of fiscal year 2009, revenues' growth between the fiscal years 2009 and 2010, assets' and assets' growth between 2009 and 2010, and number of credit relationships established by the firm at the end of 2010:Q1. All firm-level variables come from Bank of Italy's Credit Register. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

$Dep.Var$: $\Delta ln(Loans)_{POST-PRE}$			
	(1)	*(2)*	*(3)*
$Sovereign_{2010Q1}$	-0.285***	-0.347***	-0.367***
	(0.105)	(0.129)	(0.138)
$Bank\ Controls_{2010Q1}$	Y	Y	Y
$Relationship\ Controls_{2010Q1}$	Y	Y	Y
$Firm\ F.E.$	Y	N	N
$Sample$	$Multiple$	$Multiple$	$Single$
$Cluster$	$Bank$	$Bank$	$Bank$
$Adj.\ R^2$	0.599	0.086	0.086
$Obs.$	424191	424191	114157

Table 10: **The Bank Lending Channel Without Fixed Effects**

This table reports the result for our baseline specification, presented in Equation (3), estimated on different samples of firms and with/without firm fixed effects. The outcome variable is the log-difference in average loans granted by bank b to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. This information comes from the Italian Credit Register. Column (1) runs the baseline regression on the sample of firms with multiple lending relationships, including firm fixed effects. Columns (2) replicates column (1) without including firm fixed effects. Column (3) replicates column (2) on the sample of firms which established only one lending relationship. The set of bank-specific and relation specific control is the same in Table 4. The main independent variables are the total exposure to Italian Sovereign, scaled by RWA and Tier1. All the bank level data are measured at 2010Q1. Standard Errors are clustered at bank level. All regressions include a constant.*** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

$\Delta ln(Total\ Loans)_{POST-PRE}$		
	(1)	(2)
$Sovereign^{WA}_{2010Q1}$	-0.206***	-0.216***
	(0.022)	(0.065)
$Estimated\ Firm\ F.E.\ (\hat{\rho}_j)$	0.914***	
	(0.002)	
$Bank\ Controls^{WA}_{2010Q1}$	Y	Y
$Relationship\ Controls^{WA}_{2010Q1}$	Y	Y
$Province\ \&\ Industry.FE$	Y	Y
$Sample$	$Multiple$	$Multiple$
$Cluster$	$Lead\ Bank$	$Lead\ Bank$
$Adj.\ R^2$	0.684	0.087
$Observations$	182287	182287

Table 11: **The Firm Borrowing Channel**

This table examines the firm borrowing channel. It reports the estimates obtained from Model (5) on the sample of firms with multiple lending relationships. The outcome variable is the log-difference in average total bank loans granted to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. The main independent variable is the weighted average of the exposure to Italian sovereign scaled by RWA of firm j's lenders. Weights are equal to the share of total bank loans provided by each lender at the end 2010:Q1. In Column (1) we control for unobserved demand-side shocks ($\hat{\rho}_j$ estimated in the baseline regression of the bank lending channel). Column (2) presents the results of the same econometric model estimated in Column (1), but without controlling for demand-side shocks ($\hat{\rho}_j$). The set of bank-specific controls and relationship controls are the usual. All bank-level and relationship variables are measured at the end 2010:Q1.Weights are equal to the share of total bank loans provided by each lender at the end of 2010:Q1. We also control for weighted average length of the bank-borrower lending relationships, province fixed effects and industry fixed effects. All the bank-specific, relationships-specific variables, province fixed-effects, industry fixed-effects are measured at the end of 2010:Q1. Standard Errors are clustered at lead bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)
$Dep.Var: \Delta ln(Total\ Loans)_{POST-PRE}$			
$Sovereign^{WA}_{2010Q1}$	-0.163***	-0.099***	-0.044
	(0.038)	(0.038)	(0.057)
$HighRevenue^{2009}_{j}$ x $Sovereign^{WA}_{2010Q1}$	0.094*		
	(0.049)		
$HighAsset^{2009}_{j}$ x $Sovereign^{WA}_{2010Q1}$		-0.051	
		(0.047)	
$Risky\ Firm_j$ x $Sovereign^{WA}_{2010Q1}$			-0.018**
			(0.009)
$HighRevenue^{2009}_{j}$	-0.010**		
	(0.005)		
$HighAsset^{2009}_{j}$		0.002	
		(0.004)	
$Risky\ Firm_j$			0.001
			(0.001)
$Estimated\ Firm\ F.E.\ (\hat{\rho}_j)$	0.778***	0.778***	0.778***
	(0.005)	(0.005)	(0.005)
$Bank\ Controls^{WA}_{2010Q1}$	Y	Y	Y
$Relationship\ Controls^{WA}_{2010Q1}$	Y	Y	Y
$Province\ \&\ Industry.FE$	Y	Y	Y
$Sample$	$Multiple$	$Multiple$	$Multiple$
$Cluster$	$Average\ Bank$	$Average\ Bank$	$Average\ Bank$
$Adj.\ R^2$	0.641	0.641	0.639
$Observations$	34188	34188	34188

Table 12: **The Firm Borrowing Channel: Firms' Heterogeneity**

This table examines the heterogeneity of firm borrowing channel across different types of firms. It reports the estimates obtained from Model (3) on the sample of firms with multiple lending relationship which also appear in the CEBI database. We include in the baseline regression of Model (3) a set of interactions between the firm j exposure to the shock and a host of firm-specific characteristics. The outcome variable is the log-difference in average total loans granted to firm j between after (2010:Q2-2011:Q1) and before (2009:Q2-2010:Q1) the onset of the sovereign crisis. The main independent variable is the weighted average of the exposure to Italian sovereign scaled by RWA of firm j's lenders. Weights are equal to the share of total bank loans provided by each lender in 2010:Q1. We interact this variable with proxies of size (Column (1) and Column (2)) and credit risk (Column (3)). We employ two different measures of size. The first, $HighRevenue$ in Column (1), is a dummy equal to one if firm j's revenues in 2009 are above the median of the distribution of revenues at that time. The second, $HighAsset$ in Column (2), is equal to one if firm j's book value of assets in 2009 are above the median of the distribution of assets across firms at the time. In Column (3) we interact our measure of sovereign exposure with a dummy for credit risk. This dummy, $Risky\ Firm$, is equal to one if firm j is considered a risky borrower based on its credit rating. The definition of risky firm follows the standard definition adopted by the Italian scoring system. In all specifications we control for unobserved demand-side shocks ($\hat{\rho}_j$) estimated in the baseline regression of the bank lending channel. The set of bank-specific controls and relationship controls are the usual, but weighted by pre-shock exposure. All bank-level and relationship variables are measured at the end 2010:Q1. Weights are equal to the share of total bank loans provided by each lender at the end of 2010:Q1. We also control for weighted average length of the bank-borrower lending relationships, province fixed effects and industry fixed effects. All the bank-specific, relationships-specific variables, province fixed-effects, industry fixed-effects are measured at the end of 2010:Q1. Standard Errors are clustered at lead bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	$1\{\Delta Ln(Asset)>0\}$	$\Delta Ln(Asset)$	$1\{\Delta Ln(Asset)>0\}$	$\Delta Ln(Asset)$	$1\{\Delta Ln(Asset)>0\}$	$\Delta Ln(Asset)$
$Sovereign^{WA}_{2010Q1}$	-0.110	-0.162*	-0.232**	-0.293**	-0.265***	-0.274**
	(0.091)	(0.091)	(0.110)	(0.125)	(0.102)	(0.118)
$HighRevenue^{2009}_{j}$ x $Sovereign^{WA}_{2010Q1}$			0.334***	0.346**		
			(0.101)	(0.134)		
$HighAsset^{2009}_{j}$ x $Sovereign^{WA}_{2010Q1}$					0.354***	0.258**
					(0.102)	(0.101)
$HighRevenue^{2009}_{j}$			0.003	-0.020		
			(0.011)	(0.014)		
$HighAsset^{2009}_{j}$					-0.099***	-0.127***
					(0.010)	(0.011)
$Estimated\ Firm\ F.E.\ (\hat{\rho}_j)$			0.204***	0.256***	0.206***	0.256***
			(0.008)	(0.010)	(0.008)	(0.010)
$Bank\ Controls^{WA}_{2010Q1}$	Y	Y	Y	Y	Y	Y
$Relationship\ Controls^{WA}_{2010Q1}$	Y	Y	Y	Y	Y	Y
$Province\ \&\ Industry.FE$	Y	Y	Y	Y	Y	Y
$Sample$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$
$Cluster$	$Lead\ Bank$	$Lead\ Bank$	$Lead\ Bank$	$Lead\ Bank$	$Lead\ Bank$	$Lead\ Bank$
$Adj.\ R^2$	0.026	0.028	0.025	0.028	0.028	0.045
$Observations$	34522	34522	34229	34229	34229	34229

Table 13: **Real Effect: Sovereign Exposure on Investments**

This table examines the effects of the sovereign crisis on investment transmitted via the lending channel. It reports the estimates obtained from Model (6) on the sample of firms with multiple lending relationships which also appear in the CEBI database. Our dependent variables are two alternative proxies of firm investments. In odd Columns, we use a dummy which is equal to 1 if the firm's total book value of asset in 2011 was higher than firm's total asset in 2009. In even Columns we look at the growth rate in total book value of asset between 2011 and 2009. The main independent variable is the weighted average of the exposure to Italian sovereign scaled by RWA of firm j's lenders. Weights are equal to the share of total bank loans provided by each lender in 2010:Q1. Columns (1) and (2) show the real effect of lenders' sovereign exposure on investment. In Columns (3)-(6), we investigate the heterogeneity of the real effect across firms of different size. We employ two different measures of size. The first, $HighRevenue$, is a dummy equal to one if firm j's revenues in 2009 are above the median across firms at the time. The second, $HighAsset$, is equal to one if firm j's book value of assets in 2009 are above the median across firms at the time. In this set of regressions we control for unobserved demand-side shocks ($\hat{\rho}_j$) estimated in the baseline regression of the bank lending channel (Equation (3)). The set of bank-specific controls and relationship controls are the usual. All bank-level and relationship variables are measured at the end 2010:Q1, but weighted by pre-shock exposure. Weights are equal to the share of total bank loans provided by each lender in 2010:Q1. We also control for weighted average length of the bank-borrower lending relationships, province fixed effects and industry fixed effects. All the bank-specific, relationships-specific variables, province fixed-effects, industry fixed-effects are measured at 2010:Q1. Standard Errors are clustered at lead bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	$1\{\Delta Ln(Asset)>0\}$	$\Delta Ln(Asset)$	$1\{\Delta Ln(Asset)>0\}$	$\Delta Ln(Asset)$	$1\{\Delta Ln(Asset)>0\}$	$\Delta Ln(Asset)$
$Sovereign^{WA}_{2010Q1}$	0.037	0.041	-0.051	-0.090	0.121	0.216
	(0.128)	(0.166)	(0.099)	(0.128)	(0.115)	(0.138)
$HighRevenue^{2009}_{j}$x$Sovereign^{WA}_{2010Q1}$			0.157	0.238		
			(0.120)	(0.189)		
$HighAsset^{2009}_{j}$x$Sovereign^{WA}_{2010Q1}$					-0.147	-0.282
					(0.138)	(0.188)
$HighRevenue^{2009}_{j}$			0.024**	-0.012		
			(0.011)	(0.023)		
$HighAsset^{2009}_{j}$					0.295***	0.473***
					(0.015)	(0.018)
$Bank\,Controls^{WA}_{2010Q1}$	Y	Y	Y	Y	Y	Y
$Relationship\,Controls^{WA}_{2010Q1}$	Y	Y	Y	Y	Y	Y
$Province\,\&\,Industry.FE$	Y	Y	Y	Y	Y	Y
$Sample$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$	$Multiple$
$Cluster$	$Lead\,Bank$	$Lead\,Bank$	$Lead\,Bank$	$Lead\,Bank$	$Lead\,Bank$	$Lead\,Bank$
$Adj.\,R^2$	0.035	0.027	0.031	0.023	0.098	0.110
$Observations$	23606	23606	31937	31937	31937	31937

Table 14: **Real Effect: Sovereign Exposure on Investments, pre-trending**

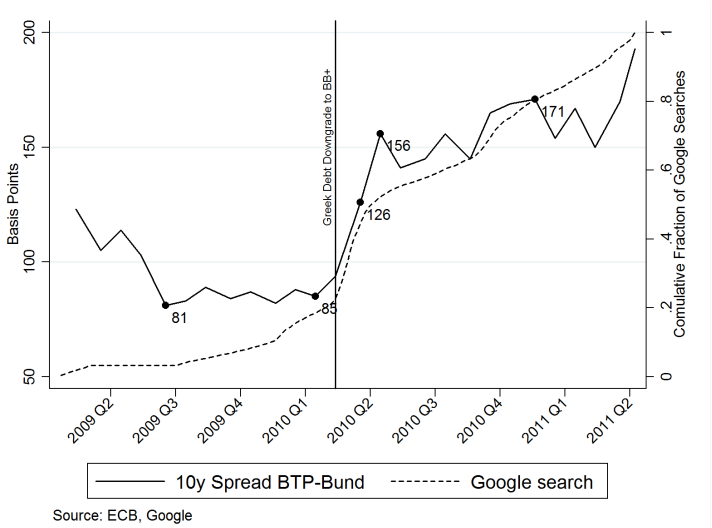
This table estimates a between firm regression testing weather firms exposed to banks with high sovereign holdings at the onset of the crisis were already reducing their investments before the Greek bailout. It reports the estimates obtained from Model (6) on the sample of firms with multiple lending relationships which also appear in the CEBI database. Our dependent variables are two alternative proxies of firm investments. In odd Columns, we use a dummy which is equal to 1 if the firm's total book value of asset in 2009 was higher than firm's total asset in 2007. In even Columns we look at the growth rate in total book value of asset between 2007 and 2009. The main independent variable is the weighted average of the exposure to Italian sovereign scaled by RWA of firm j's lenders. Weights are equal to the share of total bank loans provided by each lender in 2010:Q1. Columns (1) and (2) show the real effect of lenders' sovereign exposure on investment. In Columns (3)-(6), we investigate the heterogeneity of the real effect across firms of different size. We employ two different measures of size. The first, $HighRevenue$, is a dummy equal to one if firm j's revenues in 2009 are above the median across firms at the time. The second, $HighAsset$, is equal to one if firm j's book value of assets in 2009 are above the median across firms at the time. The set of bank controls are the same as in the main specifications. Bank-specific controls are the weighted average of bank-specific controls for the pool of lenders. Weights are equal to the share of total bank loans provided by each lender in 2010:Q1. We also control for weighted average length of the bank-borrower lending relationships, province fixed effects and industry fixed effects. All the bank-specific, relationships-specific variables, province fixed-effects, industry fixed-effects are measured at 2010:Q1. Standard Errors are clustered at lead bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

Table 15: **Real Effects: Size and Dependence on External Finance**

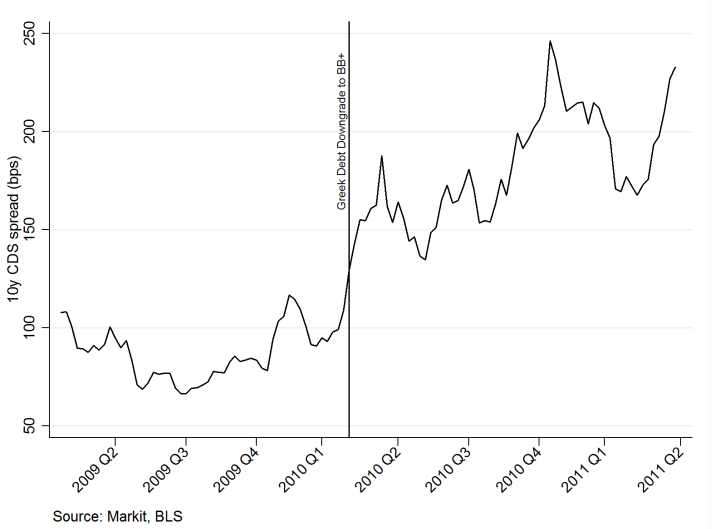
Dep. Var :	1(ΔInvest > 0)		%ΔInvest		1{ΔEmpl > 0}		%ΔEmpl	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Sovereigns}^{AVE}_{2010Q1}$	-0.059	-0.126	-0.173**	-0.197**	-0.020	-0.207	-0.031*	-0.123*
	(0.079)	(0.095)	(0.086)	(0.094)	(0.161)	(0.132)	(0.070)	(0.067)
$\text{Sovereigns}^{AVE}_{2010Q1}$x RZ Index_{2009}	0.011	0.019	-0.036*	-0.055**	-0.067**	-0.046	-0.041*	-0.055**
	(0.018)	(0.018)	(0.019)	(0.021)	(0.028)	(0.037)	(0.021)	(0.022)
$\text{Sovereigns}^{AVE}_{2010Q1}$x High Revenues_{2009}		0.209**		0.277**		0.201		0.108
		(0.097)		(0.110)		(0.131)		(0.070)
$\text{Sovereigns}^{AVE}_{2010Q1}$x RZ Index_{2009}		-0.011		0.060**		0.046		0.060**
x High Revenues_{2009}		(0.023)		(0.028)		(0.045)		(0.026)
RZ Index_{2009}xHigh Revenues_{2009}		0.001		-0.007**		0.002		-0.004*
		(0.002)		(0.003)		(0.004)		(0.002)
High Revenues_{2009}		0.004		-0.024**		0.072***		0.008
		(0.009)		(0.009)		(0.016)		(0.007)
Estimated Firm FE ($\hat{\rho}_j$)	0.203***	0.202***	0.255***	0.256***	0.131***	0.128***	0.092***	0.091***
	(0.009)	(0.009)	(0.011)	(0.011)	(0.010)	(0.010)	(0.007)	(0.007)
$\text{Bank Controls}^{AVE}_{2010Q1}$	Y	Y	Y	Y	Y	Y	Y	Y
$\text{Relationship Controls}^{AVE}_{2010Q1}$	Y	Y	Y	Y	Y	Y	Y	Y
Province & Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Sample	Multiple CADS	Multiple CADS	Multiple CADS	Multiple CADS	Multiple CADS	Multiple CADS	Multiple CADS	Multiple CADS
Cluster	Lead Bank	Lead Bank	Lead Bank	Lead Bank	Lead Bank	Lead Bank	Lead Bank	Lead Bank
Adj. R^2	0.031	0.031	0.032	0.032	0.042	0.042	0.044	0.044
Observations	34740	34740	34740	34740	16445	16445	16445	16445

Sample: Firms with multiple lending relationships appearing in the CADS database

This table examines the effects of the sovereign crisis on corporate investments and employment transmitted via the lending channel. It reports the estimates obtained from model (**??**) on the sample of firms with multiple lending relationships appearing in the CADS database. The dependent variables are two proxies of firm investments and employment. The main independent variable is the weighted average of the exposure to Italian sovereigns of firm j's lenders ($\text{Sovereigns}^{AVE}_{2010Q1}$). We interact with the firm level shock with a proxy of firm's size (High Revenues_{2009}) and dependence on external finance (RZ Index). All regressions include a set of weighted averaged bank-specific and relationship-specific controls are measured at the end 2010:Q1. All regressions include province fixed effects and industry fixed effects measured at the end of 2010:Q1, and we control for unobserved demand-side shocks ($\hat{\rho}_j$) estimated in the baseline regression of the bank lending channel (equation (3)). Standard Errors are clustered at lead bank level. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.



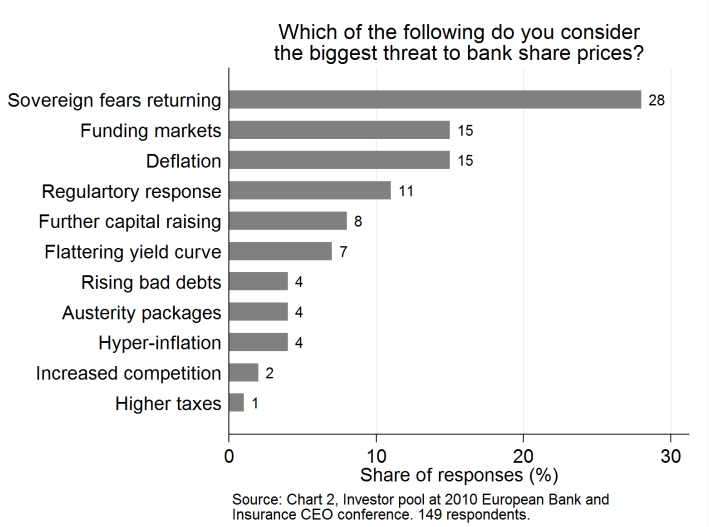
(a) **10y Spread Italy and Media Coverage**



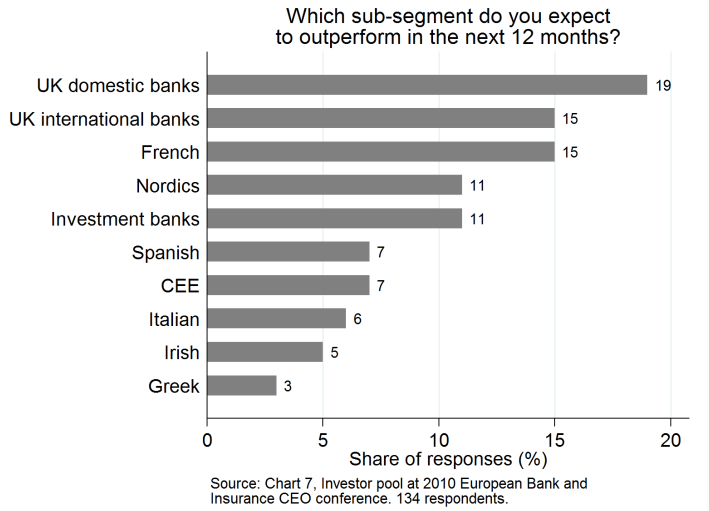
(b) **Bank's CDS Spread**

Figure 1: **Sovereign yield around the Greek bailout**

Figure 1a shows, on the left-hand axis (solid line), the dynamics of the spread between the yield of 10-year Italian zero-coupon bonds and that of 10-year zero-coupon bonds issued by Germany. Data from ECB. On the right-hand axis (dashed line) Figure 1a displays the frequency of Google searches of key words "Euro Crisis" using Google Trends. The y-axis reports the ratio of the Google searches of the key words in every week and the total number of Google searches of the same key words between the beginning of 2009:Q1 end of 2011:Q2. Source: http://www.google.com/trends/. Sources: ECB, Google.
Figure 1b reports the time series of the average of the CDS spreads on unsecured senior debt of the top 5 Italian banks (solid line). Data are taken from Markit database and include only the CDS issued in Euro. Sources: Markit.



(a) **Threat to bank's share prices**



(b) **Expected performance of financial institutions**

Figure 2: **Investor pool: European Bank and Insurance CEO conference**

Figure 2a and Figure 2b display the survey results of two questions from the investor poll conducted during the European Bank and Insurance CEO conference organized in September 2010 in London by Bank of America Merrill Lynch. Source: investor poll conducted during the European Bank and Insurance CEO. Charts available at http://ftalphaville.ft.com/2010/10/04/359726/european-bank-watch-past-present-and-future/.

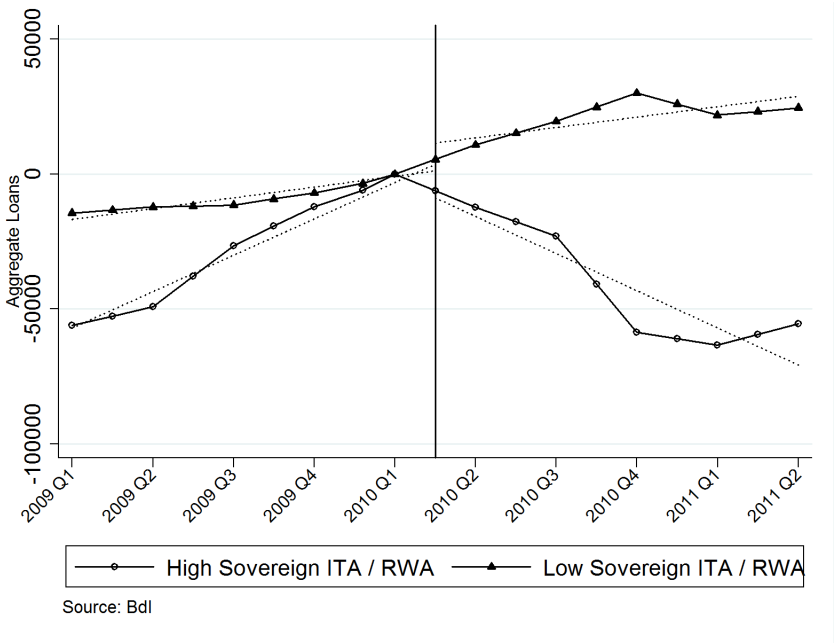


Figure 3: **The bank lending channel**

Figure 3 illustrates the bank lending channel semi-parametrically by comparing lending to firms from banks with high holdings of Italian sovereign bonds, the most exposed to the sovereign shock, and banks with lower holdings. A bank is classified as high sovereign if its residual holdings of Italian sovereign over risk-weighted assets in 2010$Q1$ are above the median. Residual holdings are calculated subtracting from the actual holdings the estimated holdings according to a set of bank-level characteristics. Both time series have been scaled such that aggregate lending is zero in 2010$Q1$, the last quarter before the sovereign shock. The vertical line marks the onset of the tensions in the sovereign bond markets.

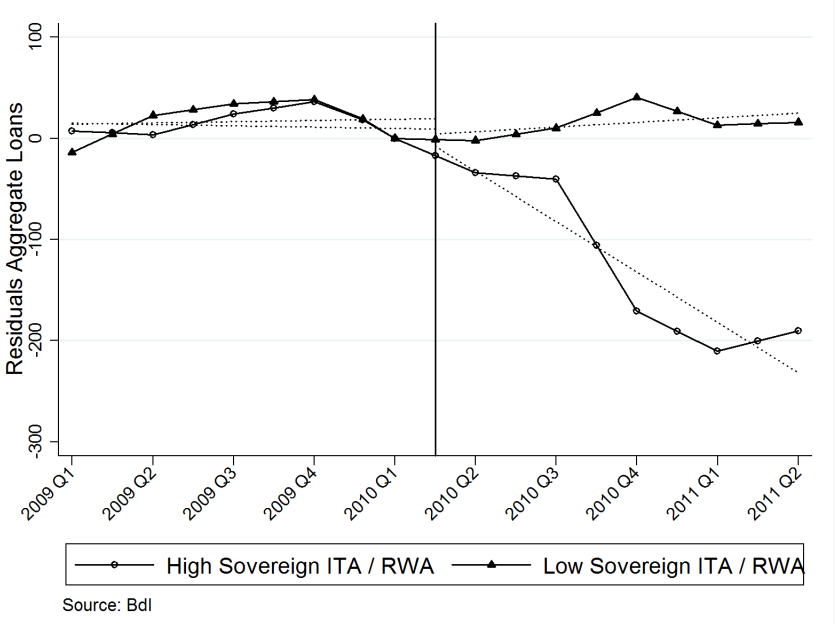


Figure 4: **The bank lending channel (con'ed)**

Figure 4 illustrates the bank lending channel semi-parametrically by comparing lending to firms from banks with high holdings of Italian sovereign bonds, the most exposed to the sovereign shock, and banks with lower holdings. A bank is classified as high sovereign if its residuals holdings of Italian sovereign over risk-weighted assets in 2010$Q1$ are above the median. Residual holdings are calculated subtracting from the actual holdings the estimated holdings according to a set of bank-level characteristics. Similarly, we focus on the amount of loans granted by each bank to his borrower in every quarter netting out the part that can be explained by bank's characteristic (other than sovereign holdings) and relationship-specific variables. We label this quantity residual loans. Both time series have been scaled such that aggregate lending is zero in 2010$Q1$, the last quarter before the sovereign shock. The vertical line marks the onset of tensions in the sovereign bond markets.

8 A Simple model of loan supply

Borrowing from Khwaja and Mian (2008) model of bank lending with costly external finance (Stein (1998)), we present a simple discrete time model that helps gaining intuition on the main identification problem of our analysis. While this cannot be used to draw any normative or positive implication, it is a useful tool to provide foundation to our empirical analysis.

Imagine a simplified setup in which a bank b can raise funds via short-term funding $S_{b,t}$ or bonds $B_{b,t}$.[49] Short-term funding bears no interest and can be considered risk-less as it is backed by a bank's holding of sovereign bonds which can always be liquidated for a fraction of their face value. That is $S_{b,t} \leq \gamma(t)G_{b,t-1}$, where $G_{b,t-1}$ is the nominal value of bank b's sovereign portfolio at the end of period $t-1$, which bank b takes as given in period t. The parameter $\gamma(t) \leq 1$ is the liquidation value of sovereign securities capturing current and future market value of government's debt. Alternatively, banks can raise funds issuing bonds $(B_{b,t})$, which have a constant marginal cost of $\alpha_B B_{b,t}$, where $\alpha_B > 0$.

With the funds they raise, banks can either lend to firms or buy sovereign bonds. Let $L_{bj,t}$ the amount of a loan granted by bank b to firm j in period t. As in Khwaja and Mian (2008) we assume that the marginal return on a loan $\hat{\theta}_j(t) - \alpha_L L_{ib,t}$ has two components. The first component is time-varying and firm-specific, $\hat{\theta}_j(t) = \theta_j(t) + \theta(t)$, capturing both time-varying firm-specific characteristics and investment opportunities $(\theta_j(t))$, as well as aggregate factors that affect the reruns of all borrowers in the economy $(\theta(t))$. The second component $(\alpha_L L_{bj,t})$ is decreasing at rate α_L in the size of the loan. Sovereign bonds $(G_{b,t})$ pay no interest and, abstracting from reasons that induce banks to invest in sovereign securities, we assume a constant an exogenous bank-specific demand $G_{bt} = G_{bt-1} = G_b$.[50]

The equilibrium quantity of loans is determined by setting the marginal cost of loans equal to their marginal return, and by imposing the bank accounting equality $L_{bj,t} + \bar{G}_b = S_{b,t} + B_{b,t}$. In particular, at time t, we have that

$$L_{bj,t} = \frac{\theta_j(t) + \theta(t) - \alpha_B G_b(1 - \gamma(t))}{\alpha_B + \alpha_L}$$

Without loss of generality, we set $\gamma_1 = \gamma$ and $\gamma_2 = \gamma + \tau$, where $\tau < 0$ is a shock to the market value of sovereign held in bank's portfolio. Then, the change in loans between period 1 and period 2 is equal to

$$\Delta L_{bj} = \frac{1}{\alpha_B + \alpha_L}(\Delta\theta_j + \Delta\theta + \alpha_B G_b \tau) \tag{7}$$

In the end, this equation describes as, at the optimum, the change in loan for bank b to firm j will depend

[49] We could generalize this to a case where also deposits were available at no cost, as in the original model. It would not change the conclusions

[50] In the empirical application, we will relax this assumption by allowing the demand of sovereign in the pre-period to be a function of bank's characteristics.

to firm demand, economy-wide shocks and bank's balance sheet factors.

9 Sovereign holdings and banks across Western countries

The choice to study the case of Italy may rise concerns regarding the external validity of our results. To address these concerns, we show that both the characteristics of the banking sector and the exposure to sovereign risk are not substantially different from those of other Western countries.

To begin with, we have collected from Bankscope balance sheet information of banks operating in a large number of countries.[51] In particular, we have focused on the sub-sample of banks that are active in Europe and United States, and compared them to Italian banks along a number of dimensions. The summary statistics per country are available in Table 16. All data refer to fiscal year 2009.

A cross-country comparison of capital structure across the financial institutions in our sample (Panel (b)) displays that Italian banks are comparable to other intermediaries in terms of capitalization and maturity of liabilities, especially intermediaries from other European countries. This is not surprising given the emphasis placed on capital requirements by the Basel regulation and the homogeneity in national regulations across Western countries. With the exception of German and English banks, equity is typically around 12-14 percent of total liabilities. The average bank in Italy, France, Ireland and the Netherlands appears to have ampler reliance on long-term funding, coherently with the business model prevailing in Europe. Furthermore, Italian banks grant slightly more loans than other European financial institutions, but they are very similar to the average US bank. At the same time, we do not observe significant differences between Italian banks and those in the other countries in terms of net income and impaired loans.

Most importantly, Italian banks are not unique in terms of their exposure to sovereign securities. According to Bankscope, Italian banks hold around 14 percent of asset in government issued bonds. While this is on the upper tail of the distribution of government bond holdings in the sample, also other countries hold a substantial portion of their assets in sovereign securities. Excluding Italy, the average portion of total assets invested in sovereign securities is about 8 percent for the banks in our sample, with Netherlands, Ireland, Greece and even USA having around 10 percent of their assets held in government debt.

Bankscope does not provide the share of the total sovereign assets that are issued by the bank's own sovereign. This information is provided by Merler and Pisani-Ferry (2012), who collected data on the share of total public debt that is held by domestic banks for a sample countries.[52] In Figure 5 we report the share of national debt held by resident financial institutions at the end of calendar years 2008 to 2011. According to these estimates, Italian banks hold 12 percent of outstanding national debt at the end of 2008, and gradually increased their holdings in the following three years, reaching 16.5 percent at the end of 2011.

[51] Bankscope is a database managed by Bureau van Dijk Electronic Publishing (BvD). This data has been used in other works and its quality has been also recently scrutinized by Gennaioli et al. (2013).

[52] This database results from combining together different national sources (national central banks, statistical authorities, treasuries)

These percentages are not very different from other countries in the euro area - such as France, Ireland and Greece (before 2011). Italian banks hold more debt issued by their own government than intermediaries in the UK, the US and the Netherlands. On the contrary, banks from Belgium, Spain, Portugal and Germany are more exposed to national sovereign debt than Italian intermediaries. Indeed, ranking our subset of countries according to the percentage of national debt held by domestic banks, the Italian banking system positions itself in the middle of the distribution.

This descriptive evidence suggests that the Italian banking system shows no anomalies when compared to that of other developed counties, both in terms of profitability and capital structure. On average, Italian banks have a higher fraction of assets represented by sovereign bonds, but this investment strategy is common to other Western countries as well.

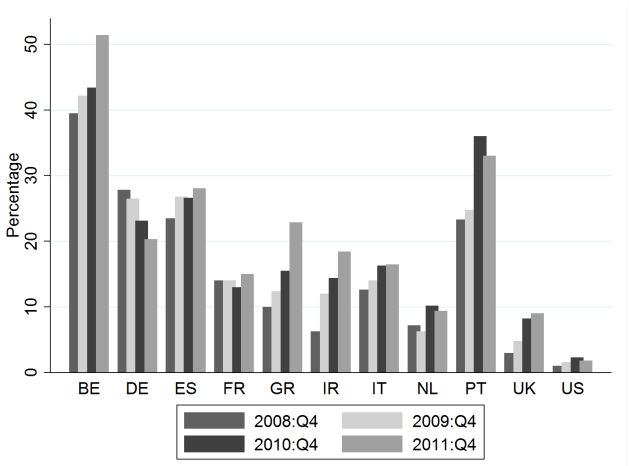


Figure 5: **Holding of Domestic Sovereign by Domestic Banks**

This graph reports share of domestic public debt held by domestic financial institutions for a selected sample of countries, across different years. Source: data from Merler and Pisani-Ferry (2012).

10 Technical Appendix

10.1 Data selection and other information on data construction

In this Section, we discuss the data construction. Starting from the universe of all business credit relationships appearing in the Credit Register, we classify firms into two groups. The first sub-sample includes a random sample of seventy percent of all borrowers which established, over the sample period we consider,

Panel (a)

	BE	DE	ES	FR	GR	IR	IT	NL	PT	UK	US
$Tot.\ SovereignSecurities/Tot.\ Asset$	0.18	0.02	0.05	0.06	0.09	0.1	0.14	0.09	0.04	0.07	0.1
	(0.23)	(0.04)	(0.05)	(0.11)	(0.09	(0.21)	(0.11)	(0.08)	(0.06)	(0.09)	(0.11)
$Tot.\ Loans/Tot.\ Asset$	0.42	0.54	0.63	0.58	0.67	0.42	0.66	0.57	0.55	0.45	0.63
	(0.28)	(0.16)	(0.23)	(0.27)	(0.13	(0.31)	(0.19)	(0.25)	(0.27)	(0.28)	(0.17)
$Return\ On\ Avg.\ Assets$	0.71	0.26	0.36	0.95	-0.13	-1.11	0.38	1.29	0.34	0.08	-0.09
	(2.65)	(0.39)	(0.97)	(3.54)	(1.15	(4.07)	(0.79)	(4.09)	(1.56)	(7.38)	(1.94)
$Return\ on\ Avg.\ Equity$	6.18	3.86	2.89	5.34	-5.52	-20.01	3.59	4.44	4.78	1.1	-2.33
	(13.53)	(4.8)	(16.9)	(15.48)	(20.68	(61.86)	(6.78)	(14.5)	(10.96)	(32.9)	(24.35)
$Net\ Income/Tot.\ Asset$	0.01	0	0	0.01	0	-0.01	0	0.01	0	-0.14	0
	(0.03)	(0.01)	(0.02)	(0.05)	(0.01	(0.05)	(0.01)	(0.04)	(0.01)	(2.58)	(0.03)
$Impaired\ Loans/Tot.\ Asset$	0.01	0.04	0.03	(0.03	0.07	0.05	0.05	0.02	0.04	0.03	0.03
	(0.01)	(0.03)	(0.02)	(0.04)	(0.06)	(0.07)	(0.04)	(0.01)	(0.05)	(0.06)	(0.03)

Panel (b)

	BE	DE	ES	FR	GR	IR	IT	NL	PT	UK	US
$Equity/Tot.\ Assets$	0.18	0.08	0.12	0.14	0.12	0.08	0.12	0.16	0.14	0.22	0.11
	(0.23)	(0.04)	(0.05)	(0.11)	(0.09)	(0.21)	(0.11)	(0.08)	(0.06)	(0.09)	(0.11)
$Long-term\ Funding/Tot.\ Asset$	0.11	0.04	0.2	0.17	0.06	0.21	0.3	.19	0.2	0.11	0.05
	(0.14)	(0.07)	(0.18)	(0.8)	(0.04)	(0.27)	(0.14)	(0.21)	(0.17)	(0.19)	(0.1)
$Deposits\ and\ Short-term\ Funding\ /Tot.\ Asset$	0.69	0.86	0.78	0.72	0.8	0.61	0.56	0.76	0.64	0.69	0.82
	(0.27)	(0.12)	(0.17)	(0.26)	(0.16)	(0.28)	(0.14)	(1.12)	(0.23)	(0.29)	(0.15)
$Tier\ 1\ ratio$	12.99	10.83	10.28	12.39	15.23	12.25	16.14	15.28	12.59	15.22	14.95
	(3.21)	(3.57)	(5.67)	(5.69)	(10.27)	(6.47)	(8.68)	(11.24)	(6.94)	(9.53)	(10.27)

Table 16: **International Comparison of Banking Systems**

This table presents several balance sheet variables capturing type of activity (Table a), asset composition and profitability (Panel a), and capital structure (Panel b) at the end of fiscal year 2009. We restrict our analysis to 11 countries: Italy (IT), Germany DE), France (FR), Belgium (BE), Netherlands (NL), United Kingdom (UK), United States (US), Greece (GR), Ireland (IR), Portugal (PT) and Spain (ES). We presents the average and standard deviation (in parenthesis) of the variables of interest across all banks operating in each country. Government bonds are reported at book value, and their nationality is not reported. Source: Bankscope. Sample Period: Fiscal Year 2009.

credit relationships with only one lender. The second group includes every firms which established multiple, simultaneous lending relationships with several banks. The presence of multiple-lender firms is not a peculiarity of Italy (cfr. footnote 14).

For each of these two sub-samples, we exclude a number of observations. We drop defaulted loans as well as new credit granted to borrowers who already have some other relations in default, as these positions may no longer reflect genuine demand and supply dynamics, but rather capture debt restructuring operations or some other source of bank-borrower agreements ascribable to default procedures. We drop observations for which no information about the lender was available.[53] We excludes credit provided by special purpose vehicles, non-bank financial intermediaries, and branches of foreign banks, as well as observations referring to borrowers which operate in the financial and insurance sector, utilities and government-related industries.[54] We eliminate firms with more than seven contemporaneous credit relationship, i.e. firms belonging to the top 5% of the distribution of lending relationships.[55] Finally, our sample includes only firms which appear in the Credit Register at least one quarter in our pre-period (2009:Q2-2010:Q1) and at least one quarter in the post-period (2010:Q2-2011:Q1). To the extent that the probability of not appearing in the Credit Register in the post-period is higher for credit rationed firms, our estimates can be considered a lower bound of the lending channel triggered by the sovereign tensions and of its real effects on investment. We end up with $538,348$ unique firm-bank credit relationships ($424,191$ referring to multi-lender firms) and more than 4.5 million quarterly observations for the two-years period going from 2009:Q2 to 2011:Q1. Our database includes 539 different banks and $274,070$ firms ($159,913$ with multiple lending relationships).[56] This sample is fully representative of the universe of firms and banks operating in Italy.

In Section (4) we explore the statistical and economic magnitude of the bank lending channel along the extensive margin. The data sets used in this analysis is constructed in a slightly different way, as we retain in our data sets also relationships that where present in the pre-shock period but ceased at some point in the post-shock period.

Also in this case, we drop defaulted loans as well as new credit granted to borrowers who already have some other relations in default, we drop: observations for which there is no available information about the lender, observations referring to borrowers which operate in the financial and insurance sector, utilities and government-related industries, and firms with more than seven contemporaneous credit relationship. We end

[53] We exclude all lending activity of Italian firms with branches of foreign banks for which no detailed balance sheet information is available. As estimated by Cingano et al. (2014), these lenders grant only a small share of total loans to Italian firms (about 6 percent).

[54] We exclude firms operating in the education sector and utilities because, for a majority of the cases, the government either runs them directly or indirectly subsidizes their activity.

[55] Our inspection of the data suggest that some of the credit relationships of firms with a high number of lending relationships do not reflect genuine credit relationships.

[56] In the sample of firms with multiple lending relationships, the average number of lending relationships is 3.5, with a standard deviation of 1.5.

up with 464, 435 unique firm-bank credit relationships referring to multi-lender firms.

10.2 Correlation between Greek and Italian yield

Our selection of the shock period around the Greek bailout is driven by two considerations: (a) The Greek bailout led to an unexpected shock to sovereign holdings, and therefore it provides with a suitable setting where to set up our quasi-experimental identification; (b) The Greek bailout was crucial to shift the expectation and the consideration of Italian sovereigns by investors. In light of these idea, we discussed in Section (2) the many papers that present evidence which corroborates our hypothesis. Furthermore, we can see evidence in this direction by studying the correlation of the spread between Italy and Greece, across four main period of analysis. Coherent with the "wake-up call hypothesis", before the events in Greece in 2009, the spread of Italy and Greece was essentially zero, and co-moved reflecting this homogeneity. This pattern changed when, in the fall of 2009, Greece started getting pressured for the alleged fiscal misconduct. While the Greek spread started rising, the Italian one over the same period remained stable. As a consequence, the correlation during that window is much lower and not even significant from zero (decreasing the window and keeping only the months since the summer, it actually becomes negative). However, in the second quarter of2010, when the shock to sovereign risk was transmitted to other European countries, among which also Italy, the correlation increased again and remained high thereafter.

Period	2006-2009Q1	2009Q2-2010Q1	2010Q2-2011Q1	2011Q2-2012
$\hat{\rho}$	0.984***	0.264	0.778***	0.641***
(p-value)	0.000	0.361	0.002	0.002

Table 17: **Correlation between the Italian and Greek spread**

We estimate the correlation between the Italian and Greek spread over German bonds, over four windows. The window is defined in the header of the table. We use monthly data on for computing the correlations. Further, yields on sovereign securities are based on the 10 year maturity bond. These choices are motivated by the fact that all these data are available online, in the BCE web page. The p-value are constructed for testing the difference of the correlation with respect to zero. All regressions include a constant. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

10.3 Semi-parametric estimation of the bank lending channel

This Section provides additional detail on the semi-parametric tests presented in Figures 3 and 4 of Section (4). We proceed in steps, beginning with the procedure to construct Figure 3.

First, we sort banks into a *"High Sovereign"* group (our "treatment group") and *a "Low Sovereign"* group (our "control group") based their (conditional) holding of Italian sovereigns in the last quarter before the shock. To do so, we run a cross-sectional of $Sovereign_{b,2010q1}/RWA_{b,2010q1}$ on a battery of bank-level characteristics and balance sheet variables,

$$Sovereign_{b,2010Q1} = \phi_0 + \Gamma \cdot X_{b,2010Q1} + \epsilon_{b,2010Q1}$$

where $X_{b,2010Q1}$ are bank-specific controls measured at the end of the first quarter of 2010. We extract the estimated residuals of this regression and we classify a bank as *"High sovereign"* whenever $\hat{\epsilon}_{b,2010Q1}$

is above the median of the cross-sectional distribution of residuals, and *"Low sovereign"* otherwise. Sorting banks according to their *residual* sovereign holdings helps us to focus only on the cross-sectional variation of their exposure that is not imputable to different bank-specific characteristics.

Second, we aggregate by quarter all corporate loans ($Ln(Loans_{bj,t})$ belonging to our sample that have been granted by banks classified as *"Low sovereign"*. We repeat this aggregation for loans granted by banks belonging to the *"High sovereign"* group. To improve the graphical exposition, we normalize each one of the two time series such that aggregate loans for the two groups take value zero in 2010:Q1 (the last quarter before the sovereign shock).

Finally, we plot the two series in Figure3.

Figure 4 offers a refinement of the non-parametric estimation presented in Figure3, by restricting our attention to the variation in bank credit (on the y-axis in Figure3) which is not explained by bank's balance sheet characteristics. To do so, we run a time-series loan-level regression of loans $Ln(Loans_{bj,t})$ on a set of bank-level characteristics, and relationship-specific characteristics,

$$Ln(Loans_{bj,t}) = \psi_0 + \Omega \cdot \bar{X}_{b,t} + \Lambda \cdot \bar{Z}_{bj,t} + \varepsilon_{bj,t}$$

where $Ln(Loans_{bj,t})$ is the natural logarithm of the value of outstanding loan issued bank b in favor of firm j in quarter t, and $\bar{X}_{b,t}$ and $\bar{Z}_{b,t}$ are four-quarters moving average of our bank-specific and relationship-specific controls. We extract the residuals ($\hat{\varepsilon}_{jb,t}$) of this regression. Sorting banks into "High" and "Low Sovereign" as described above, we aggregate $\hat{\varepsilon}_{jb,t}$ into two time series. As above, we normalize each time series such that they take value zero in 2010:Q1, and plot them over time in Figure 4.

10.4 Estimates of effect of the sovereign shock on aggregates bank credit via the lending channel.

To put our analysis into perspective we assess what percentage of the drop in bank credit can be imputed to the transmission of the sovereign shock via the bank lending channel. To do so, we conduct a counter factual exercise using the estimates presented in Table 4. Under the assumption that our model

in Equation (5) produces an unbiased estimate of the conditional expectation of the growth in lending $\mathbb{E}(\Delta ln\bar{Loan}_{bj}|\bar{G}_j, \bar{X}_j, \bar{Z}_j, \hat{\rho}_j, \tau_{province}, \tau_{industry})$, we can predict $\Delta lnLoan_{bj}$ under a scenario with sovereign tensions ($\hat{\alpha}_1 < 0$) and under a counter factual scenario in their absence ($\hat{\alpha}_1 = 0$). We denote the former by $\hat{y}_j^S$ and the latter by $\hat{y}_j^{NS}$. Then, we derive $\hat{s_j} = \hat{y_j^S} - \hat{y_j^{NS}}$, which is the decline of lending at firm level that is due to the sovereign shock. In order to aggregate this effect, we need to combine this firm-specific factor $\hat{s_j}$ with the cross-sectional distribution in pre-shock loan level ($\bar{Loan}_{j,Pre}$), and aggregate across all firms. In particular, we estimate the aggregate decline in lending as $d = \frac{\sum_j \hat{s_j} \cdot \bar{Loan}_{j,Pre}}{\sum_j \bar{Loan}_j}$. Our estimates suggest that about 2% of the decline in aggregate lending to non-financial corporations can be imputed to the transmission of the sovereign shock through the balance sheet of financial institutions.

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