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Giuseppe Cappelletti, Giovanni Guazzarotti **The role of counterparty risk
and asymmetric information
in the interbank market**

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Abstract

We study the effect of counterparty risk on the ability of Italian banks to access the foreign unsecured interbank market during the sovereign debt crisis in the second half of 2011. With the onset of the crisis, interest rates in the Italian interbank market soared and foreign lending decreased significantly. To isolate the effect of the rise in counterparty risk, we compare the funding of Italian banks with that of foreign banks' branches and subsidiaries in Italy, which were presumably unaffected by the sovereign crisis insofar as they could count on the actual or potential support of their parent bank. We find that the rise in counterparty risk substantially decreased the probability of obtaining funds from foreign banks. When the analysis is restricted to Italian and foreign banks with relatively comparable asset compositions, the result holds. In addition, where safer banks or more stable lending relationships are involved the effect is attenuated.

JEL classification: G21, G28, C23, C24

Keywords: Interbank market, Counterparty risk, Financial crisis

NON-TECHNICAL SUMMARY

This paper analyzes the operation of the Italian interbank market during the most acute phase of the sovereign debt crisis and estimates the effect of the increase in counterparty risk on the ability of Italian banks to finance themselves through foreign intermediaries. The analysis differs from most previous studies for the time period covered; other works have mainly assessed the impact on the interbank market of the Lehman Brothers bankruptcy. Moreover, the identification technique allows us to causally identify the effect of counterparty risk on the banks' ability to obtain funding on the segment of the interbank market that is more sensitive to information.

The study focuses on Italian intermediaries, comparing those belonging to Italian banking groups and those belonging to foreign groups. The assumption is that the latter have been affected to a lesser degree by the crisis, since they are less exposed to Italian government bonds and benefit from the increased implicit guarantee by the State of residence of the parent bank.

The main results are as follows:

- The reduction of activity on the interbank market during the sovereign debt crisis mainly reflected the increase in the credit risk of Italian counterparts. From July to December 2011, loans outstanding decreased by 16 percent for Italian banks, while they were almost constant for subsidiaries and foreign branches operating in Italy.
- About 85 percent of the drop was due to funding that had been interrupted in the six months after July 2011. In particular, the probability of getting a loan from a foreign bank was on average 6 percentage points lower for an Italian bank compared to a bank controlled by a foreign group.
- The increase in counterparty risk relating to Italian banks had a stronger effect on less stable financing relationships, for which the information asymmetry is generally higher. In particular, the effect is equal to 10 percentage points for banks that had a debt position with a foreign intermediary for less than six months, while the same effect is not statistically significant for the banks with a more lasting debt position.
- During the crisis of sovereign debt, foreign banks discriminated between more and less risky debtor banks. In particular, for the best-capitalized Italian banks the probability of receiving a loan from a foreign bank was similar to that of the subsidiaries of foreign groups, while for the less capitalized banks this probability was significantly lower.

1 Introduction¹

Interbank markets are crucial to banks' liquidity management and to the transmission of monetary policy. They represent an important funding channel, and their functioning affects borrowing conditions for households and firms. The recent financial crisis had a severe impact on the European money market, driving up interest rates and drastically reducing total transactions. A key feature of the crisis was the difficulty that the interbank market had in redistributing liquidity (see, for example, Brunnermeier, 2009). One of the causes of this relative market failure was liquidity hoarding, as banks stopped lending due to precautionary motives, given the illiquidity of their assets (Allen, Carletti and Gale, 2009). A second channel of contagion was the increase in actual and perceived counterparty risk, especially in the segments more exposed to information asymmetry, namely unsecured and cross-border positions (Heider et al. 2009). While most studies of the crisis following the Lehman Brothers bankruptcy have examined its overall effects on the interbank market, we focus specifically on the impact of heightened of counterparty risk due to the sovereign debt crisis.

In 2010-11, when the crisis started, financial intermediaries in Greece, Portugal and, to a lesser extent, Spain and Italy had trouble raising wholesale funding and had to rely on central bank liquidity (Panetta et al. 2011). The increase in sovereign risk worsened banks' credit risk through several channels. First, losses on holdings of government debt weakened balance sheets, as banks are typically highly exposed to the debt of their own sovereigns. Second, higher sovereign risk reduced the value of collateral at banks' disposal for wholesale funding and central bank liquidity. Third, sovereign downgrades generally resulted in lower ratings for domestic banks, increasing their wholesale funding costs and potentially impairing their market access. Fourth, the deterioration in sovereign financial sustainability reduced the funding benefits that banks derive from implicit and explicit government guarantees.²

In July 2011 the spread between Italian and German ten-year government bonds jumped by 100 basis points and kept increasing through the end of the year, to over 4 percentage points. Adopting a quasi-experimental methodology, we exploit the sharp, sudden rise in the yields on Italian sovereign debt, which can be deemed an exogenous increase in the riskiness of Italian banks: both low growth and high public debt are in fact long-standing features of the Italian economy, and the interbank market was not a direct source of instability for

¹We would like to thank Massimiliano Affinito, Fernando Alvarez, Antonio De Ninno, Antonio Di Cesare, Ginette Eramo, Roberto Felici, Domenico Giannone, Giorgio Gobbi, Florian Heider, David Marques Ibanez, Paolo Mistrulli, Enrico Sette, Tony O'Connor and seminar participants at the ECB for helpful comments and suggestions.

²Furthermore, sovereign tensions may have heightened investors' risk aversion, which in turn may have increased the premia demanded on banks' securities, while the impact on capital markets may have reduced banks' fee and trading income, and the rise in sovereign yields may have crowded out private debt issuance.

public debt.

This paper seeks to gauge the extent to which the increase in counterparty risk due to the sovereign crisis affected Italian banks' access to foreign bank lending. We study the unsecured segment of the market and restrict analysis to foreign lenders, who may have less precise credit information on Italian borrowers than domestic banks and may be more sensitive to changes in credit risk. The focus on foreign lenders also helps to disentangle counterparty risk from the liquidity hoarding channel, since foreign banks were affected less severely by the crisis and had no motive for precautionary liquidity hoarding.

To find a causal link between creditworthiness and funding, we exploit the differential impact of sovereign risk on foreign and domestic banks in Italy. In particular, to isolate the effect of a change in counterparty risk, we use diff-in-diff methodology to compare the borrowing capacity of Italian banks with that of peer banks that were not affected by the crisis. As a control group, we use the Italian branches and subsidiaries of foreign banks, on the assumption that the latter, being headquartered in countries where the increase in sovereign risk was much more moderate, were accordingly more sheltered from sovereign strains: foreign branches and subsidiaries in fact could count on being saved by their parent banks or on funding through their groups. This argument is confirmed by the behavior of the interest rates charged to Italian intermediaries on the overnight unsecured segment of the e-MID market (Figure 1).³ The average rate on overnight loans to Italian banks jumped in the second half of 2011, while that on loans to foreign-owned banks was broadly unchanged; both rates dropped in December as a consequence of the ECB's longer-term refinancing operations, which crowded out the market for private funds.

The fact that the funding conditions of foreign-owned banks in Italy were only marginally impaired during the sovereign crisis is confirmed by the data on lending to the non-financial sector. Bofondi et al. (2013) show that during the crisis the corporate lending of Italian banks grew by about 3 percentage points less than that of the subsidiaries of foreign banks, while the interest rate charged by Italian banks was 15 to 20 basis points higher.⁴

Our data cover all the bilateral borrowing positions between Italian banks and foreign banks. We study the effect of the crisis on the probability that a borrowing relationship will still be standing after the outbreak of the crisis. Our baseline model includes a set of lender and borrower characteristics. We find that the rise in counterparty risk due to the sovereign crisis lowered the probability of an Italian bank's obtaining a loan from a foreign bank by an average of 6 percentage points. The effect is less pronounced for safer, i.e. better capitalized banks, and for more stable relationships, suggesting the importance

³During the crisis the perception of a substantial stigma effect led borrowers to prefer anonymous to transparent markets; as a consequence the role of the e-MID in the interbank market decreased significantly. By comparison with the pre-crisis period, the share of very short-term e-MID transactions (overnight, tomorrow-next and spot-next) in total transactions (e-MID plus OTC) dropped from 2/3 to 1/3.

⁴The same results hold in a macro perspective (Albertazzi et al., 2012).

of asymmetric information.

The paper is structured as follows: the next section examines the related literature, Section 3 discusses the dataset and the main descriptive statistics, Section 4 presents the empirical model and the main results, Section 5 describes our robustness checks, and Section 6 concludes.

2 Related literature

There is a vast literature on contagion across banks, focusing in particular on how the default of one bank is transmitted to others through balance-sheet links (interbank loans, cross-holdings of securities, correlation between portfolios).⁵ Simulations suggest that in such networks contagion is likely to be rare, even in the absence of government or central bank intervention (Upper, 2007).⁶ Karas and Schoors (2012) study other channels of contagion. In particular, using data for the Russian interbank market they show that the crises of 1998 and 2004 can be replicated by simulations that hypothesize the possibility of liquidity runs. In their model, contagion results from banks calling in loans from the borrowers that suffer substantial losses owing to the initial default. Their simulations suggest that liquidity runs are one of the main sources of systemic risk in the interbank market and may stem from heightened risk aversion on the part of lenders, increased borrower (counterparty) risk, or both. The practical relevance of these factors in the real world – that is, to what extent the increased counterparty risk could lessen the probability of lending in the interbank market and cause a liquidity run – remains an open question.

One of the causes of the market collapse in 2008 was liquidity hoarding by banks, which ceased to lend out of precaution, given the illiquidity of their assets (Allen, Carletti and Gale, 2009). A second channel of contagion was the rise in actual and perceived counterparty risk. In a well-functioning market, counterparty risk induces an increase in the risk premium demanded by the lenders and an adjustment of the amount borrowed, but it does not cause the whole market or part of it to break down. Heider et al. (2009) propose a theoretical model of the possibility of a failure of the interbank market in the presence of asymmetric information and counterparty risk, hypothesizing that the severity of the crisis depends on the level and distribution of the counterparty risk. When risk is not widely dispersed, the unsecured market works smoothly despite asymmetric information. When risk increases, adverse selection may force safer banks to withdraw from the market and turn to other sources of funding, such as the secured market. However, when both the level and the dispersion of the credit risk are high, the entire market may break down. In this worst-case

⁵See, among others, Mistrulli, 2007, and Manna and Schiavone, 2012.

⁶Affinito (2012) analyses the effect of the crisis on central bank refinancing, interbank lending and their interaction.

scenario, banks may be unwilling to lend because of extreme adverse selection or unwilling to borrow because of very high interest rates.

Afonso et al. (2011) examine the impact of the financial crisis on the US interbank market. They find that in the days following the Lehman Brothers default, the specific characteristics of borrowing banks became a more important factor in lending banks' decisions, causing increased differentiation on the federal funds market between high-type and low-type borrowers, both in amounts lent and in cost of funds; subsequently, when the government intervened to support systemically important banks, the market returned to pre-crisis levels. Cassola et al. (2008) observe that the economic and financial crisis of 2007-10 exacerbated the problems of cross-country information asymmetry and caused a decline in cross-border transactions within the euro area, consistent with the theoretical results of Freixas and Holthausen (2004).

Our contribution to this literature is to investigate the counterparty risk channel, i.e. the importance of counterparty risk for the interbank market. Where most previous studies concern the post-Lehman crisis, our paper focuses on the effects of the European sovereign debt crisis. Our work is also related to the strand of the literature on the determinants of interbank lending relationships. Affinito (2010), for one, finds that in the Italian market there exist some close, stable relationships between borrowing and lending banks, and that these long-term relationships persisted even during the sub-prime crisis.⁷ The persistence of close interbank relations may reflect less severe problems of asymmetric information, hence lower counterparty risk. We contribute to this literature by testing whether the counterparty risk channel (that is, the probability that a lending relationship will break up when counterparty risk rises) is related to the characteristics of the lending relationship.

3 The Italian inter-bank market

The interbank money market is composed of financial instruments whereby banks exchange short-term funds. The main instruments used by Italian banks are deposits and repurchase agreements. Transactions may take place either on regulated or over-the-counter (OTC) markets.⁸ The main regulated markets in Italy are e-MID (for unsecured interbank deposits) and MTS (where banks exchange repos). Transactions are bilateral in the OTC and e-MID markets and go through a central counterparty in MTS (and a number of other regulated markets). At the end of 2010, deposits represented more than 80% of total interbank positions, of which a third were overnight; repos accounted for slightly less than 20%.

⁷Furfine (2001) studies the effects of interbank customer relationships on interbank interest rates in the US. Cocco et al. (2009) include some of the determinants of interbank customer relationships in their analysis.

⁸See Affinito (2008) and Cappelletti et al. (2010) for an account of developments in the Italian interbank market in the first part of the crisis.

Most transactions take place between banks that belong to the same group (Figure 2 and Figure 3). At the end of 2010 total interbank balance-sheet liabilities of Italian banks amounted to €760 billion. Intra-group assets made up over 70% of total interbank exposures (65% before the crisis). The top five groups accounted for about 65% of all positions, and this share increased during the crisis. In the pre-crisis period the importance of foreign counterparties increased considerably. At the end of 2010, liabilities vis-à-vis foreign banks accounted for more than 50% of total extra-group balance-sheet positions (most of these within the top five groups).

In this paper we seek to measure the extent to which the increase in counterparty risk curtailed Italian banks' access to foreign bank lending. Transactions that involve banks not belonging to the same banking group or banks domiciled in different countries are naturally more information-sensitive; and all the more so where they are not backed by collateral or guaranteed by a central counterparty.⁹ Our analysis focuses accordingly on the unsecured segment of the market and on foreign lenders, which we assume have less precise credit information on Italian borrowers than domestic banks and are more sensitive to changes in credit risk. Moreover, focusing on foreign lenders helps us to distinguish counterparty risk from the liquidity hoarding channel, since some foreign banks were less severely affected by the crisis and so had little incentive for precautionary hoarding.

We use monthly balance-sheet information on the interbank borrowing positions of Italian banks from January to December 2011. The data come from the Bank of Italy's prudential supervisory reports, which give the gross bilateral exposures (assets and liabilities) of each Italian bank with respect to all other banks, both domestic and foreign. With these data we can distinguish between intra-group and extra-group and between secured and unsecured positions. Still, we do not observe the balance-sheet characteristics of foreign lenders, apart from their exposure to the Italian market. Information on single transactions can be retrieved either through TARGET or e-MID, but neither of these sources guarantees a complete picture of banks' borrowing capacity, so we rely only on supervisory data regarding overall banks' borrowing positions.

The sample consists of 269 banks, of which 89 were branches or subsidiaries of foreign banks and the rest were members of Italian groups or solo banks (Table 1). In order to identify the effect of the increase in the riskiness of Italian banks we focused on unsecured loans, because this is the largest component of banks' funding and because in collateralized transactions (either secured or through central counterparty) the borrower's creditworthiness matters less.

We study the effect of the increase in credit risk, positing that the euro area sovereign

⁹The financial turmoil severely affected the extra-group, foreign and unsecured segments of the market, which are characterized by higher counterparty risk and higher information sensitivity. Following the outbreak of the crisis the market shifted from bilateral to central counterparty transactions and from long-term to short-term instruments.

debt crisis was exogenous with respect to the riskiness of individual banks. In the second half of 2011, the spread between Italian and German government bonds soared from 190 basis points at the end of June to over 400 basis points at the end of December. In the same period, unsecured transactions, especially lending from foreign counterparties, decreased substantially. At the end of 2010 unsecured foreign loans had amounted to €120 billion, of which €50 billion were to Italian and €70 billion were to foreign-owned banks. The overall value oscillated around that amount in the first half of 2011 but declined sharply, by almost 10 per cent, in the second half.

The patterns of lending to Italian and to foreign-owned banks diverged significantly in the course of the crisis: while foreign loans to banks belonging to foreign groups remained almost unchanged, those to Italian groups shrank by 16 per cent. More than four fifths of the decline reflected the discontinuance of lending relationships, the rest a reduction in the value of outstanding loans. Meanwhile, the distribution of borrowing positions across lenders became more concentrated. As a consequence of reduced foreign funding, Italian banks increased their financing from the Eurosystem. The resources raised served not only to offset the contraction in foreign lending but also to hoard liquidity against the refinancing risk of maturing bonds.

Italian banks' capacity to obtain funds through their foreign branches diminished even more sharply.¹⁰ In November 2011 there was also a steep fall in transactions through central counterparties, presumably in connection with the loss of value of Italian government bonds as collateral.¹¹

4 The model and the results

We exploit the sovereign debt crisis to measure the effect of an exogenous increase in the credit risk of Italian banking groups in the interbank market. Our identification strategy relies on diff-in-diff methodology. The outbreak of the crisis in Italy was basically exogenous with respect to the lending policies of Italian banks. Both low growth and high public debt are long-standing features of the Italian economy. Nor was the Italian banking system a source of instability for the public finances (see, among others, IMF 2010 Article IV consultation on Italy) and Italy did not experience any housing bubble. In short, the skyrocketing of Italian sovereign spreads starting in July 2011 was not triggered by any specific domestic event (Bofondi et al., 2013).

¹⁰Such transactions are not considered in the analysis, insofar as they are loans to foreign banks.

¹¹In the previous years, during the sub-prime crisis, foreign lending to Italian banks shifted in part from bilateral to central counterparty transactions, to reduce counterparty risk. Foreign lending through central counterparties declined again with the outbreak of the sovereign crisis, presumably owing to the decline in the value of Italian government bonds used as collateral. In this paper, however, we only consider bilateral positions, for which we know the identity of both parties.

Therefore, we can adopt a quasi-experimental methodology, exploiting the sharp increase in the yield on Italian sovereign debt in July 2011. The period studied runs from January to December 2011: the pre-treatment period from January to June and the post-treatment period from July to December, when interest rates on Italian government bonds increased. The treatment group consists of Italian group or independent banks, the control group of foreign-owned banks operating in Italy. The observations are the borrowing positions of each sample bank with respect to each foreign bank at the end of each month.

We first estimate a standard linear model for the percentage change in unsecured loans. The results confirm that banks belonging to Italian groups suffered a sharper reduction than foreign-owned banks in lending from foreign banks (Table 2). Given the volatility of the dependent variable and the relatively short time span, when we tried to factor in bank fixed effects the significance of the estimates diminished significantly.

Accordingly, we elected to focus on the probability of foreign bank f lending to an Italian bank i at time t using the following logit model:¹²

$$\begin{aligned} & \Pr(L_{i,f,t} > 0 | X) \\ & = \text{Logit}(\alpha + \beta Post_t + \gamma Treat_i + \delta Treat_i * Post_t + \eta X_{i,t} + \varphi Y_{f,t}) \end{aligned} \quad (1)$$

where $L_{i,f,t}$ is the gross position between borrower i and lender f at time t ; $Treat_i$ is a dummy variable equal to 1 if i belongs to an Italian banking group and to 0 if it is a branch or subsidiary of a foreign bank; $Post_t$ is equal to 1 if time t is equal to December 2011 (i.e. after the tensions in the government bond market increased sharply) and to 0 if time t is equal to June 2011. $X_{i,t}$ is a set of controls specific for each borrower i and time t . $Y_{f,t}$ is a set of controls specific for each lender f and time t . We control for borrower i overall interbank positions (distinguishing between secured and unsecured transactions) and borrower i balance sheet characteristics. In particular, based on borrowers' balance-sheet data we can control for outstanding capital, funding capacity, lending activity, asset composition (i.e. the share of securities issued by firms domiciled in countries with lower ratings, the share of high-rated euro-area banking groups), and outstanding bad loans. Since we focus on foreign lenders, we could include among the controls only lender f 's overall interbank position vis-à-vis Italian banks.

Table 3 shows our baseline estimate. The effect of the rise in counterparty risk on the probability of an Italian bank's receiving a loan from a foreign bank is negative, and the coefficient is statistically significant. The descriptive evidence – namely, that foreign banks cut their lending to Italian banks more sharply than that to foreign bank branches and subsidiaries – is therefore confirmed in our multivariate framework, where we control for

¹²We tried a variety of statistical models, linear probability models, probit and tobit models, always obtaining the same results.

observable bank characteristics. While the coefficient of the interaction term gives us the sign of the effect, to estimate its magnitude we need to compute the average treatment effect on the treated, which is equal to:

$$\tau (Post_i = 1, Treat_t = 1, X_{i,t}, Y_{f,t}) := \frac{\Delta^2 E (Y_{i,f,t} | Treat_i = 1, Post_t = 1, X_{i,t}, Y_{f,t})}{\Delta Treat \Delta Post} - \frac{\Delta^2 E (Y_{i,f,t}^0 | Treat_i = 1, Post_t = 1, X_{i,t}, Y_{f,t})}{\Delta Treat \Delta Post} =$$

where $Y_{i,f,t}^0$ is the counterfactual outcome for the treated bank had it not been treated (Puhani, 2012). The associated standard errors are computed using delta methods. Given the usual identification assumptions, the average treatment effect is equal to:

$$\tau (Post_i = 1, Treat_t = 1, X_{i,t}, Y_{f,t}) = \text{Logit} (\alpha + \beta + \gamma + \delta + \eta X_{i,t} + \varphi Y_{f,t}) - \text{Logit} (\alpha + \beta + \gamma + \eta X_{i,t} + \varphi Y_{f,t})$$

These estimates show that in the wake of the sovereign crisis the probability of an Italian bank obtaining a loan from a foreign bank decreased by about 6 percentage points in comparison with branches or subsidiaries of foreign groups (Table 3). Moreover, the effect varies within the set of banks hit by the shock, with a maximum effect of more than 10 points (Figure 4). Including only subsidiaries of foreign banking group the estimate does not change (Table 6).

The European sovereign debt crisis affected a good many countries, including Croatia, Cyprus, Greece, Ireland, Malta, Spain, Portugal and Slovenia. Banks domiciled in these non-core countries could have had an incentive to hoard liquidity and cut lending to all other banks, regardless of their creditworthiness. To disentangle the counterparty risk and the liquidity hoarding motives, we estimate equation (1) separately for foreign lenders domiciled in core countries (Austria, Belgium, Finland, France, Germany, Luxembourg) and non-core countries (Croatia, Cyprus, Greece, Ireland, Malta, Spain, Portugal and Slovenia). The hypothesis is that banks domiciled in non-core countries should have reduced their lending to all banks in Italy, whether Italian-owned (treated group) or foreign-owned (control group), since these lenders themselves were damaged by the sovereign crisis and stopped lending for precautionary motives (liquidity hoarding). And in fact in this estimation the probability of Italian banks' receiving funding from foreign banks domiciled in core countries falls by around 10 percentage points against 6 percentage points in the baseline estimation (Table 5 third and fourth columns), while the estimated change in lending from foreign banks domiciled in non-core countries is not statistically different from zero (Table 5 first and second columns). As a further robustness check, we estimate the baseline model with a

control group consisting only of Italian banks that are either branches or subsidiaries of groups domiciled in non-core euro-area countries. The differential effect is now statistically non-significant (Table 5 columns fifth and sixth), which further suggests that we are in fact capturing the effect of the increased counterparty risk provoked by the sovereign debt crisis.

In order to check whether foreign lenders behaved differently according to the borrower's financial soundness, we run an estimate with a treated group consisting only of Italian banks in the top quartile of ratios of capital to total assets. The last two columns of Table 5 shows that for these banks the probability of receiving funds from abroad did not decrease more than that for branches and subsidiaries of foreign groups. This suggests that the crisis did not affect lenders' ability to assess borrowers' creditworthiness.

We also seek to determine the factors that amplified or attenuated the reduction of funding from foreign banks owing to the increase in counterparty risk. First we test whether the better-informed banks, i.e. groups with branches or subsidiaries in Italy, were less affected by the heightened credit risk of Italian banks, in that this diminished effect might reflect the fact that these banks have more information on the creditworthiness of Italian banks. However, we find that having a branch or a subsidiary in Italy has no statistically significant effect on the probability of lending to an Italian bank. Possibly foreign banks with affiliates in Italy replaced extra-group with intra-group lending.¹³

Next we test whether the effect of the increase in counterparty risk is influenced by the existence of a lending relationship, either because lenders discount the long-term value of the relationship or because lending relationships reduce information asymmetry. To test this hypothesis we need to jettison the assumption of constant treatment effect and instead consider different subsamples according to the number of months in which a lending position was in being.¹⁴ We find that long-term relationships were in fact more resilient to the crisis (Table 6). These results are in line with the findings of Affinito (2012) on the importance of interbank customer relations for Italian banks.

5 Robustness checks

In principle, domestic and foreign banks may differ in several dimensions, so that it may not be warranted to compare them in order to gauge how the increase in sovereign spreads affected the probability of receiving funds from abroad. However, Bofondi et al. (2013) rebut this argument on a number of grounds. First, the Italian banking system is sophisticated and Italian banks, especially the larger ones, have business models, lending technologies, and geographical scope similar to those of foreign subsidiaries. Second, our regressions

¹³If the total exposure to a given country is limited, the foreign parent company decides whether to grant a loan to a group member or to a non-group bank.

¹⁴There are some econometric difficulties in determining whether the treatment has an effect on some sub-samples, defined by observable characteristics (see Lee, Shaikh, 2013).

include bank fixed effects, controlling for all unobserved heterogeneity among lenders, and in particular for differences in the ex-ante composition of loan portfolios, lending policies, and the extent of the network of outlets.

As a further robustness check, in order to adjust for differences in observable characteristics, we match each treated bank with a similar control-group bank based on a propensity score (Rosenbaum and Rubin, 1983). Table 7 reports summary statistics for the control variables in the first half of 2011, distinguishing between Italian and foreign-owned banks. For each variable, the table also shows the simple difference of the characteristics between the two groups before and after the sample has been matched based on the propensity score (Abadie, 2004). Note that the Italian banks have proportionally more assets in securities issued by other Italian banks and proportionally less in securities issued by firms domiciled in high-rated countries. The differences in lending activity are not statistically significant. The differences in observable characteristics could indicate that foreign-owned banks may not be a good control group to estimate the outcome for Italian banks on the counterfactual hypothesis of their not being treated. The estimates produced by such simple comparison of outcomes, that is, may be biased.

Consequently, we select a subsample of branches and subsidiaries of foreign banking groups in order to control fully for observable differences between the treated and the control groups. We match banks based on the propensity score ($p(X_{i,t})$), which measures the conditional probability of a deterioration in creditworthiness given the covariates $X_{i,t}$. First we estimate the propensity score running a logit estimate on observable bank characteristics and then we use nearest-neighbor matching without replacement to pair each Italian bank with the foreign bank closest to it in estimated $p(X_{i,t})$. To improve the match, we drop the banks whose propensity score falls outside the support of the propensity score of foreign banks (Figure 5). We run both linear probability and non-linear models, considering different sets of controls. Table 8 and Table 9 show the estimates, which confirm those of the baseline model, with an increase in the point estimate of the average treatment effect.

Given the non-linear relation between exogenous and dependent variables, interpreting a difference-in-difference estimate in non-linear models is difficult (Ai and Norton, 2003; Lechner, 2011; Puhani, 2012). To overcome this problem, as a robustness check we perform a change-in-change estimate, following Athey and Imbens (2006). This enables us to drop the assumption of linear relation between unobservable characteristics and the probability of a loan. Moreover, the distribution of unobservables may differ between treatment and control group, although we have to assume that this distribution does not depend on whether the bank is in the control or the treatment group.

We examine only the bilateral positions at the end of June and July 2011, running an unconditional estimate on the discrete outcome variable that indicates whether or not bank i is lending to bank f at a certain date; in this setting a point estimate is possible only if we

assume conditional independence between unobservable characteristics and membership of the treated group; otherwise we can only estimate an upper and a lower bound of the average treatment effect. This estimate shows that the difference between Italian and foreign banks is small but still significant.

We then assume that the probability of getting a loan depends linearly on our explanatory variable and assume a non-linear function of unobserved characteristics of borrower and lenders, of time (t) and of the treatment:

$$1_{\{L_{i,f,t} > 0\}}(L_{i,f,t}) = \alpha + \eta X_{i,t} + \varphi Y_{f,t} + h^k(u_{i,f}, t)$$

where h^k is a weakly monotonic function of unobservable characteristics $u_{i,f}$ and of time, and it is indexed on being treated or not ($k \in \{NI, I\}$).

Hence, we estimate a change-in-change model of the residuals of a linear probability model on the controls.¹⁵ This second specification, which delivers point estimates under weaker assumptions, also confirms that the probability of getting a loan from a foreign bank is significantly lower for Italian banks following the rise in counterparty risk (Table 10).¹⁶

6 Conclusions

This paper isolates and quantifies the effect of the increase in the riskiness of Italian banks during the sovereign debt crisis on their ability to borrow from foreign banks. Analyzing all borrowing positions of Italian banks vis-à-vis foreign banks in the unsecured interbank market between January 2011 and December 2011, we show how these borrowing positions changed following the sharp increase in Italian government bond yields (sovereign spreads). In this way we estimated the effects of counterparty risk alone on the functioning of interbank market, at least in the unsecured segment, which is more information-sensitive.

Adopting a quasi-experimental methodology, we exploit the upsurge in Italian sovereign yields in July 2011 as an exogenous shock to counterparty risk. In fact, the sovereign crisis was fundamentally exogenous to the interbank market: both low growth and high public debt are long-standing features of the Italian economy, and the interbank market was not a direct source of instability for the public debt. To identify the effect of the heightening of counterparty risk, we compared the borrowing capacity of sets of banks that were affected differentially by the crisis. Foreign banks headquartered in countries where sovereign risk

¹⁵In order to guarantee the identification of the potential outcome for the treated group, the estimate must be conditional on realizations of characteristics that are in the common support of the treated and control groups before and after the treatment.

¹⁶As a further robustness check, we estimate the entire set of models using consolidated data (i.e. borrowing positions at group level) and only overnight positions. Again, the results support the hypothesis that the increase in counterparty risk significantly aggravated Italian banks' difficulty in obtaining funds from foreign banks.

increased substantially less were relatively shielded from the impact of sovereign tensions compared with Italian banks.

We estimated a baseline model factoring in a set of lender and borrower characteristics: lender's interbank lending volumes, borrower's net and gross interbank positions on secured and unsecured markets, borrower's asset composition, borrower's balance-sheet characteristics.

We find that the effect was statistically significant and economically important. Following the crisis, the probability of an Italian bank receiving a loan from a foreign bank fell by 6 percentage points more than that of branches and subsidiaries of foreign banking groups. The effect rises to 12 points if the sample is restricted to lenders domiciled in the core euro-area countries. The effect is less pronounced for safer banks, i.e. the more strongly capitalized ones, and for those with more stable relations with foreign banks. As a robustness check, to allow for fundamental differences in business between Italian and foreign banks, we ran the same regression using only comparable banks, with no essential alteration of the results.

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Figure 1: Average overnight rate in the unsecured e-Mid market (percentage points)

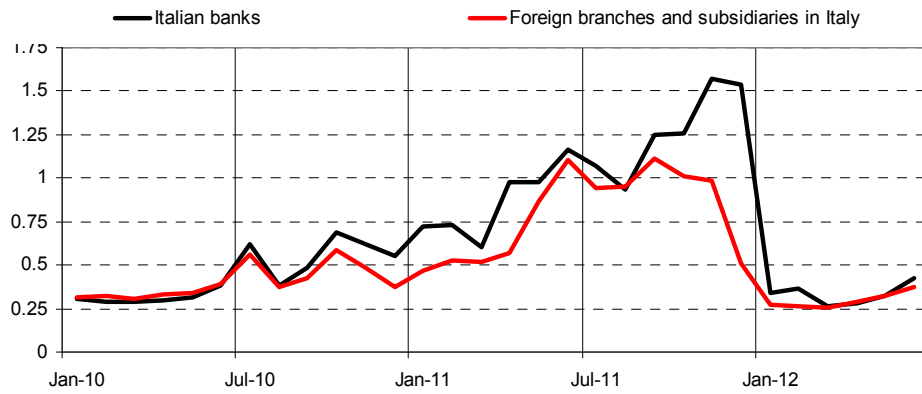


Figure 2: The Italian unsecured interbank market (bln Euro)

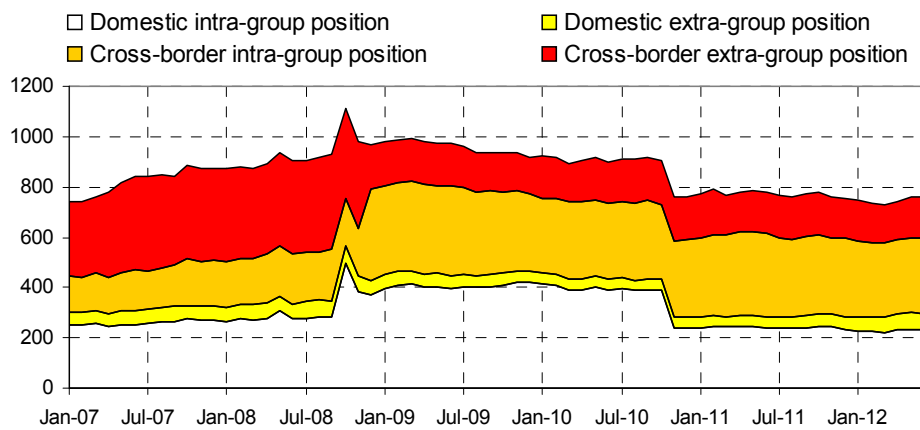


Figure 3: Cross-border position by bank residence (bln Euro; Base: June 2011 = 100).

— Italian group lending to foreign group — Foreign group lending to Italian group
- - - - - Foreign group lending to foreign group - - - - - Intra-group foreign banking group lending

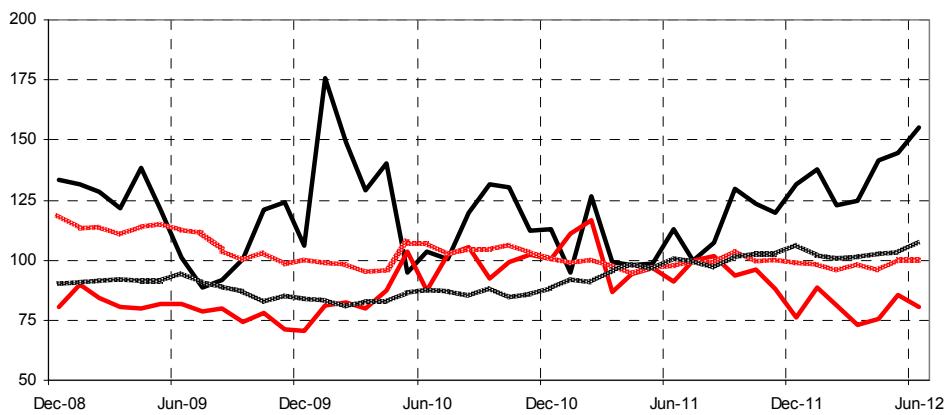
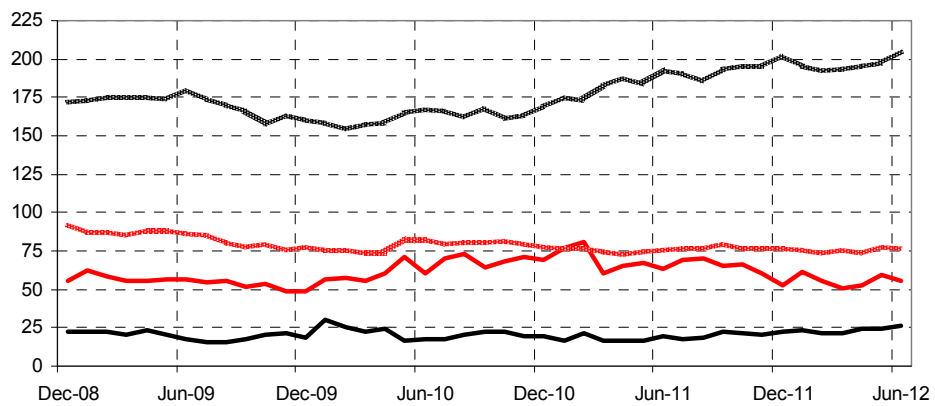
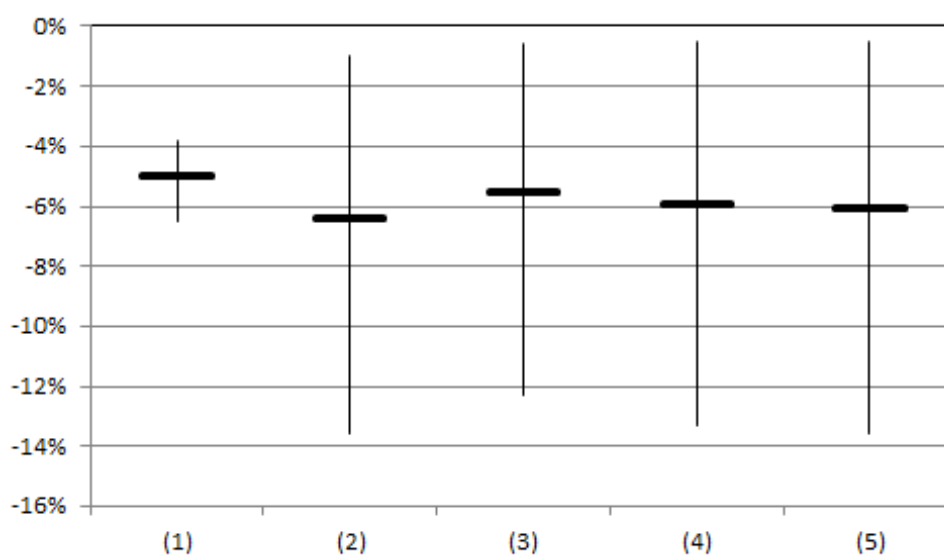


Figure 4: Distribution of the average treatment effect on the treated.



Model specification:

- (1) Includes dummy variables for treated group, post periods and their interaction;
- (2) Includes previous period interbank position for the borrower;
- (3) Includes previous period interbank position for the lender;
- (5) Includes portfolio characteristics for the borrower;
- (6) Includes previous period balancesheet characteristics for the borrower.

Figure 5: Common support between treated and control group

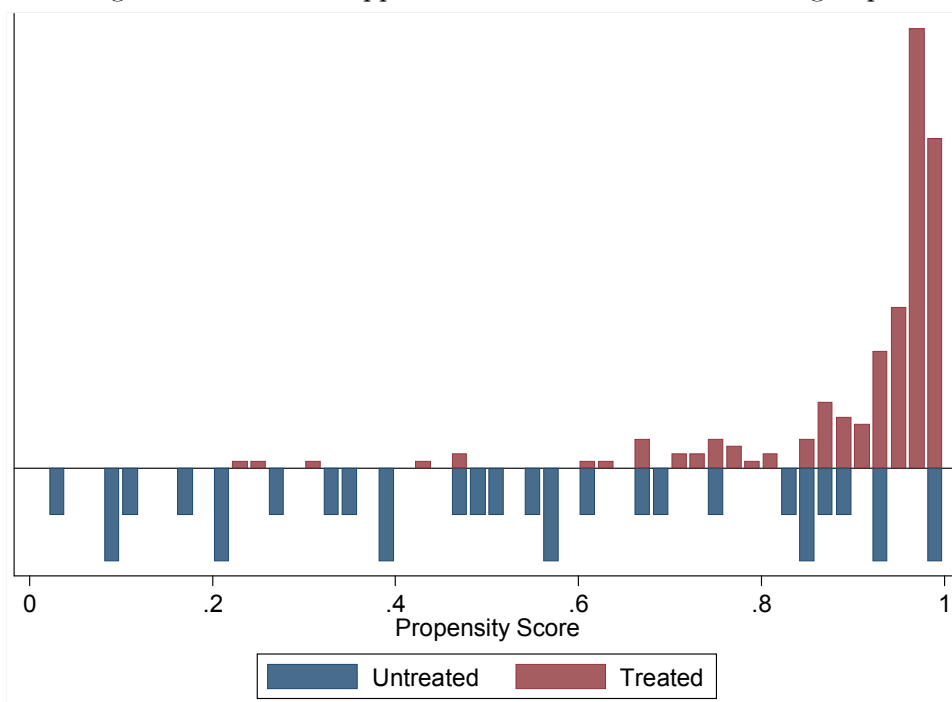


Table 1: Italian banks' unsecured foreign borrowing positions

	Dec-06	Dec-09	Jun-10	Dec-10	Jun-11	Dec-11
Total interbank secured loans (extra group) (1)	40	38	54	60	77	73
Total interbank loans through central counterparties (1)	21	44	101	117	107	72
Total interbank unsecured loans (1)	959	914	959	744	766	746
of which: <i>intragroup</i>	529	447	529	463	482	459
of which: <i>cross-border</i>	615	621	615	455	459	422
of which: <i>intragroup cross-boarder</i>	240	198	240	214	220	187
Number of Banks (borrowing from foreign banks in 2010 or in 2011)	224	221	220	211	210	209
Italian banks	148	152	152	143	141	137
Foreign branches and subsidiaries	76	69	68	68	69	72
Average number of unsecured borrowing position	13	13	13	12	12	11
Italian banks	11	14	14	13	13	12
Foreign branches and subsidiaries	19	11	11	10	9	9
Total value borrowing position (billions)	213	177	184	179	188	183
Italian banks	54	55	66	61	65	53
Foreign branches and subsidiaries	158	122	118	118	123	130

Source: supervisory data. Note (1) millions of Euro.

Table 2: Banks' unsecured position (percentage change)

	(1)	(2)	(3)	(4)	(5)	(6)
Italian Group	9034321***	10500000	10500000	8478275	9408222	4385349
Post	-16453.3***	-350416.6	-360495.6	-2477936**	-2482321**	-2355189**
Italian Group * Post	-9001946***	-10000000*	-10000000*	-7146429**	-8164720**	-6874592*
Interbank relation	N	N	N	N	N	-1693587
Past share of foreign banks bonds	N	N	N	Y	Y	Y
Loan outstanding in the previous period	Y	Y	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	Y	Y	Y	Y
Past level of unsecured extra-group position	N	Y	Y	Y	Y	Y
Past level of Eurosystem position	N	Y	Y	Y	Y	Y
Past level of intra-group position	N	Y	Y	Y	Y	Y
Past level of Lender intra group lending	N	N	Y	Y	Y	Y
Past level of Lender unsecured position	N	N	Y	Y	Y	Y
Past share of Italian banks securities	N	N	N	Y	Y	Y
Past share of foreign high rank banks	N	N	N	Y	Y	Y
Past share of PIGS securities	N	N	N	Y	Y	Y
Past Funding gap	N	N	N	N	Y	Y
Past Capital over total assets	N	N	N	N	Y	Y
Past Loans over total assets (t-1)	N	N	N	N	Y	Y
Number of observations	15,537	12,541	11,666	10,815	10,815	10,794

Note: In all regressions standard errors are clustered across treated and control groups. Only banks that have been active in at least one date are included in the sample. (1) Includes dummy variables for treated group, post periods and their interaction; (2) Includes previous period interbank position for the borrower; (3) Includes previous period interbank position for the lender; (4) Includes portfolio characteristics for the borrower; (5) Includes previous period balance sheet characteristics for the borrower; (6) Includes the number of months in which the bank has an outstanding loan from the foreign bank during the last year and the share of the previous period outstanding loan with respect the total interbank position for the borrower and for the lender.

Table 3: Banks' unsecured position

	(1)	(2)	(3)	(4)	(5)	(6)
Italian Group	-0.037	-0.227*	-0.406***	-0.381***	-0.499***	-0.476**
Post	0.069	0.085	0.062	0.064	0.084	0.087
Italian Group * Post	-0.499***	-0.598***	-0.498***	-0.539***	-0.553***	-0.655***
Treatment Effect on the Treated	-0.0497***	-0.0603***	-0.0639***	-0.0547***	-0.0587***	-0.0601***
Interbank relation	N	N	N	N	N	1.364***
Past share of foreign banks bonds	N	N	N	Y	Y	Y
Loan outstanding in the previous period	Y	Y	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	Y	Y	Y	Y
Past level of unsecured extra-group position	N	Y	Y	Y	Y	Y
Past level of Eurosystem position	N	Y	Y	Y	Y	Y
Past level of intra-group position	N	Y	Y	Y	Y	Y
Past level of Lender intra group lending	N	N	Y	Y	Y	Y
Past level of Lender unsecured position	N	N	Y	Y	Y	Y
Past share of Italian banks securities	N	N	N	Y	Y	Y
Past share of foreign high rank banks	N	N	N	Y	Y	Y
Past share of PIGS securities	N	N	N	Y	Y	Y
Past Funding gap	N	N	N	N	Y	Y
Past Capital over total assets	N	N	N	N	Y	Y
Past Loans over total assets (t-1)	N	N	N	N	Y	Y
Number of observations	15,537	12,541	11,666	10,815	10,815	10,794

Note: In all regressions robust standard errors are used and observations are clustered in by unit of observation. (1) Includes dummy variables for the treated group, post periods and their interaction; (2) Includes previous period interbank position for the borrower; (3) Includes previous period interbank position for the lender; (4) Includes portfolio characteristics for the borrower; (5) Includes previous period balance sheet characteristics for the borrower; (6) Includes the number of months in which the bank has an outstanding loan from the foreign bank during the last year and the share of the previous period outstanding loan with respect to the total interbank position for the borrower and for the lender.

Table 4: Banks' unsecured position (in the control group only subsidiaries are included)

	(1)	(2)	(3)	(4)	(5)	(6)
Italian Group	0.117	0.239*	-0.311**	-0.195	-0.353**	0.113
Post	0.224	0.186	0.07	0.049	0.065	0.21
Italian Group * Post	-0.668***	-0.653***	-0.51***	-0.504***	-0.517***	-0.845***
Treatment Effect on the Treated	-0.0646***	-0.0656***	-0.0721***	0.0192***	0.0183***	-0.0601***
Interbank relation	N	N	N	N	N	0.554***
Past share of foreign banks bonds	N	N	N	Y	Y	Y
Loan outstanding in the previous period	Y	Y	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	Y	Y	Y	Y
Past level of unsecured extra-group position	N	Y	Y	Y	Y	Y
Past level of Eurosystem position	N	Y	Y	Y	Y	Y
Past level of intra-group position	N	Y	Y	Y	Y	Y
Past level of Lender intra group lending	N	N	Y	Y	Y	Y
Past level of Lender unsecured position	N	N	Y	Y	Y	Y
Past share of Italian banks securities	N	N	N	Y	Y	Y
Past share of foreign high rank banks	N	N	N	Y	Y	Y
Past share of PIGS securities	N	N	N	Y	Y	Y
Past Funding gap	N	N	N	N	Y	Y
Past Capital over total assets	N	N	N	N	Y	Y
Past Loans over total assets (t-1)	N	N	N	N	Y	Y
Number of observations	15,537	12,541	11,666	10,815	10,815	10,794

Note: In all regression robust standard errors are used and observation are clustered in unit of observation. (1) Includes dummy variables for treated group, post periods and their interaction; (2) Includes previous period interbank position for the borrower; (3) Includes previous period interbank position for the lender; (4) Includes portfolio characteristics for the borrower; (5) Includes previous period balance sheet characteristics for the borrower; (6) Includes the number of months in which the bank has an outstanding loan from the foreign bank during the last year and the share of the previous period outstanding loan with respect the total interbank position for the borrower and for the lender.

Table 5: Estimation on different subsamples

	Lender from non core countries (1)		Lender from core countries (2)		Control groups includes only borrowers belonging to non-core country banking group (3)		Control groups includes only borrowers belonging to core country banking group (4)		Borrowers with higher share of capital over total assets (5)	
	(6)	(7)	(6)	(7)	(6)	(7)	(6)	(7)	(6)	(7)
Italian Group	0.198	-0.452	0.123	0.186	-0.021	0.749	0.028	-0.527***	-0.459	-0.413
Post	0.836	0.615	0.17	0.197	0.589	0.619	0.161	0.151	0.443	0.153
Italian Group * Post	-1.219**	-0.787	0.19***	0.221**	-1.027**	-1.046	-0.595***	-0.613***	-0.89**	-0.599
Treatment Effect on the Treated	-	-	-0.108 ***	0.121 ***	-	-	-0.074 ***	-0.092 ***	-	-
Interbank relation	N	N	N	N	N	N	N	N	N	N
Past share of foreign banks bonds	N	Y	N	Y	N	Y	N	Y	N	Y
Loan outstanding in the previous period	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	N	Y	N	Y	N	Y	N	Y
Past level of unsecured extra-group position	N	Y	N	Y	N	Y	N	Y	N	Y
Past level of Eurosystem position	N	Y	N	Y	N	Y	N	Y	N	Y
Past level of intra-group position	N	Y	N	Y	N	Y	N	Y	N	Y
Past level of Lender intra group lending	N	Y	N	Y	N	Y	N	Y	N	Y
Past level of Lender unsecured position	N	Y	N	Y	N	Y	N	Y	N	Y
Past share of Italian banks securities	N	Y	N	Y	N	Y	N	Y	N	Y
Past share of foreign high rank banks	N	Y	N	Y	N	Y	N	Y	N	Y
Past share of PIGS securities	N	Y	N	Y	N	Y	N	Y	N	Y
Past Funding gap	N	Y	N	Y	N	Y	N	Y	N	Y
Past Capital over total assets	N	Y	N	Y	N	Y	N	Y	N	Y
Past Loans over total assets (t-1)	N	Y	N	Y	N	Y	N	Y	N	Y
Number of observations	1,199	844	7,165	5,066	13,130	9,261	15,215	10,698	7,008	6,531

Note: In all regressions robust standard errors are used and observation are clustered in unit of observation. We report the treatment effect on the treated only when the interaction term's significance is higher than 1 per cent. (1) The sample includes only lenders domiciled in non core EURO country (Greece, Cyprus, Croatia, Ireland, Malta, Spain, Portugal and Slovenia); (2) The sample includes only lenders domiciled in core EURO country (Austria, Belgium, Finland, France, Germany, Luxembourg); (3) The sample includes only borrowers domiciled in Italy or in a non core EURO country (Greece, Cyprus, Croatia, Ireland, Malta, Spain, Portugal and Slovenia); (4) The sample includes only borrower's domiciled in Italy or in a core EURO country (Austria, Belgium, Finland, France, Germany, Luxembourg); (5) the treated group includes only Italian banks belonging to the last quartile in term of capital over total assets; (6) Includes dummy variables for the treated group, the post-treatment periods and their interaction; (7) the specification of the model includes dummy variables for treated group, post periods and their interaction, previous period interbank position for the borrower, previous period interbank position for the lender, portfolio characteristics for the borrower, previous period balance sheet characteristics for the borrower.

Table 6: Estimation subsampling banks based on the duration of the outstanding lending position

	Banks with outstanding loan positions with less than 6 months of duration (1)		Banks with outstanding loan positions with more than 6 months of duration (1)	
	(2)	(3)	(2)	(3)
Italian Group	-0.116	0.053	-0.171	-1.393**
Post	0.274*	0.459***	-1.492***	-2.276***
Italian Group * Post	-0.488***	-0.655***	-0.344	0.387
Treatment Effect on the Treated	-0.0395**	-0.1039***	-0.0277	-0.0848
Interbank relation	N	N	N	N
Past share of foreign banks bonds	N	Y	N	Y
Loan outstanding in the previous period	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	N	Y
Past level of unsecured extra-group position	N	Y	N	Y
Past level of Eurosystem position	N	Y	N	Y
Past level of intra-group position	N	Y	N	Y
Past level of Lender intra group lending	N	Y	N	Y
Past level of Lender unsecured position	N	Y	N	Y
Past share of Italian banks securities	N	Y	N	Y
Past share of foreign high rank banks	N	Y	N	Y
Past share of PIGS securities	N	Y	N	Y
Past Funding gap	N	Y	N	Y
Past Capital over total assets	N	Y	N	Y
Past Loans over total assets (t-1)	N	Y	N	Y
Number of observations	15,537	12,541	11,666	10,815

Note: In all regressions robust standard errors are used and observations are clustered in unit of observation. (1) The reference date is June 20th 2011; (2) Includes dummy variables for the treated group, post-treatment period and their interaction; (3) Includes dummy variables for treated group, the post-treatment periods and their interaction, previous period interbank position for the borrower, previous period interbank position for the lender, portfolio characteristics for the borrower, previous period balance sheet characteristics

Table 7: Change across time (before and after the crisis) of covariate' values for banks belonging to treatment and control groups (propensity score matching; billions of Euro and percentage points)

	Banks belonging to Italian banking groups	Banks belonging to foreign banking groups	t	t-test p> t
Total secured borrowing	Unmatched Matched	0.16 0.22	0.04	0.83 0.408 2.03 0.044
Total unsecured borrowing	Unmatched Matched	0.49 0.42	1.13 0.37	-2.02 0.045 0.22 0.824
Total borrowing from Eurosystem	Unmatched Matched	0.00 0.00	0.00 0.00	0.17 0.866 0.71 0.480
Share of assets issued from banks of core countries over total assets(1)	Unmatched Matched	1.23 0.92	4.65 0.49	-2.17 0.031 1.15 0.253
Share of assets issued from Italian banks over total assets	Unmatched Matched	31.42 36.89	16.22 61.73	2.48 0.014 -4.20 0.000
Share of government bonds issued by Ireland, Italy, Spain and Portugal over total assets	Unmatched Matched	46.94 42.22	16.64 15.64	4.79 0.000 6.13 0.000
Retail funding over total assets	Unmatched Matched	60.91 58.80	80.20 50.65	-5.36 0.000 4.04 0.000
Capital over total assets	Unmatched Matched	7.27 7.99	3.82 6.30	3.54 0.000 1.50 0.135
Loans over total assets	Unmatched Matched	81.19 80.54	84.58 81.29	-1.04 0.301 -0.26 0.793
Bad loans over total assets	Unmatched Matched	36.64 36.79	35.23 36.05	0.58 0.560 0.40 0.688

Table 8: Propensity score matched DID estimate (linear probability models)

	(1)	(2)	(3)	(4)	(5)
Treatment Effect on the Treated	-0.0527***	-0.0774***	-0.0803***	-0.0658***	-0.065***
Loan outstanding in the previous period	Y	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	Y	Y	Y
Past level of unsecured extra-group position	N	Y	Y	Y	Y
Past level of Eurosystem position	N	Y	Y	Y	Y
Past level of intra-group position	N	Y	Y	Y	Y
Past level of Lender intra group lending	N	N	Y	Y	Y
Past level of Lender unsecured position	N	N	Y	Y	Y
Past share of Italian banks securities	N	N	N	Y	Y
Past share of foreign high rank banks	N	N	N	Y	Y
Past share of PIGS securities	N	N	N	Y	Y
Past share of foreign banks bonds	N	N	N	Y	Y
Past Funding gap	N	N	N	N	Y
Past Capital over total assets	N	N	N	N	Y
Past Loans over total assets (t-1)	N	N	N	N	Y
Number of observations	7,985	7,985	3,623	3,459	3,459

Note: In all regressions robust standard errors are used and observations are clustered in unit of observation. (1) Includes dummy variables for the treatment group, the post-treatments periods and the interaction between these two dummies; (2) Includes previous month interbank position for the borrower; (3) Includes previous month interbank position for the lender (4) Includes portfolio characteristics for the borrower; (5) Includes previous month balance sheet characteristics for the borrower.

Table 9: Propensity score matched DID estimate (non-linear probability models)

	(1)	(2)	(3)	(4)	(5)
Italian Group	0.3164***	-0.1723	-0.2607*	-0.2238	-0.4718***
Post	0.1677	0.2365*	0.0788	0.0496	0.0884
Italian Group * Post	-0.7865***	-0.8623***	-0.6967***	-0.6681***	-0.7558***
Treatment Effect on the Treated	-0.088***	-0.09***	-0.073***	-0.073***	-0.082***
Loan outstanding in the previous period	Y	Y	Y	Y	Y
Past level of secured extra-group position	N	Y	Y	Y	Y
Past level of unsecured extra-group position	N	Y	Y	Y	Y
Past level of Eurosystem position	N	Y	Y	Y	Y
Past level of intra-group position	N	Y	Y	Y	Y
Past level of Lender intra group lending	N	N	Y	Y	Y
Past level of Lender unsecured position	N	N	Y	Y	Y
Past share of Italian banks securities	N	N	N	Y	Y
Past share of foreign high rank banks	N	N	N	Y	Y
Past share of PIGS securities	N	N	N	Y	Y
Past share of foreign banks bonds	N	N	N	Y	Y
Past Funding gap	N	N	N	N	Y
Past Capital over total assets	N	N	N	N	Y
Past Loans over total assets (t-1)	N	N	N	N	Y
Number of observations	7,985	7,985	3,623	3,459	3,459

Note: In all regression robust standard errors are used and observation are clustered in unit of observation. (1) Includes dummy variables for treated group, post periods and their interaction; (2) Includes previous month interbank position for the borrower; (3) Includes previous month interbank position for the lender (4) Includes portfolio characteristics for the borrower; (5) Includes previous month balance sheet characteristics for the borrower.

Table 10: CIC Estimate

	(1)	(2)	(3)	(4)	(5)
Italian Group	-	-	-	-	-
Post	-	-	-	-	-
Treatment Effect on the Treated	-0.047	-0.086	-0.031	-0.045	-0.137
s.e.	0.007	0.007	0.008	0.008	0.008
Loan outstanding in the previous period	N	Y	Y	Y	Y
Past level of secured extra-group position	N	N	Y	Y	Y
Past level of unsecured extra-group position	N	N	Y	Y	Y
Past level of Eurosystem position	N	N	Y	Y	Y
Past level of intra-group position	N	N	Y	Y	Y
Past level of Lender intra group lending	N	N	N	Y	Y
Past level of Lender unsecured position	N	N	N	Y	Y
Past share of Italian banks securities	N	N	N	Y	Y
Past share of foreign high rank banks	N	N	N	Y	Y
Past share of PIGS securities	N	N	N	Y	Y
Past share of foreign banks bonds	N	N	N	Y	Y
Past Funding gap	N	N	N	N	Y
Past Capital over total assets	N	N	N	N	Y
Past Loans over total assets (t-1)	N	N	N	N	Y
Number of observations	9,913	9,913	9,878	9,343	9,343

Note: In all regressions robust standard errors are used and observations are clustered in unit of observation. (1) Includes dummy variables for the treatment group, the post-treatments periods and the interaction between these two dummies; (2) Includes previous period interbank position for the borrower; (3) Includes previous period interbank position for the lender; (4) Includes portfolio characteristics for the borrower; (5) Includes previous period balance sheet characteristics for the borrower.

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