CAN THE PROVISION OF LONG-TERM LIQUIDITY HELP TO AVOID A CREDIT CRUNCH? EVIDENCE FROM THE EUROSYSTEM'S LTROS

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ABSTRACT. We build an exceptionally rich set of data on individual firms and banks operating in France to assess whether the 3-year Long-Term Refinancing Operations (LTROs) implemented by the Eurosystem in December 2011 and February 2012 had a positive impact on banks' supply of credit to firms. We control for firms' demand and risk factors by looking at firms which borrow at least from two banks and we also control for risk factors at the level of banks. We find that *(i)* LTROs had a positive impact on loan supply in France: on average, everything else being constant, one billion euros borrowed translated into 95 millions of additional bank credit to firms; *(ii)* the transmission took place with the first round of the LTROs to which financially more constrained banks were more likely to bid; *(iii)* the opportunity to swap short-term central bank borrowing for long-term one was instrumental in this transmission; and *(iv)* this increase in loan supply did not benefit to small firms, but only to the top decile of the largest borrowers.

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I. Introduction

Can central banks sustain private credit by pumping liquidity onto banks's balance sheets when the economy has slided into a recession? Since Keynes (1936) and Samuelson (1948) the conventional answer to this long-standing debate is that such "quantitative easing" (QE) policies become ineffective as the economy approaches a liquidity trap.[1] Over the recent years, the effectiveness of such QE policies started to be debated anew as major central banks implemented them to overcome the zero lower bound on interest rates.[2] Most available studies have focused on the price impact of large scale bond purchases by the central bank.[3] However, results from recent research (e.g. Paravisini (2008)) hint at an additional transmission mechanism, the so-called "bank lending channel", through which QE policies might be effective at the zero lower bound: injections of central bank liquidity into balance sheets of commercial banks can increase lending as they relieve them from the frictions they face in their access to external financing. To date, the question of whether such recent QE policies had an impact on the quantities of loan supplied by banks remains unsettled.

In this paper, we use the Eurosystem's 3-year Long Term Refinancing Operations (LTROs) to evaluate to what extent a central bank can revive credit by "pushing on the rope" of liquidity injections to the banking system. We build a unique dataset of bank-firm credit linkages as well as bank and firm balance sheet information for France. We show that banks that bid more to the LTROs did use this cheap and potentially unlimited funding source to lend more to non-financial corporations. In addition, taking advantage of a unique feature of this operation, namely the 3-year maturity at which the central bank liquidity was lent, we find that such a quantitative policy is more likely to succeed if the central bank lends at longer horizons.

The Eurosystem's LTROs represented a very large positive funding liquidity shock to the euro area's banking system. They were announced in early December 2011 and implemented in two separate rounds at the end of December 2011 and February 2012. The first round provided EUR 489 billions to 523 banks while the second one allotted EUR 530 billions to 800 institutions. The total liquidity injection increased the size of the Eurosystem's balance sheet by more than a fifth and amounted to 80 percent of the monetary base in the euro area, 20 percent of total bank credit to euro area firms and almost 11 percent of the area's nominal GDP. Furthermore, this

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[1]As Samuelson puts it in his classic textbook: "By increasing the volume of their government securities and loans and by lowering Member Bank legal reserve requirements, the Reserve Banks can encourage an increase in the supply of money and bank deposits. They can encourage but, without taking drastic action, they cannot compel. For in the middle of a deep depression just when we want Reserve policy to be most effective, the Member Banks are likely to be timid about buying new investments or making loans. If the Reserve authorities buy government bonds in the open market and thereby swell bank reserves, the banks will not put these funds to work but will simply hold reserves. (...) In terms of the quantity theory of money, we may say that the velocity of circulation of money does not remain constant. 'You can lead a horse to water, but you cant make him drink'." (pp. 353-354)

[2]Cf. e.g. Gambacorta et al. (2014) for an empirical assessment of recent QE policies in advanced economies and Auerbach and Obstfeld (2005) for a theoretical defense of the Japanese QE of the early 2000s.

[3]Cf. for instance Chen et al. (2012), Gertler and Karadi (2013), Krishnamurthy and Vissing-Jorgensen (2011) and Li and Wei (2013).

money was lent for three years at a very low interest rate compared to the funding terms banks faced in wholesale markets at the time.[4]

The LTROs were implemented in the context of the escalating sovereign debt crisis in the euro area, which dragged down the economic outlook. Against this backdrop, loan demand by firms was indeed likely to be depressed, even in a core euro-area country like France which was not directly under financial stress. Also, the risk associated with existing credit to firms may have increased over 2012, which may have led to higher external finance premia faced by firms applying for loans. As a consequence, controlling adequately for firms' demand and risk is key for our purpose. We solve the usual problem of disentangling the demand for and supply of loans by exploiting the information contained in the French credit register run by the Banque de France. This database collects all (on- and off-balance sheet) credit exposures of individual resident banks to non-financial resident firms with outstanding amounts above EUR 25,000 and therefore provides with a quasi-exhaustive sample of bank-firm credit relationships for France.[5] Following the methodology of Khwaja and Mian (2008), we restrict our sample to firms that have credit relationships with at least two banks before the announcement of the policy measure. By including firm fixed effects in our regressions, we then compare the changes in the credit supplied to the same firm by two different banks which received different sums of money at the Eurosystem's LTROs. This allows us to identify the impact of the LTROs on the supply of credit to non-financial corporates while controlling effectively for firm-specific characteristics that may affect their demand for credit or their intrinsic level of risk.

Another major difficulty in identifying the effect of this unlimited provision of liquidity is that banks were free to choose the amount of central bank liquidity they borrowed to the Eurosystem.[6] Intuitively, one may expect that banks willing to bid higher amounts at the LTROs would be more stressed than other banks and therefore might want to de-leverage more aggressively than the others. As a consequence, and in addition to controlling for the demand for loans, evaluating the causal impact of LTROs on the supply of bank credit also requires to control for bank-specific factors that are likely to both impinge on their own credit supply to firms and affect their desired bid for central bank liquidity. We control for such factors by merging the detailed dataset from the credit register with banks' balance sheet information, as well as information on the operations of banks with the Eurosystem and market information on the maturity of banks' bond issues before the LTROs. Furthermore, our approach with effective firm controls also shields our estimate from a last potential source of endogeneity bias: the fact that a bank may have bid more at the LTROs because this bank's lending was ex ante biased towards a certain type of firms (e.g. less profitable or more risky firms). Again, since in our diff-in-diff style regression we compare the credit supplied by *two* different banks to the *same*

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[4]Section III provides more details on these operations.

[5]The scope of our database is limited to credit supplied to firms operating in France. Still, France is an interesting particular case to study as the financing of its firms is largely bank-based and it is the second biggest economy in the euro area.

[6]The only limit being set by their access to eligible collateral that they could pledge with the Eurosystem.

firm, this potential for bias is wiped out. Overall, our measure of the effects of the LTROs on credit supply to firms is thus unlikely to be biased by the endogenous nature of the bids.

We first find that such unlimited liquidity provision measure had a positive impact on credit supplied to firms. According to our baseline estimates, a EUR 1 billion of central bank money lent to the average bank holding company led to an increase in credit by EUR 95 millions made available to the average firm over the 12-months period from September 2011 to September 2012. Importantly, we also find that this effect is almost exclusively associated with the first round of the LTROs, which took place before ECB's President Mario Draghi on 9 February 2012 publicly dismissed fears of any stigma that could be associated with a bank's bidding at these operations. Relaxing the threat of stigma actually encouraged more banks to bid at the second LTRO in late February 2012, but these institutions were likely to be less constrained to roll-over the financing of their existing investments and more eager to exploit an attractive funding opportunity. Indeed, we show that the latter were on average better capitalized. This confirms that the positive bank funding shock has a stronger impact on bank lending when banks are *ex ante* financially constrained.

Second, we provide new insights about the benefits of providing central bank liquidity at longer horizons than what is usual in lender of last resort operations. The Eurosystem had been lending under a full allotment procedure since the subprime crisis intensified in October 2008, but before December 2011 its liquidity had been provided only at relatively short maturities of between one week and six months.[7] A novelty of the 2011 LTRO facility was then that a potentially unlimited amount of central bank liquidity was for the first time lent at the long horizon of three years, which substantially reduced the uncertainty faced by banks about their ability to withstand future funding stress. It is therefore important to ascertain whether the possibility offered to banks to swap their short-term central bank borrowing for longer-term one mattered or not. We answer this question by disentangling the effects of the maturity swap associated with the LTROs and the effects of the increase in total borrowed reserves over the allotment period. We find confirmation that maturity was indeed important: the bulk of the stimulus to bank lending associated with bids at the first LTROs comes from a substitution of short-term by long-term bank borrowing.

Third, we document distributional issues linked with the LTROs. Indeed, an important question is whether implemented monetary policy measures have helped to limit credit restrictions to smaller firms during the crisis. We know that small and medium-sized firms are typically more dependent on banks for their funding than larger ones, as small firms have generally a more limited access to wholesale funding markets. Due to informational frictions, these firms are also less likely to switch easily from one lender to another in order to smooth out the negative effects of the bank lending channel when financial conditions deteriorate. To answer this question, we look at the impact of the first LTRO round across firms of different sizes. We find that the LTROs only benefited to large firms, i.e. firms in the upper decile of the borrowing distribution. For very large firms, i.e. firms in the top 1 percent of the borrowing distribution,

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[7]An exception were the 1-year LTROs launched in June and December 2009. By construction however, these were fully reimbursed at the end of 2010.

the benefit of being linked to a bank that borrowed from the ECB's LTROs is 3.5 times larger than for the average.[8] Moreover, we find that the LTROs had no significant impact on credit provision to small and intermediate firms.[9] So, at least in France, the policy failed to meet one of its objective which was to relax the credit constraints for small borrowers.

In addition to the overall impact of such interventions on loans supplied to firms, we can also address some important issues by interacting the LTRO variable with various firms' characteristics other than their size. We find that banking groups that borrowed from the ECB's LTROs tended to increase significantly less their lending to firms with whom they had a longstanding relationship (defined as a credit link that is more than three years old), suggesting that the measure did not predominantly favor ever-greening. Likewise, firms' credit risk does not seem to be a key determinant of the increase in loan supply. However, and importantly, fringe firms in terms of credit rating, i.e. firms of intermediate credit quality which were not eligible to the collateral framework of the Eurosystem before January 2012 but became eligible as a consequence of an extension of the collateral suited for central banks refinancing operations (the so called ACC program of February 2012), benefited more than others from the LTRO borrowing of their lenders. This suggests that firms in this risk bucket were facing a form of credit rationing before the extension. Lastly, we also find that the impact of such liquidity provision was marginally greater when banks were better capitalized. This suggests that weaker banks may have transmitted somewhat less the positive shock to the real economy, but instead may have used the proceeds of the LTROs to hoard liquidity, buy other assets, or deleverage.

Last but not least, we acknowledge that identifying a positive effect of the LTROs on credit provision by some banks to their borrowing firms is not enough to conclude that this policy was effective in mitigating a credit crunch at a more aggregate level. Indeed, the firms which benefited from a higher supply of credit from some of their lenders thanks to this monetary policy measure may have faced higher restrictions by its other relationship lenders, so that the credit supply shock induced by the central bank may not have been enough to compensate a contraction of credit supply by non-participating banks. Following Khwaja and Mian (ibid.) and others, we therefore look at the aggregate effects of the Eurosystem's LTROs by collapsing our dataset of bank-firm exposures at the bank level. We find confirmation of strong significant effects of the first round of the LTROs on the availability of bank credit to non-financial firms, suggesting that within-firm substitution effects played a minor role on average.

The rest of the paper is organized as follows. Section II discusses some related literature. In Section III, we describe the Eurosystem's LTROs more in depth. Section IV details our identification strategy. Section V presents the data. We discuss our results on the bank lending channel in section VI and firm-level effects in section B. Finally, section VIII concludes.

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[8]These firms account for nearly 60 percent of total bank credit to non-financial institutions in France

[9]Small and intermediate firms are defined here as the ones borrowing less than the 90th percentile of the distribution, i.e. 713,000 euros.

II. Related Literature

Our results are relevant for at least three strands of the recent literature in banking and monetary policy. First, as stated above, our paper fits in the large empirical literature on the bank lending channel. Early theoretical work, like Bernanke and Blinder (1988), has highlighted the possibility that, in the presence of some market imperfections, banks are unable to shield their borrowers from negative shocks to their liquidity position. Recently, a series of empirical studies have shown that this bank lending channel was indeed at play during the recent financial crisis in the US as well as in Europe, so that the negative liquidity supply shock consecutive to the freeze of interbank markets in 2007-2008 explains a substantial part of the observed credit contraction (See for instance Cornett et al., 2011; Iyer et al., 2014; and Puri et al., 2011). While most empirical studies look at the negative side of the lending channel, when tighter policy or increased funding stress entail less lending by financial institutions (see e.g., Kashyap and Stein, 1995, 2000; Khwaja and Mian, 2008; and Schnabl, 2012), we contribute here to quantifying the positive side of the lending channel, when a policy action relieves part of the financial frictions that affect banks. In this respect, our results confirm the findings of Paravisini (2008), who looks at the effects of an Argentine governmental program designed to support bank lending to SMEs in poor areas and finds evidence of a positive effect of the program because beneficiary banks where financially constrained and would have had to forego profitable investment opportunities absent the program.

Second, our paper also obviously belongs in the burgeoning literature assessing recent non-conventional monetary policies. In particular, our study is one of the very first to evaluate the Eurosystem's LTROs.[10] Interestingly, the modalities of the ECB's LTROs, i.e. massive direct liquidity injections into the banking system instead of asset purchases, are close to the modelling assumptions in Gertler and Karadi (2011) and Benmelech and Bergman (2012), two recent influential theoretical studies vindicating quantitative central bank policies.[11] Our results can therefore be viewed as an empirical confirmation of their theories and evidence that the Eurosystem's LTROs (at least partly) met their objectives of fostering bank lending to the real economy, even though they may also have encouraged opportunistic "carry trade" government bond purchases by some banks.[12]

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[10]Two other recent studies are Darracq Paries and De Santis (2013) and Cahn et al. (2014). The former aim at assessing the macro effects of this policy in euro area countries using a panel VAR methodology with country level data. The latter use a standard DSGE model with a frictional banking sector and evaluate the multiplier effect of the LTROs for output at the area level.

[11]Gertler and Karadi (2011) analyse non-conventional credit easing policies in a dynamic general equilibrium framework where banks face agency problems with their depositors so that their ability to fund new profitable investment is limited by their current net worth. They show that quantitative central bank interventions can be effective in fostering profitable bank lending and therefore enhance welfare during a financial crisis. Further, Benmelech and Bergman (2012) look at the conditions under which quantitative central bank policies can be successful in stimulating bank lending in a setup where the price of firms' collateral, firms' available liquidity and bank lending interact, resulting in the possibility of multiple equilibria. Although they show the possibility of a "credit trap" situation, where banks prefer to hoard additional central bank liquidity rather than pass it on to firms, they also find that massive enough liquidity injections can succeed in jump-starting bank credit in a crisis situation, notably if the initial level of non-financial firms' leverage is not too high.

[12]As claimed recently by Acharya and Steffen (2014).

Last, our paper also contributes to the debate about the potential stigma effects associated with participating at lender-of-last-resort operations. For fear of such stigma, stressed banks may avoid to bid at liquidity facilities designed by central banks, therefore impeding policy efforts to mitigate the impact of a crisis.[13] In the case of the Eurosystem's LTROs, the first round of December 2011 was likely to be plagued with a stigma, but the second was supposedly not, as the ECB publicly dismissed such fears before the second injection took place. By comparing the impact on credit supply of the two rounds, our results shed new light on this debate. They notably suggest that relieving the stigma may imply a trade-off. On the one hand, more banks are likely to participate in the program, making it look more successful. On the other hand however, additional participating banks may be less financially constrained ex ante and may have an incentive to behave in a more opportunistic way which does not meet the objectives of the central bank, for instance using the proceeds of the operation to pursue carry trade strategies instead of increasing their lending to the real economy.[14]

III. The Eurosystem's LTROs of 2011-2012

The Governing Council of the ECB announced on 8 December 2011 its decision to implement two so-called longer-term refinancing operations (LTROs) with a maturity of three years and the option of early repayment after one year. These LTROs were presented as part of a larger policy package which also included an extension of the pool of eligible collateral obtained by a reduction of the rating threshold for certain types of ABS and the decision to allow national central banks to accept as collateral Additional Credit Claims (ACC), i.e. bank loans to firms of intermediary credit quality. [15]

The announcement was motivated by a commitment to "ensure enhanced access of the banking sector to liquidity" and the measure was expected to "support the provision of credit to households and non-financial corporations". It took place against the backdrop of an intensification of the sovereign debt crisis in the euro area over the second semester of 2011, which dragged down real activity significantly and prompted the ECB to revise downward its outlook for GDP growth in 2012. The outlook for credit and and GDP growth was duller in peripheral countries under heightened market stress, but signs of tensions possibly leading to a credit crunch made themselves felt more broadly across the euro zone. As an illustration, Figure 1 displays a measure of the spreads of bonds issued by European banks, as compared to the German government bond, for the four largest economies of the eurozone since the inception of the euro. According to this common measure of funding stress, European banks faced unprecedented levels of funding pressures in the second half of 2011, even higher as what they had

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[13]see e.g. Armantier et al. (2014) for a measure of the stigma recently associated with borrowing at the Fed's Discount Window during the subprime crisis.

[14]For banks which were not forced ex ante to limit their investments in relationship borrowers because of their own funding problems, buying standardized assets is intuitively more appealing than paying the screening costs associated with new lending.

[15]The latter measures on collateral took effect in February 2012 only. The package also notably included a reduction of the compulsory reserve ratio from 2 to 1 percent of banks' deposits

to go through after the failure of Lehman Brothers.[16] While spreads shot higher in peripheral countries mired in the sovereign debt crisis, spreads paid by French banks also reached historical highs. Available surveys with bank loan officers suggest that this negative funding shock translated into tighter credit conditions offered to bank customers. Figure 2 shows how credit conditions to non-financial firms evolved in France in 2011, as measured by the Eurosystem's Bank Lending Survey (the euro area's equivalent for the Fed's SLOOS). The increase in the BLS credit tightening index over the last quarter of the year points to a rapid contraction in the supply of credit. Interestingly, the figure also shows that, at least according to the loan officers' accounts, demand for credit by non-financial firms also receded sharply over the course of 2012. This highlights the crucial need for adequately controlling for demand effects when evaluating the impact of the ECB's measures on credit supply over this period of time.

The first LTRO operation, which took place on 21 December 2011, provided EUR 489.2 billion to 523 credit institutions in the euro area. The second operation took place on 29 February 2012 and saw the allotment of EUR 529.5 billion to 800 credit institutions, in addition to the EUR 6.5 billion allotted in the regular three-month LTRO on that date. When taking into account other operations conducted the same weeks (like three-month operations and regular weekly operations) and operations maturing at these dates, the first round of LTROs amounted to a net injection of EUR 210 billion while the second amounted to a net injection of EUR 311 billions.

The surge in the number of participating banks as well as in the quantities borrowed between the two rounds may be explained, at least partly, by official statements by the ECB aimed to dismiss fears of stigma being associated with bidding at the operations and therefore enhance participation. Indeed, in a press conference following the Governing Council of 9 February 2012, ECB's President Mario Draghi stressed very explicitly that there was and should be "no stigma whatsoever attached to these facilities". Preliminary analyses presented by the ECB in its Monthly Bulletins of January and March 2012 suggest that funding considerations played a major role in banks' bidding behavior in the three-year LTROs. While a substantial number of banks bidding in the three-year LTROs did not issue debt securities in 2011, it was however obvious that even if a bank had been able to obtain longer-term funds in the bond market, it could still have had a strong incentive to borrow from the Eurosystem owing to the lower cost involved.

IV. Empirical identification strategy

In this section, we detail our strategy to identify the credit supply effects associated with a bank's uptake at the Eurosystem's LTROs. When seeking to estimate these effects, two problems may arise. Firstly, the positive credit supply effect of the LTRO may be correlated with demand effects on the side of borrowers. In other words, our dependent variable, i.e. the rate

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[16]Country-aggregates are computed from individual bond spreads as weighted averages, where the weights are relative to the outstanding amounts of each issue. Individual spreads towards the German Bund are computed according to the methodology of Gilchrist and Mojon (2014), which takes care of matching corporate and government bonds of similar maturities.

of growth of credit received by a given firm from a given bank, combines both the effect of possible changes in credit supplied by the bank and possible changes in credit demanded by the firm. A proper identification therefore requires to adequately control for loan demand. Secondly, the amount of central bank liquidity taken at the LTROs was freely chosen by bidding commercial banks. Therefore the LTROs uptake observed for a given bank was endogenous to some of its characteristics, typically its degree of financial stress, which may also affect its supply of credit to related firms. A proper identification therefore requires to control for all the banks' characteristics that jointly affect the LTROs uptakes and the supply of credit.

We focus on the effect of the measure on the growth of bank credit to firms (the intensive margin) between September 2011 and September 2012, i.e. before and after the LTROs.[17] First, let us suppose that we run for this purpose a simple cross-sectional regression on all bank-firm pairs with OLS. The estimated equation would then read:

$$(1) \qquad \Delta L_{ij} = \beta_0 + \beta_1 LTRO_i + u_{ij},$$

where ΔL_{ij} is the change in credit exposure (expressed in logarithm) of bank i on firm j, $LTRO_i$ is the amount of ECB's LTRO taken by bank i, β_0 and β_1 are parameters to be estimated. Let us then suppose that the error term can itself be decomposed into a firm-specific factor, η_j, and a zero-mean innovation ε_{ij}: $u_{ij} = \eta_j + \varepsilon_{ij}$.

The OLS estimate of the coefficient of interest, β_1^{OLS}, is biased if $corr(LTRO_i, \eta_j) \neq 0$. This is likely since the reasons why banks bid at the LTROs, namely a situation of financial stress and depressed economic activity, may also impinge on firms' borrowing behavior, summarized by the η_j term. For instance, firms would tend to borrow less for investment purpose, but they could also draw heavily on their available credit lines to keep it going as their revenues drop and other sources of funding vanish.[18]

We control for this source of bias by following the "within-firm" estimation approach of Khwaja and Mian (2008). The idea is to introduce firm fixed effects in equation 1. The estimation equation then reads:

$$(2) \qquad \Delta L_{ij} = \beta_0 + \beta_j + \beta_1^{FE} LTRO_i + \varepsilon_{ij},$$

The fixed effects β_j then absorb all relevant firm characteristics, like their investment opportunities, their credit risk, their financial soundness etc., that may impinge on their demand for bank credit. Basically, the FE approach tests whether the same firm borrowing from two

[17]Limiting the information set to a "pre" and a "post" time period allows to address concerns of autocorrelation of residuals that would bias the coefficient estimates in a panel setup (cf., Bertrand et al., 2004). Note that we choose here to consider simply two dates around the event instead of collapsing the time dimension by averaging monthly credit levels for each bank-firm pair over one year before and one year after the "event window", as is often done in similar studies. Indeed, as the sovereign debt crisis has been ongoing since early 2010, many other shocks may have affected individual credit exposures over the 12-month period before November 2011 and the the 12-month period after mid-2012, therefore possibly blurring the effect we want to identify. Note that Iyer et al. (2014), who work with Portuguese credit data over the first two years of the sub-prime crisis, strike the same choice.

[18]See for instance Ivashina and Scharfstein (2010) on the dynamics of credit lines drawdowns during the subprime crisis in the US.

different banks gets more credit from the bank that took more liquidity at the LTROs (or in other terms, benefited from a larger positive liquidity shock). However, it is important to note that the FE coefficient β_1^{FE} can only be estimated in a sub-sample of firms with multiple bank relationships (multibank firms).

Like in the OLS case, the fixed effect estimator will also be biased when $\text{corr}(LTRO_i, \varepsilon_{ij}) \neq 0$, that is when some omitted variables that affect the LTRO take-up of a bank also directly condition the bank's decision to supply credit. For illustration purpose, let us consider the extent to which a bank was funding itself on the interbank market before the announcement of the LTROs. In the context of the escalating sovereign debt crisis of the euro, a bank's low level of interbank liabilities (excluding liquidity obtained from the Eurosystem) was a signal that this bank had presumably lost access to the interbank market, or at least was constrained in its ability to tap wholesale funding. For this reason, this bank, absent the LTROs, was likely to cut down its supply of credit to the economy. Omitting to control for interbank liabilities in regression 2 would therefore lead us to *underestimate* the true effect of the LTROs, even though we do include firm fixed-effects in the regression. Of course, this omitted variable bias can be solved simply by augmenting the previous fixed-effect regression (2) with the required bank-specific control variables, which we denote by Z_i. The empirical model now reads:

$$\Delta L_{ij} = \beta_0 + \beta_j + \beta_1 LTRO_i + Z_i'\gamma + \eta_{ij}, \tag{3}$$

which again can be estimated using the usual fixed-effect estimator.

However, adding a few bank-specific controls on the right-hand side of the equation may not be enough to solve the issue of the endogenous nature of the LTROs bids. First, the additional controls may not exhaust the source of omitted variable bias, which calls for robustness checks using more than the usual candidate regressors in bank loan supply equations, like bank capitalization or bank liquidity measures. Second, one can think of a simultaneity bias where loan supply would depend on LTROs and LTROs would depend on loan demand. Indeed, it may be the case that the propensity of a bank to tap the LTRO facility is correlated with some features of its pool of borrowers, e.g. this bank lends to less profitable or more risky firms, which again could bias the estimated coefficient of interest. Importantly, however, this problem is mitigated here by our within-firm approach. Since our estimate compares credit inflows received from two different banks by the same firm, this bias is wiped out if banks are randomly associated to every type of firms. Clearly, if some banks are nevertheless specialized lenders to low risk firms or high risk firms, then the concern remains. Using detailed information we have on the rating of borrowers, we show nevertheless in the following that our estimate of β_1 is unchanged when we also control for measures of the average quality of banks' loan portfolios. This suggests that the adverse hypothesis of a partitioned banking system, with bad banks lending to bad firms and conversely good banks lending to good firms, is not vindicated in our sample.

The next section details how we select the firm-bank pairs involved in this regression and construct our dependent and explanatory variables.

V. Data

A. Data Sources

The data used for our analysis combines five different datasets.

We start from a large dataset of bank-firm linkages available at the Bank of France: the Credit National Register (Centrale des Risques). The aim of the register is to collect data on bank exposures to residents on a monthly basis to monitor and control systemic risk. More specifically, the monthly data come from mandatory reports by credit institutions to the register provided that their commitments or risk exposures (e.g., credit claims) on a company as defined by a legal unit and referenced by a national identification number (SIREN), reach a total of EUR 25,000. These statements covers the funds made available or drawn credits, the bank's commitments on credit lines and guarantee, and specific operations (medium and long-term lease with purchase option, factoring, securitized loans, etc.). Recipients are single businesses, corporations, sole-proprietorship engaged in professional activities. They may be registered in France or abroad. Reporting financial intermediaries include all resident credit institutions, investment firms, and other public institutions. We include all firm-bank pairs that appear at least once in the large linkage dataset in September 2011 –three months before the first LTRO was launched. The second date we consider is September 2012 e.g. one year later and 7 months after the second LTRO. If in September 2012, the pair is absent from the linkage data, we posit that exposure is equal to zero.

Second, we merge these credit register data with an exhaustive record of the access of French banks to the Eurosystem's refinancing operations (main refinancing operations, longer-term operations of 3 months to 3 years, fine-tuning operations etc.). The dataset covers all the operations of all individual credit institutions located in France (domestic and foreign) with the Eurosystem over the years 2006 to 2013. The Banque de France Markets Department records in its database all liquidity outflows by bidding bank and type of operation at weekly frequency. We reconstruct for each individual institution with monthly frequency the total outstanding amount of liquidity borrowed from all types of operations, net of repayments, that we then aggregate at the banking group level. Note that aggregated data at the group level are preferred here because of the presence of internal capital markets within banking groups, with some subsidiaries submitting to the Eurosystem's operations for the benefit of the whole group. We use this measure of total group borrowing from the Eurosystem to compute, at the banking group level, our indicator of the change in central bank borrowing over the period of implementation of the LTROs.[19] We also compute, for each banking group, the ratio of its uptakes from the 3-year LTROs to its total assets. Last, we construct a dummy variable that takes the value of one when the banking group took part in at least one of the ordinary weekly refinancing operations over the years 2006-2011. This "MRO user" indicator singles out groups that are sophisticated enough to bid at regular operations, and thus have the technology to also easily bid at the 3-year LTROs of the Winter 2011-2012.

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[19]September 2011 to December 2012 as regards the first LTRO round, December 2011 to March 2012 as regards the second, and the six months from September to March when considering both rounds.

Third, we merge the data with bank-level information taken from the regulatory reporting submitted to Banque de France. All balance sheet variables are measured as of June 2011 and refer to consolidated banking group statements in the case of French groups. Balance sheet items of subsidiaries of foreign groups are on an unconsolidated basis.

Fourth, we merge with firm-level accounting and rating information, also available from the Bank of France (Centrale des Bilans). Such information is updated annually. Accounting information follows the tax forms that firms have to fill in and provides us with extremely detailed data on the balance sheet and the income statement. In principle, firm's financial statements are collected in so far as its turnover exceeds EUR 0.75 million. Credit ratings are awarded by a special unit at the Bank of France, which is in charge of maintaining the credit national register. The register covers a vast number of firms: when restricting to 12-month fiscal years and closing date at the end of December the database covers more than 160,000 firms in their legal unit form for 2011.

Last, we take the detailed information on outstanding bond issues of French banking groups from SNL and compute the total amounts of outstanding bonds maturing over the three year period covered by the LTROs.

B. Preparation of the dataset and descriptive statistics

As is standard with huge datasets, the merged database requires some minimal cleaning to be suitable for regression analysis. This necessary cleaning proceeds in three steps. Starting with the complete credit register dataset, we first collapse credit exposures at the level of banking groups (in French: GEAs, for "groupe économique d'appartenance") in order to assess the share of each group in total lending to domestic firms. A total of 200 banking groups or stand-alone banks are registered as active lenders in the credit register as of September 2011. The distribution of these groups' market share of (drawn) corporate credit is very skewed to the left, with 170 banks holding each less than 0.1 percent of total credit to firms. We discard these "small" lenders, which collectively account for 2.4 percent of total drawn credit. Among the remaining 30 banks, we also delete 5 banks whose total assets jump by more than 50% in absolute value over the 12-months period from September 2011 to September 2012. These banks are likely to have merged with other institutions or to have been restructured over this period of time, which shall blur our measure of changes in their credit supply. Nevertheless, these 5 banks make up less than 2 percent of total drawn credit offered to domestic firms. Last but not least, we drop the Belgian-French banking group Dexia, which went nearly bankrupted in early October 2011, was bailed out by the French and Belgian Governments and had then to undergo a long process of restructuring over the period of our study.[20] This leaves us with a sample of 24 banking groups and stand-alone credit institutions, which we list in Appendix A.

Our final sample of banks is quite representative of credit provision to non-financial firms in France, with a coverage of more than 89 percent of drawn credit to firms in the Fall of 2011. It includes all major French private banking groups, a handful of public credit institutions which

[20]Dexia accounted in September 2011 for some 6.5 percent of drawn bank credit to firms in France. We nevertheless checked that our main results are robust to the inclusion of this bank.

are active lenders to firms (notably SMEs, like OSEO), as well as 13 French subsidiaries of foreign banking groups (which together account for slightly less than 5 percent of total credit to domestic firms). Importantly, the selected banking groups account for almost all submissions to the Eurosystem's LTROs (91% of the total amounts allotted in France over the two rounds, cf. table 4).

Table 1 presents detailed descriptive statistics for the selected banks. The average bank is relatively large, with total assets at EUR 494 billions, but the sample ranges from quite small institutions (mostly foreign subsidiaries) to the big players of the French banking sector (groups with total assets of the order of magnitude of France's nominal GDP). Although the total assets of these banks increases over the 12-months period of study, their total supply of credit to firms decreases by 1.43 percent on average. The average bank is well capitalized, with a (Tier 1) leverage ratio of roughly 8 percent. The funding pressure associated with maturing bonds over 2012-2014 as well as the degree of dependence from Eurosystem's liquidity varies a lot across banks, with a median at zero but some institutions showing up to 2.6 percent of their balance sheet at roll-over risk and 10 percent of their liabilities being funded by the Eurosystem in September 2011. Last, the average recourse to the LTROs amounts to 1.2 percent of total assets, but this average recourse increases to 2.8 percent of the banks' total assets for the 11 banking groups that eventually tapped the facility as shown in table 3.

Table 3 further compares the profiles of LTRO-bidders and non-bidders. Among the 24 French banking groups and foreign subsidiaries in our sample, only 10 did borrow at the LTROs: 6 participated in the first round, 8 in the second and 4 in both. Interestingly, the average bidder at the second round is 42 percent smaller than the average bidder at the first round. It is also more capitalized.

In a second step of the data cleaning process, we go back to the firm-bank level information and compute the share of each corporate firm in total credit granted to firms (including undrawn credit lines) as of September 2011. We then discard all credit links which do not involve any of the selected 24 banks. This leaves us with a collection of credit exposures which nevertheless represents more than 88 percent of total bank credit to domestic corporates (including undrawn credit lines). Small credit exposures tend to be more volatile than large one and they are more often associated with very small borrowers. This is also confirmed in our dataset. In order to limit the impact of outliers on the results of regressions where the dependent variable is the growth rate of firm-bank specific credit exposures, we therefore delete observations for firms that borrowed less than a total of 25 thousand euros in September 2011 from all selected banks, which is also the threshold above which a credit institution has to post a new exposure to a given firm in the national credit register.

Based on percentiles of the distribution of total bank credit across firms that are linked to the selected banks in September 2011, we then define four size groupings where we sort the remaining 1,360,334 borrowing firms. Not surprisingly, this distribution is also very much

skewed to the left.[21] The first grouping stands for "small borrowers", which are likely to be also small firms. These are defined as firms with total bank credit below the median of 136 thousand euros. Their average total bank borrowing (including credit granted by banks that we do not keep in the sample) is indeed very small and stands at around 70 thousand euros. These more than 682,000 firms account for only a tiny 3.4 percent of total bank credit granted to domestic firms. The second grouping includes 542,000 borrowers in the sixth to ninth deciles of the borrowing distribution, which make out about 11 percent of total bank credit obtained by firms. We denote them "intermediate borrowers" in the following. The average amount of credit received by an "intermediate borrower" is about four times larger than the amount granted to a "small" one, at some 295 thousand euros. The third grouping includes the 122,000 firms in the last decile of the distribution, with the exception of the last percentile. The average amount of credit granted to these "large borrowers" is again six times larger than for the intermediate borrowers and stands at nearly 1.83 million euros. These "large borrowers" account for some 15 percent of total bank credit to firms. Last we denote firms in the last percentile of the distribution of total bank credit granted as "very large borrowers". The 13,600 firms in this grouping benefit from nearly 69 million euros each of bank credit on average and they account for 58 percent of the total quantity of bank credit received by domestic firms.

Finally, we drop exposure observations with extreme rates of growth over the period of study. Here, we define outliers as exposures with annual growth rates below the second percentile or above the 98th percentile of the total distribution for all selected 1,360,000 borrowing firms and 24 lending banks. The deleted observations account for less than 9 percent of total bank credit to domestic firms. Overall, we thus end up with a sample of 1,390,270 bank-firm credit links (involving some 1,172,000 firms), which represent 79 percent of the total amount of bank credit to firms. The sub-sample of multibank firms, which is the relevant one for our baseline FE regressions as explained above in section IV, is of course smaller. Nevertheless, it still includes 211,209 firms with 428,594 bank-firm relationships and accounts for 57 percent of total bank credit to French firms.

Table 5 presents descriptive statistics for the selected firms in our sample before the ECB announced the LTROs. The upper panel presents statistics for all firms, while the next two panels show statistics for multibank firms and monobank firms respectively, where a multibank firm is defined as a firm receiving credit from two different banks. The last panel relates to the subsample of firms for which we have access to balance sheet information from the FIBEN database. Intuitively, multibank firms are larger borrowers than monobank firms, but the difference between the average and the median of total credit borrowed (EUR 4.6 millions and 0.4 millions respectively) nevertheless points to a high degree of heterogeneity among these firms. Among these multibank firms, 14 percent enjoy a Banque de France rating that makes their debt eligible as collateral to the Eurosystem's operations (high quality firms) and 76 percent maintain a credit relationship with an average length of more than three years. Complete balance

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[21]With a mode around EUR 150,000. Note that we sort firms linked to *selected* banks but according to the total bank credit each of them receives from *all* banks. The point here is to construct a measure of total firm borrowing which provides the best possible proxy for firm size.

sheet information is available for some 17 percent of these multibank firms. Not surprisingly, these multibank FIBEN firms are even larger, better rated and have an even higher probability to maintain a long term relationship with their lenders. The average size of their assets is EUR 43 millions and they employ an average of 85 staff. Their low average profitability reflects the weak macroeconomic situation that was prevalent in 2011.

To conclude with, Table 6 shows some statistics for multibank firms sorted into size buckets. We find here confirmation to the intuition that smaller firms are connected to a smaller number of banks than larger firms. They also face a sharper contraction of credit over the period of study. Last but not least, the comparison with the subsample of firms for which we have access to balance sheet information confirms that borrowing size is positively correlated with asset size. As a matter of fact, the correlation between total borrowing (including unused commitments) and total assets is 0.74 for these FIBEN firms.

VI. Did the 3-year LTROs increase loan supply to firms?

In this section we present our estimation results of the impact of LTROs on bank credit supplied to firms located in France. More specifically, we look at the impact of the LTRO up-take of a bank (expressed as a fraction of its total assets) on the growth rate of total credit distributed to firms (including undrawn credit lines) by this bank between September 2011 and September 2012, following he methodology described above in Section IV. We analyse the impact of the operation as a whole but also distinguish between the effects of the first round (implemented in December 2011) and of the second round (implemented in February 2012). We also disentangle the *quantitative* impact from the *qualitative* impact, associated with the longer maturity of the facility, of these massive long-term liquidity injections on loan growth. Finally we provide a set of robustness checks of our main results.

A. Overall impact

The first four columns in Table 7 investigate the combined impact of the two rounds of LTROs on bank credit supply to firms. In the first two columns, firms' characteristics – their risk profile and credit demand – are not controlled for, as in equation 1) above. The first column provides results for the whole population of firms,while in the second one the sample of firms is restricted to multibank firms. In the third column, we then control for firms fixed effects, but not for bank-specific risk factors, as in equation 2. Lastly, the fourth column present results when both controls are used, as in equation 3.

Columns (1) and (2) show a non-significant impact of the 3-year LTROs on loans distributed to firms. However, these estimates are prone to the two sources of bias discussed above. First, banks may have increased their supply of loans to firms that demanded such loans the most. Column (3) therefore reports an estimate that controls for firms' specific characteristics, including their loan demand. Comparing column (3) and with column (2) underlines that the coefficient estimates becomes (slightly) smaller and significant: not controlling for firms' specific demand or risk would therefore lead us to overestimate the impact of the LTROs.

Second, the banks which tapped the most the full liquidity allotment measures were probably more stressed banks and hence the ones which had to deleverage the most. Column (4) shows the impact of 3-year LTRO when we control for the key balance sheet characteristics of selected banks, hence their degree of financial stress. As expected, banks with higher capital ratios and easier access to interbank market reduced their supply of loans less than others. Banks that chose to have more liquid assets also had a tendency to reduce their loans to firms compared to the average. Lastly banks that were frequent bidders at the central bank refinancing operations had relatively more dynamic credit growth, while public French groups reduced significantly much more their credit to firms and foreign banks were not significantly different than French groups. Overall, the results reported in column (4) show that the LTRO liquidity provision had a positive and significant impact on loans distributed to firms. More stressed banks bid more at the liquidity operation while de-leveraging more than the average bank. To put it differently, the reduction of credit supplied to firms would have been worse had this unconventional liquidity provision not been implemented. Not controlling for banks characteristics would lead us to underestimate this positive impact on loan growth.

We can go further and get a sense of the economic significance of such previous estimates. Let δ_i denote the growth rate of loan supplied to firms by a bank i. We can get an estimate of such growth rate by observing its LTRO take-up: $\widehat{\delta_i} = .60 \times LTRO_i$. The change in loans supplied by bank i is then easily derived from its pre-LTRO stock of loans L_i namely $\Delta \widehat{L_i} = \widehat{\delta_i} \times L_i$. Summing over all the banks, the supply of credit increases by a total of 14,6 billions. This is to be compared with the sum of individual LTROs take-ups by the banks in our sample, which amounts to 153 billions. Put differently, everything else being constant, we find that 1 billion EUR injected by the Eurosystem led the average bank to supply 95 millions in supplementary loans and credit lines to firms.

B. First and second rounds

So far, we analyzed the impact of the 3-year LTRO measure as a whole. However, it is also worth investigating whether the two rounds of the LTROs had different impacts on credit supply to firms. Indeed, the issue at stake here is that the population of banks bidding at the first round might have differed from the population of banks bidding at the second one. As we highlight below, the former group consists of banks that were more stressed than the average. In contrast, relatively less stressed banks might have refrained from tapping the facility during the first round as they did not urgently need this liquidity and also might have been concerned not to send bad signals about their financial situation.

This assumption gains some empirical support if one looks at the correlations between bank variables as shown in Table 2.The take-ups at the first LTRO round were negatively correlated with the capital ratio of the bank, while take-ups at the second round were positively correlated with capitalization. Table 8 provides a more formal assessment of this assumption. Columns (1) and (2) report the probit regression results of the bank decision to bid at respectively the first round and the second round, as a function of its capital ratio. The coefficient on capital is significantly negative for the first round, confirming that better capitalized banks bid on average

less at the first round. In contrast it is not significant for the second round. Columns (3) and (4) show the results of Tobit regressions of bank LTRO take-ups on bank capital at respectively the first round and the second round of the LTROs. Again, the results underline that better capitalized banks bid less at the first round and more at the second one.

Columns (5) and (6) in Table 7 then report estimation results of regression (3), that we run for respectively the first and the second round of the LTROs. The results illustrate that the impact of the second LTRO is much lower than the impact of the first one and becomes even non-significant. Everything else being constant, the liquidity banks bid at the second LTRO was not used to significantly increase lending to firms. So LTRO liquidity injections were efficient when they relieved stressed banks from their funding constraints.

C. Quantity and maturity effects

We then look further at the *quantitative* vs the *qualitative* margins of the first LTRO, where we denote as qualitative the characteristics of the operation in terms of maturity. Note that the 3-year LTROs were not the first unlimited liquidity operations conducted by the Eurosystem. They added to similar refinancing operations with maturities of 3 months, 6 months or even 1 year, which the Eurosystem conducted since it switched to full allotment procedures in October 2008. As regards the 3-year LTROs, the total amount of liquidity borrowed at the central bank by euro area banks was quite substantial (above one trillion euros) and larger than what banks had borrowed at past or still existing liquidity facilities since 2008. So, like other operations that lead to an increase of the balance sheet of the central bank, a first direct consequence of the operations was to increase the amount of liquidity in the financial system. However, while some banks which tapped the 3-year operations added this longer-term borrowing to their existing shorter-term central bank borrowing, others used the proceeds of the LTROs to reimburse the money previously borrowed. So the amount of *quantitative easing* associated with the 3-year-LTROs is given by the increase in total borrowed liquidity (net of such substitution). We denote ΔQ_i this quantity as measured for bank i.

This quantitative easing feature of the operation was not specific to the 3-year LTROs. In contrast, the long maturity was a novelty. One may therefore wonder whether and to what extent this long maturity mattered. More precisely, one would like to disentangle the impact of the *quantity* of liquidity offered with these two operations from the impact of the longer *maturity* at which the liquidity could be secured. For this purpose, we construct a variable MS_i which measures the amount of shorter-term central bank liquidity that has been swaped by bank i for 3-year borrowings at the central bank (MS for Maturity Swap). More specifically, we define $MS_i = 0$ if $LTRO_i = 0$ and $MS_i = \min(LTRO_i - \Delta Q_i, 0)$ if $LTRO_i > 0$. We then estimate the following regression:

$$(4) \qquad \Delta L_{ij} = \beta_j + \beta_{qe}\Delta Q_i + \beta_{ms}MS_i + Z_i'\gamma + \eta_{ij}.$$

Column (7) shows the results of this regression for the first round of 3-year-LTROs. The results strikingly show that the impact of the quantitative easing part of the measure drops to almost

zero and becomes non-significant once one controls for the impact of the maturity swap associated with the operation. By contrast, the swap of short-term for long-term borrowing has a strong positive and significant impact on banks' lending to firms. One can thus conclude that the positive impact of the liquidity provision on bank loan supply mostly resulted from the long maturity of the operations.

D. Robustness

We provide here evidence that our main results are robust to a variety of tests. First we run *placebo* regressions over a period prior to the LTROs in order to ascertain that the standard assumption of *ex ante* " parallel trends" does hold in the baseline. Second, we check that our baseline results are not quantitatively affected by the inclusion of additional controls for the *ex ante* situation of selected banks. Last, we also provide evidence that our findings still hold when we restrict the sample to French banking groups only.

A fundamental assumption of diff-in-diff style cross-sectional regressions such as the one presented in Table 7 is that outcomes for the "treated" and the "control" groups would have been the same in the absence of the treatment (here the LTRO-uptakes).[22] In our case, we can state this hypothesis as follows: banks that bid at the LTROs would not have had higher average loan growth over the period following the LTROs if the latter had not been implemented by the Eurosystem. It is, of course, impossible to test directly whether this hypothesis is true as we cannot observe the counterfactual for treated banks. However, we can test indirectly this assumption by running what is commonly referred to as a *placebo* regression. This consists in undertaking the same regression specifications but on a previous (non-overlapping) period in the sample in order to test whether we can identify a statistically significant relationship during this period. Such a relationship would be difficult to interpret and would undermine the validity of the baseline results. Table 9 shows the result of these placebo regressions, where the dependent variable is the growth rate of total credit to firms over the one-year period from September 2010 to September 2011, i.e. the year before the announcement of the LTROs. Bank balance sheet ratios are now measured as of June 2010 instead of June 2011. However, the LTRO-linked variables, which are our main explanatory variables, are kept the same. Note also that, for comparison purpose, the sample of multibank firms and the sample of banks are the same as before.[23] Importantly, we find that neither the LTRO take-ups of the Winter 2011-2012, nor the associated maturity swaps of central bank borrowing, did have any significant impact on bank lending to firms over the year before the announcement of the LTROs. This confirms our main findings and shows that the estimated effect does not reflect a correlation of the LTRO uptakes with previous credit growth trends, which would in turn impinge on credit growth outcomes over the period of study.

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[22]This assumption is often denoted the "parallel trends" hypothesis. See e.g. Angrist and Pischke (2009, section 5.2).

[23]Note that some bank-firm links disappear as they are not observed over this different period. Besides, one balance sheet ratio is not available for one small foreign bank subsidiary in June 2010, which limits the sample of banks to 23 when bank controls are included as regressors.

In a second round of robustness checks, we run the main regression of credit growth on take-ups at the first LTRO while including as regressors some additional bank controls, which mainly aim at better capturing the composition and quality of banks' assets (and off-balance sheet credit commitments): corporate loans and debt securities to total assets, the ratio of undrawn corporate credit commitments to total assets, and the ratio of loans eligible as collateral for the refinancing operations of the Eurosystem (i.e. high quality loans) to total loans. Indeed, a concern could be that standard capital and liquidity ratios do poorly reflect potentially relevant balance sheet constraints stemming from a low quality of loans in the credit book or a relatively high level of corporate credit commitments. We also consider on the liability side the deposits-to-assets ratio as a standard measure of stable funding. In table 10, we thus show that the results are not qualitatively affected when we include any of these bank variables as additional controls. In particular, the propensity of a bank bidding at the first LTRO to forward to its customer firms the liquidity received is not affected by the fact that this bank holds a loan portfolio of lower quality (cf. column 3). At most can we infer from this exercise that a bank which is relatively more invested in corporate loans tends to transmit the monetary stimulus marginally less (cf. column 1).

Another possible concern related with the issue of omitted variable bias is that the implementation of the LTROs happened at a time when a lot was going on in the environment faced by banks. Notably, another major event which took place in the euro area over the Winter of 2011-2012 was the forced recapitalization of major European banking groups engineered by the European Banking Authority (EBA) as part of its 2011 Capital Exercise. As Mésonnier and Monks (2015) show, this exercise actually impinged on the dynamics of credit supplied by banking groups identified with a capital shortfall. Not accounting for this EBA capital shortfall, that banks were compelled to fill before June 2012, could therefore lead us to underestimate the frictions associated with a bank's insufficient capitalization.[24] Besides, as the EBA announcements about the capital shortfall of individual banking groups were released before the first round of the LTROs, we may worry that this information may have also influenced banks' bids at the LTROs. Using the detailed bank capital information released by the EBA, we thus check whether controlling for the level of the EBA capital shortfall does affect our results.[25] The first two columns of Table 11 show the results of running the baseline regressions for the first LTRO round, when the EBA capital shortfall of EU banking groups is included on the right-hand side.[26] We first find confirmation that banking groups with a capital shortfall to fill in the first semester of 2012 tend to lend less in 2011-2012. As shortfall banks presumably face a higher

[24]Note also that our baseline capital ratio is an unweighted tier 1 capital ratio (a leverage ratio), whereas the EBA capital shortfall is calculated in terms of a ratio of core tier 1 capital to risk-weighted assets. It is well documented that weighted and unweighted bank capital ratios are not necessarily strongly correlated, at least as regards major institutions.

[25]The EBA calculation is based on balance sheet information and sovereign bond market prices as of Weptember 2011.

[26]The shortfall variable is truncated at zero: banking groups with a capital surplus in the EBA's metrics are considered unconstrained by the Capital Exercise. Note also that foreign subsidiaries belonging to European groups monitored by the EBA are supposed here to face the same constraint as their parent company. As non-EU banks are not supervised by the EBA, their EBA shortfall is by definition zero.

level of stress, they are likely to bid more at the LTROs. Thus, not accounting for the EBA capital shortfall should lead us to undervalue the strength of the transmission of the LTROs to credit supply. This is indeed what comes out in column 1 of the Table as the LTRO 1 coefficient is more than twice what we get in the baseline. However, the EBA shortfall turns out not to be significant when we regress credit growth on the maturity swap included in the LTROs, as shown in column 2 of the Table. It is not neither when we run the regression on the total LTRO uptakes (results not shown here for brevity). For this reason, we prefer to be conservative and keep results without the EBA capital shortfall variable as our baseline.

Finally, we provide evidence in the last two columns of Table 11 that our results remain qualitatively unaffected when we restrict the sample to French banking groups only. The selection of banks then drops to only 9 groups, which limits the variability of bank controls and thus may deteriorate the precision of our estimates. However, this exercise is vindicated for robustness because foreign subsidiaries of European groups may benefit indirectly from the LTRO uptakes of their parent company located in other euro area countries. Indeed, euro area banks tend to borrow from the Eurosystem by bidding at the window of the National Central Bank of their home country and then share the borrowed liquidity with their subsidiaries located in other euro area countries. As far as the selected foreign subsidiaries do not bid at the LTRO in France, ignoring this potential liquidity spill-over within foreign banking groups is conservative for our results: indeed, these foreign subsidiaries which are deemed "untreated" may in fact be partially "treated" and supply more credit than they otherwise would. This would however tend to minimize, not maximize, our estimate of the treatment effect. Nevertheless, a more formal test is vindicated as there is one foreign bank in our sample which is not headquartered in the euro area and which bid at the LTROs in France. This bank has thus the potential to bias upward our estimate as it may benefit from the unobserved LTRO uptakes of other parent institutions located elsewhere in the area. Fortunately enough, we find evidence that it is not the case. As shown in the Table, the estimated effect turns out to be even stronger once we limit the sample to French banking groups, although we then also control for the amount of bond financing these banks have to roll-over over the 2012-2015 period.

VII. Additional results

In this section we investigate whether the impact of the LTROs differs across firms. In particular we look at the effect of borrowers' size (in terms of total loans), firms' credit risk, the eligibility as collateral to central bank liquidity operations, the number of banks serving a firm, the length of the average relationship with its banks, and, for a subset of firms for which we have balance-sheet information, size in terms of total assets, profitability and financial soundness. We then turn to the issue of whether the positive impact of LTRO on loan supply that we identified at the level of an individual firm results from an increase of loan supplied to a firm or from a substitution between loans supplied by different banks within such firm.

A. To which type of firms did bank lend more?

Beyond the positive impact of the LTROs on credit supply as a whole, it is also interesting to investigate whether banks increased more their loans to specific categories of firms.

Table 12 sheds some light on this issue. For comparison purpose, the results obtained for the first LTRO round and the whole population of multibank firms are repeated in column (1). Columns (2) to (5) then present the results obtained for four different sub-samples of firms ranked according to the total amount of their outstanding credit from all their banks (which is, as said above, a good proxy of their balance sheet size). The results underline that the first LTRO, hence the two LTROs as a whole, had a significant positive impact in terms of enhanced credit supply to large borrowers, i.e. firms which are in the top decile of the borrowing distribution, but did not transmit into more credit granted to smaller firms. Besides, very-large borrowers, i.e. the top 1 percent of firms in terms of total borrowing size, benefited more than three times as much as firms in the rest of the top decile from this increased supply of bank credit. This means that the measure failed to meet one of his implicit target which was to avoid a credit crunch on small and medium sized firms which do not have access to alternative sources of external finance.

Table 13 provides further evidence on how other firms' characteristics may affect banks' loan supply. Specifically we estimate the following version of equation (3) where the LTRO variable is also interacted with a firm characteristic X_i:

$$(5) \qquad \Delta L_{ij} = \beta_j + \beta_1 LTRO_i + \beta_2(X_j \times LTRO_i) + Z_i'\gamma + \varepsilon_{ij}.$$

We first investigate whether less-risky firms received more funds than others from their borrowers's own uptake at the LTROs. Our simplified measure of the risk bucket of a firm is the eligibility of its debt as collateral for refinancing operations with the Eurosystem, as defined before December 2011. Highly-rated firms are indeed eligible, while low-rated firms, or firms without any rating, are not. The results in column (1) show that higher rated firms did not benefit more from the LTRO uptake of the related banks. At least, credit-quality, when roughly measured according to the eligibility status, had no specific impact in addition to a firm's size: indeed, as shown, banks lent on average more to big firms which were also generally the "eligible" ones and did not lend more to small lenders which generally were the "non-eligible" ones.

An interesting special case in terms of firms' credit risk is the bucket of firms which were not eligible prior to the LTROs, but became eligible in February 2012. At this date, the Eurosystem indeed implemented an extension of the pool of eligible collateral and included loans to firms with a rating just below the previous threshold. These firms are denoted ACC firms in the following (ACC stands for Additional Credit Claims in the Eurosystem's jargon). As column (2) shows, no matter their size, "fringe" ACC firms belonging to the newly eligible credit category indeed benefited from a stronger transmission of the LTRO liquidity borrowed by their lenders.

We then ask whether the strength of the borrower-lender relationship matters for explaining the transmission of the LTROs to firms. Column (3) shows that firms with more bank relationships fared better overall: the higher the number of banks lending ex-ante to a given firm, the more this firm benefited from an increase in credit supply due to the LTROs. However, this effect disappears when the regression is run separately for each size bucket. As the number of lenders for a firm is strongly correlated with its borrowing size, the effect of multiple banking is difficult to disentangle from the effect of firm size. By contrast, firms with an older (greater than 3 years) relationship with their bank received less loans from the LTROs than the average. This finding holds for the whole sample of firms as well as within each size bucket. Interestingly, it contrasts with the results of Iyer et al. (2014) on the consequences of the 2007 bank funding squeeze for Portuguese firms, as "relationship borrowers" in their sample seem to be relatively shielded from the transmission of this negative shock.[27] This hints at the fact that concerns about the potential for ever-greening of existing loans over this period could be limited.

Finally, the last three columns (5) to (7) of Table 13 provide additional results for the sub-sample of firms for which complete balance sheet information is available. For this sub-sample of some 37,000 multi-bank firms, we find that: the size of the firm in terms of its total assets does not matter; the past profitability of a firm – measured as the ratio of net operating profits to net turnover – has a positive impact for large borrowers; the financial soundness of a firm – measured as the ratio of earnings before tax to earnings before net interest payments and tax – had a positive impact, but only as small borrowers are concerned.

B. Looking for aggregate effects

So far, we presented evidence that banks which borrowed at the LTROs tended to subsequently supply more credit to their borrowing firms. An important issue is then to assess to what extent this means that firms received more credit overall. Indeed, it may be the case that the additional credit line obtained by a firm from one bank which borrowed heavily at the LTROs substitutes for existing credit supplied by other lenders. In other words, it is necessary to check whether the firm borrowing channel was operating in order to be able to conclude that the LTROs had aggregate effects.

We test for this firm borrowing channel by collapsing our data and running similar regressions as before, but at the firm level instead of the level of credit exposures. For each firm, we therefore construct a measure of the average LTRO bid of its relationship banks as the weighted average of the LTRO bids of each of its lenders, where the weights are the volumes of credit obtained from each of these lenders before the LTROs. Note that, in this setup, we cannot control for firm demand as we did before using firm fixed effects. We can nevertheless control rather satisfyingly for a set of firm characteristics and highly granular dummy variables defining the industrial sector of the firm (over 706 different sectors).

[27]Note however that Iyer et al. (2014) define the strength of the relationship by the volume of credit provided by the bank to the firm before their event of interest, which may also be interpreted as a measure of a firm's size and may also be correlated with its rating class. Chodorow-Reich (2014) finds for the US that pre-crisis clients of banks in worse financial condition had a 50 percent lower likelihood of receiving a new loan or a positive modification in the nine months following Lehman's failure.

Table 14 present the results of these firm level regressions, when considering the 182,000 multibank firms belonging to the previous sample.*To limit the impact of outlier firms, we drop the bottom and top 5% of firms in terms of total credit growth over the period of study.* Columns (1) reports the results obtained for the LTRO as a whole controlling for the size bucket of the firm. Column (2) adds to the set of controls industry specific fixed effects. Column (3) includes additional firm controls namely used in the previous subsection. For all these specifications, the coefficient associated with the averaged LTRO bid variable is significant and of similar magnitude as the coefficient we estimated using bank-firm exposure data.

In column (4), we include additional controls for the other characteristics of a firm's relationship banks, which we again compute as weighted averages across all lenders to this firm. It then turns out that the total effect of LTROs on lending to firms is marginally smaller and not significant anymore. However, a closer look at the respective effects of the two LTRO rounds reveals that this dampening of the total effect is mainly due to the inclusion of the second round, when less constrained banks had more incentives to bid. Columns (5) and (6) indeed present the results of the same regression when we consider as an explanatory variable the LTRO take-up at the first and the second rounds of the liquidity injection respectively. The coefficient associated with the first round is stronger as before and highly significant, while the coefficient associated with the second round is close to zero and not significant.

All in all, the results presented in this section confirm that the LTROS impinged on the availability of bank credit to non-financial firms, suggesting that within-firm substitution effects played a minor role on average.

VIII. Conclusion

We use in this paper the Eurosystem's LTROs of end 2011-early 2012 as a natural experiment to test whether a central bank can successfully push on the rope of huge increases of bank reserves in order to stimulate the provision of bank credit to the economy during a financial crisis. We base our investigation on a very rich dataset of bank-firm exposures in France, wich allows us to control effectively for determinants of credit demand by individual firms as well as for characteristics of banks that may bias our assessment of their propensity to transmit the monetary stimulus. We find robust evidence that a quantitative policy aimed at injecting huge amounts of central liquidity into the banking system can work when banks are financially constrained and the quantitative policy relieves this constraint. The odds that this unconventional measure succeeds are also higher if the central bank lends at longer maturities. Indeed, we find that banks did on average use the LTRO take-ups to increase their lending to firms on the intensive margin. Moreover, this effect was mostly associated with the first round of the LTRO, before the ECB officially removed the stigma potentially associated with participating in the operation. We interpret this as hinting that the transmission of the monetary stimulus is indeed stronger when bidding banks face high funding strains and have strong incentives to borrow at the central bank despite the stigma. Importantly, as the Eurosystem was at the time of the LTROs already lending without limit at a weekly maturity against good collateral, we show

that what mattered most was the possibility offered to banks to swap their existing short-term borrowing at the central bank for a long-term one. However, the increased supply of credit was however not evenly distributed across firms. In particular, only larger corporate borrowers did apparently benefit from the LTRO bonanza. Firms with higher bargaining power, like firms with a higher number of lenders ex ante or firms that were less dependent on their long-run borrowing relationship with banks, received more than the average. Also, fringe firms in terms of collateral eligibility with the Eurosystem faced a higher supply of credit as the Eurosystem simultaneously relaxed its collateral policy. Last, our results tend to alleviate the claim that the long-term liquidity injections may have encouraged the evergreening of existing bad loans on the books of banks. As a matter of fact, we do not find evidence that less profitable, more financially-strained relationship borrowers did receive more than the average, as the evergreening hypothesis would suggest.

This said, a final note of caution is warranted in interpreting our results. Whereas we find robust evidence that the Eurosystem's LTROs indeed helped to sustain the provision of bank credit to firms in France, we think that our results may understate the true impact. First of all, we investigate here changes to bank credit supply along the *intensive* margin only. Since the French credit register does not record loan applications, measuring properly the effects of the LTROs on the *extensive* margin of credit provision (e.g. on a higher probability for a treated bank to accept a loan application, *mutatis mutandis*) remains out of our reach. Besides, this massive injection of liquidity into the Eurosystem's banking system obviously was instrumental in improving market sentiment in Europe and alleviating the degree of stress on various markets segments. The resulting overall improvement of funding terms for banks also benefited, directly and indirectly, to governments and non-financial firms. However, while our results should reflect the direct quantitative impact of the LTROs, by construction our within-firm methodology ignores other indirect consequences on banks' total ability to lend.

Last, our results suggest that the LTROs failed to meet one of their objectives which was to shield small firms, which are deemed to be more dependent on banks than large ones for funding their working capital and investments, from the heightened risk of a credit crunch. This finding can be interpreted as calling for more targeted forms of quantitative policies, such as the "funding-for-lending" scheme implemented by the Bank of England over 2012-2014 or the "Targeted-LTROs" announced by the Eurosystem in June 2014. However, the success of these few recent experiments is largely perceived as mixed. The relevance of more sophisticated forms of large injections of central bank liquidity to stimulate the provision of credit to some groups of borrowers thus remains a largely unsettled issue, that we leave for further research.

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TABLE 1. Descriptive statistics for the selected banking groups

	mean	p50	sd	p10	p90
All banks					
Total Assets (bns)	494·44	27·01	1,059·08	1·62	1,918·24
Total Assets Growth	2·31	3·01	15·59	−13·89	20·18
Loans	37·47	16·18	37·97	5·12	96·93
Total Credit Growth	−1·43	1·75	14·11	−22·24	12·68
Drawn Credit Growth	−3·90	0·19	17·48	−26·22	14·86
Interbank Assets	18·90	13·58	20·38	1·82	51·46
Securities Portfolio	16·05	4·58	19·88	0·00	44·30
Capital	8·01	6·40	5·99	2·33	16·68
Interbank Liabilities	31·58	17·50	30·58	1·73	83·14
Deposits	24·20	21·86	23·68	1·09	62·80
Provisions	0·83	0·28	1·73	0·05	1·72
MRO user	0·58	1·00	0·50	0·00	1·00
LTRO	1·15	0·00	2·27	0·00	2·31
LTRO Maturity Swap	0·29	0·00	0·59	0·00	1·07
Quant. Easing	1·09	0·00	2·32	0·00	3·40
Nb of indiv. banks included	13·04	2·50	22·36	1·00	34·00
French banking groups only					
ECB Dependence	3·42	0·00	4·67	0·00	10·47
Bond Rollover	4·64	1·54	8·91	0·00	14·54
MRO user	0·82	1·00	0·40	0·00	1·00

Note. This table presents descriptive statistics for the 24 selected banking groups in our sample (hereby banks). Bank total assets are expressed in billions of euros. Total assets and credit growth are in percent and are defined in terms of logarithm difference of the corresponding variable. Unless otherwise stated, the other rows refer to ratios of the mentioned balance sheet item to total assets of the bank (in precent). All balance sheet variables are measured as of June 2011 in terms of ratio to the total assets and refer to consolidated banking group statements in the case of French groups. Balance sheet items of subsidiaries of foreign groups are measured on an unconsolidated basis. *Bank loans* is the ratio of drawn credit to firms to the bank's total assets. *Bank Capital* is the unweighted Tier 1 capital-to-assets ratio. *Bank Liquid Assets* and *Bank Interbank Liabilities* are, respectively, the ratios of cash and interbank loans, and of total interbank liabilities (excluding liabilities vis-à-vis the Eurosystem) to total assets. *MRO User* is a dummy vraiable indicating participation in the regular refinancing operations of the Eurosystem before the LTROs. *Bank Bond Rollover* is the ratio (in percent) of the total bond issues of the group that are expected to mature over the years 2012-2014, divided by total assets as of June 2011. *Bank ECB dependence* is the ratio (in percent) of total borrowing of the banking group from the Eurosystem as measured in September 2011 (i.e., before the 3-year LTROs), divided by total consolidated interbank liabilities as of June 2011. *LTRO Maturity Swap* measures the substitution of 3-year LTRO funding to ECB funding of shorter maturity (in proportion of total assets), while *Quant. Easing* measures the overall increase of ECB borrowing by the banking group (inproportion of total assets). *Nb of banks in BHC* refers to the number of subsidiaries of each group for which we observe bank-firm credit linkages in September 2011.

TABLE 2. Correlation matrix of bank-specific covariates

	LTRO	LTRO 1	LTRO 2	Size	Loans	Liq. A.	Cap.	EBA Cap. Short.	Intbk L.
LTRO	1.00								
LTRO Round 1	0.12	1·00							
LTRO Round 2	0.97	−0·14	1·00						
Size	0.33	0·66	0·15	1·00					
Loans	-0.07	−0·38	0·03	−0·70	1·00				
Interbank Assets	-0.28	−0·09	−0·26	−0·11	−0·18	1·00			
Capital	0.43	−0·31	0·51	−0·04	0·11	−0·33	1.00		
EBA Capital Short.	-0.16	−0·00	−0·16	−0·18	0·16	0·14	-0.07	1·00	
Interbank Liab.	-0.37	−0·31	−0·29	−0·57	0·57	0·12	-0.35	0·35	1·00

Note. This table presents the correlation matrix of bank control variables used in the following regressions, for the 24 selected banks. *Bank size* is measured as the logarithm of bank total assets. All balance sheet variables are measured as of June 2011 in terms of ratio to the total assets and refer to consolidated banking group statements in the case of French groups. Balance sheet items of subsidiaries of foreign groups are measured on an unconsolidated basis. Remaining variables are a measure of bond issued to be rolled over in 2012-2014 and dummy variables for participation in standard refinancing operations, state-owned institutions and foreign subsidiaries, as defined in Table 1 above.

TABLE 3. Characteristics of banking groups in the sample by LTRO bidding behaviour

	No LTRO $N = 14$	LTROs $N = 10$	LTRO 1 $N = 6$	LTRO 2 $N = 8$
Total Assets (bns)	11.72	1,170.24	1,908.57	1,105.63
Total Assets Growth	2.30	2.31	-0.77	1.84
Loans	51.52	17.79	8.04	19.87
Total Credit Growth	-3.36	1.27	-3.77	2.08
Drawn Credit Growth	-7.14	0.63	-3.92	1.12
Interbank Assets	25.05	10.29	14.24	8.30
Securities Portfolio	6.18	29.88	31.61	28.13
Capital	7.94	8.11	4.83	9.20
Interbank Liabilities	43.70	14.62	13.58	14.86
Deposits	22.94	25.95	35.11	24.66
Provisions	0.62	1.12	0.32	1.35
LTRO	0.00	2.76	1.47	2.97
LTRO Maturity Swap	0.00	0.69	1.16	0.49
Quant. Easing	0.24	2.28	0.68	2.47
Nb of indiv. banks included	2.57	27.70	43.00	22.38

Note. This table presents the mean of selected characteristics for the 24 selected banking groups (hereby banks), sorted by their LTRO bidding behaviour. Column (1) refers to banks that did not bid at the LTROs, column (2) to LTRO bidders, columns (3-4) to banks that bid at the first LTRO, or at the second round respectively (note that some groups bid at both). Bank total assets, total credit to firms (incl. credit lines) and drawn credit to firms (the latter two aggregated from credit register information) are expressed in billions of euros. Total credit growth is in percent. Unless otherwise stated, the other rows refer to ratios of the mentioned balance sheet item to total assets of the bank (in percent). All balance sheet variables are measured as of June 2011 and refer to consolidated banking group statements in the case of French groups. Balance sheet items of subsidiaries of foreign groups are measured on an unconsolidated basis. See Table 1 for more details.

TABLE 4. Share of total alloted LTROs by type of bidders in sample

	Nb. of banking groups	All LTROs	LTRO 1	LTRO 2
Non-bidders	14	0.00	0.00	0.00
Bidders at LTRO 1	6	0.81	0.93	0.61
Bidders at LTRO 2	8	0.62	0.48	0.87
Bidders at LTRO 1 or 2	10	0.91	0.93	0.87

Note. This table documents the coverage of our sample of banking groups in terms of share of the total LTROs alloted to resident banks in France. Rows 2 and 3 relate to BHCs that bid at the first and second round respectively, while these two groups overlap. The last row relates to BHCs that bid at either the first or the second, or at both LTROs.

TABLE 5. Descriptive statistics for firms in the sample

	N	mean	p50	sd	min	max
All firms						
Firm Total Credit Growth	1.17e+06	-5.71	-8.00	30.21	-31.30	21.55
Firm Total Credit	1.17e+06	1,093.05	153.00	41,997.11	46.00	780.00
Firm ECB Eligibility Status	1.17e+06	0.05	0.00	0.21	0.00	0.00
Firm Relationship Age	1.17e+06	0.67	1.00	0.47	0.00	1.00
Firm Nb of Banks	1.17e+06	1.25	1.00	0.64	1.00	2.00
Firm with BS info	1.17e+06	0.06	0.00	0.23	0.00	0.00
Monobank firms						
Firm Total Credit Growth	960,494	-7.58	-8.34	26.62	-31.51	13.63
Firm Total Credit	960,494	330.36	128.00	7,733.52	43.00	493.00
Firm ECB Eligibility Status	960,494	0.03	0.00	0.17	0.00	0.00
Firm Relationship Age	960,494	0.64	1.00	0.48	0.00	1.00
Firm Nb of Banks	960,494	1.00	1.00	0.00	1.00	1.00
Firm with BS info	960,494	0.03	0.00	0.17	0.00	0.00
Multibank firms						
Firm Total Credit Growth	211,209	2.82	-5.94	41.85	-30.54	44.63
Firm Total Credit	211,209	4,561.44	417.00	97,457.69	116.00	3,242.00
Firm ECB Eligibility Status	211,209	0.14	0.00	0.34	0.00	1.00
Firm Relationship Age	211,209	0.76	1.00	0.43	0.00	1.00
Firm Nb of Banks	211,209	2.41	2.00	0.82	2.00	3.00
Firm with BS info	211,209	0.17	0.00	0.38	0.00	1.00
Subsample of multibank firms with balance sheet information						
Firm Total Credit Growth	36,750	10.07	-0.98	51.59	-35.03	66.01
Firm Total Credit	36,750	7,434.00	664.00	111428.99	145.00	5,330.50
Firm ECB Eligibility Status	36,750	0.40	0.00	0.49	0.00	1.00
Firm Relationship Age	36,750	0.82	1.00	0.38	0.00	1.00
Firm Nb of Banks	36,750	2.80	2.00	1.10	2.00	4.00
Firm Nb Employees	36,750	85.24	20.00	1,362.68	4.50	115.50
Firm Size	36,750	42,986.64	2,872.29	1.15e+06	770.64	23,291.50
Firm Profitability	36,750	-0.14	0.04	20.31	-0.01	0.15
Firm Financial Soundness	36,750	0.59	0.77	15.22	0.11	1.03

Note. This table presents descriptive statistics for firms in our sample. Multibank firms refer to firms that received credit from at least two different banking groups in September 2011. In contrast, monobank firms are defined as firms that display a credit relationship with only one banking group. Total credit includes undrawn credit lines and is expressed in thousand of euros. Growth rates are in percent. *ECB Eligibility Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral for refinancing operations with the Eurosystem. *Relationship Age* is a dummy that takes the value of one if the average length of a firm's credit relationship with its lenders is above three years. *Firm with BS info* denotes firms for which detailed balance sheet information is available (from the FIBEN database). All firms' balance sheet and structural variables are averages over the 2010 and 2011 year-end values. *Size* is the firm's total asset size in thousand of euros. *Profitability* is the ratio of net operating profits to net turnover (in percent). *Financial Soundness* is the ratio of earning before tax to earning before net interest payments and tax (in percent).

TABLE 6. Descriptive statistics for multibank firms in the sample, sorted by borrower size

	Small	Intermediate	Large	Very large
All multibank firms				
Nb of firms	29,325	110,374	61,307	10,203
Firm Total Credit	100	311	1,451	16,844
Firm Total Credit Growth	-6.56	-6.73	-5.34	-0.98
Firm Nb of Banks (incl. non-selected)	2.00	2.00	3.00	4.00
Multibank firms with balance sheet information				
Nb of firms	3,366	15,861	14,988	2,641
Firm Size	954	1,519	5,722	58,151

Note. This table reports the median of listed variables across multibank firms in our sample (unless otherwise stated), sorted by the size of their total bank borrowings in September 2011. Multibank firms refer to firms that received credit from at least two different banking groups. Total credit includes undrawn credit lines and is expressed in thousand of euros, as is Firm size. Growth rates are in percent. *ECB Eligibility Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral for refinancing operations with the Eurosystem. Firm *ACC Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral as part of the Additional Credit Claim category. *Firm Relationship Age* is a dummy that takes the value of one if the average length of a firm's credit relationship with its lenders is above three years. *Firm with BS info* denotes firms for which detailed balance sheet information is available (from the FIBEN database). Rows 3 to 6 thus report the share of firm of the described type in each size grouping.

TABLE 7. Impact of the 3-year LTROs on bank lending to firms

	(1)	Total LTROs (2)	(3)	(4)	Round 1 (5)	Round 2 (6)	Round 1 (7)
Bank LTRO	−0·16	0·34	0·28*	0·60**	0·93***	0·05	
	(0·46)	(0·25)	(0·14)	(0·26)	(0·34)	(0·33)	
Maturity Swap							3·23***
							(0·93)
Quantitative Easing							−0·07
							(0·46)
Bank Size				0·03	−0·28	−0·17	−0·15
				(0·33)	(0·32)	(0·41)	(0·31)
Bank Liquid Assets				−0·12*	−0·04	−0·07	−0·05
				(0·07)	(0·06)	(0·07)	(0·06)
Bank Capital				0·35***	0·46***	0·38***	0·61***
				(0·10)	(0·10)	(0·10)	(0·12)
Bank Interbank Liabilities				0·29***	0·23***	0·21***	0·30***
				(0·07)	(0·05)	(0·08)	(0·06)
ECB MRO User				7·28***	8·36***	8·84***	5·83***
				(2·05)	(1·97)	(2·28)	(1·69)
Foreign Bank				−0·36	−2·43*	−1·47	−3·85***
				(1·54)	(1·44)	(1·95)	(1·41)
Public Bank				−9·69***	−7·79***	−7·85***	−9·00***
				(2·48)	(2·09)	(2·53)	(2·03)
Multibank firms	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
N	1,390,270	428,594	428,594	428,594	428,594	428,594	428,594
R^2	0·00	0·00	0·53	0·54	0·54	0·54	0·54

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Credit is defined as total commited credit (drawn and undrawn) in all columns. The sample is restricted in all regressions to firms that have at least two banking relationships, except in column (1) which provides with results on all firms. *Bank LTRO* measures the ratio of total amounts borrowed at the two 3-year LTROs by the lending bank, divided by this bank's total assets (in percent). In columns (5) and (6), this refers to respectively the up-take at the first and second rounds of LTROs. *LTRO Maturity Swap* measures the substitution of 3-year LTRO funding to ECB funding of shorter maturity (in proportion to total assets), while *Quant. Easing* measures the overall increase of ECB borrowing by the banking group (in proportion to total assets). In column (7), this refers to the same measures as derived from the first round of LTROs. Bank controls are consolidated balance sheet variables and ratios (as of June 2011) and dummy variables for participation in standard refinancing operations, state-owned institutions and foreign subsidiaries, as defined in Table 1 above. A constant is included but not shown. Standard errors in parenthesis are clustered at the bank*firm sector (NAF 1 digit) level (210 clusters). The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 8. Determinants of LTRO bids by selected banks, first vs second round.

	Prob. of bid		LTRO/A.	
	LTRO1	LTRO2	LTRO1	LTRO2
	(1)	(2)	(3)	(4)
Bank Capital	-0.17*	0.03	-0.28*	0.30*
	(0.09)	(0.04)	(0.14)	(0.16)
N	24	24	24	24
Pseudo R^2	0.15	0.02	0.12	0.05

Note. Columns (1-2) of this table present the results of Probit regression, where the dependent variable is a dummy variable indicating whether a bank bid or not at the specified LTRO round, while columns (3-4) present the results of Tobit regressions, where the dependent variable is a bank's take-up at the specified LTRO round, divided by this bank's total assets (in percent). Bank-specific regressors are defined in Table 1 above. A constant is included but not shown. Robust standard errors are shown in parenthesis. The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 9. Placebo regressions: "impact" of the 3-year LTROs on bank lending to firms one year before (over Sept. 2010-Sept. 2011)

| | Total LTROs | | | | Round 1 | Round 2 | Round 1 |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bank LTRO	−0·43	−0·31	−0·52	−0·03	0·09	−0·14	
	(0·55)	(0·40)	(0·42)	(0·84)	(1·56)	(0·47)	
Maturity Swap							2·00
							(1·59)
Quantitative Easing							−0·64
							(1·79)
Bank Size				0·02	0·03	−0·04	0·16
				(0·55)	(0·59)	(0·64)	(0·57)
Bank Liquid Assets				−0·14	−0·14**	−0·13**	−0·10
				(0·09)	(0·06)	(0·06)	(0·07)
Bank Capital				0·08	0·09	0·12	0·27
				(0·29)	(0·33)	(0·31)	(0·34)
Bank Interbank Liabilities				0·15	0·16***	0·14*	0·19***
				(0·13)	(0·05)	(0·08)	(0·05)
ECB MRO User				3·49	3·36	3·78	3·33
				(2·81)	(2·76)	(3·25)	(2·67)
Foreign Bank				−1·25	−1·28	−1·57	−2·04
				(2·29)	(2·65)	(2·32)	(3·67)
Public Bank				−6·64*	−6·60***	−6·32**	−6·36***
				(3·89)	(2·00)	(2·92)	(2·24)
Multibank firms	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
N	1,150,864	360,836	360,836	357,311	357,311	357,311	357,311
R^2	0·00	0·00	0·59	0·59	0·59	0·59	0·59

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Credit is defined as total commited credit (drawn and undrawn) in all columns. The sample is restricted in all regressions to firms that have at least two banking relationships, except in column (1) which provides with results on all firms. *Bank LTRO* measures the ratio of total amounts borrowed at the two 3-year LTROs by the lending bank, divided by this bank's total assets (in percent). In columns (5) and (6), this refers to respectively the up-take at the first and second rounds of LTROs. *LTRO Maturity Swap* measures the substitution of 3-year LTRO funding to ECB funding of shorter maturity (in proportion to total assets), while *Quant. Easing* measures the overall increase of ECB borrowing by the banking group (in proportion to total assets). In column (7), this refers to the same measures as derived from the first round of LTROs. Bank controls are consolidated balance sheet variables and ratios (as of June 2011) and dummy variables for participation in standard refinancing operations, state-owned institutions and foreign subsidiaries, as defined in Table 1 above. A constant is included but not shown. Standard errors in parenthesis are clustered at the bank*firm sector (NAF 1 digit) level (210 clusters). The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 10. Impact of the first round of 3-year LTROs on bank lending to firms. Adding bank balance sheet controls.

	(1)	(2)	(3)	(4)	(5)
Bank LTRO Round 1	0.98***	0.94***	0.91**	1.16***	1.10***
	(0.34)	(0.34)	(0.35)	(0.37)	(0.39)
Bank Size	-0.27	-0.33	-0.39	0.07	-0.38
	(0.31)	(0.33)	(0.32)	(0.37)	(0.34)
Bank Liquid Assets	-0.05	-0.04	-0.03	-0.02	-0.02
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Bank Capital	0.50***	0.47***	0.48***	0.38***	0.44***
	(0.10)	(0.10)	(0.11)	(0.10)	(0.10)
Bank Interbank Liabilities	0.21***	0.23***	0.21***	0.15***	0.23***
	(0.05)	(0.05)	(0.06)	(0.06)	(0.05)
ECB MRO User	6.54***	8.06***	8.28***	7.54***	8.58***
	(1.90)	(1.82)	(1.91)	(2.00)	(2.06)
Foreign Bank	-2.00	-2.30	-2.77*	-1.91	-3.16*
	(1.45)	(1.45)	(1.45)	(1.46)	(1.65)
Public Bank	-6.71***	-7.95***	-7.53***	-3.15	-7.03***
	(2.22)	(2.11)	(2.10)	(2.89)	(1.79)
Bank Loans	-0.03*				
	(0.02)				
Bank Undrawn Commit.		-0.03			
		(0.02)			
Bank Eligib. Loans			-0.03		
			(0.03)		
Bank Securities Portfolio				-0.06	
				(0.04)	
Bank Deposits					0.03
					(0.03)
N	428,594	428,594	428,594	428,594	428,594
R^2	0.54	0.54	0.54	0.54	0.54

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Credit is defined as total commited credit (drawn and undrawn) in all columns. The sample is restricted in all regressions to firms that have at least two banking relationships, except in column (1) which provides with results on all firms. *Bank LTRO Round 1* measures the ratio of amounts borrowed at the first 3-year LTRO by the lending bank, divided by this bank's total assets (in percent). *Loans*, *Undrawn* are the ratios of loans and undrawn credit lines for all resident entities of a group to the consolidated assets of this group. *Eligible loans* is the ratio of ECB eligible loans to loans for all resident entities of the group. Standard errors in parenthesis are clustered at the bank*firm sector (NAF 2 digits) level. The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 11. Impact of the first round of 3-year LTROs on bank lending to firms. Controlling for the EBA Capital exercise of 2011 and sample limited to French groups.

	All banks		French banks	
Bank LTRO Round 1	2.27***		1.29***	
	(0.64)		(0.41)	
Maturity Swap		3.16***		5.88**
		(0.92)		(2.94)
Quant. Easing		0.27		0.43
		(0.56)		(0.71)
Bank Size	-0.35	-0.15	-5.76**	-6.72***
	(0.31)	(0.31)	(2.23)	(1.81)
Bank Liquid Assets	-0.04	-0.06	0.69*	1.05***
	(0.06)	(0.06)	(0.37)	(0.37)
Bank Capital	0.51***	0.61***	0.58***	0.62***
	(0.10)	(0.12)	(0.17)	(0.17)
EBA Capital Shortfall	-2.23**	-0.51		
	(0.88)	(0.54)		
Bank Interbank Liabilities	0.25***	0.30***	0.17*	0.20**
	(0.05)	(0.06)	(0.09)	(0.08)
ECB MRO User	7.28***	5.59***	27.00***	26.97***
	(1.70)	(1.73)	(7.70)	(6.13)
Foreign Bank	-3.90**	-4.27***		
	(1.52)	(1.55)		
Public Bank	-8.37***	-9.15***	-19.81***	-17.54***
	(2.00)	(2.05)	(5.29)	(4.55)
Bank Bond Rollover			-0.86***	-0.86***
			(0.29)	(0.22)
N	428,594	428,594	405,509	405,509
R^2	0.54	0.54	0.56	0.56

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Credit is defined as total commited credit (drawn and undrawn) in all columns. The sample is restricted in all regressions to firms that have at least two banking relationships, except in column (1) which provides with results on all firms. *Bank LTRO Round 1* measures the ratio of amounts borrowed at the first 3-year LTRO by the lending bank, divided by this bank's total assets (in percent). *LTRO Maturity Swap* measures the substitution of 3-year LTRO funding to ECB funding of shorter maturity (in proportion to total assets), while *Quant. Easing* measures the overall increase of ECB borrowing by the banking group (in proportion to total assets). A constant is included but not shown. Standard errors in parenthesis are clustered at the bank*firm sector (NAF 2 digits) level. The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 12. Impact of the first round of LTROs on bank lending to firms, by size of borrowers

	(1) All	(2) Small	(3) Interm.	(4) Large	(5) Very large
Bank LTRO Round 1	0.93***	0.41	0.31	0.99**	3.30***
	(0.34)	(0.52)	(0.40)	(0.40)	(0.51)
Bank Size	-0.28	-0.17	-0.33	-0.48	1.08**
	(0.32)	(0.54)	(0.34)	(0.43)	(0.51)
Bank Liquid Assets	-0.04	-0.14	-0.11	-0.11	-0.03
	(0.06)	(0.12)	(0.06)	(0.08)	(0.06)
Bank Capital	0.46***	0.57**	0.42***	0.36***	0.63***
	(0.10)	(0.22)	(0.13)	(0.13)	(0.12)
Bank Interbank Liabilities	0.23***	0.35**	0.26***	0.25***	0.28***
	(0.05)	(0.15)	(0.08)	(0.07)	(0.05)
ECB MRO User	8.36***	10.75***	10.86***	7.69***	-1.93
	(1.97)	(3.66)	(2.41)	(2.14)	(2.77)
Foreign Bank	-2.43*	-3.19	-1.48	-1.67	-1.25
	(1.44)	(2.58)	(1.57)	(1.85)	(2.12)
Public Bank	-7.79***	-14.31***	-10.48***	-9.85***	1.19
	(2.09)	(4.85)	(2.91)	(2.99)	(2.02)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	428,594	44,372	208,630	143,749	31,843
R^2	0.54	0.71	0.56	0.46	0.40

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of committed credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). The sample is restricted in all regressions to firms that have at least two banking relationships. Firms are sorted into size buckets according to the distribution of total bank credit across firms in September 2011. Column (1) repeats the results for all multibank firms, while columns (2-5) present the results of separate regressions run on sub-samples of firms sorted by borrowing size. *Small* firms are below the median, *intermediate* in the 6th to 9th deciles, *large* in the 90th to 99th percentiles, *very large* in the top percentile of the credit size distribution. *Bank LTRO Round 1* measures the ratio of total amounts borrowed at the first 3-year LTRO by the lending bank, divided by this bank's total assets (in percent). Bank controls are consolidated balance sheet variables and ratios (as of June 2011) and dummy variables for participation in standard refinancing operations, state-owned institutions and foreign subsidiaries, as defined in Table 1 above. A constant is included but not shown. Standard errors in parenthesis are clustered at the bank*firm sector (NAF 1 digit) level. The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 13. First LTRO round and credit supply to firms: non-linear firm effects

| Interaction term (X)	(1) Eligible	(2) ACC	(3) Nb Bk	(4) Relation.	(5) Size	(6) Profitab.	(7) Fin. Sound.
			All firms			*Firms with BS info*	
All borrowers							
Bank LTRO Round 1	0·93**	0·72**	−0·45	2·99***	2·93*	2·24***	2·23***
	(0·38)	(0·31)	(0·50)	(0·45)	(1·66)	(0·37)	(0·36)
X*LTRO Round 1	−0·01	1·89***	0·47***	−2·91***	−0·08	0·01**	0·00
	(0·53)	(0·45)	(0·15)	(0·33)	(0·18)	(0·00)	(0·01)
N	428,594	428,594	428,594	428,594	81,620	81,502	81,620
R^2	0·54	0·54	0·54	0·54	0·51	0·51	0·51
Small borrowers							
Bank LTRO Round 1	0·61	0·15	−8·54**	2·52***	26·80	−1·15	−2·74
	(0·54)	(0·49)	(3·68)	(0·61)	(16·41)	(2·48)	(2·67)
X*LTRO Round 1	−2·91	4·69	4·32**	−3·33***	−4·14*	0·64	1·81**
	(2·18)	(3·84)	(1·78)	(0·76)	(2·36)	(1·51)	(0·89)
N	44,372	44,372	44,372	44,372	4,651	4,651	4,651
R^2	0·71	0·71	0·71	0·71	0·75	0·75	0·75
Intermediate borrowers							
Bank LTRO Round 1	0·34	0·22	−1·71*	2·79***	−3·13	2·01**	1·97**
	(0·44)	(0·39)	(0·92)	(0·50)	(4·48)	(0·91)	(0·89)
X*LTRO Round 1	−0·34	1·01	0·83*	−3·72***	0·70	−0·00	0·03
	(0·65)	(0·73)	(0·43)	(0·44)	(0·64)	(0·03)	(0·08)
N	208,630	208,630	208,630	208,630	29,799	29,776	29,799
R^2	0·56	0·56	0·56	0·56	0·56	0·56	0·56
Large borrowers							
Bank LTRO Round 1	0·95**	0·63**	−1·67***	2·67***	7·42	1·27*	1·24*
	(0·46)	(0·31)	(0·54)	(0·57)	(4·86)	(0·67)	(0·65)
X*LTRO Round 1	0·24	2·38***	0·80***	−2·24***	−0·71	0·04**	0·04
	(0·71)	(0·55)	(0·17)	(0·38)	(0·52)	(0·02)	(0·08)
N	143,749	143,749	143,749	143,749	37,807	37,757	37,807
R^2	0·46	0·46	0·46	0·46	0·45	0·45	0·45
Very large borrowers							
Bank LTRO Round 1	3·22***	3·11***	2·96***	4·28***	0·97	3·23***	3·19***
	(0·55)	(0·54)	(1·10)	(0·79)	(5·29)	(0·61)	(0·59)
X*LTRO Round 1	0·30	1·45*	0·07	−1·18**	0·20	0·01***	−0·00
	(0·70)	(0·86)	(0·21)	(0·59)	(0·48)	(0·00)	(0·00)
N	31,843	31,843	31,843	3,184	9,363	9,318	9,363
R^2	0·40	0·40	0·40	0·40	0·38	0·38	0·38
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of committed credit volume (drawn and undrawn) for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). The sample is restricted in all regressions to firms that have at least two banking relationships. Firms are sorted into size buckets according to the distribution of total bank credit across firms in September 2011. *Small* firms are below the median, *intermediate* in the 6th to 9th deciles, *large* in the 90th to 99th percentiles, *very large* in the top percentile of the credit size distribution. *ECB Eligibility Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral for refinancing operations with the Eurosystem. Firm *ACC Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral as part of the Additional Credit Claim category. *Firm Relationship Age* is a dummy that takes the value of one if the average length of a firm's credit relationship with its lenders is above three years. *Size* is the firm's total asset size in thousand of euros. *Profitability* is the ratio of net operating profits to net turnover (in percent). *Financial Soundness* is the ratio of earning before tax to earning before net interest payments and tax (in percent). *Bank LTRO Round 1* measures the ratio of total amounts borrowed at the first round of 3-year LTROs by the lending bank, divided by this bank's total assets (in percent). Bank controls are consolidated balance sheet variables and ratios (as of June 2011) and dummy variables for participation in standard refinancing operations, state-owned institutions and foreign subsidiaries, as defined in Table 1 above. A constant is included but not shown. Standard errors in parenthesis are clustered at the bank*firm sector (NAF 1 digit) level. The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

TABLE 14. Credit substitution at the firm level

|	(1)	(2)	(3)	(4)	(5)	(6)
	Total of two LTRO rounds				LTRO 1	LTRO 2
Bank LTRO	0·32**	0·39**	0·40**	0·30	0·75***	−0·02
	(0·14)	(0·17)	(0·19)	(0·25)	(0·26)	(0·20)
Intermediate	1·07***	1·78***	1·70***	1·60***	1·84***	1·23**
	(0·34)	(0·47)	(0·51)	(0·52)	(0·45)	(0·61)
Large	3·35***	4·43***	4·22***	4·06***	4·37***	3·55***
	(0·63)	(0·38)	(0·43)	(0·45)	(0·45)	(0·60)
Very Large	7·29***	8·92***	8·58***	8·19***	8·45***	7·62***
	(0·99)	(0·79)	(0·77)	(0·62)	(0·70)	(0·77)
Firm Relationship Age			−1·34	−1·36	−1·34	−1·37
			(0·84)	(0·85)	(0·86)	(0·85)
Firm Eligibility			1·39***	1·32***	1·33***	1·30***
			(0·25)	(0·25)	(0·25)	(0·25)
Firm ACC			2·11***	2·08***	2·09***	2·06***
			(0·33)	(0·33)	(0·33)	(0·32)
Sector fixed effects	No	Yes	Yes	Yes	Yes	Yes
Bank controls	No	No	No	Yes	Yes	Yes
N	182,248	182,248	182,248	182,248	182,248	182,248
R^2	0·01	0·06	0·06	0·06	0·06	0·06

Note. This table presents the results of OLS regressions, where the dependent variable is the change in the (log) level of committed credit volume (drawn and undrawn) for each selected firm over the period from September 2011 to September 2012 (in percent). *Bank LTRO* measures the weighted average ratio of total amounts borrowed at the LTROs by a bank lending to a given firm, divided by this bank's total assets (in percent) and weighted by the share of this bank in total bank borrowing by this firm. The sample is restricted in all regressions to firms that have at least two banking relationships with selected banking groups, so as to compare with the results of previous regressions run at the bank-firm level. Columns (1-4) refer to the total take-up at both LTROs, while columns (5-6) refer to the rounds 1 and 2 of the LTROs respectively. Firms are sorted into size buckets according to the distribution of total bank credit across firms in September 2011. *Small* firms are below the median, *intermediate* in the 6th to 9th deciles, *large* in the 90th to 99th percentiles, *very large* in the top percentile of the credit size distribution. *ECB Eligibility Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral for refinancing operations with the Eurosystem. Firm *ACC Status* is a dummy variable that takes the value of one if the firm's rating makes loans to this firm eligible as collateral as part of the Additional Credit Claim category. *Firm Relationship Age* is a dummy that takes the value of one if the average length of a firm's credit relationship with its lenders is above three years. *Bank controls* are weighted averages over all banks lending to a given firm of bank controls as defined in previous tables, whereby the weights are the share of each bank in total bank borrowing by this firm. A constant is included but not shown. Standard errors in parenthesis are clustered at the detailed industry level (NAF 5 digits). The symbols *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

FIGURE 1. Bond spreads for euro-area banks
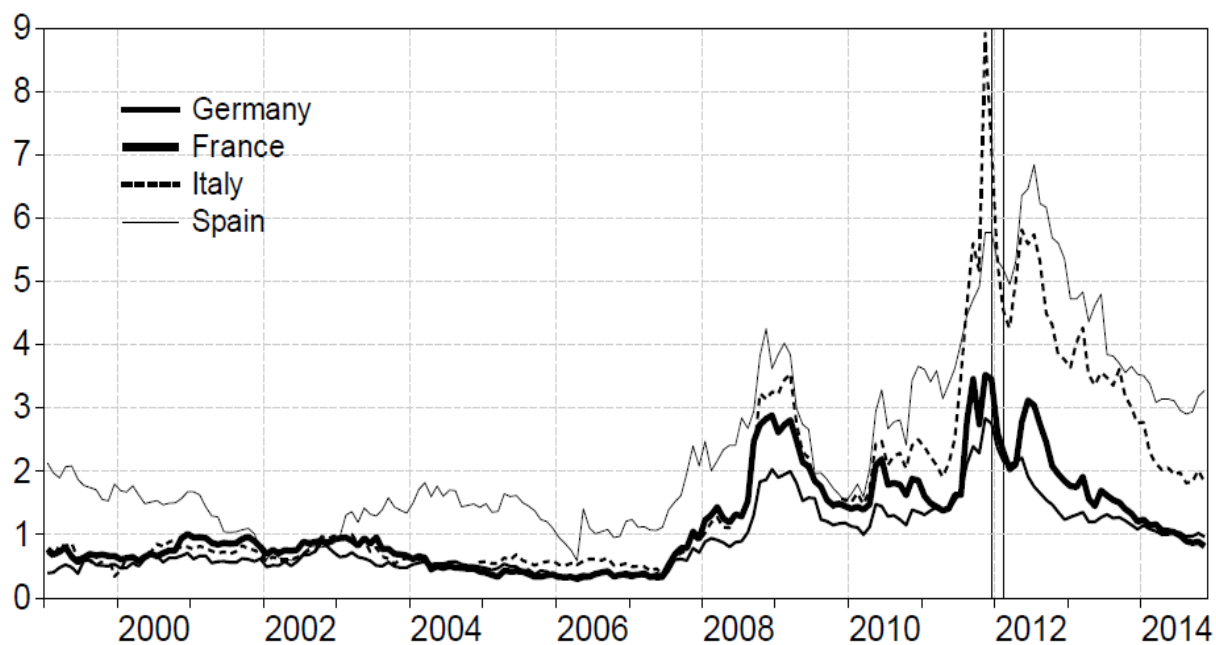
Note. This figure shows for each country the average spread of bank bonds towards the German Bund. Aggregate spreads are computed from individual bond data following the methodology in Gilchrist and Mojon (2014). Vertical lines stand for the two rounds of the LTROs.

FIGURE 2. Tightness of credit conditions (credit supply) to, and demand of credit by non-financial corporates in France
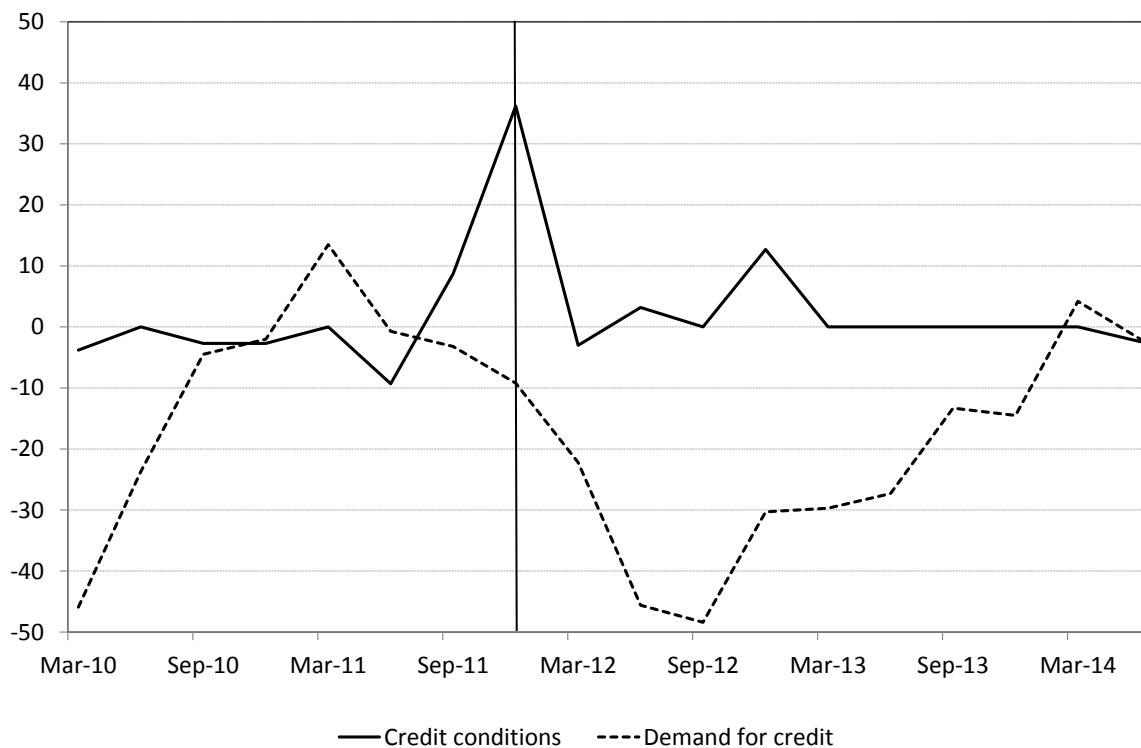
Note. This figure shows the index of credit conditions for bank lending to non-financial firms (solid line) and the index for credit demand by non-financial firms (dashed line), as taken from the Eurosystem's Bank Lending Survey for France. Positive numbers denote respectively tighter supply and stronger demand. End-of-quarter figures refer to perceived changes over the last three months.

A. List of banking groups

TABLE A.1. List of banking groups in sample

Code	Name of BHC	Num. of banks	Public	Foreign
1163	BPCE	91	0	0
27	CREDIT AGRICOLE	59	0	0
29	CREDIT MUTUEL	34	0	0
768	BNP-PARIBAS	34	0	0
30	SOCIETE GENERALE	33	0	0
1133	CREDIT IMMOBILIER DE FRANCE	13	0	0
263	GENERAL ELECTRIC	11	0	1
160	HSBC HOLDINGS	7	0	1
129	ING	4	0	1
223	RABOBANK	4	0	1
52	RENAULT	3	0	0
291	COMMERZBANK	3	0	1
63	PSA PEUGEOT CITROEN	2	0	0
159	BARCLAYS	2	0	1
248	AGENCE FRANCAISE DE DEVELOPPEMENT	2	1	0
1024	OSEO	2	1	0
1186	ABN AMRO BANK	2	0	1
158	ESPIRITO SANTO	1	0	1
349	BBVA	1	0	1
839	MIZUHO FINANCIAL GROUP	1	0	1
923	JP MORGAN CHASE	1	0	1
970	HYPO REAL ESTATE	1	0	1
1033	MITSUBISHI UFJ FINANCIAL	1	0	1
40031	CDC	1	1	0

Note. Column (2) displays the number of individual banks considered in our sample for each selected banking group. This number may differ from the total number of affiliates of each group. French subsidiaries of foreign banks are treated as independent groups and are not consolidated with their holding companies overseas.