Do SMEs Benefit from Unconventional Monetary Policy and How? Micro-Evidence from the Eurozone

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Abstract

We study the impact of the announcement of the ECB's Outright Monetary Transactions Program on small firms' access to finance using a matched firm-bank dataset from eight Eurozone countries. We find that following the announcement, credit access improved relatively more for firms borrowing from banks with high balance sheet exposures to impaired sovereign debt, with such firms less likely to be refused a loan or to be price rationed. Loan terms also improved as manifested by a lengthening of loan maturities. We also find that unconventional monetary policy improved firms' expectations about the availability of future debt finance.

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1. Introduction

The euro area sovereign debt crisis which unfolded in the spring of 2010 significantly disrupted financial markets and real economic activity in the euro area, both of which were at the time still reeling from the impact of the global financial crisis of 2008–09. Borrowing costs for a number of peripheral countries reached levels which endangered their ability to service their debt, banks tightened credit standards rapidly, and economic confidence hit a new all-time low.[1] The extraordinary nature of the crisis prompted the European Central Bank (ECB) to take a number of unprecedented steps to improve the functioning of the banking sector and to support the economic recovery. In terms of scale, the Outright Monetary Transactions (OMT) Program, whose details were announced in August and September 2012, has arguably been the most ambitious unconventional policy employed in the euro area since its inception,[2] as well as one of the most successful ones, with bond yields on sovereign debt issued by stressed countries declining immediately, sharply, and permanently.[3]

In this paper, we use restricted-access data from the ECB's "Survey on the Access to Finance of Enterprises" (SAFE) to evaluate the impact of the OMT announcement on Eurozone small businesses' credit access. Specifically, we exploit the fact that during the sovereign debt crisis, five euro area countries (Greece, Ireland, Italy, Portugal, and Spain, henceforth denoted as "stressed countries") experienced a substantial deterioration in their sovereign creditworthiness, while the rest of the countries in the Eurozone did not. Because banks tend to hold large quantities of debt securities issued by domestic sovereigns,[4] investors rapidly lost

[1] See Lane (2012) for an analysis of the causes and consequences of the crisis.

[2] Under the OMT Program, the ECB committed to purchasing in secondary markets—and under a number of strict conditions—*unlimited* amounts of government debt issued by eligible Eurozone governments.

[3] For details, see Altavilla et al. (2014), Krishnamurthy et al. (2014), and Szczerbowicz (2015).

[4] For theoretical models of incentives for purchases of sovereign debt by domestic banks, see, for example, Acharya and Rajan (2013), Broner et al. (2014), and Gennaioli et al. (2014). For empirical evidence on the

faith in the banking sectors of stressed countries, which pushed banks' funding costs up and forced them to reduce lending.[5] Consequently, the benefits—in terms of firms' credit access and real investment—from using monetary policy tools aimed at reducing sovereign pressures on bank balance sheets could be substantial, too, in particular in the case of small and medium enterprises (SMEs) which are heavily dependent on bank credit.[6] The aggregate consequences can be equally substantial as SMEs in Europe provide two out of three private sector jobs and contribute more than half of total business-provided value added.[7]

Despite the paramount importance of this question, our paper is the first to study whether and how unconventional monetary policy during the sovereign debt crisis affected small businesses' credit access. We do so in three separate dimensions. First, we study the evolution of credit access by small euro area firms, before and after the announcement of the OMT program. Second, we observe the impact of the OMT announcement on credit terms, such as interest rates on loans, loan amounts, and loan maturities. Third, we study changes in small firms' expectations about future funding. To that end, we employ unique micro-level data on 2,628 SMEs in eight euro area countries for which we observe their credit relationships, as well as the evolution of their access to credit over the short- and medium-run. Identification rests on comparing credit access for identical firms borrowing from banks with different degrees of pre-OMT-announcement exposures to impaired sovereign debt.

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propensity of banks to hold domestically issued sovereign debt, see Acharya and Steffen (2015), Battistini et al. (2014), Becker and Ivashina (2015), Horvath et al. (2015), and Ongena et al. (2016), among others.

[5] See Adelino and Ferreira (2014), Albertazzi et al. (2012), Balduzzi et al. (2015), Bedendo and Colla (2014), Bofondi et al. (2014), Correa et al. (2012), De Marco (2014), Ivashina et al. (2015), and Popov and Van Horen (2015), among others, for evidence on changes in bank lending during the sovereign debt crisis.

[6] Empirical evidence suggests that given their high reliance on bank credit (Berger and Udell, 1998; Ferrando et al., 2014), SMEs are particularly likely to experience funding shocks when banks adjust their loan portfolios in response to shocks to their balance sheets (Duygan-Bump et al., 2015).

[7] This argument extends to the U.S., too, where SMEs account for roughly half of the labor force (Stangler and Litan, 2009).

Our findings are threefold. First, we find that the announcement of the OMT Program had an immediate positive effect on SMEs' credit access. Relative to otherwise similar firms, firms borrowing from banks with large balance sheet exposures to impaired sovereign debt became considerably less likely to be credit constrained in the six months to one year after the announcement. This improved credit access was due to lower credit denial rates and lower rates of credit price rationing. Second, we find that after the OMT announcement, small firms immediately experienced an improvement in loan terms, as manifested by a lower share of firms that were offered credit at higher rates and by a lengthening of loan maturities. Put differently, we find that as a result of the ECB's intervention, not only did bank credit become more widely available, but it became available at more advantageous loan terms, reducing the overall cost to firms of financing investment projects. Finally, we examine the adjustment of SMEs' expectations about future funding. We find that firms benefiting from unconventional monetary policy are considerably more likely to expect further improvement in bank lending in the future. This suggests that unconventional monetary policy can have real effects through two separate channels—an immediate improvement in the access to and the terms of bank credit, and an improvement in firms' expectations about the cost and availability of future funding.

We measure bank balance sheet exposure to impaired sovereign debt in two ways. First, for a sample of 2,628 firm-observations linked to 126 banks, we use data from Bankscope on banks' total sovereign bond holdings relative to total assets, and we distinguish between stressed and non-stressed countries to gauge the risk of the underlying asset. Second, for a sub-sample of 2,122 firm-observations linked to 25 banks, we use data from the European Banking Authority's (EBA) stress test from June 2012 on banks' holdings of sovereign bonds issued by stressed countries, relative to total assets. The tests based on these two empirical proxies provide remarkably similar estimates of the impact of the OMT on credit access, conditional on the firm's lender's balance sheet exposure to impaired sovereign debt.

While a number of demand-side effects can clearly play a role at the same time when central banks are employing unconventional monetary policy tools (for instance, by affecting

consumers' demand for goods and services), we go to great lengths to identify the causal impact of the OMT announcement through the channel of the supply of bank credit. First, we employ country-sector-time fixed effects in all regressions. In this way, we net out the effect of shocks that are common to all firms in a country at the same point in time, such as sovereign risk or the perception that the euro itself will survive, and even to all firms in the same sector in the same country at the same point in time (e.g., shocks to the demand for housing in Spain in the second half of 2012). The combination of fixed effects also soaks up the effect of shocks that are common to all banks in a country, such as the government's ability to support the banking sector, as identification rests on a *within-country* comparison of banks with different balance sheet exposures to impaired sovereign debt. Second, we show that the trend in credit access that we uncover did not exist before the OMT announcement, corroborating a genuine monetary policy effect through the channel of bank lending. Third, we isolate the subset of the most creditworthy corporate borrowers, specifically, firms whose credit history improved the most in the past six months. We show that even within this sample, firms borrowing from banks with large exposures to impaired debt are more likely to benefit from the OMT announcement than similarly creditworthy firms from non-exposed banks. Finally, we run our tests on a small sub-set of firms that are observed more than once during the sample period. This allows us to include firm fixed effects in the regression which reduces concerns about omitted variable bias at the firm level related, for example, to unobservable investment opportunities of non-financial firms.

Because we focus on the effect of the OMT Program, our paper is related to the literature on monetary policy and the bank lending channel (e.g., Bernanke and Blinder, 1988; Kashyap and Stein, 1994). The bank lending channel posits that the transmission of monetary policy operates—at least in part—through the asset side of banks' balance sheets by affecting the supply of bank loans. We use micro data to analyse the effect of the OMT announcement, so we avoid the criticism in this literature on the transmission of monetary policy that aggregate data is not up to the task (e.g., Kashyap et al., 1996). Our paper thus contributes to the literature on the impact of conventional (e.g., Gertler and Gilchrist, 1994; Jimenez et al., 2012)

and unconventional monetary policy (e.g., Acharya et al., 2015b; Eser and Schwaab, 2016; Giannone et al., 2012; Gilchrist and Zakrajsek, 2013; Gilchrist et al., 2015; Krishnamurthy and Vissing-Jorgensen, 2011; Foley-Fisher et al., 2016) on both nominal and real economic variables. Most closely related to our paper is a concurrent paper by Acharya et al. (2016), the only other paper to study the real effects of the OMT announcement. While we also study the impact of the OMT on bank lending, we go deeper in a number of important theoretically motivated dimensions: we capture the SME segment in addition to large firms; we distinguish between formal and informal credit constraints; within the universe of formal constraints, we distinguish between denial rates, quantity rationing, and price rationing; we study changes in loan terms in addition to credit access; and we study changes in firms' expectations about future funding.

Our paper builds on a rapidly growing literature on how shocks to lenders affect (especially small) firms' access to finance. The most challenging issue faced by this literature is distinguishing between supply and demand effects. One research strategy, for example, is to exploit experiments that provide a laboratory that naturally accomplishes this identification (e.g., Peek and Rosengren, 1997; Khwaja and Mian 2008; Chava and Purnanandam 2011; Lin and Paravisini, 2013). While these natural experiments allow for relatively easy identification of supply shocks, they are hard to come by and have not been available during the current global crisis. Another strategy is to examine the substitution between bank loans and capital market instruments such as commercial paper (e.g., Kashyap et al., 1993) or corporate bonds (Becker and Ivashina, 2014), where the latter strategy can only be applied to firms which have access to public debt markets. Yet another alternative is to estimate demand and supply equations using data that includes firm level characteristics in a disequilibrium model that identifies credit constrained borrowers (e.g., Carbo-Valverde et al., 2016; Kremp and Sevestre, 2013). Another strategy has been to exploit credit registry data in countries where firms routinely obtain credit from multiple banks. This creates an environment that naturally controls for demand effects (e.g., Albertazzi and Marchetti, 2010; Jimenez et al., 2012; Iyer et al., 2014). The identification approach that we use in this paper is to measure supply effects directly from a firm-level survey dataset that is specifically designed for this purpose. Because of data availability, this approach

has been particularly helpful in identifying the effects of the credit crunch in Europe during the financial crisis (e.g., Popov and Udell, 2012; Beck et al., 2014; Pigini et al., 2014; Presbitero et al., 2014). However, ours is the first paper to use survey data to study the effect of unconventional monetary policy on SMEs' access to finance.

Another contribution of the paper is that in our analysis of the OMT Program, we look at access to finance both in the quantity and in the price dimension. A few other papers on the current global crisis have also considered loan pricing effects (e.g., Santos, 2011), but most focus on quantity effects only (e.g., Ivashina and Sharfstein, 2010; Puri et al., 2011; Jimenez et al., 2012).[8,9]

Finally, ours is the first paper to examine the effect of monetary policy on SMEs' expectations about future funding. For example, several recent papers have examined the effect of shocks to credit access on firms' use of trade credit (e.g., Garcia-Apenini and Montoriol-Garriga, 2013; Carbo-Valverde et al., 2016; Ferrando and Mullier, 2015). However, our data allow us to look at the universe of financing sources available to SMEs, including bank loans, credit lines, retained earnings, trade credit, equity, and debt securities. We can therefore observe how SMEs adjust their expectations about their sources of future funding in response to unconventional monetary policy that improves current access to bank credit.

The rest of the paper is organized as follows. Section 2 reviews the sovereign debt crisis in the euro area and the details of the ECB's OMT Program, and it presents the research hypotheses. Section 3 summarizes the data. Section 4 discusses the empirical strategy. Section 5 presents the evidence on the impact of the OMT Program. Section 6 concludes.

[8] Some papers on this crisis that use firm-level survey data combine price and quantity effects based on questions that ask whether the firm was "affected by the cost or availability of credit" (e.g., Campello et al., 2010).

[9] Quantity effects include non-price credit rationing, such as denying credit or granting a smaller loan amount than the one requested (e.g., Stiglitz and Weiss, 1981).

2. Sovereign stress, unconventional monetary policy, and access to finance

2.1. The euro area sovereign debt crisis and the ECB's response

The sovereign debt crisis which erupted in the euro area in 2010 sent ripples through the global banking system and prompted interventions by governments and central banks on a scale comparable to the programs implemented during the financial crisis of 2008–09. Over the course of 2010–2012, yields on sovereign bonds issued by the governments of Greece, Ireland, and Portugal reached levels which made their overall stock of debt unserviceable, with Italy and Spain facing record costs of issuing new debt, too.[10] On the fiscal response side, the €440 billion-strong European Financial Stability Facility (EFSF) was established by the 27 member states of the EU in May 2010 with a mandate to provide financial assistance to euro area states. Its committed funding was later boosted to around €1 trillion.

On the side of monetary policy, the ECB implemented a series of non-standard monetary policy measures. In May 2010, the ECB instituted the Security Markets Program (SMP) whereby it began open market operations buying government and private debt securities in secondary markets, reaching about €220 billion in February 2012, and simultaneously absorbing the same amount of liquidity to prevent a rise in inflation (Eser and Schwaab, 2015). In December 2010, the ECB extended €489 billion in loans to more than 500 European banks at a fixed 1 percent interest rate. This was followed, in February 2012, by a second long-term refinancing operation, injecting an additional €530 billion into the banking system.[11]

Concerned that the effect of all these interventions would be short-lived, on 2nd August 2012 the ECB announced that it would undertake outright transactions in secondary sovereign

[10] The yields on 10-year government bonds reached 12.3 percent in July 2011 (Ireland), 7.5 percent in November 2011 (Italy), 18.3 percent in January 2012 (Portugal), 48 percent in April 2012 (Greece), and 7 percent in June 2012 (Spain). Greece received a €110 billion bail-out package from the EU and the IMF in May 2010; Ireland received an €85 billion bail-out package in November 2010; and Portugal received a €78 billion bail-out package in May 2011.

[11] See ECB (2013) Box "Early repayment of funds raised through three-year longer-term refinancing operations: economic rationale and impact on the money market ", Monthly Bulletin, February.

bond markets (OMT Program), aimed at safeguarding an appropriate monetary policy transmission and the singleness of the monetary policy. It set a number of conditions. The technical details of the program itself were announced on 6th September 2012. First, a country seeking access to the OMT must request financial assistance from the EFSF. Second, the EU and/or IMF must agree to provide financial assistance through the EFSF and lay out the terms of a deficit reduction program that the country must abide by. Third, the applicant country must agree to the terms of the program. At this point, the ECB can start purchasing sovereign bonds issued by the requesting country, focusing on the shorter part of the yield curve (with maturity of 3 years or less). The ECB set no ex ante quantitative limits on the amount of government bonds that could be purchased through the OMT Program. However, in order to neutralize the potential impact on the money supply, all bond purchases would be offset by selling other securities of equal amount. The Program would run until the country regained market access and could once again fund itself normally in bond markets.

Despite the fact that no OMT Programs were ready to start at the time of the announcement, the financial markets reacted immediately by pricing in a decline of both short term and long term interest rates in all European countries previously suffering from elevated interest levels. By the end of 2013, even though the ECB did not purchase a single bond through the OMT Program, capital had flown back into stressed countries such as Italy and Spain, and government bond yields had tumbled, returning to pre-crisis levels (Altavilla et al., 2014).

2.2. Unconventional monetary policy and access to finance: Empirical mechanisms

Theory has emphasized both the role of borrowers' balance sheets (e.g., Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Bernanke et al., 1996), whereby expansionary monetary policy can strengthen firms' balance sheets by increasing cash flow net of interest and by raising the value of collateral assets, as well as the role of lenders' balance sheets (e.g., Bernanke and Blinder, 1992; Kashyap et al., 1993), whereby monetary policy regulates the pool of funds available to bank-dependent borrowers in the presence of reserve requirements on bank deposits. More broadly, theory suggests that during a crisis when lenders become more

balance-sheet-constrained the benefits of unconventional monetary policy increase (Gertler and Karadi, 2011).

In the case of the OMT Program, we expect the main effect to come through strengthening of the balance sheets of banks holding large amounts of sovereign debt. There are at least three mechanisms at play. First and foremost, as the OMT announcement reduces yields on previously impaired sovereign debt, investors now perceive banks with substantial balance sheet exposures to a risky sovereign as less risky and start lowering the rates they demand to keep funding them. There is already abundant evidence that the OMT announcement had such an effect on bank borrowing costs. For example, Acharya et al. (2015c) provide evidence that U.S. money market funds became more willing to provide unsecured funding to European banks after the OMT announcement. Studying euro area sovereign markets, money markets, and banking markets, Szczerbowicz (2015) shows that the OMT announcement not only reduced sovereign market tensions, but also lowered long-term bank funding costs.

Second, the eligibility of sovereign bonds as collateral to secure wholesale funding increases as well. Finally, as yields on sovereign debt decline, the sovereign's ability to support the domestic banking sector increases, and this effect should be stronger for banks that were at a higher risk before the policy's announcement. Consequently, banks' funding costs after the OMT should go down relatively more for banks with large balance sheet exposures to risky sovereign debt, leading us to expect SMEs to face more favourable lending conditions if they have credit relationships with such banks. Even though in practice we cannot distinguish between these three mechanisms, they all go in the same direction, comprising a "bank funding" channel of unconventional monetary policy. We note that this is a distinctly different mechanism from other channels activated by the OMT which affect all firms in the economy

equally, such as expectations about the survival of the euro or improved consumers' confidence.[12]

The research hypothesis then is:

H0: By reducing yields on certain sovereign bonds, the OMT is expected to lead to a relatively larger improvement in credit access by firms borrowing from banks with large holdings of such bonds.

3. Data

The main data source for our analysis is the firm-level "Survey on the Access to Finance of Enterprises" (SAFE) run jointly by the ECB and the European Commission. The SAFE has been conducted fourteen times since 2009. The survey started after the financial crisis initially hit the euro area. The survey waves include the period before the sovereign debt crisis (survey waves 1 and 2, from 1st January until 31st December, 2009); the period during which the sovereign debt crisis unfolded (wave 3, from 1st April until 30th September, 2010); the period of the sovereign debt crisis (waves 4, 5, 6, and 7, from 1st October 2010 until 30th September 2012); and the period after the OMT Program announcement (waves 8 and on, from 1st October 2012). This firm-level SME survey contains information on each respondent firm's characteristics (size, sector, autonomy, turnover, age, and ownership) and on its assessment of recent short-term developments regarding its financing including information on its financing needs and its access

[12] This is closely related to the distinction in the literature between the "bank lending supply shock" that focuses on the banking channel and the "credit supply shock" that focuses on a general credit supply shock (see, for example, Kahle and Stulz, 2013).

to finance.[13] The sample contains only non-financial firms and excludes firms in agriculture, public administration, and financial services.[14]

We next merge the SAFE with two datasets containing information on banks' exposures to sovereign debt—Bankscope and the EBA stress tests. To do so, we make use of a variable called "BANKER", made available through a merge with Bureau van Dijk's Amadeus dataset and originally acquired from the Kompass dataset. This variable displays the name of the banks with which the firm has a credit relationship. Following Kalemli-Ozcan, Laeven, and Moreno (2015), we use OpenRefine and Reconcile-CSV to match bank names to the BvD ID numbers of banks and we subsequently match these bank names with bank information on total sovereign bond holdings and on total assets from Bankscope. We also manually match bank names to information from the EBA stress tests, a procedure facilitated by the fact that only 90 banks took part in those. If a firm reports more than one bank, we use the bank reported first as the firm's main bank. In all, we recover information on 126 banks from Bankscope and 25 banks from the EBA in eight countries with which the firms in the dataset have a credit relationship.[15]

In our analysis, we use the four waves around the announcement of the OMT Program, waves 6 and 7 (pre-OMT) and waves 8 and 9 (post-OMT), for a total of 30,040 possible

[13] The survey's main results are published in the ECB website every six months. For more information on the survey and its individual waves, see http://www.ecb.europa.eu/stats/money/surveys/sme/html/index.en.html.

[14] The SAFE data include an oversample of firms in smaller countries. For this reason, the survey providers also compute sampling weights that adjust the sample to be representative of the frame from which the sample was drawn. As a result, all empirical tests in the paper make use of sampling weights which restore the representativeness of each individual firm with respect to the average firm in the population of firms in the Eurozone.

[15] There is no firm-bank match for firms in Belgium, Finland, and Italy, reducing the sample to eight countries from the original 11 eurozone countries in SAFE.

observations. Most of the firms are interviewed only once in the survey but there is a small subsample of firms present in at least two waves.[16]

Table 1 reports descriptive statistics on the main variables of interest. All survey-based percentages are weighted statistics that restore the proportions of the economic weight (in terms of number of employees) of each size class, economic activity, and country. *Credit constrained*, our main dependent variable, is a dummy variable equal to 1 in four different cases: a) the firm's application for a bank loan or credit line in the past 6 months was denied (*Loan application denied*); b) the firm received less than 75 percent of the loan amount it requested (*Rationed*); c) the firm refused the loan offer because the rate was too high (*High cost*); or d) the firm did not apply for a loan because it feared a rejection (*Discouraged from* applying).[17] Of the 30,040 firms in the dataset, 16.3 percent were on average credit constrained. Looking at the individual components of *Credit constrained*, we find that in the past six months, about four percent of the firms were denied credit, four percent were rationed, eight percent were discouraged from applying, and less than one percent refused a credit offer due to its high cost.[18]

Table 1 summarizes information on a range of other firm-specific characteristics. Almost half of our sample includes firms in stressed countries (Greece, Ireland, Portugal, and Spain). The survey includes mostly SMEs, with more than two thirds of firms having less than 50 employees, and less than 8 percent of the firms having more than 250 employees. In terms of turnover, the majority of firms are small with annual turnover less than EUR 2 million (49 percent). 26 percent have turnover between EUR 2 and 10 million. Firms are mostly

[16] Out of the 21110 unique firms present in waves 6–9, 3937 are observed at least once during the pre-OMT and at least once during the post-OMT period.

[17] The strategy of merging together formally and informally constrained borrowers is standard since the work of Jappelli (1990).

[18] Firms are interviewed at the end of each wave. Therefore, if a firm is included in wave 8 (1st October 2012 – 31st March 2013) and it is asked about its credit experience in the past six months, this experience is limited to the period 1st October 2012 – 31st March 2013 and does not spill over back into the pre-OMT period.

independent rather than subsidiaries of a larger firm (87 percent) and are individually or family-owned (81 percent). The sample includes mostly firms that are 10 or more years old (80 percent), but around 13 percent are between 2 and 10 years old. Finally, between one-fifth and one-quarter of companies in our sample report that their outlook—in terms of sales and profitability, their capital conditions, and their credit history—was on average improving during the sample period.

On the bank's side, about 6 percent of the average bank's assets are comprised of sovereign bonds, with a low of 0.01 percent and a high of 20.6 percent. There are 2,628 firms in the dataset comprising survey waves 6, 7, 8, and 9 which report the identity of a creditor that can be matched to Bankscope, and 2,122 firms which report the identity of a creditor that can be matched to data from the EBA.

Recent studies aiming at identifying the transmission of monetary policy through bank lending have typically relied on credit registers (e.g., Jimenez et al., 2012) or on syndicated loan data (e.g., Acharya et al., 2016). Relative to the former, the SAFE does not contain information on the universe of firms and loans, but only on a small representative sample of firms, and relative to the latter, it does not have—for most firm—multiple firm-specific and bank-specific observations over time. Nevertheless, our dataset contains a small panel component of firms which allows us to perform tests with firm fixed effects that aim at eliminating omitted variable bias related to unobservable firm-specific heterogeneity. More importantly, it contains information on firm-specific outcomes that other types of datasets do not have access to. First, we have data on discouraged firms, allowing us to capture informal credit constraints, in addition to formal ones. Second, we have data on changes in the terms of granted loans, allowing us to study the impact of monetary policy beyond mere credit granting. Finally, we have data on firms' expectations about future funding, allowing us to study the impact of monetary policy through the channel of adjusting expectations.

4. Empirical strategy and identification

We investigate the impact of unconventional monetary policy on small firms' credit access by comparing the evolution of credit access around the time of the OMT announcement for firms borrowing from banks with high balance sheet exposures to impaired sovereign debt relative to firms borrowing from banks with low such exposures.

We employ two different ways of computing a bank's balance sheet exposure to impaired sovereign debt. In the first model, we take data from Bankscope on total sovereign bond holdings in 2012, and we distinguish between firms in countries with sovereign debt problems during the 2010–2012 period (Greece, Ireland, Portugal, and Spain—"stressed countries") and firms in countries without sovereign debt problems during the 2010–2012 period (Austria, France, Germany, and the Netherlands—"non-stressed countries").[19] The groups are of roughly similar size, with 9,767 unique firms (14,011 observations) in stressed countries and 11,343 unique firms (16,029 observations) in non-stressed countries.

In this model, we use three sources of identifying variation in our analysis: the time before and after the ECB's OMT announcement; the cross section of firms borrowing from banks with different balance sheet exposures to sovereign bonds relative to their assets; and the issuer of sovereign bonds. We estimate the following difference-in-difference-in-differences (DIDID) model:

[19] The choice of countries is motivated by the fact that all countries in the treatment group experienced severe problems in accessing government bond markets over the sample period. In 2010, 10-year bond yields reached levels usually associated with a high probability of sovereign default: 1210 basis points (Greece), 950 basis points (Ireland), 750 basis points (Portugal), and 550 basis points (Spain). European policy makers recognized the severity of the sovereign problems in these five countries. Greece received a bailout from the EC and the IMF in May 2010, Ireland received one in November 2010, and Portugal agreed on a bailout in May 2011. As mentioned above, the European Central Bank instituted the SMP whereby in May 2010 it started buying (in secondary markets) Greek, Irish, and Portuguese government debt, and in August 2011 it intervened in Italian and Spanish debt markets, too. For comparison, yields on 10-year government bonds for the six countries in the control averaged 340 basis points at the end of 2010, similar to yields on 10-year US treasury bills.

$$\begin{aligned}\Pr ob(Credit\_constrained_{iscbt}=1)= \quad & \varphi(\beta_1 Post_t \times Stressed_c \times Sov\_bonds/Assets_{iscb} \\ & +\beta_2 Stressed_c \times Sov\_bonds/Assets_{iscb} \\ & +\beta_3 Post_t \times Sov\_bonds/Assets_{iscb} \\ & +\beta_4 X_{iscbt}+\beta_5\phi_{sct}+\beta_6\eta_b+\varepsilon_{iscbt})\end{aligned} \tag{1}$$

In the main tests, $Credit\_constrained_{iscbt}$ is a dummy variable equal to 1 if firm *i* in sector *s* in country *c* borrowing from bank *b* at time *t* is credit constrained. A firm is credit constrained if its application for a bank loan or credit line was denied, if it was credit rationed, if it was price rationed, or if it was discouraged from applying. In later tests, we also study the evolution of the individual components of credit market experience. $Post_t$ is a dummy variable that captures the ECB's OMT announcement and is equal to 0 between 1st October 2011 and 30th September 2012 (survey waves 6 and 7), and to 1 between 1st October 2012 and 30th September 2013 (survey waves 8 and 9).[20] $Stressed_c$ is a dummy variable equal to 1 if the firm is domiciled in a stressed countries (Greece, Ireland, Portugal, and Spain), and to 0 otherwise. $Sov\_bonds/Assets_{iscb}$ is the ratio of sovereign bond holdings to total assets of bank *b* with which firm *i* in sector *s* in country *c* has a credit relationship during the entire sample period. Data on these exposures come from Bankscope, for 2012. While Bankscope does not distinguish between domestic and foreign bond holdings, the vast majority of sovereign bonds held by banks in the Eurozone are issued by the domestic sovereign.[21] X_{isct} is a vector of time-varying firm-level control variables; ϕ_{sct} is an interaction of country, sector,[22] and time (i.e.,

[20] We deliberately choose a symmetric sample period around the OMT announcement that is long enough to allow us to measure any material change in credit access. In robustness tests, we compare credit access six months before and six months after the OMT announcement.

[21] Using an ECB dataset on monthly holdings by 250+ Eurozone banks that distinguishes between domestic and foreign sovereign bond holdings, Ongena, Popov, and van Horen (2016) report that the share of domestic sovereign bond holdings out of total sovereign bond holdings for the median Eurozone bank at the time of the OMT announcement was 0.97.

[22] Sectors are defined at the 1-digit SIC level.

survey wave) fixed effects; η_b is a bank fixed effect which is common to all firms borrowing from the same bank; and ε_{iscbt} is an i.i.d. error term. $Stressed_c \times Post_t$, $Stressed_c$, and $Post_t$ are not included in the specification because their effect on access to finance is subsumed in the matrix of country-sector-time fixed effects. $Sov\_bonds / Assets_{iscb}$ is not included in the specification because its effect on access to finance is subsumed in the bank fixed effects.

The coefficient of interest is β_1. In a classical DIDID sense, it captures the change in access to finance from the pre-treatment to the post-treatment period, for firms borrowing from banks with large sovereign exposures relative to firms borrowing from banks with low sovereign exposures, in stressed versus non-stressed countries. A negative coefficient β_1 would imply that all else equal, after the OMT announcement access to finance improved more for firms borrowing from banks with large sovereign bond exposures in stressed countries.

In the second model, we use data on banks' holdings of bonds issued by Greece, Ireland, Italy, Portugal, or Spain, from the June 2012 stress test by the EBA, and we distinguish between firms borrowing from banks with relatively high holdings and firms borrowing from banks with relatively low such holdings. We now use two sources of identifying variation in our analysis: the time before and after the ECB's OMT announcement, and the cross section of firms borrowing from banks with different balance sheet exposures to impaired sovereign debt. We estimate the following Difference-in-differences (DID) model:

$$\begin{aligned}\Pr ob(Credit\_constrained_{iscbt} = 1) = \quad & \varphi(\beta_1 Post_t \times Stressed\_sov\_bonds / Assets_{iscb} \\ & + \beta_2 X_{iscbt} + \beta_3 \phi_{sct} + \beta_4 \eta_b + \varepsilon_{iscbt})\end{aligned} \qquad (2)$$

All variables and fixed effects are the same as in Model (1), with the exception of $Stressed\_sov\_bonds / Assets_{iscb}$ which denotes the ratio of the holdings of sovereign bonds issued by stressed countries to the total assets of bank *b* with which firm *i* in sector *s* in country *c* has a credit relationship during the entire sample period. Data on these exposures come from the capital exercise conducted by EBA in June 2012, just prior to the OMT announcement. A negative coefficient β_1 would imply that all else equal, after the OMT announcement access to

finance improved more for firms borrowing from banks with large relative holdings of impaired sovereign debt relative to firms borrowing from banks with low such relative holdings.

Both models are saturated to provide additional identification of the credit supply effect of unconventional monetary policy. The vector of firm-specific variables X_{iscbt} controls for the firm's demand for credit by capturing the independent impact of firm-level heterogeneity related to size, age, turnover, ownership structure, etc. Ample evidence points to a negative relation between profitability and the demand for external funds (Almeida and Campello, 2010). Therefore, we expect larger and older firms, whose projects have matured, to have a lower demand for external financing. We also include interactions of country, sector, and time fixed effects. These eliminate variation in access to finance that is specific to a particular sector in a particular country at a particular point in time (e.g., construction in Spain during the housing bust). It also alleviates concerns that the observed variation in credit access is driven by global shocks that are common to all firms (e.g., a global repricing of risk). Finally, the vector of bank fixed effects η_b controls for all observable and unobservable characteristics of an individual bank, such as capitalization, business model, risk appetite, etc. The combination of firm-specific factors and various fixed effects addresses the concern that our estimates can be contaminated by shocks to credit demand unrelated to the supply of credit. For example, while agency cost problems may have become less severe and/or growth opportunities may have improved more for firms domiciled in stressed countries, this should be accounted for by the firm-specific information and by the country-sector-time fixed effects.

The models are estimated using probit, where standard errors are clustered at the country level.

5. The OMT and credit access Empirical evidence

5.1. Main result

In Table 2, we present the point estimates for Model (1) and Model (2) whereby we compare the change in access to finance from the pre-OMT period to the post-OMT period, for

firms borrowing from banks with larger versus smaller balance sheet exposures to impaired sovereign debt. In terms of the precise sample period, we compare the period 1st October 2011 – 30th September 2012 (survey waves 6 and 7) to the period 1st October 2012 – 30th September 2013 (survey waves 8 and 9). Again, this is a comparison of access to finance over the medium-term, the one year after the announcement relative to the one year before the announcement. We thus allow for the effect to build beyond an immediate short-term reaction, but we stop the sample period before it becomes contaminated by consequent developments in the business environment and in monetary policy.

Estimates of Model (1) are reported in columns (1) and (2). We first report, in column (1), a version of Model (1) without firm-specific covariates, but with country-sector-time and with bank fixed effects. The model thus controls for all unobservable trends that are common to firms in the same sector in the same country, as well as for time-invariant bank characteristics that can affect the propensity to supply credit to SMEs. The data strongly reject the hypothesis that the OMT had no effect on credit access. In particular, we find that in the year after the OMT announcement, the probability that an otherwise similar firm would be credit constrained declined significantly more for firms borrowing from banks with a significant exposure to domestic sovereign debt and, in particular in stressed countries. The effect is significant at the 1 percent statistical level, and it is economically meaningful, too. The point estimate on the interaction term is -0.020. Given an interquartile range for the ratio of *Sovereign bonds / Assets* of 5.085, the point estimate implies that in the year after the OMT announcement, a firm in a stressed country experienced a 10.2 percentage point decline in the probability that it would be credit constrained, relative to a firm in a non-stressed country, if before the announcement it was associated with a bank at the 75th of sovereign debt exposure, compared to a firm associated with a bank at the 25th percentile of sovereign debt exposure.

Turning to the other interactions of interest, we find that firms borrowing from banks with large relative sovereign bond holdings are on average more likely to be credit constrained throughout the sample period if they are domiciled in fiscally stressed countries. Such firms are

on average also more likely to be credit constrained after the OMT announcement. All of these effects are strongly significant at the 1 percent statistical level.

In column (2), we add all firm-specific covariates to the regression. We find that a number of those have the expected sign. For example, firms that are stand-alone rather than subsidiaries of a larger group are more likely to be credit constrained, potentially because they are more opaque and/or because they (or their entrepreneurs) have less collateral (e.g., Berger and Udell 1998, 2006). The youngest firms (less than two years of age) are more likely to be credit constrained, potentially because of their lower informational opacity (Berger and Udell, 1995; Cole 1998). Firms with a higher turnover are less likely to be credit constrained, potentially because high turnover signals reliable project quality. Finally, firms with improving capitalization and/or improving credit history (over the past 6 months) are less likely to be credit constrained than firms whose capital or credit history deteriorated or did not change, implying that banks use hard information in their credit granting decisions.[23]

Importantly, we continue finding that the probability that an otherwise similar firm would be credit constrained declined significantly more after the OMT announcement for firms borrowing from banks with a significant exposure to domestic sovereign debt domiciled in stressed countries. The effect is once again significant at the 1 percent statistical level, albeit economically lower than in column (1). The point estimate on the interaction term is -0.011, implying that in the year after the OMT announcement, a firm in a stressed country experienced a 5.6 percentage point decline in the probability that it would be credit constrained, relative to a firm in a non-stressed country, if before the announcement it was associated with a bank at the 75th instead of the 25th percentile of sovereign debt exposure. The

[23] While we do not find that firm size matters, a finding that runs contrary to the evidence in Hadlock and Pierce (2010), we are not looking at listed firms, like they do, but at SMEs for whom age is potentially a more important determinant of credit constraints than size.

variables and fixed effects included in this regression explain about 19 percent of the variation in credit access over the sample period.

In the next two columns of Table 2, we report analogous versions of Model (2), with country-sector-time and bank fixed effects, and without (column (3)) and with (column (4)) firm covariates. Once again we find that larger firms, older firms, and firms whose capital quality is improving are less likely to be credit constrained. Importantly, we continue finding—for balance sheet exposure to impaired debt being proxied by relative holdings of bonds issued by stressed governments—a strong and significant (at the 1 percent statistical level) effect of the OMT announcement. Numerically, the point estimate of -0.035 on the interaction term in the model with firm covariates implies that in the year after the OMT announcement, a firm associated with a bank at the 75th percentile of impaired sovereign exposures experienced a 13.4 percentage point decline in the probability that it would be credit constrained, relative to a firm associated with a bank at the 25th percentile of such exposures.[24]

5.2. Falsification tests

The key identifying assumption of our DIDID and DID approach is that in the absence of the OMT-provided positive shock to bank funding costs for banks with relatively large balance sheet exposures to impaired sovereign debt, all firms would be subject to the same trend in credit access.[25] This need not be the case, and the break in trends we report in Table 2 may have started already before the OMT announcement for reasons unrelated to sovereign stress or to unconventional monetary policy. While we condition our tests on observables, our empirical strategy would be compromised if firms in stressed countries borrowing from banks with large sovereign balance sheet exposures experienced an improvement in credit access

[24] Appendix Table 1 shows that our results obtain when we compare credit access during the six months after the OMT announcement to credit access during the six months before the announcement.

[25] See Roberts and Whited (2011) for details.

already before the OMT announcement due to, for example, better (unobservable) growth opportunities. If this were to be the case, we might incorrectly interpret pre-determined trends as evidence of the positive effect of unconventional monetary policy (see Roberts and Whited, 2011).

To address this potential problem we take advantage of the fact that our original dataset is long enough to allow us to test our key identifying assumption explicitly. We now focus on survey waves 6–7 which were conducted over the period 1st October 2011 – 30th September 2012. As both survey waves took place before the OMT announcement, we can apply our DIDID strategy to test for differences in credit access trends across firms *within* the pre-OMT sample period, for both Model (1) and Model (2). In practice, in column (1) of Table 3, we compare the change in credit access across firms with credit relationships to more versus less sovereign-debt-exposed banks, in stressed versus non-stressed countries. Then, in column (2) we compare the change in credit access across firms with credit relationships to banks with higher versus lower relative holdings of bonds issued by stressed governments.

The estimates from both regressions suggest that there was no difference in credit access across firms exposed to different credit shocks coming from banks with different degrees of exposure to impaired sovereign debt in the one year before the OMT announcement. In both cases, the point estimate on the interaction of interest is not significantly different from zero, and in both regressions, the sign is actually positive. These placebo tests thus confirm that the improvement in credit access we registered in Table 2 did not predate the announcement of the OMT program.[26]

5.3. Robustness

[26] From the point of view of the theoretical mechanism we test in this paper—bank lending being affected by the price of a class of assets that bank hold on their portfolios—these results are not surprising. In the year before the OMT, average sovereign bond yields hovered for a long time around higher levels, but were relatively flat: the average yield on a 10-year bond issued by the Italian, Irish, Spanish, or Portuguese government was 7.4 in the month of the OMT announcement, and 7.6 a year earlier. For comparison, that same number was 4.9 a year after the OMT announcement.

In Table 4 we address a number of non-trivial concerns about our empirical model. We report two panels of results: Panel A where the reported estimates are based on Model (1) and Panel B where the estimates are based on Model (2).

To begin with, our choice of the main sample period is one year before and one year after the OMT announcement. We believe that this sample period allows for a reasonable lag in the evolution of any improvement in bank funding costs due to the OMT announcement to the real sector. Nevertheless, it might be that a shorter time frame would provide for a cleaner identification of the effect on credit access by minimizing any contamination by developments that took place over the course of the year after the OMT announcement. To address this issue, in column (1) we adapt our empirical models to test for a short-term OMT effect whereby we compare credit access during the six months before the OMT announcement (wave 7) to credit access during the six months after the announcement (wave 8). This empirical strategy reduces the number of available observations to 825 and to 587, respectively. Nevertheless, we keep finding a strong effect of the OMT announcement on the probability of firms borrowing from banks with significant exposures to impaired sovereign debt. The effect is significant at the 1 percent statistical level in Panel A, and it is more than five times larger than the one reported in column (2) of Table 3, suggesting that the immediate effect of the announcement is indeed much stronger than the medium-run effect.

Next, we note that although our DIDID and DID specifications allows us to control for omitted variables that affect both the treatment and the control group in a similar manner, identification of the causal effect requires controlling for any systematic shocks to the treatment group. That is, we need to control for other shocks that might be correlated with the financial sector's exposure to sovereign stress. For example, it might be the case that constraints mapping firm-specific net worth tightened differently across the treatment and the control group around the time of the OMT announcement. Our results so far can thus be the outcome of a mechanism whereby the allocation of loanable funds is largely driven by firms' balance sheet strength (Ashcraft and Campello, 2007).

We address this concern by controlling for such shocks explicitly. In column (2), we add interactions of all firm-specific variables with the *Stressed* and the *Post* dummies (Panel A) and with the *Post* dummy (Panel B). This procedures aims at accounting for the possibility that the effect of various empirical proxies for net worth, such as age and size, is time-varying and our main explanatory variable may be picking up part of it. However, we find for both Model (1) and Model (2) that association with a creditor with substantial balance sheet exposure to impaired sovereign debt continues to explain a substantial portion of the variation in changes in credit access after the announcement of the ECB's OMT program.

One other consideration is related to the fact that Greece is an outlier in the sample: it is the only country to have effectively been shut out of international bond markets and to have experienced a quasi-default when private investors were asked in February 2012 to accept a write off equal to 53.5 percent of the face value of Greek governmental bonds. We therefore test if our results are robust to the exclusion of Greek firms from the sample. The evidence reported in column (3) of both panels confirms that this is the case.

We next address the possibility that the changes in credit access that we observe are driven by shocks to firms' demand for credit that are unrelated to shocks to credit supply. So far, we have attempted to identify a credit supply shock driven by changes in monetary policy by comparing firms with credit relationships with banks that benefited a lot from the OMT-driven decline in the yields of certain sovereign bonds to firms with credit relationships with banks whose funding costs were arguably not strongly affected by the OMT. This identification strategy also allows us to control for a range of firm-specific characteristics and for country$\times$sector$\times$survey wave fixed effects, ensuring that our results are not contaminated by firm-specific factors such as size or age, or by general changes in country-sector-specific conditions, such as country-specific shocks to the demand for real estate services. However, it can still be the case that during the sample period, agency cost problems are less severe and/or unobservable growth opportunities are better for firms borrowing from affected banks.

We address this issue in two different ways. First, we isolate those firms whose credit history improved in the past six months, and re-run our main specification on this sub-sample

of firms. There are between 147 and 179 firm observations during the sample period where the firms also have full balance sheet information, disclose their main creditor, and report an improvement in credit history. We then re-run our main tests on the sub-samples of such firms. By doing so, we address the possibility that the distribution of firms' creditworthiness may not overlap sufficiently across treatment and control firms. The estimates reported in column (4) strongly reject the hypothesis that the reduction in credit access we reported so far is driven by systematic changes in the composition of credit history that we have somehow failed to capture. In particular, we find that even within the sample of the most creditworthy firms, those associated with a bank with a large balance sheet exposure to impaired sovereign debt are more likely to experience an improvement in credit access after the OMT announcement. In Panel A, this effect is also significant at the 1 percent statistical level.

Second, we isolate those firms that are observed at least once before and at least once after the announcement of the OMT Program. While the panel component in the SAFE is too limited to allow us to include firm fixed effects in the primary regressions, there are between 78 and 106 firms with full balance sheet information which also disclosed their main creditor, which are present at least once in each sub-period, and for which the empirical proxy for credit access changed between the pre-OMT and the post-OMT period. We can therefore run our model on this limited sub-sample of panel firms and include firm fixed effects, thereby addressing lingering concerns about omitted variable bias related to time-invariant firm characteristics that can be correlated with the demand for credit.

The point estimate from these modified versions of Model (1) and (2) are reported in column (5) of Panels (A) and (B). We continue finding a significant (at least at the 10 percent statistical level) effect of the OMT on firms with credit relationship with banks exposed to impaired sovereign debt. In both cases, the effect is if anything numerically larger than in the baseline specification. Importantly, this more restricted test confirms that variations in changes in credit access after the OMT are strongly related to creditors' funding costs even in a specification which controls for unobservable firm quality.

One remaining concern is related to selection. We are so far calculating the share of credit constrained firms out of the whole survey population. An alternative approach would be to calculate this number as the share of the population of firms with positive demand for credit. This alternative approach excludes firms that declare no demand for bank credit because they have enough internal resources. Out of the 30,040 firm observations in our final dataset, 12,914 (or about 43 percent) declare a need for bank credit, while the rest declare that they do not need bank credit because they have enough retained earnings to finance their investment and day-do-day operations. We now focus on the sub-sample of firms with a strictly positive demand for credit, and address the selection issue of them being a non-random sample of the population by employing a two-stage Heckman model. In practice, in the first stage we regress on all right-hand-side variables that we have used so far the probability that a firm will declare a positive need for credit. We include an instrument that is then excluded in the second stage, namely, a dummy variable equal to one if the firm's own outlook has improved in the past six months, and to zero if it has not. We argue that this variable should satisfy the relevance condition because a better outlook should increase the demand for funding and hence for credit, and it should satisfy the exclusion restriction as it is unlikely that the bank can observe the firm's improved outlook so quickly. We calculate the inverse Mills' ratio from the first-stage and include it in the second stage, which is now only based on 863 firm observations in Panel A and on 624 firm observations in Panel B.[27] The results from the second stage are reported in column (6), and they strongly confirm that firms with credit relationships with banks positively affected by the OMT were more likely to experience an improvement in credit access in the wake of the OMT announcement.[28]

5.4. Types of credit constraints

[27] See Ongena et al. (2013) for a more in-depth discussion in a similar context.

[28] Our main specification has the advantage of maximizing the size of the sample we work with. Nevertheless, all of the remaining results in the paper also obtain when using this specification (results available upon request).

Our main proxy for credit access so far is a dummy variable equal to 1 if the firm is rejected, quantity rationed, price rationed, or discouraged from applying. This approach is common to the literature that uses survey data to study credit access (Jappelli, 1990; Cox and Japelli, 1993; Duca and Rosenthal, 1993; Popov and Udell, 2012; Ongena et al., 2013; Ferrando and Mulier, 2015), and it captures both *formal* and *informal* credit constraints. Nevertheless, the components of this proxy are important in their own right. The empirical literature on the bank lending channel based on evidence from credit registries (e.g., Jimenez et al., 2012; Ioannidou et al., 2015) relies exclusively on empirical proxies for whether the firm's credit application has been accepted or denied by its bank. Alternatively, recent evidence lends support to the notion that in some countries, informal credit constraints can be more prevalent than formal ones (Brown et al., 2011), and that in general such constraints can vary systematically across countries in a way which can yield biased results (Popov, 2016). The theoretical literature has also drawn a distinction between the adjustment of credit supply in the quantity and in the price dimension, whereby credit rationing emerges in equilibrium in the presence of information asymmetries between borrowers and lenders which prevent interest rates from equilibrating the market (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981).

To study empirically this distinction, we split the *Credit constrained* variable into its four components, i.e., into four separate dummy variables: *Loan application denied*; *Rationed*; *High cost*; and *Discouraged from applying* (using the same definitions for each as before). Table 5 reports the estimates from these alternative models, and once again we report the estimates of Model (1) and Model (2) in separate panels. We find that the bulk of the decline in overall credit constraints for firms borrowing from affected banks is due to a decline in loan denial rates (column (1)) and in price rationing (column (3)), whereby the effect of the OMT announcement is negative in both empirical specifications. We also find evidence for a decline in the share of firms that were offered a loan smaller than 75 percent of the amount they asked for (column (2) of Panel B), as well as evidence that the share of firms that refrain from filing a credit application because they fear a rejection declined, too (column (4) of Panel A). However, these two effects are significant in only one of the empirical specifications. Nevertheless, the

most sizeable result is the decline in discouragement rates (column (4) of Panel A), suggesting that some firms borrowing from weak banks may have indeed refrained from asking for credit before the OMT announcement in order to avoid generating a negative credit history. This underscores the importance of considering informally constrained firms in studying the evolution of credit constraints, as well as one of the main advantages of using survey data relative to credit registries that do not contain information on informal constraints.

5.5. Loan terms

We now turn to the firms' answers regarding terms on granted loans. In particular, firms are asked whether in the past six months, their main bank increased, decreased, or kept unchanged the following loan terms: the level of interest rates; the size of the loan; the maturity of the loan; and the collateral requirements. Studying the evolution of loan terms can give us additional information on how firms benefit from unconventional monetary policy, i.e., not only through improved loan availability, but also through better loan terms.

For each of these four categories of loan terms, we create a separate dummy variable equal to 1 if the bank increased the particular loan term, and to zero if the bank decreased it or kept it unchanged. Then we re-run Models (1) and (2)—with country-sector-time and bank fixed effects and firm-specific covariates—where the dependent variable is, in turn, the probability that each of the four loan terms has been increased by the firm's bank in the past six months. We report the estimates from these tests in Panel A and Panel B of Table 6.

We find strong evidence that the OMT announcement affected not just access to finance in general, but also the terms on loans extended by banks that experienced a positive shock to their funding as a result of the OMT-driven decline in sovereign bond yields. In particular, we find that in an environment of rising interest rates, firms whose credit relationship was with banks that had a substantial balance sheet exposure to impaired sovereign debt were less likely to report an increase in the interest rates on loans offered by their main bank (column (1)). We also find that the average size of offered loans increased (column (2)), and that the average

maturity of offered loans increased as well (column (3)), although in the former case, the evidence in Panel B goes in the opposite direction. Finally, there was no effect on the collateral requirements applied by banks on granted loans (column (4)). Our findings thus suggest that the announcement of the OMT Program not only made it less likely that firms would have no access to bank credit, but it also led to an improvement in the terms of bank credit. Allowing firms to take larger loans with longer maturities at the same or lower rates is consistent with predictions in the literature that improved access to finance should have a materially positive impact on the ability of firms to fund their investment projects, with potentially significant positive real effects on overall business investment and employment (e.g., Campello et al., 2010; Chodorow-Reich, 2014).[29] However, our result is not consistent with some papers like Kahle and Stulz (2013) that find that during the crisis capital expenditures of small, bank-dependent firms did not decrease more than for otherwise comparable firms. But, there is a very important difference between the firms we study and the firms identified as "small, bank-dependent firms" in Kahle and Stulz (2013). Our firms are nearly entirely composed of SMEs while the sample of small, bank-dependent firms in Kahle and Stulz are considerably larger than our SMEs and are not "small" based on international criteria used to define SMEs.[30]

5.6. Expectations about future funding

We have so far shown that by reducing the underlying riskiness of a particular asset class—sovereign debt issued by a number of fiscally stressed countries—the announcement of

[29] See Kahle and Stulz (2013) for a discussion of this literature.

[30] Kahle and Stulz (2013) do not provide summary statistics on the size of the firms used to define their "small, bank dependent" firms. However, they use as their definition the firm size associated with the bottom quintile of firms quoted on the NYSE. Moreover, their data come from Compustat which is comprised of firms that issue registered securities (i.e., traded securities) in the U.S. none of which are likely "small" firms and the vast majority would not be considered mid-sized firms based on the European Commission's size category definitions (e.g., less than 50 employees for small businesses and less than 250 employees for midsized businesses). This labeling inconsistency reflects a broader issue in the corporate finance literature where the term "small firm" is often used to describe firms with very different size characteristic and potentially very different channels through which they access finance.

the ECB's OMT program improved credit access for small business firms with credit relationships with banks that had a substantial exposure to this asset class. We have also shown that such SMEs benefited from better terms on business loans.

There is another channel through which monetary policy can affect the real sector—changes in expectations about future economic conditions. During normal times, changes in current interest rates reflect changing expectations about future interest rates. This can also lead firms to adjust their expectations about future business prospects which can also have a material impact on their investment decisions. Unconventional monetary policy can have a similar effect if its introduction signals a regime shift in the Central Bank's stance and a strengthened willingness to adopt unconventional tools in the future.[31] The OMT Program was an example of one such tool employed by the ECB. Its announcement followed a number of measures that were deemed inadequate by markets which were clamouring for something much more powerful—a "big bazooka"—throughout the sovereign debt crisis.

We now turn to evaluating how the OMT announcement affected firms' expectations about future access to finance. It is possible that the announcement affected positively the population of firms by improving all firms' confidence in the future business environment. If so, then the OMT may have affected firms' expectations about future funding coming from a range of external sources, not only from banks. Alternatively, if firms that were borrowing from unaffected banks during the crisis were already facing sufficiently beneficial credit conditions before the OMT, the OMT may have affected positively the expectations of those firms only that were borrowing from constrained banks. While our identification strategy does not allow us to evaluate the former proposition, it allows us to test for a differentially stronger change in expectations by firms with credit relationships with affected banks.

[31] In the same spirit Gertler and Karadi (2011) offer a model in which both current and expected unconventional policies influence both current and expected lending decisions of banks and borrowing decisions of firms.

The SAFE survey contains questions on firms' expectations about how the availability of a number of sources of external finance will change in the next six months.[32] These external sources are: bank loans; credit lines; trade credit; equity; and debt securities. We construct five dummy variables equal to 1 if a particular firm expects that a particular source of external funds will improve in the next six months and to 0 if the firm expects it to deteriorate or remain unchanged. We then rerun Models (1) and (2) using each of these five dummies as the dependent variable.

The point estimates from these regressions are reported in Table 7. We find that firms with a credit relationship with banks that arguably benefited relatively more—in terms of funding cost—from the OMT announcement are considerably more likely to expect that the availability of bank loans will further improve in the future (column (1)). This is true both in the case of Model (1), reported in Panel B, where the effect is significant at the 1 percent statistical level, and in the case of Model (2), reported in Panel B, where the effect is significant at the 15 percent statistical level. Moreover, in Panel A, the effect is numerically almost four times larger than the actual improvement in credit access by treated firms which we registered for the same population in column (2) of Table 2.

We also find that firms' expectations about future funding are not affected on any other dimension: firms with a credit relationship with banks benefiting from the OMT announcement are not more likely than firms with a credit relationship with other banks to expect an improvement in the availability of credit lines, trade credit, or equity. In column (5) of Panel B, we find that firms associated with banks positively affected by the OMT were less likely to expect an improvement in the availability of debt securities, but this test is based on only 125 observations. Our results thus suggest that unconventional monetary policy does affect the expectations of future access to finance of firms that are currently benefiting from improved

[32] Berger, Bouwman, and Kim (2016) have used a similar question about firm expectations about future access to finance in the National Federation of Independent Businesses' Small Business Economic Trends Survey in the U.S.

access to bank credit, but only in the dimension of a further improvement in the availability of *de novo* credit. We conclude that for a sub-class of firms associated with banks that arguably experienced a reduction in funding costs thanks to the OMT, unconventional monetary policy ended up not only improving current credit access, but also raising expectations about future credit access, with potential material consequences for firms' investment.

6. Conclusion

In this paper, we examine the impact of one particular unconventional monetary policy tool on small firms' access to finance. In particular, we investigate whether firms whose creditor had a substantial exposure to impaired sovereign debt benefited relatively more—in terms of the probability of being credit constrained—from the announcement in August and September 2012 of the ECB's intention to purchase an unlimited amount of impaired sovereign bonds (the OMT Program), relative to similar firms borrowing from an unaffected creditor. We also study whether by reducing the riskiness of a group of banks, unconventional monetary policy improved credit access by leading banks to offer more beneficial terms on granted loans. Finally, we examine the adjustment in affected firms' expectations of the availability of future funding. We do so for a sample of 2,628 SMEs in eight euro area countries, using a restricted access dataset containing rich balance sheet information for individual firms, as well as information on the identity of their main creditor.

We find that the announcement of the OMT Program resulted in a strong short-term (six months) and medium-term (one-year) improvement in access to credit by firms borrowing from banks with substantial balance sheet exposures to impaired sovereign debt. Relative to similar firms borrowing from unaffected banks, such firms became less likely to be denied credit, to be price rationed, and to refrain from applying for a bank loan for fear of a rejection. We also find that for such firms, the terms on offered loans improved. In particular, interest rates were less likely to increase, average loan size increased, and average loan maturity lengthened. Finally, we find that such firms were more likely to expect that the availability of bank loans would further improve in the immediate future. Our paper thus contributes to the small emerging

literature on the real effects of unconventional monetary policy tools enacted in recent years by Central Banks by providing the first piece of evidence on the impact of unconventional monetary policy on small businesses' credit access.

Our results imply that unorthodox monetary policy can lead to an improvement in credit access by reducing the riskiness of a class of assets that weighs heavily on some banks' balance sheets. While an important first step in studying the effect of monetary policy on the real economy, data limitations prevent us from studying whether the effect we uncover in the data extends to firms' decisions such as capital investment or employment.[33] Another important question is how to design policies which ensure that bank credit supports the Schumpeterian creative destruction during recessions whereby the allocation of credit in the economy ensures that efficient start-ups replace inefficient incumbents. Future research can greatly benefit from exploring these promising avenues.

[33] See, e.g., Acharya et al. (2015a), Acharya et al. (2016), Balduzzi et al. (2015), and Kalemli-Ozcan et al. (2015) for evidence on firms' investment decisions during the sovereign debt crisis.

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Table 1. Summary statistics

Variable	Observations	Mean	St. dev.	Min	Max
Access to finance					
Credit constrained	30,040	0.163	0.369	0	1
Loan application denied	30,040	0.040	0.196	0	1
Rationed	30,040	0.041	0.208	0	1
High cost	30,040	0.008	0.089	0	1
Discouraged from applying	30,040	0.082	0.279	0	1
Interest rate	10,010	0.491	0.500	0	1
Loan size	9,947	0.176	0.381	0	1
Maturity	9,674	0.079	0.270	0	1
Collateral requirements	9,928	0.390	0.488	0	1
Expectations about future availability					
Bank loans	23,209	0.154	0.361	0	1
Credit lines	23,196	0.131	0.338	0	1
Trade credit	18,174	0.108	0.310	0	1
Equity	7,047	0.097	0.295	0	1
Debt securities	4,816	0.060	0.237	0	1
Firm characteristics					
Main bank's sovereign bonds / Assets	2,628	6.210	4.478	0.007	20.597
Main bank's stressed bonds / Assets	2,122	2.068	3.372	0.001	13.469
Stressed	30,040	0.466	0.499	0	1
Stand-alone firm	30,020	0.874	0.332	0	1
Individual- or family-owned	30,016	0.813	0.390	0	1
Size_1	30,040	0.338	0.473	0	1
Size_2	30,040	0.340	0.474	0	1
Size_3	30,040	0.249	0.432	0	1
Size_4	30,040	0.073	0.260	0	1
Age_1	28,605	0.013	0.115	0	1
Age_2	28,605	0.057	0.232	0	1
Age_3	28,605	0.129	0.335	0	1
Age_4	28,605	0.800	0.400	0	1
Turnover_1	29,481	0.491	0.500	0	1
Turnover_2	29,481	0.262	0.440	0	1
Turnover_3	29,481	0.171	0.377	0	1
Turnover_4	29,481	0.075	0.264	0	1
Own outlook better	28,479	0.185	0.388	0	1
Capital better	29,667	0.251	0.434	0	1
Credit history better	28,723	0.219	0.413	0	1

Note: This table presents weighted summary statistics for the variables used in the empirical tests. The weights restore the proportions of the economic weight (in terms of number of employees) of each size class, economic activity and country and are applied to the variables derived from the survey. 'Credit constrained' is a dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 6 months, but it was discouraged from applying because it expected to be rejected, or it applied but its loan application was denied, or it applied and got less than 75% of the requested amount, or it refused the loan because the cost was too high. 'Loan application denied' is a dummy equal to 1 if in the past 6 months the firm applied for a loan but the

application was denied. 'Rationed' is a dummy equal to 1 if in the past 6 months the firm applied for a loan and received less than 75% of the requested amount. 'High cost' is a dummy equal to 1 if in the past 6 months the firm applied for a loan but refused the loan offer due to its high cost. 'Discouraged from applying' is a dummy equal to 1 if in the past 6 months the firm did not apply for a loan because it expected its credit application to be denied. 'Interest rate' is a dummy variable equal to one if in the past six months the firm's bank increased the interest rate on new business loans. 'Loan size' is a dummy variable equal to one if in the past six months the firm's bank increased the size of new business loans. 'Maturity' is a dummy variable equal to one if in the past six months the firm's bank increased the maturity of new business loans. 'Collateral requirements' is a dummy variable equal to one if in the past six months the firm's bank increased the collateral requirements on new business loans. 'Bank loans' is a dummy variable equal to one if the firm expects that the availability of bank loans will improve in the next six months. 'Credit lines' is a dummy variable equal to one if the firm expects that the availability of bank credit lines will improve in the next six months. 'Trade credit' is a dummy variable equal to one if the firm expects that the availability of trade credit will improve in the next six months. 'Equity' is a dummy variable equal to one if the firm expects that the availability of equity will improve in the next six months. 'Debt securities' is a dummy variable equal to one if the firm expects that the availability of debt securities will improve in the next six months. 'Main bank's sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Stand-alone firm' is a dummy variable equal to 1 if the firm is an autonomous profit-oriented enterprise. 'Individual- or family-owned' is a dummy variable equal to 1 if the firm's owner is an individual or a family. 'Listed' is a dummy variable equal to 1 if the firm is listed on the stock market. 'Size_1' is a dummy variable equal to 1 if the firm has between 1 and 9 employees. 'Size_2' is a dummy variable equal to 1 if the firm has between 10 and 49 employees. 'Size_3' is a dummy variable equal to 1 if the firm has between 50 and 249 employees. 'Size_4' is a dummy variable equal to 1 if the firm has 250+ employees. 'Age_1' is a dummy variable equal to 1 if the firm is less than 2 years old. 'Age_2' is a dummy variable equal to 1 if the firm is between 2 and 5 years old. 'Age_3' is a dummy variable equal to 1 if the firm is between 5 and 10 years old. 'Age_4' is a dummy variable equal to 1 if the firm is 10+ years old. 'Turnover_1' is a dummy variable equal to 1 if the firm's annual turnover is less than €2 mln. 'Turnover_2' is a dummy variable equal to 1 if the firm's annual turnover is between €2 mln. and €5 mln. 'Turnover_3' is a dummy variable equal to 1 if the firm's annual turnover is between €5 mln. and €10 mln. 'Turnover_4' is a dummy variable equal to 1 if the firm's annual turnover is €10+ mln. 'Own outlook better' is a dummy variable equal to 1 if the firm's own outlook improved in the past 6 months. 'Capital better' is a dummy variable equal to 1 if the firm's capital improved in the past 6 months. 'Credit history better' is a dummy variable equal to 1 if the firm's credit history improved in the past 6 months.

Table 2. Unconventional monetary policy and credit access: Main test

	Credit constrained			
	Bankscope data on sovereign exposures		EBA data on stressed exposures	
	(1)	(2)	(3)	(4)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.020***	-0.011***		
	(0.005)	(0.003)		
Main bank's sovereign bonds / Assets × Stressed	0.068***	0.068***		
	(0.013)	(0.004)		
Main bank's sovereign bonds / Assets × Post	0.015***	0.007***		
	(0.004)	(0.002)		
Main bank's stressed bonds / Assets × Post			-0.030***	-0.035***
			(0.012)	(0.010)
Stand-alone firm		0.078***		0.085***
		(0.026)		(0.030)
Individual- or family-owned		0.030		0.007
		(0.030)		(0.034)
Size_1		0.021		0.041
		(0.084)		(0.073)
Size_2		-0.015		0.004
		(0.034)		(0.021)
Size_4		0.044		0.036
		(0.041)		(0.051)
Age_1		0.595***		0.641***
		(0.041)		(0.029)
Age_2		-0.103*		-0.067
		(0.036)		(0.053)
Age_4		0.058***		0.092***
		(0.014)		(0.017)
Turnover_1		0.049		0.038
		(0.093)		(0.049)
Turnover_2		0.006		-0.030
		(0.043)		(0.019)
Turnover_4		-0.133***		-0.142***
		(0.030)		(0.023)
Capital better		-0.057**		-0.090***
		(0.023)		(0.0101)
Credit history better		-0.052**		-0.015
		(0.027)		(0.020)
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	2,144	2,016	1,592	1,499
R-squared	0.14	0.19	0.09	0.15

Note: This table presents difference-in-difference-in-differences estimates of access to bank credit in the past 6 months. The estimation period is 1st October 2011 – 30th September 2013. 'Credit constrained' is a dummy variable equal to 1 if in the past 6 months the firm was denied credit, quantity rationed, price rationed, or discouraged from applying. 'Main bank's sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Post' is a dummy variable equal to 0 if

the time period is between 1st October 2011 and 30th September 2012 (waves 6–7), and to 1 if the time period is between 1st October 2012 and 30th September 2013 (waves 8–9). 'Stand-alone firm' is a dummy variable equal to 1 if the firm is an autonomous profit-oriented enterprise. 'Individual- or family-owned' is a dummy variable equal to 1 if the firm's owner is an individual or a family. 'Listed' is a dummy variable equal to 1 if the firm is listed on the stock market. 'Size_1' is a dummy variable equal to 1 if the firm has between 1 and 9 employees. 'Size_2' is a dummy variable equal to 1 if the firm has between 10 and 49 employees. 'Size_4' is a dummy variable equal to 1 if the firm has 250+ employees. 'Age_1' is a dummy variable equal to 1 if the firm is less than 2 years old. 'Age_2' is a dummy variable equal to 1 if the firm is between 2 and 5 years old. 'Age_4' is a dummy variable equal to 1 if the firm is 10+ years old. 'Turnover_1' is a dummy variable equal to 1 if the firm's annual turnover is less than €2 mln. 'Turnover_2' is a dummy variable equal to 1 if the firm's annual turnover is between €2 mln. and €5 mln. 'Turnover_4' is a dummy variable equal to 1 if the firm's annual turnover is €10+ mln. 'Outlook better' is a dummy variable equal to 1 if the firm's outlook, with respect to sales, profitability, and business plan, improved in the past 6 months. 'Capital better' is a dummy variable equal to 1 if the firm's capital improved in the past 6 months. 'Credit history better' is a dummy variable equal to 1 if the firm's credit history improved in the past 6 months. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 3. Unconventional monetary policy and credit access: Falsification tests

	Credit constrained: Pre-trend, two waves	
	Bankscope data on sovereign exposures	EBA data on stressed exposures
	(1)	(2)
Main bank's sovereign bonds / Assets × Stressed × Post	0.018	
	(0.035)	
Main bank's stressed bonds / Assets × Post		0.010
		(0.048)
Firm-specific controls	Yes	Yes
Country × Industry × Time FEs	Yes	Yes
Bank FE	Yes	Yes
No. Observations	513	318
R-squared	0.26	0.01

Note: This table presents difference-in-difference-in-differences estimates of access to bank credit in the past 6 months. The estimation period is 1st October 2011 – 30th September 2012. 'Credit constrained' is a dummy variable equal to 1 if in the past 6 months the firm was denied credit, quantity rationed, price rationed, or discouraged from applying. 'Main bank's Sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Post' is a dummy variable equal to 0 if the time period is between 1st October 2011 – 31st March 2012 (wave 6), and to 1 if the time period is between 1st April 2012 – 30th September 2012 (wave 7). All other firm-specific control variables from column (2) of Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4. Unconventional monetary policy and credit access: Robustness tests

Panel A. Bankscope data on sovereign exposures

	Short run	Firm balance sheet shocks	Excluding Greece	Most creditworthy firms	Panel firms	Heckman correction
	(1)	(2)	(3)	(4)	(5)	(6)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.060***	-0.020***	-0.011***	-0.019***	-0.041*	-0.053***
	(0.007)	(0.007)	(0.003)	(0.001)	(0.023)	(0.005)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls × Stressed × Post	No	Yes	No	No	No	No
Country × Industry × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	No	Yes
Firm FE	No	No	No	No	Yes	No
No. Observations	825	2,016	1,714	179	213	863
R-squared	0.20	0.24	0.20	0.31	0.33	0.31

Panel B. EBA data on stressed exposures

	Short run	Firm balance sheet shocks	Excluding Greece	Most creditworthy firms	Panel firms	Heckman correction
	(1)	(2)	(3)	(4)	(5)	(6)
Main bank's stressed bonds / Assets × Post	-0.021*	-0.039***	-0.030**	-0.050	-0.299**	-0.045*
	(0.012)	(0.006)	(0.015)	(0.164)	(0.135)	(0.030)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls × Post	No	Yes	No	No	No	No
Country × Industry × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	No	Yes
Firm FE	No	No	No	No	Yes	No
No. Observations	587	1,425	1,133	147	156	624
R-squared	0.16	0.20	0.18	0.26	0.52	0.29

Note: This table presents difference-in-difference-in-differences estimates of access to bank credit in the past 6 months. The estimation period is 1st April 2012 – 31st March 2013 (column (1)) and 1st October 2011 – 30th September 2013 (columns (2)–(6)). In column (3), all firms domiciled in Greece are excluded from the analysis. In column (4), only the firms whose own credit history improved in the past 6 months are included in the regression. In column (5), only firms observed at least once before the OMT announcement and at least once after the OMT announcement are used. In column (6), a two-stage Heckman correction procedure is applied which incorporates information from non-applicant firms. 'Credit constrained' is a dummy variable equal to 1 if in the past 6

months the firm was denied credit, quantity rationed, price rationed, or discouraged from applying. In Panel A, 'Main bank's Sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. In Panel B, 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. In column (1), 'Post' is a dummy variable equal to 0 if the time period is between 1st April 2012 and 30th September 2012 (wave 7), and to 1 if the time period is between 1st October 2012 and 31st March 2013 (wave 8). In columns (2)–(6), 'Post' is a dummy variable equal to 0 if the time period is between 1st October 2011 and 30th September 2012 (waves 6–7), and to 1 if the time period is between 1st October 2012 and 30th September 2013 (waves 8–9). All other firm-specific control variables from column (2) of Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5. Unconventional monetary policy and credit access: Types of credit constraints

Panel A. Bankscope data on sovereign exposures

	Loan application denied	Rationed	High cost	Discouraged from applying
	(1)	(2)	(3)	(4)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.002*	-0.001	-0.007***	-0.024**
	(0.001)	(0.003)	(0.002)	(0.012)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	1,360	1,426	1,325	1,737
R-squared	0.31	0.19	0.23	0.24

Panel B. EBA data on stressed exposures

	Loan application denied	Rationed	High cost	Discouraged from applying
	(1)	(2)	(3)	(4)
Main bank's stressed bonds / Assets × Post	-0.003**	-0.019***	-0.007***	-0.007
	(0.002)	(0.001)	(0.001)	(0.008)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	1,062	1,069	307	1,340
R-squared	0.28	0.17	0.20	0.25

Note: This table presents difference-in-difference-in-differences estimates of loan terms in the past 6 months. The estimation period is 1st October 2011 – 30th September 2013. 'Loan application denied' is a dummy equal to 1 if in the past 6 months the firm applied for a loan but the application was denied. 'Rationed' is a dummy equal to 1 if in the past 6 months the firm applied for a loan and received less than 75% of the requested amount. 'High cost' is a dummy equal to 1 if in the past 6 months the firm applied for a loan but refused the loan offer due to its high cost. 'Discouraged from applying' is a dummy equal to 1 if in the past 6 months the firm did not apply for a loan because it expected its credit application to be denied. In Panel A, 'Main bank's Sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. In Panel B, 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Post' is a dummy variable equal to 0 if the time period is between 1st October 2011 and 30th September 2012 (waves 6–7), and to 1 if the time period is between 1st October 2012 and 30th September 2013 (waves 8–9). All other firm-specific control variables from column (2) of Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6. Unconventional monetary policy and credit access: Loan terms

Panel A. Bankscope data on sovereign exposures

	Interest rate	Loan size	Maturity	Collateral requirements
	(1)	(2)	(3)	(4)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.524***	0.107***	0.033***	-0.030
	(0.041)	(0.030)	(0.007)	(0.029)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	712	634	440	800
R-squared	0.45	0.31	0.46	0.24

Panel B. EBA data on stressed exposures

	Interest rate	Loan size	Maturity	Collateral requirements
	(1)	(2)	(3)	(4)
Main bank's stressed bonds / Assets × Post	-0.052***	-0.057**	-0.039	-0.077
	(0.013)	(0.019)	(0.047)	(0.059)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	522	470	355	588
R-squared	0.39	0.30	0.06	0.22

Note: This table presents difference-in-difference-in-differences estimates of loan terms in the past 6 months. The estimation period is 1st October 2011 – 30th September 2013. 'Interest rate' is a dummy variable equal to one if in the past six months the firm's bank increased its rates on new business loans. 'Loan size' is a dummy variable equal to one if in the past six months the firm's bank increased the size of new business loans. 'Maturity' is a dummy variable equal to one if in the past six months the firm's bank increased the maturity of new business loans. 'Collateral requirements' is a dummy variable equal to one if in the past six months the firm's bank increased the collateral requirements on new business loans. In Panel A, 'Main bank's Sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. In Panel B, 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Post' is a dummy variable equal to 0 if the time period is between 1st October 2011 and 30th September 2012 (waves 6–7), and to 1 if the time period is between 1st October 2012 and 30th September 2013 (waves 8–9). All other firm-specific control variables from column (2) of Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7. Unconventional monetary policy and credit access: Expectations about future financing

Panel A. Bankscope data on sovereign exposures

	Bank loans	Credit lines	Trade credit	Equity	Debt securities
	(1)	(2)	(3)	(4)	(5)
Main bank's sovereign bonds / Assets × Stressed × Post	0.042***	0.016	0.180	0.007	0.111
	(0.015)	(0.013)	(0.177)	(0.046)	(0.096)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
No. Observations	1,682	1,359	1,343	295	127
R-squared	0.19	0.24	0.23	0.01	0.42

Panel B. EBA data on stressed exposures

	Bank loans	Credit lines	Trade credit	Equity	Debt securities
	(1)	(2)	(3)	(4)	(5)
Main bank's stressed bonds / Assets × Post	0.018	-0.006	0.022	-0.012	-0.361***
	(0.013)	(0.014)	(0.017)	(0.050)	(0.146)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
No. Observations	1,274	1,008	1,087	290	125
R-squared	0.16	0.22	0.21	0.02	0.49

Note: This table presents difference-in-difference-in-differences estimates of firms' expectations of the availability of future funding sources. The estimation period is 1st October 2011 – 30th September 2013. 'Bank loans' is a dummy variable equal to one if the firm expects that the availability of bank loans will improve in the next six months. 'Credit lines' is a dummy variable equal to one if the firm expects that the availability of bank credit lines will improve in the next six months. 'Trade credit' is a dummy variable equal to one if the firm expects that the availability of trade credit will improve in the next six months. 'Equity' is a dummy variable equal to one if the firm expects that the availability of equity will improve in the next six months. 'Debt securities' is a dummy variable equal to one if the firm expects that the availability of debt securities will improve in the next six months. In Panel A, 'Main bank's Sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. In Panel B, 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Post' is a dummy variable equal to 0 if the time period is between 1st October 2011 and 30th September 2012 (waves 6–7), and to 1 if the time period is between 1st October 2012 and 30th September 2013 (waves 8–9). All other firm-specific control variables from column (2) of Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Appendix Table 1. Unconventional monetary policy and credit access: Short-run effect

	Credit constrained	
	Bankscope data on sovereign exposures	EBA data on stressed exposures
	(1)	(2)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.060***	
	(0.007)	
Main bank's sovereign bonds / Assets × Stressed	0.155***	
	(0.004)	
Main bank's sovereign bonds / Assets × Post	0.037***	
	(0.003)	
Main bank's stressed bonds / Assets × Post		-0.021*
		(0.012)
Firm-specific controls	Yes	Yes
Country × Industry × Time FEs	Yes	Yes
Bank FE	Yes	Yes
No. Observations	825	587
R-squared	0.20	0.16

Note: This table presents difference-in-difference-in-differences estimates of access to bank credit in the past 6 months. The estimation period is 1st April 2012 – 31st March 2013. 'Credit constrained' is a dummy variable equal to 1 if in the past 6 months the firm was denied credit, quantity rationed, price rationed, or discouraged from applying. 'Main bank's sovereign bonds / Assets' is the ratio of sovereign bond holdings to total assets of the firm's main bank, in percentage points. 'Main bank's stressed bonds / Assets' is the ratio of holdings of sovereign bonds issued by Greece, Ireland, Italy, Portugal, and Spain to total assets of the firm's main bank, in percentage points. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Portugal, or Spain, and to 0 if the firm is domiciled in Austria, France, Germany, or the Netherlands. 'Post' is a dummy variable equal to 0 if the time period is between 1st April 2012 and 30th September 2012 (wave 7), and to 1 if the time period is between 1st October 2012 and 31st March 2013 (wave 8). All other firm-specific control variables from column (2) of Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.