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 lengthening of loan maturities. Unconventional monetary policy has a positive impact on firms' investment and profitability, while its effect on firm innovation is weaker.

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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 micro-level data on 2,628 SMEs from the ECB's "Survey on the Access to Finance of Enterprises" (SAFE) and information about their banking relationships to evaluate the impact of the OMT announcement on Eurozone small business credit access. Specifically, we take advantage of 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 faith in the banking sectors

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[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. (2016), Krishnamurthy et al. (2018), 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

of the 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, particularly with respect to small and medium enterprises (SMEs) which are heavily dependent on bank credit.[6,7]

Our paper is the first to study whether and how unconventional monetary policy during the sovereign debt crisis affected small business credit access. We do so on 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 including interest rates, loan amounts, and loan maturities. Third, we study changes in financial and real outcomes, such as profitability and the propensity to innovate. Identification rests on comparing credit access for identical firms borrowing from banks with different degrees of pre-OMT-announcement exposures to impaired sovereign debt.

Our findings are fourfold. First, we find that after the announcement of the OMT Program, banks with larger balance sheet exposures to impaired sovereign bonds experienced a greater improvement in their financial health, as measured by a faster increase in share prices and a faster decline in CDS spreads. Second, relative to otherwise similar firms, firms borrowing from banks with larger balance sheet exposures to impaired sovereign bonds became considerably less likely to be credit constrained in the six months to one year after the OMT

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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 (2016), Albertazzi et al. (2014), Balduzzi et al. (2018), Bedendo and Colla (2015), Bofondi et al. (2018), Correa et al. (2017), 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., 2016), 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] 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. This argument extends to the U.S., too, where SMEs account for roughly half of the labor force (Stangler and Litan, 2009).

announcement. This improved credit access is due to lower credit denial rates, to a decline in the share of firms that refuse a loan due to high cost, and to a decline in discouraged loan applications. Third, we find that after the OMT announcement, small firms immediately experienced an improvement in loan terms, as reflected in declining loan rates and increasing 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 under more advantageous terms, reducing the overall cost to firms of financing investment projects. And, fourth, in terms of "real effects", while we find that profitability and investment increased for firms that benefited from improved access to finance, we do not find strong evidence that the post-OMT improvement in access to finance translated into significant innovation by small firms.

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 measure exposure by distinguishing between banks located in stressed versus non-stressed countries. 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.

We go to great lengths to control for demand effects in order to identify the causal impact of the OMT announcement through the bank credit supply channel. 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 (e.g., sovereign risk or the perception that the euro itself will survive), and 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). This 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. Strengthening this point, we find that access to finance did not improve for firms that did not experience an increase in profitability. 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.

Because we focus on the effect of the OMT Program, our paper is related to research 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 to avoid the criticism in this literature that aggregate data is not up to the task (e.g., Kashyap et al., 1996). Our paper contributes to both 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., 2015a; 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; Heider et al., 2018) 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 SMEs 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 also builds on a rapidly growing literature on how shocks to lenders affect firm access to finance. The key challenge in this literature is distinguishing between supply and demand effects. One research strategy is to exploit natural experiments (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)—a strategy, however, that can only be applied to firms that have access to public debt markets. Some papers 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 alternative is 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. This approach has been particularly helpful in identifying the effects of the twin crises in Europe (e.g., Popov and Udell, 2012; Presbitero et al., 2014; Pigini et al., 2016; Ferrando et al., 2017; Beck et al., 2018). However, ours is the first paper to use survey data to study the effect of unconventional monetary policy on SME access to finance.

Another contribution of the paper is that in our analysis of the OMT Program, we look at access to finance on both the quantity and price dimensions. 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 one of the first papers to examine the real effect of monetary policy on

[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).

SMEs. Our dataset, which contains proxies for firm profitability and innovation, allows us to study the impact of unconventional monetary policy on firm performance, for a representative sample of the population rather just for large listed firms as in Acharya et al. (2016).

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

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

Erupting in 2010, the sovereign debt crisis prompted government and central bank interventions comparable in scale to those implemented during the financial crisis of 2008–09. As we discuss in Section 4, over the course of 2010–2012, yields on sovereign bonds issued by Italy and Spain hit record levels and those of Greece, Ireland, and Portugal reached levels that made their overall stock of debt unserviceable. On the fiscal side this led to the establishment of the €440 billion European Financial Stability Facility (EFSF) in May 2010 to provide financial assistance to euro area states, a commitment that was later boosted to around €1 trillion.

On the monetary policy side, 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 an increase 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.[10]

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 bond markets (the OMT Program), aimed at safeguarding an appropriate monetary policy transmission and the singleness of monetary policy. It set a number of conditions the technical

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

[10] 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.

details of which 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). Importantly, the ECB set no ex ante quantitative limits on the amount that could be purchased through the OMT Program. However, the potential impact on the money supply would be neutralized by selling a comparable amount of other securities. The Program would run until the country regained market access and could once again fund itself normally in bond markets.

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 flowed back into stressed countries such as Italy and Spain, and government bond yields had returned to pre-crisis levels (Altavilla et al., 2016).

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

Theory has emphasized both the role of borrower balance sheets (e.g., Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Bernanke et al., 1996), and lender balance sheets (e.g., Bernanke and Blinder, 1992; Kashyap et al., 1993). Under the former, expansionary monetary policy can strengthen firm balance sheets by increasing cash flow and increasing collateral values. Under the latter, monetary policy regulates the pool of funds available to bank-dependent borrowers. 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).

We expect the main effect of the OMT to operate through a strengthening of the balance sheets of banks that hold 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 perceive exposed banks as less risky thereby

reducing their funding costs. Indeed, there is abundant evidence that the OMT announcement had such an effect. For example, Acharya et al. (2015b) show that U.S. money market funds became more willing to provide unsecured funding to European banks after the OMT announcement and Szczerbowicz (2015) shows that the OMT announcement reduced sovereign market tensions and lowered long-term euro area bank funding costs. Second, the eligibility of sovereign bonds as collateral in wholesale funding will increase. And, finally, as yields on sovereign debt decline, the sovereign's ability to support the domestic banking sector increases—an effect that should be stronger for banks that were at a higher risk before the policy's announcement.

This forms the main hypothesis that we test in our paper. That is, we test the hypothesis that bank funding costs after the OMT go down relatively more for banks with large balance sheet exposures to risky sovereign debt and that SMEs with credit relationships with these banks benefit from improved lending conditions. While we acknowledge that we cannot distinguish among the above 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 consumer confidence.[11]

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 starting in 2009 just after the financial crisis 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 when the sovereign debt crisis unfolded (wave 3, from 1st April until 30th September, 2010); the period of the sovereign debt crisis itself (waves 4, 5, 6, and 7, from 1st October 2010 until 30th September 2012); and the period after the OMT

[11] This is closely related to the distinction 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 (e.g., Kahle and Stulz, 2013).

Program announcement (waves 8 and on, from 1st October 2012).[12] This firm-level SME survey contains information on each respondent firm's characteristics and on its assessment of recent short-term developments regarding its financing including information on its financing needs and its access to finance.[13] The sample contains only non-financial firms and excludes firms in agriculture, public administration, and financial services.[14]

We merge the SAFE with two datasets containing information on bank exposure to sovereign debt, Bankscope and the EBA stress tests, and with the Bureau van Dijk's Amadeus dataset to identify bank-firm credit relationships. We manually match bank names to information from the EBA stress tests on 65 participating banks. 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][16]

In our analysis, we use the four waves around the announcement of the OMT Program, waves 6 and 7 (pre-OMT)[17] and waves 8 and 9 (post-OMT), for a total of 2,628 possible

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[12] 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.

[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 also provides sampling weights that adjust the sample to be representative of the frame from which the sample was drawn. All empirical tests in the paper use the sampling weights to 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.

[16] To identify bank-firm relationships, we use the variable "BANKER", available through a merge with Bureau van Dijk's Amadeus dataset and information in it acquired from the Kompass dataset. Following Kalemli-Ozcan, Laeven, and Moreno (2015), we use OpenRefine and Reconcile-CSV to match bank names to a bank's BvD ID number.

[17] Because the OMT announcement falls during wave 7, in later robustness tests we exclude this wave from the analysis.

observations on firms that reported at least one bank credit relationship. Most firms are interviewed only once except a small subsample of firms present in at least two waves.[18]

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).[19] Of the 2,628 firms in the dataset, 17.9 percent were on average credit constrained. Looking at the individual components of *Credit constrained* during the past six months, about four percent of the firms were denied credit, four percent were rationed, eight percent were discouraged, and less than one percent refused a credit offer due to its high cost.

Table 1 also summarizes information on other firm-specific characteristics. Most firms are SMEs, two thirds of which have less than 50 employees. Almost half of our sample are firms in stressed countries (Greece, Ireland, Portugal, and Spain). On the bank 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 on 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

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[18] 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.

[19] Merging together formally and informally constrained borrowers is standard since the work of Jappelli (1990).

to the latter, it does not have—for most firms—multiple firm-specific and bank-specific observations over time. Nevertheless, our dataset contains a small panel component of firms which allows us to use firm fixed effects that help eliminate omitted variable bias related to unobservable firm-specific heterogeneity. More importantly, it contains information on firm-specific outcomes that are absent in other types of datasets. 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 credit extension. Third, we have data on firms' expectations about future funding, allowing us to study the impact of monetary policy through the channel of adjusting expectations. Finally, we also have data on recent innovative activities.

4. Empirical strategy and identification

We investigate the impact of unconventional monetary policy on small firm 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 exposure to impaired sovereign debt relative to firms borrowing from banks with low exposure.

We compute a bank's balance sheet exposure to impaired sovereign debt in two different ways. 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 this period (Austria, France, Germany, and the Netherlands—"non-stressed countries").[20] The groups are of roughly similar

[20] 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.

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: 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:

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

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).[21] $Stressed_c$ 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

[21] 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.

held by banks in the Eurozone are issued by the domestic sovereign.[22] X_{isct} is a vector of time-varying firm-level control variables; ϕ_{sct} is an interaction of country, sector,[23] and time (i.e., 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,[24] Portugal, or Spain, from the June 2012 stress test by the EBA, and we distinguish between firms borrowing from banks with relatively high versus low holdings of these bonds. 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:

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

[22] Using an ECB dataset on monthly holdings by 250+ Eurozone banks 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.

[23] There are seven SIC 1-digit sectors per country in the dataset: mining; construction; manufacturing; wholesale or retail trade; transport; real estate; other services to businesses or persons.

[24] While (as noted in footnote 15) we cannot use Italian firms in our data, we can use Italian bonds from the EBA.

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 total assets of bank *b* with which firm *i* in sector *s* in country *c* has a credit relationship during the entire sample period. 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.

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 firm credit demand 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. It also alleviates concern that the observed variation in credit access is driven by global shocks that are common to all firms. Finally, the vector of bank fixed effects η_b controls for all observable and unobservable characteristics of an individual bank. The combination of firm-specific factors and various fixed effects addresses the concern that our estimates are contaminated by shocks to credit demand unrelated to credit supply. For example, while agency costs may have become less severe and/or growth opportunities may have improved more for firms in stressed countries, this should be accounted for by firm-specific information and by the country-sector-time fixed effects.[25] Both models are estimated using both probit and OLS, where standard errors are clustered at the country level.[26]

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[25] There are at least two reasons for focusing on the OMT and not on other ECB policies. First, the share of firms with information on bank-firm relationships increases over time, and so there are very few firms with such information before the OMT: 633 firms report their creditor in wave 6, right before the OMT, but only 97 in wave 2, right before the Securities Markets Program (SMP) activated in May 2010. Second, the OMT is arguably the most successful unconventional monetary policy announced by the ECB, which is not the case with the SMP which only temporarily reduced yields. At the same time, a number of other developments took place around the time of the OMT announcement; for example, the ECB reduced interest rates by 25 basis points in July 2012, and the

5. The OMT and credit access: Empirical evidence

5.1. The OMT announcement and bank performance

As a preliminary step, we investigate the effect of the OMT announcement on the financial health of large European banks. We conduct an event study using both monthly and daily changes in share prices and in CDS spreads, compiled from Bloomberg. We do so for two separate samples, one comprising the 65 banks participating in the EBA stress tests, and one comprising the 25 EBA banks with credit links to firms in the SAFE survey. We take data on stressed countries' exposures from the capital exercise conducted by EBA in June 2012, just prior to the OMT announcement. Similar to Krishnamurthy et al. (2018), we time the OMT announcement at 1st August 2012. By employing a high-to-medium-frequency analysis and a narrow window around the OMT announcement dates, we seek to separate the effect of the OMT announcement from other concurrent events that might potentially influence the condition of the banking sector.

Results in columns (1) and (3) of Table 2, Panel A, report regression estimates of monthly changes in bank share prices on the interaction of banks' exposures to stressed countries and a post-OMT dummy, and columns (2) and (4) do the same for monthly changes in bank CDS spreads. The point estimates imply that banks with larger balance sheet exposures to impaired sovereign debt experienced a relatively larger increase in share prices and a relatively larger decline in their CDS spreads. All effects are significant at least at the 10 percent statistical level. The analysis based on daily data points into the same direction, with three out of the four effects significant at the 5 percent statistical level (Panel B). The overall evidence thus strongly suggests that the OMT announcement led to an improvement in bank financial health, more so for banks with larger exposures to impaired sovereign bonds.

European Stability Mechanism was set up in October 2012 to provide a permanent backstop for euro area countries no longer able to tap the market. Therefore, it is possible that a potential break in trends in SME access to finance around the summer/fall of 2012 is not entirely due to the OMT, but to a larger package of policies aimed at rescuing the euro.

[26] While there are only eight clusters, the main results in the paper are robust to a small-cluster correction.

5.2. Main result

In Table 3, we present the point estimates for Model (1) and Model (2) where we compare the change in access to finance from the pre-OMT to the post-OMT period, for firms borrowing from banks with larger versus smaller balance sheet exposures to impaired sovereign debt. Specifically, 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). This is a comparison over the medium-term, i.e., one year after to 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). In column (1), we estimate a probit model, and we report the marginal effects. Focusing on our main variables of interest, we find 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 significant at the 1 percent statistical level. [27]

The difference-in-differences approach we employ is predicated on an interaction term, and calculating and interpreting marginal effects in non-linear models with triple interaction terms is not straightforward (e.g., Ai and Norton, 2003; Norton et al., 2004). To address this issue, in column (2), we estimate Model (1) using OLS. The point estimate on the interaction term is -0.014, and likewise significant at the 1 percent level. This implies that in the year after

[27] Our control variables suggest that: stand-alone firms (i.e., non-subsidiaries) are more likely to be credit constrained, possibly because they are more opaque and/or have less collateral (e.g., Berger and Udell 1998, 2006); the youngest firms are more likely to be credit constrained, again possibily because of their opacity (Berger and Udell, 1995; Cole 1998); firms with higher turnover are less likely to be credit constrained, possibly signalling higher project quality; and firms with improving capitalization and/or improving credit history (over the past 6 months) are less likely to be credit constrained possibly because banks use hard information in their loan underwriting. One seemingly counterintuitive finding on our controls, is that we do not find that firm size matters, a finding that runs contrary to the evidence in Hadlock and Pierce (2010). However, 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. In the interest of space, we will focus in the remainder of the paper on our main independent variables.

the OMT announcement, a firm in a stressed country experienced a 7 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.

In the next two columns of Table 2, we report analogous versions of Model (2), using probit (column (3)) and OLS (column (4)). 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 level) OMT announcement effect. Numerically, the point estimate of -0.044 on the interaction term in column (4) 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 16.8 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.[28]

5.3. 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.[29] This need not be the case, and the break in trends we report in Table 3 may have started before the OMT announcement for reasons unrelated to sovereign stress or to unconventional monetary policy. While we condition our tests on observables, our empirical

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[28] The reported size of the measured effect is large, which means that there are probably significant benefits to firms from switching banks. While firms in the SAFE survey often report more than one bank, we have linked each firm to the first bank it reports, under the assumption that this is the firm's "main bank." As the "main bank" is also typically the largest one, this has allowed us to maximize the sample used in the regressions by matching with EBA information on banks' exposures to stressed countries. We need to acknowledge, however, that switching between banks, for firms with multiple banking relationships, is not only possible but also likely; however, the problem is plausibly limited over such a short sample period. Because the matching between firms in the SAFE and the same firms' bank information in Amadeus was a one-off performed in 2014, it is not feasible for us to investigate the exact extent of bank switching over time. At the same time, other researchers using Amadeus have concluded that banking relationships are remarkably sticky (Kalemli-Ozcan et al., 2015); for example, only around 3% of German firms switch their main bank from one year to the next (Hoewer et al., 2011).

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

strategy would be compromised if firms in stressed countries borrowing from banks with large sovereign balance sheet exposures experienced an improvement in credit access before the OMT announcement due to, for example, better (unobservable) growth opportunities.

To address this potential problem we take advantage of the fact that the length of our original dataset allows us to test our key identifying assumption explicitly. We 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 column (1) of Table 4, 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 only not significantly different from zero but also wrongly signed indicating that the improvement in credit access reported in Table 3 did not predate the OMT announcement.[30]

Next, we perform another set of falsification tests where we hypothesize that the post-OMT improvement in bank financial health that we documented in Table 2 led to an improvement in access to finance for firms borrowing from benefiting banks only as long as these firms also experienced an improvement in profitability. To that end, in columns (3) and (4) of Table 4 we re-estimate Models (1) and (2) after excluding firms which declared that they

[30] From the point of view of the theoretical mechanism we test in this paper—lending being affected by the price of a class of bank assets—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.

experienced an increase in profitability in Survey waves 8 and 9. The data fail to reject the hypothesis that the OMT did not have an impact on the remaining firms.

5.4. Robustness

In Table 5 we address a number of non-trivial concerns regarding our empirical model. Panel A relates Model (1) and Panel B to Model (2). Our first concern relates to using one year before and one year after the OMT announcement as the main sample period. 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. Nevertheless, a shorter time frame might provide cleaner identification 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) versus during the *six months* after the announcement (wave 8). This reduces the number of available observations to 863 and to 592, respectively. Nevertheless, we keep finding a strong effect of the OMT announcement. 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 an immediate announcement effect that is indeed much stronger than the medium-run effect.

Next, we note that although our DIDID and DID specifications allow 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.

We next address the concern that all announcements related to the OMT were made between July and September 2012 before most of wave 7 was conducted—our pre-OMT period. It may therefore not be appropriate to classify firms in wave 7 as pre-OMT observations. While our approach is still superior to classifying them as post-OMT, we need to show that these observations are not driving our results. To address this concern, we drop wave 7. Column (3) shows that the main point estimate is still negative, and significant (now at the 5 percent level).

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 (4) of both panels confirms that this is the case.

We next address the possibility that the observed changes in credit access are driven by shocks to firm credit demand that are unrelated to shocks to credit supply. So far, we have attempted to identify a monetary policy-driven credit supply shock by comparing firms with credit relationships with banks that benefited more from the OMT-driven decline in impaired sovereign bond yields to firms with credit relationships with banks that benefited less. 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 could 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 observations during the sample period with firm-level full balance sheet information and main creditor information for firms that report an improvement in credit history. We then re-run our main tests on the sub-samples of these firms. By doing so, we address the possibility that the distribution of firm creditworthiness may not overlap sufficiently across treatment and control firms. The estimates reported in column (5) 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 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 estimates from these modified versions of Model (1) and (2) are reported in column (6) of Panels (A) and (B). We continue finding a significant (at least at the 10 percent 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. Up to this point we have calculated the share of credit constrained firms based on the entire survey population. An alternative approach would be to calculate this ratio as the share of the population of firms with a positive demand for credit (48 percent of firms). This alternative excludes firms that report no demand for bank credit because they have enough internal resources. On this subsample we address the selection issue that these firms are a non-random sample of the population by employing a two-stage Heckman model. 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 demand for credit. We include an instrument that is then excluded in the second stage, a dummy variable equal to one if the firm's own outlook has improved in the past six months, and 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.[31] The second-stage results, reported in column (7), strongly confirm that firms with credit relationships with positively affected banks were more likely to experience an improvement in credit access after the OMT announcement.[32]

5.5. Types of credit constraints

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,

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

[32] 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).

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 versus the price dimensions, whereby under asymmetric information credit rationing emerges in equilibrium rather than an equilibrating interest rate (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981).

To explore 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 6 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)), in price rationing (column (3)), and in discouragement (column (4)), with the OMT announcement effect 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 requested (column (2) of Panel B), although this effect is significant in only one specification.

There are two important conclusions from our results. First, the OMT announcement has affected small firm access to finance in both the quantity and the price dimension. Second, the OMT announcement has mitigated both formal and informal credit constraints. The latter finding underscores one of the main advantages of using survey data relative to credit registries that do not contain information on informal constraints.

5.6. Loan terms

We now turn to the terms on granted loans. In the SAFE, firms are asked whether in the past six months, their main bank increased, decreased, or kept unchanged the following loan

terms: interest rate; loan size; maturity; and 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 loan availability, but also through loan terms.

For each of these 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 7.

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 an OMT-driven positive shock to their funding access. 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 (Panel A, column (2)), and that the average maturity of offered loans increased as well (Panel A, column (3)), although in the latter case, the evidence in Panel B goes in the opposite direction. Finally, there was no effect on the collateral requirements (column (4)). Our findings thus suggest that the announcement of the OMT Program not only made it less likely that firms would be denied access to bank credit, but it also led to an improvement in credit terms. Extending larger loans with longer maturities 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).[33] However, our result is not consistent with Kahle and Stulz (2013) who find that during the crisis capital expenditures by small, bank-

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

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 (2013) are considerably larger than our SMEs and are not "small" based on international criteria used to define SMEs.[34]

5.7. The OMT and real activity

So far we have established that the announcement of the OMT Program had a positive impact on access to finance—both directly and through improved expectations about future funding—for firms whose banks were exposed to impaired sovereign debt and thus plausibly benefited from the OMT-driven reduction in sovereign bond yields. We now ask whether this improvement in access to finance had an impact on SME decisions and outcomes. As the ultimate goal of both conventional and unconventional monetary policy is to stimulate real economic activity, it is important to determine whether the OMT announcement led to an increase in firms' activities, and whether such "real effects" from the improvement in access to finance were focused on current operations (i.e., financing working capital) or whether they also extended to long-term operations (e.g., innovation).

Regarding the latter, while there is considerable evidence connecting venture capital financing to innovation, it is important to note that there is also evidence that commercial banks play a role in financing innovation, particularly for smaller and external finance-dependent firms (e.g., Benfratello et al., 2008; Cornaggia et al., 2015; Ferrando and Lekpek, 2018). The SAFE questionnaire includes some information that allows us to assess potential real effects from the OMT a bit further. While it contains no questions about investment, it does ask firms whether they have recently engaged in a number of innovative activities. In particular, we exploit questions that ask firms whether in the past year they have introduced: 1) a new product or service; 2) a new production process; 3) a new management structure; or 4) new sales methods. To ensure timing consistency, we focus on wave 9 which was conducted fully 1

year after the OMT. Table 1 reports that a non-negligible fraction of all firms—between a quarter and a third of those that answered these questions—have engaged in some type of innovative activity over the course of the past 12 months.

The results from this modified version of Models (1) and (2) are shown in Table 8. The evidence from Model (1), reported in Panel A, indicates that firms which plausibly benefited—in terms of access to finance—from the OMT have also introduced a new production process (column (2)) and a new management structure (column (3)) in the past 12 months. However, this evidence is not corroborated by the tests employing Model (2) (Panel B). Therefore, the results can best be described as lacking consistent evidence that the post-OMT improvement in access to finance translated soon enough into significant innovation, particularly in the critical areas of product and process innovation. Furthermore, the degree of innovativeness of firms is often related to the diversification of financial instruments (Ferrando and Lekpek, 2018), which is not taken into consideration in this analysis.

We also match the firms in the SAFE to the Amadeus database, which allows us to extract information on their investment and profitability. We measure firm investment as the period-on-period percentage change in tangible assets, and firm profitability as the ratio of cash flows to assets. We then regress both variables on the interactions of sovereign exposure and the post-OMT dummy. The estimates from these regressions are reported in Table 9. The evidence unequivocally suggests that after the OMT announcement, firms whose creditors had higher impaired sovereign exposures experienced an increase in both capital investment and in cash flows. The data thus lend support to the idea that for small firms capital accumulation responds more strongly to improved credit market conditions than innovative activities.

6. Conclusion

In this paper, we examine the impact of a particularly important unconventional monetary policy tool on small firm access to finance. Specifically, we investigate whether firms whose bank 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 bank. We also

study whether by reducing the riskiness of a group of banks, unconventional monetary policy improved credit access by encouraging 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 medium-term 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. In addition, we find that for these firms loan terms also improved. In particular, interest rates were less likely to increase, average loan size increased, and average loan maturity lengthened. Finally, we document a strong impact of improved credit market conditions on capital investment and on profitability, but we do not find consistent evidence that the post-OMT improvement in access to finance translated into significant firm-level innovation. 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 business 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 significantly impaired the balance sheets of many banks. It provides an important first step in studying the effect of monetary policy on the real economy, although data limitations prevent us from quantifying the overall macroeconomic impact of the effect we uncover in the data on firms' real decisions.[35] 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

[35] See, e.g., Acharya et al. (2016), Acharya et al. (2018), Balduzzi et al. (2018), and Kalemli-Ozcan et al. (2015) for evidence on firms' investment decisions during the sovereign debt crisis.

economy ensures that efficient start-ups replace inefficient incumbents. Future research can greatly benefit from exploring these promising avenues.

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Table 1. Summary statistics

Variable	Observations	Mean	St. dev.	Min	Max
Access to finance					
Credit constrained	2,628	0.179	0.384	0	1
Loan application denied	2,628	0.040	0.197	0	1
Rationed	2,628	0.061	0.240	0	1
High cost	2,628	0.009	0.093	0	1
Discouraged from applying	2,628	0.085	0.279	0	1
Interest rate	995	0.576	0.494	0	1
Loan size	1,000	0.176	0.381	0	1
Maturity	977	0.078	0.268	0	1
Collateral requirements	996	0.434	0.496	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	2,628	0.710	0.454	0	1
Stand-alone firm	2,627	0.872	0.334	0	1
Individual- or family-owned	2,628	0.780	0.414	0	1
Size_1	2,628	0.156	0.363	0	1
Size_2	2,628	0.406	0.491	0	1
Size_3	2,628	0.339	0.474	0	1
Size_4	2,628	0.098	0.298	0	1
Age_1	2,568	0.002	0.048	0	1
Age_2	2,568	0.019	0.135	0	1
Age_3	2,568	0.073	0.261	0	1
Age_4	2,568	0.906	0.292	0	1
Turnover_1	2,592	0.323	0.468	0	1
Turnover_2	2,592	0.361	0.481	0	1
Turnover_3	2,592	0.233	0.423	0	1
Turnover_4	2,592	0.083	0.276	0	1
Own outlook better	2,548	0.203	0.402	0	1
Capital better	2,611	0.236	0.425	0	1
Credit history better	2,549	0.215	0.411	0	1
New product	1,153	0.355	0.479	0	1
New process	1,135	0.247	0.431	0	1
New organization	1,156	0.306	0.461	0	1
New sales method	1,155	0.287	0.452	0	1
Investment	2,191	0.239	0.214	0	0.960
Cash flow	1,862	0.049	0.101	-1.000	0.755

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. '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. 'New product' is a dummy variable equal to one if in the past six months the firm introduced a new or significantly improved product or service to the market. 'New process' is a dummy variable equal to one if in the past six months the firm introduced a new or significantly improved production process or method. 'New organization' is a dummy variable equal to one if in the past six months the firm introduced a new organization of management. 'New sales method' is a dummy variable equal to one if in the past six months the firm introduced a new way of selling goods and services. 'Investment' denotes the change in tangible assets over the past year divided by last year's tangible assets. 'Cash flows' denotes the firm's cash flows divided by total assets.

Table 2. Unconventional monetary policy and bank profitability and risk

Panel A. Monthly data on bank profitability and risk

	Δ Share price	Δ CDS spread	Δ Share price	Δ CDS spread
	65 EBA banks		Sample banks	
	(1)	(2)	(3)	(4)
Main bank's stressed bonds / Assets × Post	0.005*	-0.147***	0.020**	-0.216*
	(0.003)	(0.058)	(0.009)	(0.142)
Year-Month FEs	Yes	Yes	Yes	Yes
Bank FEs	Yes	Yes	Yes	Yes
No. Observations	1,505	1,683	630	668
R-squared	0.16	0.17	0.20	0.25

Panel B. Daily data on bank profitability and risk

	Δ Share price	Δ CDS spread	Δ Share price	Δ CDS spread
	65 EBA banks		Sample banks	
	(1)	(2)	(3)	(4)
Main bank's stressed bonds / Assets × Post	0.001**	-0.002***	0.000	-0.005**
	(0.000)	(0.001)	(0.000)	(0.002)
Year-Month FEs	Yes	Yes	Yes	Yes
Bank FEs	Yes	Yes	Yes	Yes
No. Observations	19,534	37,914	6,943	9,887
R-squared	0.22	0.27	0.27	0.39

Note: This table presents difference-in-differences estimates of banks' financial health. The model is estimated using OLS. The estimation period is April 2011 – March 2014. The dependent variable is the change in the bank's share price (columns (1) and (3)) and the change in the bank's CDS spread (columns (2) and (4)). The underlying data are monthly (Panel A) and daily (Panel B). The regressions are performed using 65 banks in the June 2012 EBA capital exercise (columns (1) and (2)) and the 25 EBA banks with credit links to firms in the SAFE survey (columns (3) and (4)). '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. 'Post' is a dummy variable equal to 1 after 1st August 2012. 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: Main test

	Credit constrained			
	Bankscope data on sovereign exposures		EBA data on stressed exposures	
	Probit	OLS	Probit	OLS
	(1)	(2)	(3)	(4)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.011***	-0.014***		
	(0.003)	(0.003)		
Main bank's sovereign bonds / Assets × Stressed	0.068***	0.012***		
	(0.004)	(0.004)		
Main bank's sovereign bonds / Assets × Post	0.007***	0.010***		
	(0.002)	(0.001)		
Main bank's stressed bonds / Assets × Post			-0.035***	-0.044***
			(0.010)	(0.014)
Stand-alone firm	0.078***	0.070*	0.085***	0.075*
	(0.026)	(0.037)	(0.030)	(0.042)
Individual- or family-owned	0.030	0.027	0.007	0.005
	(0.030)	(0.031)	(0.034)	(0.040)
Size_1	0.021	0.041	0.041	0.062
	(0.084)	(0.095)	(0.073)	(0.074)
Size_2	-0.015	-0.022	0.004	0.005
	(0.034)	(0.044)	(0.021)	(0.022)
Size_4	0.044	0.049	0.036	0.044
	(0.041)	(0.040)	(0.051)	(0.046)
Age_1	0.595***	0.511***	0.641***	0.540***
	(0.041)	(0.036)	(0.029)	(0.026)
Age_2	-0.103*	-0.108**	-0.067	-0.075
	(0.036)	(0.055)	(0.053)	(0.076)
Age_4	0.058***	0.069***	0.092***	0.128***
	(0.014)	(0.016)	(0.017)	(0.025)
Turnover_1	0.049	0.049	0.038	0.041
	(0.093)	(0.097)	(0.049)	(0.057)
Turnover_2	0.006	0.002	-0.030	-0.041*
	(0.043)	(0.052)	(0.019)	(0.025)
Turnover_4	-0.133***	-0.116**	-0.142***	-0.135***
	(0.030)	(0.045)	(0.023)	(0.034)
Capital better	-0.057**	-0.051*	-0.090***	-0.085***
	(0.023)	(0.032)	(0.010)	(0.017)
Credit history better	-0.052**	-0.049*	-0.015	-0.012
	(0.027)	(0.032)	(0.020)	(0.015)
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	2,016	2,016	1,499	1,499
R-squared	0.19	0.19	0.15	0.14

Note: This table presents difference-in-difference-in-differences estimates of access to bank credit in the past 6 months. The model is estimated using probit (columns (1) and (3)) and OLS (columns (2) and (4)). The estimation period is 1st October 2011 – 30th September 2013. See Table 1 for variable definitions and sources. 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: Falsification tests

	Credit constrained			
	Pre-trend, two waves		Excluding increasing-profitability firms	
	Bankscope data on sovereign exposures	EBA data on stressed exposures	Bankscope data on sovereign exposures	EBA data on stressed exposures
	(1)	(2)	(3)	(4)
Main bank's sovereign bonds / Assets × Stressed × Post	0.013		-0.005	
	(0.020)		(0.004)	
Main bank's stressed bonds / Assets × Post		0.028		-0.026
		(0.031)		(0.018)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	545	326	1,708	1,233
R-squared	0.32	0.23	0.29	0.25

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 (columns (1) and (2)) and 1st October 2011 – 30th September 2013 (columns (3) and (4)). See Table 1 for variable definitions and sources. In columns (1) and (2), '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). In columns (3) and (4), firms in waves 8 and 9 which say that their profit has increased in the past 6 months are excluded from the regressions. See Table 1 for variables definitions. All other firm-specific control variables from Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population, and 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: Robustness tests

Panel A. Bankscope data on sovereign exposures

	Credit constrained						
	Short run	Firm balance sheet shocks	Excluding Wave 7	Excluding Greece	Most creditworthy firms	Panel firms	Heckman correction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.049***	-0.018***	-0.008**	-0.014***	-0.019***	-0.038*	-0.030***
	(0.006)	(0.004)	(0.004)	(0.003)	(0.001)	(0.025)	(0.009)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls × Stressed × Post	No	Yes	No	No	No	No	No
Country × Industry × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	No	Yes
Firm FE	No	No	No	No	No	Yes	No
No. Observations	863	2,016	1,683	1,714	179	213	863
R-squared	0.24	0.20	0.18	0.20	0.31	0.33	0.38

Panel B. EBA data on stressed exposures

	Credit constrained						
	Short run	Firm balance sheet shocks	Excluding Wave 7	Excluding Greece	Most creditworthy firms	Panel firms	Heckman correction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Main bank's stressed bonds / Assets × Post	-0.030**	-0.042**	-0.038**	-0.038*	-0.050	-0.299**	-0.057*
	(0.013)	(0.017)	(0.019)	(0.022)	(0.104)	(0.134)	(0.032)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls × Post	No	Yes	No	No	No	No	No
Country × Industry × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	No	Yes
Firm FE	No	No	No	No	No	Yes	No
No. Observations	592	1,499	1,291	1,200	147	156	624
R-squared	0.17	0.16	0.14	0.15	0.26	0.52	0.35

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. 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). See Table 1 for variables definitions. All other firm-specific control variables from Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population, and 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: 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	-0.028***	0.002	-0.083***	-0.020***
	(0.003)	(0.002)	(0.005)	(0.003)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	1,357	1,423	325	1,734
R-squared	0.18	0.15	0.11	0.16

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	-0.026**	-0.040***	-0.006***	-0.021**
	(0.013)	(0.014)	(0.002)	(0.010)
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	0.13	0.11	0.08	0.17

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. See Table 1 for variables definitions. All other firm-specific control variables from Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population, and 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: 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	-0.074***	0.074***	0.055***	-0.018
	(0.005)	(0.022)	(0.020)	(0.020)
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	0.49	0.35	0.44	0.28

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	-0.035***	-0.019	-0.033*	-0.050
	(0.009)	(0.018)	(0.016)	(0.040)
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	0.44	0.33	0.41	0.26

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. See Table 1 for variables definitions. All other firm-specific control variables from Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population, and 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 8. Real effects of unconventional monetary policy and credit access: Innovation

Panel A. Bankscope data on sovereign exposures

	New product	New process	New organization	New sales method
	(1)	(2)	(3)	(4)
Main bank's sovereign bonds / Assets × Stressed × Post	-0.019	0.039**	0.065**	-0.025
	(0.013)	(0.018)	(0.031)	(0.037)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	1,153	1,075	1,152	1,088
R-squared	0.22	0.24	0.18	0.18

Panel B. EBA data on stressed exposures

	New product	New process	New organization	New sales method
	(1)	(2)	(3)	(4)
Main bank's stressed bonds / Assets × Post	-0.028	-0.032	-0.042*	-0.048
	(0.017)	(0.024)	(0.022)	(0.039)
Firm-specific controls	Yes	Yes	Yes	Yes
Country × Industry × Time FEs	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
No. Observations	959	915	960	904
R-squared	0.20	0.22	0.15	0.16

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. See Table 1 for variables definitions. All other firm-specific control variables from Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population, and 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 9. Real effects of unconventional monetary policy and credit access: Investment and cash flows

Panel A. Bankscope data on sovereign exposures

	Investment	Cash flow
	(1)	(2)
Main bank's sovereign bonds / Assets × Stressed × Post	0.004**	0.004***
	(0.002)	(0.001)
Firm-specific controls	Yes	Yes
Country × Industry × Time FEs	Yes	Yes
Bank FE	Yes	Yes
No. Observations	2,053	1,756
R-squared	0.40	0.31

Panel B. EBA data on stressed exposures

	Investment	Cash flow
	(1)	(2)
Main bank's stressed bonds / Assets × Post	0.011***	0.011*
	(0.002)	(0.006)
Firm-specific controls	Yes	Yes
Country × Industry × Time FEs	Yes	Yes
Bank FE	Yes	Yes
No. Observations	1,483	1,208
R-squared	0.39	0.32

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. See Table 1 for variables definitions. All other firm-specific control variables from Table 3 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population, and 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.