Quantitative easing in the euro area and SMEs' access to finance: Who benefits the most?*

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Abstract: Using a firm-level dataset measuring financial access in the euro area, I analyze the heterogeneous impact of the ECB's Public Sector Purchase Programme (PSPP) on the access to finance as well as on firm's investment and employment outcomes for small firms. The analysis shows that the PSPP improved financial access by increasing credit supply, easing financial constraints and reducing the interest rate charged on credit. The impact of the PSPP is amplified by banks which hold a higher share of sovereign debt on their balance sheet or which are less capitalized. Smaller firms and firms in the periphery of the euro area benefit the most from the PSPP. By improving financial access, the PSPP increased firm's employment and investment growth. Hence, the PSPP helped the firms which needed the most support and stimulated the real economy.

JEL-Classification: E44, E51, E52, E58
Keywords: Unconventional monetary policy, bank lending channel, ECB, SME, monetary policy heterogeneity, employment, investment

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1 Introduction

After the Global Financial Crisis, bank lending to companies in the euro area slowed down significantly. With the intensification of the European sovereign debt crisis and the slow deleveraging process of European banks, the European economy came close to a credit crunch. From 2012 until 2015, the stock of corporate credit decreased strongly, despite an easing of interest rates and, consequently, lending rates for corporates (figure 1). The European Central Bank (ECB) undertook unprecedented action to repair the bank lending channel of monetary policy, including conventional and unconventional measures such as the Targeted Long Term Repurchase Operations (TLTRO). However, bank lending only started to recover sustainably with the start of quantitative easing in the form of the ECB's Public Sector Purchase Programme (PSPP) in March 2015 (announcement January 2015).[1]

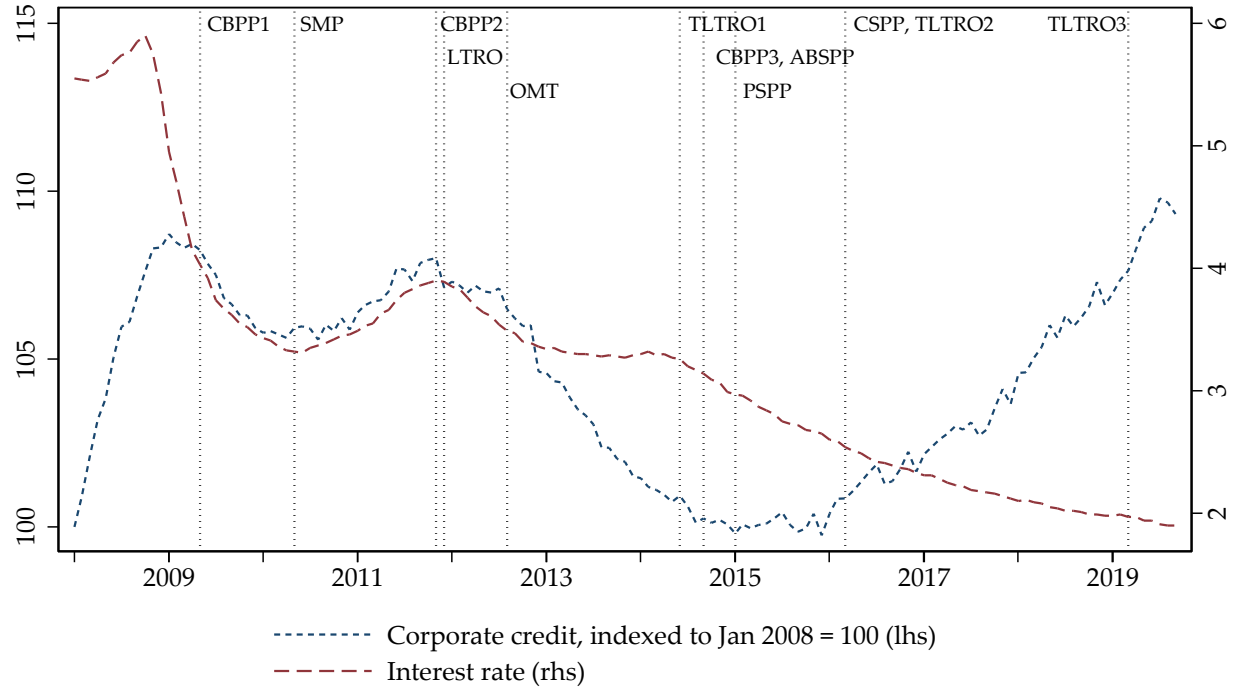
During the European sovereign debt crisis, bank lending to small and medium-sized enterprises (SME) in countries under stress decreased particulary (Wehinger 2014; Ferrando *et al.* 2017; Balduzzi *et al.* 2018; De Marco 2019); those firms which are most dependent on bank lending as source of funding.[2] SMEs play a pivotal role in the euro area economy, they employ two thirds of the labor force and generate approximately 60% of value added (Kraemer-Eis *et al.* 2017).

This paper analyzes the impact of the ECB's PSPP on credit access, credit conditions as well as employment and investment outcomes for SMEs, using firm-level data of the Survey on the Access to Finance of Enterprises (SAFE). I estimate the effect of the PSPP on credit supply, credit availability, financial constraints, the interest rate charged on credit lines as well as firm's employment and investment growth using a fixed effects model, by controlling for credit demand, the business cycle,

[1] The stock of corporate credit increased slightly from 2010 onwards until end of 2011, although the European sovereign debt crisis was already under way (end of 2009 - mid 2012). In May 2010, the Securities Markets Programme (SMP) was introduced to remove tensions in certain credit market segments, which hampered the proper transmission of monetary policy. The ECB purchased government and corporate bonds in secondary markets (Ireland, Greece, Spain, Italy, Portugal). In contrast to the PSPP, the purchases were fully sterilized. Hence, the SMP may have also had a positive effect on credit access.

[2] From 2002-2008, on average, close to 70% of non-financial corporations' financing took place with banks. The share decreased to approximately 50% in the period of 2002 to early 2016, which implies that the structure of non-financial corporations' external financing started to change recently (European Central Bank 2016). Nevertheless, the share remains much higher than that in the US (25%). US corporates rely more on capital markets and non-bank lending to fund themselves.

Figure 1 — Corporate credit in the euro area



Notes: The figure displays the stock of corporate credit in the euro area as loans vis-a-vis euro area non-financial corporations reported by monetary financial institutions excluding European System of Central Banks (ESCB) indexed to January 2008 to deduct the effects of factors that do not relate to transactions (i.e. re-classifications, changes in exchange rates, price fluctuations and write-offs/write-downs) from the MFI Balance Sheet Items Statistics (ECB). The interest rate represents the interest rate charged by credit and other institutions (monetary financial institutions except money market funds and central banks) on loans to corporations (outstanding amounts) as the annual agreed rate with the original maturity (MFI interest rate statistic, ECB). The vertical lines correspond to the announcement date of the ECB's unconventional monetary policies: CBPP = Covered Bond Purchase Programme, SMP = Securities Markets Programme, LTRO = Long-term Refinancing operations, OMT = Outright Monetary Transactions, TLTRO = Targeted Long-term Refinancing Operations, ABSPP = Asset-backed Securities Purchase Programme, PSPP = Public Sector Purchase Programme, CSPP = Corporate Sector Purchase Programme. For more information on ECB's policies refer to table A.1.

firm's balance sheet conditions and firm's characteristics. The set-up of the euro area as a monetary union makes a heterogeneous transmission mechanism across jurisdictions likely. The firm-level nature of the data allows to distinguish between aggregate and heterogeneous effects of monetary policy across firm's country, size, age and sector.

The analysis shows that the PSPP is correlated with an improved access to finance of SMEs. A 1 percentage point increase of the cumulative PSPP purchases as percent of the government bond market size correlates with an increased probability that credit supply increased by 0.5 percentage points, that the availability of credit lines respectively bank loans increased by 0.26 percentage points, and 0.24 percentage points; and a reduction of the probability that a firm is financially constraint with

regards to credit lines or bank loans by 0.1 percentage points as well as an interest rate reduction by 0.1 percentage points. The transmission mechanism of the PSPP is amplified by banks holding a high level of sovereign debt on their balance sheet, as well as with lower capitalization. Firms in the periphery of the euro area and micro firms (1-9 employees) benefitted the most from the PSPP. Both higher credit access and the PSPP are correlated with higher firm employment and investment growth. Hence, the ECB's quantitative easing programme was successful in improving credit access for firms which needed the most support and in stimulating the real economy.

The study is closely related to the work by Betz and De Santis (2019) and Ferrando *et al.* (2019), who also use firm-level data from the SAFE to analyze the effects of the ECB's unconventional monetary policy on credit access.[3] Betz and De Santis (2019) study the impact of the Corporate Sector Purchase Programme (CSPP) on credit supply. They find that the CSPP improved credit access relatively more for firms, who borrow from banks with a high exposure to firms eligible under the CSPP. Ferrando *et al.* (2019) analyze the effect of the Outright Monetary Transactions (OMT) on financial constraints as well as firm's investment and profitability. Their findings suggest that following the OMT announcement, financial constraints were relaxed relatively more for firms borrowing from banks which have a high exposure to impaired sovereign debt. Additionally, loan maturity increased and firms' investment and profitability improved. In contrast, I analyze the PSPP, which comprises the majority of the ECB's asset purchases. Furthermore, I distinguish between different measures of credit supply, including a distinction between bank loans and credit lines and the impact on the interest rates charged on credit lines, which allows a quantification of the effect, while most other measures are qualitatively. Finally, I add the analysis of the effect on employment growth and a discussion of monetary policy heterogeneity across firm characteristics and country.

The paper first gives an overview of the existing literature on the determinants of the access to finance of SMEs and the bank lending channel of (unconventional) monetary policy, followed by the ECB's monetary policy decisions and the PSPP. I continue with a description of the dataset and the econometric strategy. The presentation and discussion of the results conclude.

[3] Both studies use a confidential dataset linking the SAFE data to the balance sheet of the creditor.

2 Literature

The literature has shown that SMEs face more difficult access to finance and higher funding costs than large companies (Wehinger 2014). Age, size and firm's balance sheet health influence credit access: Younger and smaller firms as well as firms with lower profits and higher leverage have higher financial constraints (Beck *et al.* 2006; Angelini and Generale 2008; Artola and Genre 2011; Ferrando and Griesshaber 2011; Ferrando *et al.* 2013; Öztürk and Mrkaic 2014; Coluzzi *et al.* 2015; Ferrando and Mulier 2015). Furthermore, real economic activity matters for SMEs' credit access. The euro area economic crisis, the financial crisis and private sector indebtedness tightened SMEs' credit access (Holton *et al.* 2013, 2014).

The European sovereign debt crisis dampened bank lending (to SMEs). In particular, SMEs in stressed countries faced more difficult access to credit than firms in the rest of the euro area (Wehinger 2014; Ferrando *et al.* 2017), which may be caused by banks' balance sheet conditions. De Marco (2019) shows that banks' exposure to sovereign debt caused a credit tightening during the European sovereign debt crisis, resulting in negative real effects for small and young firms. Balduzzi *et al.* (2018) find that during the financial and European sovereign debt crisis, increases of banks' CDS spreads resulted in lower bank lending to younger and smaller firms, causing lower employment and investments. Popov and Van Horen (2015) provide evidence that banks with high exposure to GIIPS sovereign debt reduced lending more than non-exposed banks. Furthermore, poorly capitalized banks cut bank lending more strongly during the financial crisis (Gambacorta *et al.* 2011; Hempell and Kok Sørensen 2010).

The paper analyzes the bank lending channel of monetary policy, introduced by Bernanke and Gertler (1995). A change of the policy rate induces an endogenous change of the external finance premium - the difference between the cost of external financing and internal funds (retained earnings). An interest rate cut hence relaxes banks' balance sheets and thereby increases loan supply. Empirical evidence has shown that the bank lending channel is more effective in economies where financing takes place via banks, rather then capital markets, as is the case in the euro area (Brissimis

and Delis 2010). There is also increasing evidence of a risk-taking channel of monetary policy (see i.e. Acharya and Steffen 2015; Neuenkirch and Nöckel 2018). In a low interest rate environment, expansionary monetary policy can lead to increased bank risk-taking, who are on the search for yield to keep their profit margins. The ECB's PSPP lowers long term rates and raises inflation expectation and thereby reduces bank funding costs. By strengthening banks' balance sheets, bank lending accelerates. Banks may also re-balance their portfolios towards higher yield assets, which may lead to loan issuance to SMEs and riskier firms.

There is a large and growing, empirical literature on the bank lending channel of monetary policy (in the euro area). Studies have shown that the ECB's (un-)conventional monetary policies have helped to increase bank lending and to lower firms' funding costs (see i.e. Giannone *et al.* 2012; De Santis and Surico 2013; Behrendt 2017; Gambetti and Musso 2017; Horvath *et al.* 2018; Abidi and Miquel-Flores 2018; Altavilla *et al.* 2020). Nonetheless, Kenourgios and Ntaikou (2019) find that the ECB's UMP have limited effectiveness to stimulate bank lending.

The evidence to what extent SMEs' credit access is improved by UMP is mixed. Ciccarelli *et al.* (2013) show that monetary policy affects real output via the credit channel, and is even more effective in crisis times and in countries under stress. However, the ECB's UMP until 2011 was not successful to improve credit availability for small firms in countries under stress.[4] Other studies find evidence that the ECB's policies improved SMEs' credit access: Ferrando *et al.* (2019) show that the ECB's Outright Monetary Transactions Program (OMT) improved SMEs' credit access by using SAFE data matched with confidential data on firms' lender's balance sheet. Firms borrowing from banks with a high exposure to impaired sovereign debt face relatively less financial constraints. Betz and De Santis (2019) analyze the impact of the ECB's Corporate Sector Purchase Programme (CSPP) on SMEs' access to finance, also using SAFE data. SMEs' credit access improved, even more for firms having a relationship with a bank which is more exposed to firms, which are eligible under the CSPP. Horvath *et al.* (2018) find evidence that the interest rate pass-through of the ECB's conventional policies was

[4]The authors proxy lending conditions of small firms with lending from small banks by using the fact that small firms tend to have a relationship with a small bank.

only complete for small loans. Furthermore, the ECB's unconventional policies (both quantitative easing and other balance sheet policies) have reduced bank interest rates.

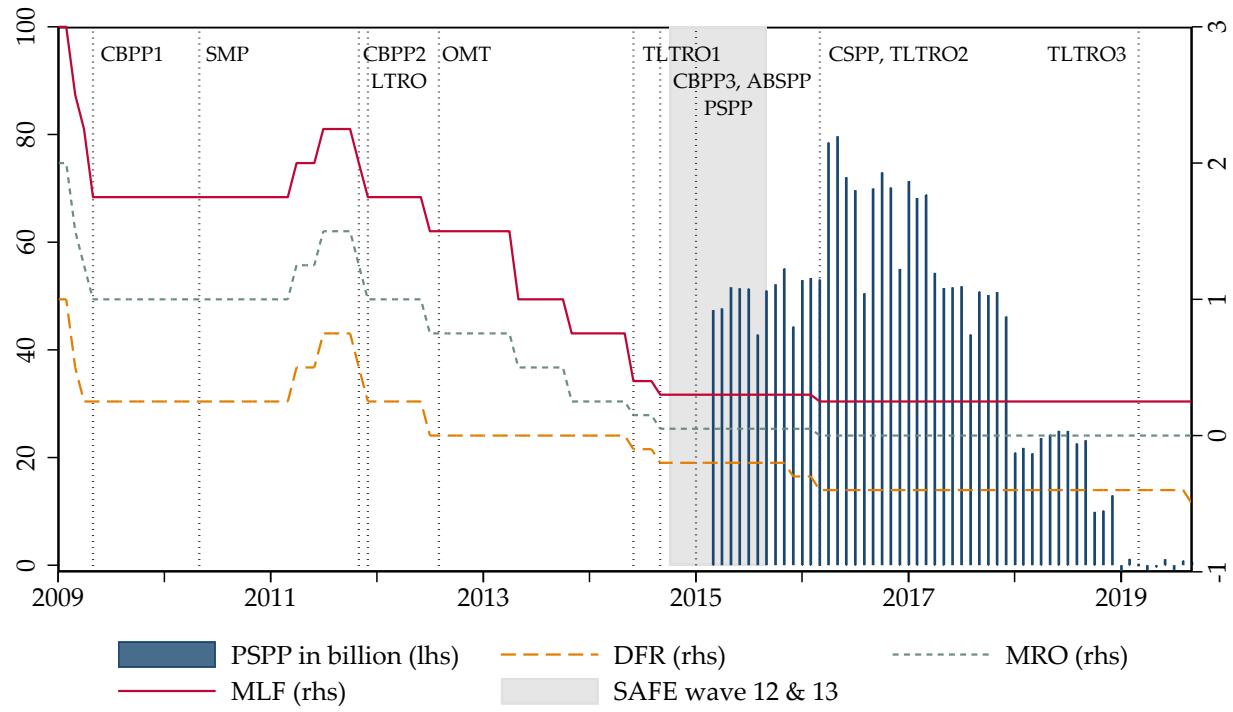
There is evidence that the transmission from the ECB's policies to bank lending, as well as its heterogeneity is driven by banks' balance sheets. Less capitalized banks respond more strongly to easing monetary policy (Brissimis and Delis 2010; Grosse-Rueschkamp *et al.* 2019; Acharya *et al.* 2019). Banks' sovereign debt exposure, capital ratio or percentage of non-performing loans also influence the transmission mechanism (Ferrando *et al.* 2019; Grosse-Rueschkamp *et al.* 2019; Altavilla *et al.* 2020).

The lenders' balance sheet conditions does not only matter for bank lending but also for employment growth of small and medium-sized firms. Chodorow-Reich (2014) shows that firms, which had a bank relationship with a less healthy lender before the Lehman crisis, have a lower likelihood to receive a bank loan after the crisis, pay higher interest rates and reduce employment by more than firms with a bank relationship with a healthy lender. Hence, lending cuts have a negative effect on output and employment (Huber 2018). There are several studies which show that UMP has a positive effect on real economic activity via the credit channel (see i.e. Giannone *et al.* 2012; Cappiello *et al.* 2010; Darracq Pariès and De Santis 2015; Ciccarelli *et al.* 2015; Gambetti and Musso 2017; Altavilla *et al.* 2020). Acharya *et al.* (2019) find that the OMT program led to an improvement in bank health, translating into increased aggregate bank lending. However, particularly under-capitalized banks lend to low-quality borrowers to prevent bailouts. These firms use the higher credit supply to build up cash reserves rather than to stimulate real activity such as higher employment or investment. This led to a credit misallocation, from which creditworthy firms in sectors with a high share of low-quality borrowers suffered from a slowdown of the economic recovery.

3 ECB's (un-)conventional monetary policies

Since the financial crisis, the ECB has introduced a number of different unconventional monetary policy measures and has lowered interest rate tremendously to enter negative territory. To set the PSPP into context, figure 2 illustrates the ECB's policy rates, the PSPP's monthly government bond

Figure 2 — ECB's monetary policy decisions



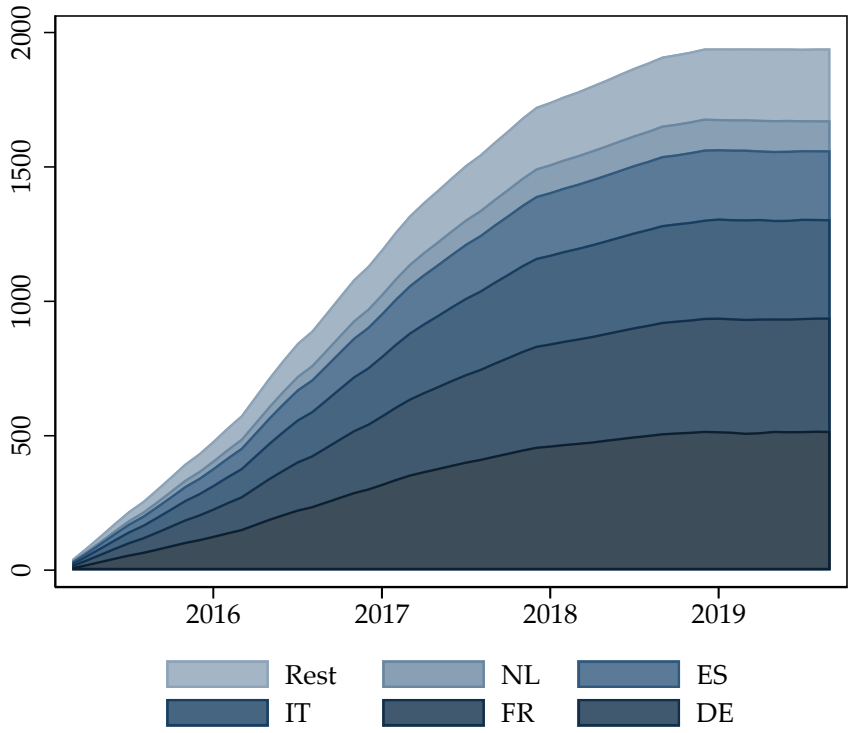
Notes: Based on Gambetti and Musso (2017). The figure displays the ECB's conventional and unconventional monetary policy decisions from January 2009 - September 2019. Left hand scale is in EUR billion. Right hand scale is in percent. The grey shaded area marks the reference period of SAFE survey wave 12 & 13. PSPP purchases are monthly euro area purchases. PSPP = Public Sector Purchase Programme, DLR = Deposit facility rate, MRO = Main refinancing operations, MLF = Marginal lending facility, CBPP = Covered Bond Purchase Programme, SMP = Securities Markets Programme, LTRO = Long-term Refinancing operations, OMT = Outright Monetary Transactions, TLTRO = Targeted Long-term Refinancing Operations, ABSPP = Asset-backed Securities Purchase Programme, CSPP = Corporate Sector Purchase Programme. For more information on ECB's policies refer to table A.1.

purchases under the PSPP and the announcement date of various other unconventional monetary policies from January 2009 until September 2019 (the time period used in the analysis). The PSPP was announced on 22 January 2015 as part of the Expanded Asset Purchase Programme (APP). The APP comprises the PSPP, the Asset-backed Securities Purchase Programme (ABSPP), the Covered Bond Purchase Programme (CBPP) and the PSPP. Among the APP, the PSPP's purchases are the biggest part with about 80% of the securities purchased. The monthly purchases of the APP were initially EUR 60 billion per month. The country distribution of the purchases are allocated according to the ECB's capital key, which is a combination of countries' GDP and population size.

There were several amendments to the APP (and consequently of the PSPP, refer to table A.1 for more details). In March 2016, a big package of additional monetary policy measures were

announced, including the expansion and extension of the purchases to EUR 80 billion per month, the inclusion of a Corporate Sector Purchase Programme (CSPP) and another series of Targeted Long-term Refinancing Operations (TLTRO 2). The reduction of APP/PSPP purchases followed in April 2017 (EUR 60 billion), January 2018 (EUR 30 billion), October 2018 (EUR 15 billion) and January 2019 (termination, but re-investment of principal payments from maturing securities). Another series of TLTRO 3 was announced in March 2019. Furthermore, during the course of the PSPP, interest rate cuts were announced in December 2015, March 2016 and September 2019.

Figure 3 — Cumulative PSPP purchases

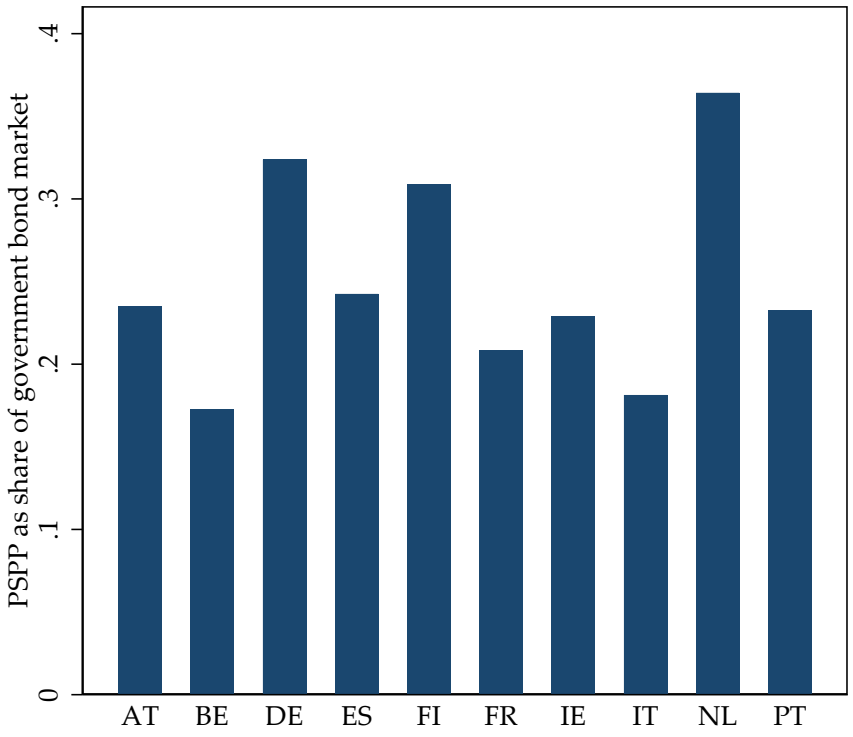


Notes: The figure displays the ECB's cumulative monthly government bond purchases under the PSPP in billion euro according to country. The "Rest" includes Austria, Belgium, Cyprus, Estonia, Finland, Ireland, Lithuania, Luxembourg, Latvia, Malta, Portugal, Slovenia and Slovakia.

Figure 3 illustrates the cumulative government bond purchases of the ECB under the PSPP from March 2015 until September 2019 by country. Due to the capital key allocation, the five biggest euro area countries - Germany, France, Italy, Spain and the Netherlands - account for 87% of all bond purchases.

However, the allocation of the government bond purchases according to the capital key does

Figure 4 — PSPP purchases as share of government bond market size



Notes: The figure displays the ECB's cumulative government bond purchases under the PSPP as share of the outstanding amount of government bonds on a country level as of September 2019 (SAFE survey wave 21).

not necessarily reflect its impact on the government bond market. The share of the cumulative government bond purchases of each countries' government bond market size may be a relevant measure to evaluate the size of the QE programme in each country. The transmission mechanism of a government purchases programme operates via raising the price of government bonds and reducing government bond yields. Thereby, long term interest rates are reduced. Therefore, I assume that the higher the share of the ECB's purchases of the country's government bond market, the bigger the effect on the government bond yield. This takes into account that the ECB's government bond purchases may be high in a cross-country comparison in terms of the capital key, but it may be low with regards to the country's government bond market.[5]

The cumulative government bond purchases as share of government bond market size at the end of September 2019 are illustrated in figure 4.[6] Considering this measure of the PSPP, the Netherlands

[5]Results hold if the the cumulative PSPP purchases are scaled by GDP.

[6]The government bond market size is measured by the amount of outstanding debt securities issued by the general government (ECB).

is the country with the highest purchases (36%), followed by Germany (32%) and Finland (30%). Belgium (17%) and Italy (18%) have the lowest shares.

4 Survey on the Access to Finance of Enterprises

The analysis uses firm-level data of the SAFE conducted by the ECB and the European Commission (EC). The survey is conducted bi-annually since 2009 relying on telephone interviews and an online questionnaire (since 2014). 60% of the participants are part of a panel, such that they were interviewed in more than one wave. The questionnaire contains information on the firm's characteristics, on the current situation of the enterprise, and on the availability of finance as well as interest rates charged on credit lines.

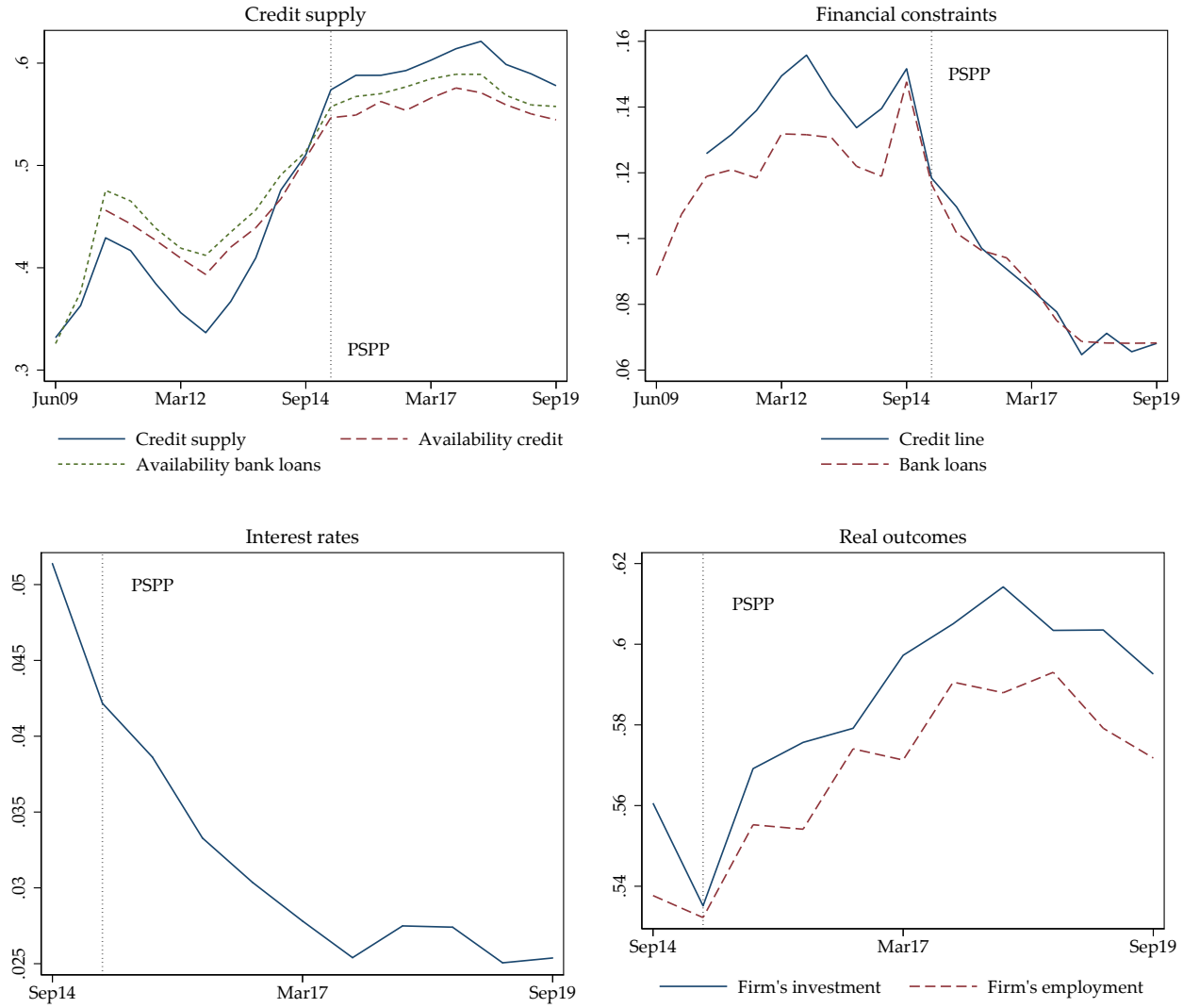
Most of the literature analyzing the bank lending channel uses bank-firm matched data on bank loans from, e.g. DealScan or national sources (i.e. Alves *et al.* 2016; Peydró *et al.* 2020; Banerjee *et al.* 2017; Acharya *et al.* 2019). Although these data allow to control for supply and demand effects and tracking down channels of which policies influence bank lending, the data is only available in certain countries (i.e., Italy, Spain, Germany, France, or Portugal). Data that are comparable across the euro area are scarce. The dataset Anacredit (Analytical Credit Dataset) harmonizes data on individual bank loans across the euro area. However, this dataset has some weaknesses in covering small loans (which are used mostly by small firms). Therefore, relying on the SAFE dataset has some advantages. First, it allows to focus on SMEs, without proxying them with either small loans or small banks. Second, a consistent comparison across euro area countries is possible. Third, it is possible to analyze both credit supply, credit demand, interest rates charged on credit and employment and investment outcomes.

The panel covers the survey results from survey waves 1-21, which runs from 2009 until 2019. The sample is limited to Austria, Belgium, Germany, Spain, Finland, France, Ireland, Italy, the Netherlands and Portugal.[7] Therefore, the sample size amounts to about 4'000 observations per

[7]These countries are part of each survey wave and the ECB's PSPP. The small euro area countries (Estonia, Cyprus, Latvia, Lithuania, Luxembourg, Malta and Slovenia) are only interviewed in every second round by the European Commission. Slovakia is only part of each round since 2014. The ECB does not buy government bonds in Greece, since the eligible criteria are not met.

survey round on average. About 40% of the data set comprise micro firms with 1-9 employees, 30% are small companies employing 10-49 workers and medium-sized companies with 50-249 employees constitute another 30%.

Figure 5 — Dependent variables



Notes: The figure displays the mean of the dependent variables over time, which are: 1. Credit supply: Firm's evaluation of banks' willingness to provide credit over the past six months. = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. A higher value indicates higher credit supply. Availability: Firm's evaluation of the availability of credit lines/bank overdrafts and bank loans over the past six months. = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. A higher value indicates higher availability. 2. Financial constraints: The share of firms facing financial obstacles with regards to credit lines or bank loans respectively. A higher value indicates more firms being constrained. 3. The interest rate is the average interest rate charged on a credit line or bank overdraft (fixed or variable) for which the firm applied over the past six months. 4. Firm's employment and investment growth over the past six months. = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. The vertical line indicates the introduction of the ECB's QE programme (SAFE survey wave 12). The dates correspond to the end of each reference period., i.e. March 2015 for survey wave 12 (refer to table A.5).

The access to finance is measured with four different sets of variables. The first one is a measure

of *credit supply*. The firms are asked whether the lenders' willingness to provide credit increased, remained unchanged or decreased over the past six months. I measure credit supply with a dummy variable equal to one, if the lenders' willingness increased, equal to 0.5 if the lenders' willingness remained unchanged and equal to zero if the lenders' willingness decreased.

Second, the *availability* of two different financial instruments is measured with a dummy variable equal to one if a company reported an improved availability of that financial instrument, equal to 0.5 if a firm reported an unchanged availability and equal to zero if a firm reported a decreased availability for the enterprise over the past six months. The financial instruments comprise: 1. credit lines, bank overdrafts or credit cards summarized as "credit" and 2. bank loans. The question on credit availability was added in survey wave 3 (2010).

The third set of variables is called *financial constraints*. It is a dummy variable which captures whether a company was financially constrained over the past six months. The variable is equal to one if a firm applied for a financial instrument, but was rejected, received less than 75% of the requested amount or refused the received offer because of too high costs. The firm is also financially constrained if it did not apply for external financing because of the possibility of a rejection.[8] The financial instruments cover 1. credit lines, bank overdrafts or credit cards summarized as "credit" and 2. bank loans. Data on financial constraints with respect to credit lines is available since survey wave 3 (2010).

Finally, the terms and conditions of credit is captured by the third measure of access to finance. Firms are asked which *interest rate* (fixed or variable) was charged on a credit line or bank overdraft which the firm applied for over the past six months.[9] This variable is not a 0/1 variable, but reflects the actual interest rates charged by banks. Data on interest rates is available since survey wave 11 (2014). If firms needed credit, but did not apply because of too high costs, the interest rate is not measured. Therefore, the variable can be seen as a lower bound. The credit supply as well as availability of credit and bank loans captures the perceived credit access, while financial constraints and interest

[8] This definition of financial constraints using SAFE data is standard in the literature (see i.e. Ferrando and Mulier 2015).

[9] The data includes interest rates charged on a credit line or bank overdraft, which the firm applied for. However, the firm does not necessarily need to have accepted in it. It also includes firms who are financially constrained, because they refused an offered credit line, but refused it because of too high costs. However, the share of firms, reporting an interest rate, but refusing the offer because of too high costs, is with 1.8% low.

rates measure financial access objectively.

Firm's employment and investment growth is measured with a dummy variable equal to one, if the firm's employment, respectively investments increased, equal to 0.5 if remained unchanged and equal to zero if it decreased over the past six months.

Figure 5 illustrates the average of the four different set of measures of credit access as well as firm's employment and investment growth over time. The average perceived financial conditions (credit supply and availability) started to improve already from September 2013 onwards. However, financial constraints still increased until September 2014, before the introduction of the PSPP. In September 2014, 15% of the survey respondents were financially constrained each with regards to credit lines or bank overdrafts as well as bank loans. With the introduction of the PSPP, financial constraints started to ease and the share of financially constraint companies decreased to 7% in 2019. The average interest rates charged on credit lines, bank overdrafts of credit card overdrafts decreased from 6% in 2014 to 2.5% in 2019. Firm's employment and investment decreased from survey wave 11 to survey wave 12, and started to increase afterwards - after the announcement of the PSPP. Investment growth started to ease again in March 2018, while employment growth has a turning point in September 2018.

To control for firm's characteristics, firm's balance sheet conditions as well as credit demand, a variety of firm level control variables will be used. Table A.2 provides an overview of their definitions. Summary statistics of all variables can be found in table A.4. The firm-level data of the SAFE survey is complemented by country-level data. The definition and sources of those macroeconomic control variables is provided in table A.3.

5 Econometric strategy

The analysis of the impact of the ECB's PSPP on the access to finance of SMEs in the euro area is divided into three parts: The first part analyzes the aggregate effect of the PSPP and discusses several challenges for identifying the impact. The second part focuses on the heterogeneity of the

ECB's policy across country, firm characteristics as well as lenders' balance sheets. The third part discusses the impact of credit access on firm's employment and investment growth to evaluate the importance of the ECB's quantitative easing programme for the real economy.

5.1 PSPP's aggregate effect on access to finance

The identification of the impact of the ECB's PSPP on credit access has several challenges. First, general macroeconomic conditions or country specific shocks impact credit access, such as the economic recovery after the European sovereign debt crisis. Second, it is crucial to distinguish between credit supply and credit demand and to control for firm-specific characteristics (Betz and De Santis 2019). Third, there may be other (un-)conventional policies of the ECB next to the PSPP, which also influence bank lending. This sub-section discusses how the analysis addresses these issues.

The analysis estimates the impact of the ECB's PSPP on the access to finance for SMEs in the euro area by estimating the following equation, inspired by Ferrando *et al.* (2019) and Betz and De Santis (2019):

$$y_{ijt} = \alpha + \beta qe_{jt} + \tau Z_{jt} + \delta X_{ijt} + \mu_i + \epsilon_{ijt} \tag{1}$$

, where y_{ijt} is the change in credit (credit supply, availability of credit or financial constraints), respectively the interest rate charged on credit lines for firm i in country j at time t. $qe_{j,t}$ is the treatment variable measuring the ECB's QE programme in country j at time t. Z_{jt} is a vector of country level control variables, X_{ijt} is a vector of time-varying firm level control variables. μ_i are firm fixed effects and ϵ_{ijt} is the error term, clustered at the firm level.

Dependent variable y_{ijt}

The dependent variable y_{ijt} comprises four different sets of measures of credit access, as described in section 4: Credit supply measuring the lenders' willingness to provide credit (= 1 increased, = 0.5 remained unchanged, = 0 decreased). Availability of credit or bank loans (= 1 increased, = 0.5 remained unchanged, = 0 decreased). Financial constraints with regards to credit lines or bank loans

(= 1 financially constraint, = 0 not financially constraint). Finally, the interest rate charged on credit lines or bank overdrafts which a firm applied for in the past six months is a continuous variable.

Treatment variable qe_{jt}

The treatment variables qe_{jt} measures the ECB's government bond purchases as cumulative purchases per country since the beginning of the programme as share of the country's government bond market size. The variable is equal to zero before the announcement and introduction of the programme (equal to zero for survey wave 1-11). The reference period for the survey wave 12 is October 2014-March 2015. The QE programme was announced on 22 January 2015 and the purchases started in March 2015. Hence, both the announcement and the start of the programme took place in SAFE survey wave 12. Therefore, the variable qe_{jt} can be seen as a treatment variable equal to zero before the treatment (QE programme). During the treatment period (survey wave 12-21, October 2015 - September 2019), the variable is not only equal to 1, but has a time and country dimension which measures the intensity of the programme. The coefficient of interest is β. I expect a positive effect on credit supply and credit availability, and a negative effect on financial constraints and the interest rate.

The rumours about a euro area QE programme and hints by ECB staff with regards to such a programme before the introduction before survey wave 12 (before October 2014) are not captured by the treatment variable. For example, Mario Draghi's speech in Jackson Hole on 22 August 2014 was seen as a sign that the ECB will introduce a QE programme. In this respect the estimates are a lower bound, because they do not include market anticipations which took place before the introduction.

However, there are other ECB's policies which may have a positive effect on credit access during the asset purchases of the PSPP, in particular the policies of the "March 2016 package". The Corporate Sector Purchase Programme (CSPP) and TLTRO II, were announced in March 2016 and started in June 2016 (refer to figure 2). Furthermore, the interest rate on the deposit facility was cut from -0.5% to -0.4%, the interest rate on the main refinancing operations from 0.05% to 0% and the interest rate on the marginal lending facility from 0.3% to 0.25% in March 2016. Particularly the CSPP may

have influenced credit access for firms.[10] Therefore, I run a robustness check which uses the data around the announcement of the PSPP only, in an event-study set-up (survey wave 11-13; April 2014 - September 2015, highlighted in grey in figure 2).[11]

Control variables

The country level variables, Z_{jt}, control for macroeconomic conditions, namely GDP growth and the inflation rate. Economic conditions have an influence on credit access (Holton *et al.* 2013, 2014). If the economic situation is solid, banks are in a better position to lend. The choice of GDP and inflation as controls is linked to the ECB's mandate to maintain price stability. The decision to introduce a QE programme was primarily driven by the low inflation environment. Furthermore, the ECB also monitors the business cycle closely. These variables vary at the country and time level.

At the firm level, X_{ijt} controls for time-varying firm characteristics. First of all, the SAFE data allows to control for firm's credit demand: Firms are asked whether credit demand for a specific financial instrument (1. credit lines, bank overdrafts or 2. bank loans) increased, remained unchanged or decreased over the past six months. If credit demand increases, it is more likely that firms are credit constrained. Furthermore, if a firm has higher demand for credit, it may evaluate credit availability to be poorer. To explicitly control for firms' credit demand is a great advantage. The literature often controls for credit demand with specific firm fixed effects, such as firm cluster fixed effects (see i.e. Khwaja and Mian 2008; Acharya *et al.* 2019). Furthermore, I control for firm's balance sheet characteristics, measured by the firm's profit, leverage, credit history and capital position. Firm's creditworthiness influences both its perceived credit availability, as well as ability to receive funding and interest rate charged on a loan (Casey and O'Toole 2014). The model is saturated with firm's age and size, because the literature has shown that smaller and younger firms face more difficult financial access (i.e. Artola and Genre 2011; Ferrando and Griesshaber 2011; Ferrando and Mulier 2015).

The sample period is survey wave 1-21 (January 2009 - September 2019), respectively survey wave

[10] See i.e. Betz and De Santis (2019) on evidence of the CSPP's impact on SMEs' credit access.

[11] There were additional interest rates cuts in September 2014 (survey wave 11) and in March 2015 (survey wave 12), together with the introduction of the PSPP.

3-21 for credit lines. If the interest rate is used as dependent variable, the sample period is survey wave 11-21 (April 2014 - September 2019), because this question was added later to the survey. Furthermore, I also control for credit supply (bank's willingness to lend), if the interest rate is the dependent variable.

5.2 PSPP's heterogeneous effects on access to finance

The set-up of the euro area with a single supra-national monetary institution, but heterogeneous economic structures and (fiscal) policies make heterogeneous dynamics of monetary policy likely. To analyze the heterogeneous effects of the PSPP, I augment the model in equation 1 with interaction effects of the ECB's government bond purchases with dummy variables for firm's characteristics:

$$y_{ijt} = \alpha + \beta qe_{jt} + \omega qe_{j,t} * W_i + \tau Z_{jt} + \delta X_{ijt} + \mu_i + \epsilon_{ijt} \tag{2}$$

where $qe_{j,t} * W_i$ is an interaction terms of the PSPP purchases with either dummies for firm's country, country group (core/periphery), size (micro, small, medium), age (less than 2 years, 2-4 years, 5-9 years, more than 9 years) or sector (manufacturing, construction, services, trade).

Countries are divided into two groups, the core and the periphery of the euro area. The division is done according to the level of the government bond yield before the introduction of the QE programme. Countries with higher government bond yield may have more room to lower the yield via quantitative easing which then transmits to bank lending to SMEs. However, the bank lending channel of monetary policy may be particularly impaired in countries under stress, such as in the periphery. The "core" comprises Germany, Austria, Belgium, Finland, France and the Netherlands. The "periphery" contains Italy, Spain, Ireland, Portugal and Slovakia.

Furthermore, the ECB's policies may operate differently, depending on the health and structure of the lenders' balance sheet or the sovereign risk. Altavilla *et al.* (2020) show that banks' exposure to sovereign debt and banks' balance sheet health are responsible for a heterogeneous pass-through of

conventional monetary policy, but non-standard measures mitigate the heterogeneity. Hence, the model in equation 1 is augmented with further country-time varying control variables and their interaction effects with the ECB's government bond purchases:

$$y_{ijt} = \alpha + \beta qe_{jt} + \gamma m_{jt} + \omega qe_{jt} * m_{jt} + \tau Z_{jt} + \delta X_{ijt} + \mu_i + \epsilon_{ijt} \tag{3}$$

, where m_{jt} is a control variable varying by country j and time t. I run four regressions, where m_{jt} is either sovereign CDS spreads, banks' sovereign debt holdings as ratio of the banks' total assets, the banks' tier 1 capital ratio or banks' CDS spreads.

Sovereign CDS spreads are an indicator for the countries' sovereign risk. If the sovereign risk is high, government bond yields are higher and the government bond purchases by a central bank may be more effective in stimulating credit access by lowering bond yields.

The literature has shown that a banks' exposure to sovereign debt holdings during the European sovereign debt crisis led to credit tightening (see i.e. Popov and Van Horen 2015; De Marco 2019). Ferrando *et al.* (2019) find that firms lending from banks with high exposure to sovereign debt to impaired countries, benefited more from the OMT announcement than firms with a relationship to a bank with low exposure. Quantitative easing could operate in a similar way. Banks' who are particularly exposed to sovereign debt, benefit more by improving its balance sheet health and hence have more capacity to increase lending.

Acharya *et al.* (2019) have shown that the OMT announcement had a positive effect on banks' health and thereby bank lending improved on the aggregate level. If the banks' capital position in a country is worse than in others, their marginal benefit from the PSPP may be even bigger and hence the positive effect on credit access may be higher. Also Gambacorta *et al.* (2011) show that an improvement in the banks' capital position lead to higher bank lending. Grosse-Rueschkamp *et al.* (2019) find evidence that a central bank's corporate bond purchases improve banks' balance sheets.

Banks with a low capital ratio and high non-performing loans holdings increase corporate lending. Therefore, an interaction effect of the PSPP with the tier 1 capital ratio is included.

Finally, there is evidence that during the financial crisis and European sovereign debt crisis, higher banks' CDS spreads led to lower bank lending, particularly for young and small firms (Balduzzi *et al.* 2018), which decreases investments and employment. The PSPP could have the opposite effect by improving bank balance sheets.

5.3 Effect on firm's employment and investment

The identification strategy to estimate the impact of credit access on employment outcomes and firm's investment is inspired by Chodorow-Reich (2014), Acharya *et al.* (2019) and Ferrando *et al.* (2019):

$$y_{ijt} = \alpha + \beta qe_{jt} + \rho i_{ijt} + \omega s_{ijt} + \gamma d_{ijt} + \delta X_{ijt} + \mu_i + \epsilon_{ijt} \tag{4}$$

, where y_{ijt} is either firm's employment growth (= 1 employment increased, = 0.5 employment remained unchanged, = 0 employment decreased) over the past six months or firm's investment growth (= 1 investment increased, = 0.5 investment remained unchanged, = 0 investment decreased). qe_{jt} is as in the analysis above the ECB's cumulative government bond purchases as percent of the government bond market. i_{ijt} is the interest rate charged on credit lines or bank overdrafts. s_{ijt} is a measure of credit supply, either willingness of banks' to provide credit, credit availability or financial constraints with regards to credit lines. d_{ijt} includes firm's credit demand. X_{ijt} is a vector of variables varying at the firm and time level, which control for the general economic outlook, firm's balance sheet characteristics (profit, leverage, credit history, capital position), firm size and firm age. The estimation includes firm fixed effects (μ_i) and standard errors are clustered at the firm level.

The advantage of the SAFE data is that it allows to distinguish between the price of credit (interest rate), credit supply and credit demand at the firm level. Furthermore, it is crucial to control for firm

characteristics such as size or profit, because employment and investment may be correlated with firm size and age. Smaller and young firms tend to grow faster (Chodorow-Reich 2014).

It is very challenging to identify the impact of the PSPP on firm's employment outcome and investment, because of many confounding factors such as monetary policy decision by the ECB or national legislation. The PSPP is expected to improve credit access via the credit channel. Thereby, it stimulates employment growth and investments. Therefore, I analyze first the impact of credit access on real outcomes by using firm-time-sector fixed effects. These fixed effects should control for any time-varying shocks at the national and sectoral level, which could have an impact on employment or investment (Acharya *et al.* 2019). Then, I include the PSPP bond purchases in the regression as treatment to identify the effect of the PSPP directly (qe_{jt}).

6 Results

I will first provide results on the aggregate effect of the PSPP on credit access, including a distinction between the announcement and the stock effect as well as an event study around the announcement date. The section continues with the presentation of heterogeneous effects across firm location (country), size, age, and sector as well as sovereign risk and lenders' characteristics (sovereign debt holdings, capital ratio, banks' CDS). A discussion of the effect on firm's employment and investments completes the results.

6.1 PSPP's aggregate effect

The analysis shows that the ECB's PSPP has significantly improved SMEs' access to finance on an euro area aggregate level by increasing credit supply and credit availability, as well as decreasing financial constraints and interest rates charged on credit. Table 1 summarizes the results of estimating equation 1.

The PSPP is as expected positively correlated with perceived credit supply, as measured by the lenders' willingness to provide credit (column 1). An increase of government bond purchases as share of the outstanding amount of government bonds by 1 percentage point is correlated with an increase of the probability that credit supply increases by 0.5 percentage points. Furthermore, the

Table 1 — Aggregate effect of the PSPP on access to finance

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
PSPP	0.457***	0.263***	0.237***	-0.126***	-0.104***	-0.084***
Macro controls						
GDP growth	1.837***	0.911***	1.110***	-0.508***	0.072	0.017
Inflation rate	-4.180***	-2.796***	-2.293***	-0.138	0.061	0.129
Firm credit demand						
Need credit line increased		0.002		0.051***		-0.001
Need credit line decreased		0.017***		0.014***		0.000
Need bank loans increased	-0.008**		0.025***		0.037***	
Need bank loans decreased	0.003		0.008**		0.003	
Credit supply						
Banks' credit supply increased						-0.001
Banks' credit supply decreased						0.003*
Firm balance sheet						
Profit increased	0.027***	0.023***	0.021***	-0.005	-0.005	-0.002**
Profit decreased	-0.045***	-0.026***	-0.030***	0.009**	0.008**	-0.001
Leverage increased	-0.004	-0.015***	-0.007*	0.018***	0.011***	-0.000
Leverage decreased	0.007**	0.002	0.003	0.002	0.004	0.003**
Credit history improved	0.116***	0.070***	0.077***	-0.011***	-0.012***	0.001
Credit history deteriorated	-0.087***	-0.089***	-0.079***	0.061***	0.050***	0.003*
Capital improved	0.053***	0.029***	0.034***	0.001	0.001	0.001
Capital deteriorated	-0.074***	-0.052***	-0.060***	0.043***	0.047***	0.001
Firm characteristics						
Micro	-0.011	-0.019	-0.008	0.018	0.020*	-0.001
Small	0.008	0.002	0.011	0.015	0.014	0.000
5 to 9 years	-0.002	-0.004	-0.005	-0.012	-0.003	0.007*
2 to 4 years	0.002	-0.003	-0.015	-0.010	-0.014	0.008*
Less than 2 years	0.016	0.025	-0.017	-0.029	-0.006	0.032**
N	84568	70572	82459	72701	89254	8892
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country level controls	YES	YES	YES	YES	YES	YES

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 1 with firm fixed effects. Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise. 4. interest rate charged on credit lines. PSPP is measured as share of government bond market size. The reference groups are: Medium and 2-4 years old firms as well as "remained unchanged" for need credit line/bank loans, banks' credit supply, profit, leverage, credit history and capital.

Table 2 — Event study: PSPP's announcement effect (survey wave 11-13)

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
PSPP	1.172***	0.496***	0.450**	-0.689***	-0.925***	-0.246***
Macro controls						
GDP growth	-0.415	-0.218	-0.137	-0.396	-0.290	-0.007
Inflation rate	-4.622***	-2.774***	-5.247***	1.886	4.312***	-0.242
Firm credit demand						
Need credit line increased	-0.021	0.007		0.053***		-0.001
Need credit line decreased	0.007	-0.008		0.005		0.007
Need bank loans increased			0.030**		0.015	
Need bank loans decreased			0.006		-0.018	
Credit supply						
Banks' credit supply increased						-0.007**
Banks' credit supply decreased						0.006*
Firm balance sheet						
Profit increased	0.005	-0.007	-0.005	0.010	-0.006	0.001
Profit decreased	-0.028**	-0.025**	-0.024**	0.016	0.009	0.005
Leverage increased	-0.006	-0.017	-0.024*	0.030*	0.005	-0.001
Leverage decreased	0.010	0.002	0.017	0.009	0.013	0.002
Credit history improved	0.101***	0.071***	0.070***	0.009	-0.019*	0.001
Credit history deteriorated	-0.085***	-0.051***	-0.080***	0.090***	0.069***	0.001
Capital improved	0.010	0.025**	0.022*	-0.014	-0.004	-0.004
Capital deteriorated	-0.080***	-0.045***	-0.020	-0.002	0.019	-0.009
Firm characteristics						
Micro	0.097**	0.035	-0.027	-0.067	-0.027	-0.004
Small	0.046	0.034	0.040	-0.031	-0.028	-0.001
5 to 9 years	0.005	0.007	0.003	-0.057	0.045	0.005
2 to 4 years	-0.006	-0.019	0.083	-0.066	-0.031	0.006
Less than 2 years	0.098	0.015	0.095	-0.093	0.110	0.012***
N	12289	12634	13934	12834	14462	2491
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country level controls	YES	YES	YES	YES	YES	YES

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 1 with firm fixed effects, using data around the announcement date of the PSPP only (event study). Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise. 4. interest rate charged on credit lines. PSPP announcement is a dummy variable equal to 1 for wave 12 and 13. The reference groups are: Medium and 2-4 years old firms as well as "remained unchanged" for need credit line/bank loans, banks' credit supply, profit, leverage, credit history and capital. Sample period: Survey wave 11-13 (April 2014 - September 2015).

PSPP has helped to improve the availability of both credit lines and bank loans (column 2 and 3): A 1 percentage point increase of the PSPP (as percent of the government bond market) is correlated with an increase of the probability that credit availability increases by 0.26 percentage points and that bank loan availability increases by 0.24 percentage points. The PSPP has as expected a negative effect on experienced financial constraints: It is correlated with a reduction of credit lines constraints by -0.12 percentage points and of bank loan constraints by -0.1 percentage points. Finally, it also has an impact on the interest rate charged on credit lines, with a reduction by -0.08 percentage points, after a 1 percentage point increase of the ECB's government bond holdings as percent of the government bond market. This is in line with Horvath *et al.* (2018) who also find that the ECB's QE have decreased bank interest rates for both small and large loans (below and above 1 million euro).

A back-on-the-envelope calculation helps to set the results into context of the overall QE programme: On average, the cumulative government bond purchases as percent of the government bond market amount to 9.1% between March 2015 and September 2019 (table A.4). Hence, the average effect of the PSPP is an increase of the probability that credit supply increases by 4.2 percentage points, an increase of the probability that the availability of credit lines or bank loans increases by 2.4 percentage points, respectively 2.2 percentage points. Furthermore, the average effect on the probability of being financially constraint is -1.1 percentage points with regards to credit lines and -0.9 percentage points with regards to bank loans. The average reduction of interest rate charged on credit lines is -0.8 percentage points. Hence, the impact of the PSPP is not only statistically significant, but also economically relevant.

To make sure that these results are not confounded by other ECB policies, such as the TLTRO or the CSPP introduced in March 2016, I restrict the sample period to survey wave 11-13 (April 2014 - September 2015). The results are summarized in table 2. The estimated coefficients are significant and higher than using the sample until September 2019, suggesting that the announcement effect of the PSPP was substantial. Furthermore, it suggests that the results are indeed driven by the PSPP and not confounded by the CSPP.

Table 3 — Effect of the PSPP on access to finance over time

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
PSPP	0.418***	0.237***	0.219***	-0.131***	-0.110***	-0.076***
Oct14-Mar15 x PSPP	12.321***	7.646***	9.602***	-2.330**	-2.156**	-0.378
Apr15-Sep15 x PSPP	1.801***	1.125***	1.237***	-0.272*	-0.358***	-0.111***
Oct15-Mar16 x PSPP	0.669***	0.521***	0.587***	-0.109	-0.145**	-0.085***
Apr16-Sep16 x PSPP	0.230***	0.157***	0.250***	-0.065	-0.047	-0.049***
Oct16-Mar17 x PSPP	0.292***	0.196***	0.226***	-0.024	-0.031	-0.029***
Apr17-Sep17 x PSPP	0.229***	0.156***	0.164***	0.023	-0.014	-0.018*
Oct17-Mar18 x PSPP	0.166***	0.101***	0.129***	-0.058**	-0.021	-0.016*
Apr18-Sep18 x PSPP	0.142***	0.091***	0.055*	-0.007	-0.014	-0.005
Oct18-Mar19 x PSPP	0.089***	0.079***	0.036	0.003	-0.000	-0.009
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country level controls	YES	YES	YES	YES	YES	YES

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 2 with firm fixed effects and survey wave interaction terms. Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise (see table A.2). 4. interest rate charged on credit lines. PSPP is measured as share of government bond market size. The reference group is wave 21. The model is saturated with credit demand (and credit supply if interest rate is the dependent variable), firm balance sheet variables and firm characteristics. Sample period: Wave 1-21 (January 2009 - September 2019).

Furthermore, it is often distinguished between the announcement effect of a QE program (stock effect) of the effect of government bond purchases (De Santis and Holm-Hadulla 2019). The results in table 1 can be seen as evidence for a flow effect, while the results of the event study around the announcement of the PSPP provide evidence on the stock effect (table 2). To illustrate the PSPP's effect over time, I interact the PSPP with time dummies (table 3). It shows that indeed the effect is bigger in the beginning of the programme than in the subsequent survey waves. However, also in the course of the PSPP, the effect is still significant until March 2019 with respect to credit supply and credit availability. The significance of the effect on financial constraint is more short-lived. Interestingly, the effect on the interest decreases continuously. The effect on credit supply and credit/bank loan availability sees a small up-tick in survey wave 16 (October 2016 - March 2017), when the ECB announced an extension of its government bond purchases of monthly EUR 60 billion by 9 months (until end of December 2017).

6.2 PSPP's heterogeneous effects

The heterogeneous effects of the PSPP on credit access by firm's origin (country) are illustrated in table 4. The reference group is Germany (panel a), respectively the core euro area (panel b). Ireland, Italy, Spain and Portugal have particularly benefitted from the QE programme, compared to Germany. Interest rates were lowered significantly more in Portugal, Italy and Spain by the PSPP. Financial constraints are especially eased in Ireland and Spain. Perceived credit access, measured by the availability of credit and credit supply also increases more by the PSPP in Belgium, the Netherlands, Austria and France compared to Germany.

It seems that countries under stress, respectively with higher government bond yields also benefitted more from the PSPP. To support this hypothesis, I allocate countries into two groups, the core and the periphery of the euro area (see section 5). Countries are allocated to the core or the periphery according to the level of government bond yields before the introduction of the QE programme. Indeed, the impact of the PSPP on all measures of credit access is higher in the periphery than in the core. For example, the interest rate charged on credit lines was lowered by 0.06 percentage points more in the periphery than in the core, after a 1 percentage point increase of the PSPP.

Table 4 — Country heterogeneity

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
a) Firm country						
PSPP	0.210***	0.127***	0.091**	-0.087***	-0.021	-0.061***
AT × PSPP	0.270***	0.304***	0.272***	0.038	0.006	0.009
BE × PSPP	0.526***	0.242**	0.216**	0.020	-0.045	-0.035
ES × PSPP	0.316***	0.189***	0.118**	-0.145**	-0.228***	-0.044**
FI × PSPP	-0.106	0.008	0.057	0.127**	0.054	0.035**
FR × PSPP	0.362***	0.118*	0.257***	0.046	0.022	-0.000
IE × PSPP	0.383***	0.307***	0.439***	-0.367***	-0.253**	-0.017
IT × PSPP	0.469***	0.229***	0.229***	-0.133*	-0.166***	-0.058***
NL × PSPP	0.424***	0.178***	0.173***	-0.026	-0.197***	-0.004
PT × PSPP	0.174*	0.071	0.065	0.049	0.072	-0.101***
b) Periphery/Core						
PSPP	0.397***	0.229***	0.217***	-0.069***	-0.050**	-0.060***
Periphery × PSPP	0.156***	0.099***	0.051	-0.165***	-0.143***	-0.057***
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country level controls	YES	YES	YES	YES	YES	YES

Notes: * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. Results of estimating equation 2 with firm fixed effects and country (panel a)/country group (panel b) interaction terms. Each panel is estimated separately. Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise. 4. interest rate charged on credit lines. PSPP is measured as share of government bond market size. The reference group is Germany (panel a). respectively the core (panel b). The core comprises Germany, Austria, Belgium, Finland, France and the Netherlands. The periphery consists of Italy, Spain, Ireland and Portugal. Countries are allocated according to the level of government bond yield before the introduction of the PSPP.The model is saturated with credit demand (and credit supply if interest rate is the dependent variable), firm balance sheet variables and firm characteristics.

Ciccarelli *et al.* (2013) show that the impact of monetary policy is heterogeneous and it had stronger effects on output during the financial crisis, particularly in countries facing stress, fuelled by the credit channel of monetary policy. However, they have argued that the ECB's LTRO may have been insufficient to improve credit availability to small firms in countries under stress.[12] In contrast to these findings, I find evidence that the PSPP had a particularly positive effect on credit access for smaller firms (table 5). The impact of the PSPP on perceived credit access, measured by credit supply and availability of credit and bank loans, is higher for micro (1-9 employees) and small firms (10-49

[12]They proxy small firms by small banks, by assuming that small firms mainly lend from small banks.

Table 5 — Firm heterogeneity

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
a) Firm size						
PSPP	0.390***	0.214***	0.189***	-0.095***	-0.092***	-0.079***
Micro × PSPP	0.161***	0.096**	0.106**	-0.051	-0.050	-0.018
Small × PSPP	0.077*	0.067*	0.058	-0.048	0.001	-0.005
Micro	-0.024*	-0.028**	-0.017	0.023	0.024*	0.002
Small	0.002	-0.004	0.007	0.020*	0.014	0.001
b) Firm age						
PSPP	0.491***	0.136	0.163*	-0.083	-0.163*	-0.065***
10 years or more × PSPP	-0.035	0.130	0.076	-0.051	0.056	-0.020
5 to 9 years × PSPP	-0.020	0.174*	0.072	0.024	0.127	-0.019
Less than 2 years × PSPP	-0.151	-0.174	0.113	0.154	-0.039	0.062
10 years or more	-0.001	-0.009	0.010	0.012	0.008	-0.006
5 to 9 years	-0.004	-0.014	0.006	-0.005	0.000	0.001
Less than 2 years	0.025	0.045	-0.011	-0.035	0.009	0.016
c) Firm sector						
PSPP	0.406***	0.241***	0.193***	-0.072**	-0.075***	-0.075***
Construction × PSPP	0.175***	-0.007	0.077	-0.061	-0.036	-0.022
Trade × PSPP	0.040	0.015	0.023	-0.032	-0.026	-0.018
Services × PSPP	0.066	0.060	0.092**	-0.122***	-0.058	-0.003
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country level controls	YES	YES	YES	YES	YES	YES

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 2 with firm fixed effects and firm size (panel a), firm age (panel b) and firm sector (panel c) interaction terms. Each panel is estimated separately. Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise. 4. interest rate charged on credit lines. PSPP is measured as share of government bond market size. The reference group are medium-sized firms (panel a), 2-4 years old firms (panel b) and the manufacturing sector (panel c). The model is saturated with credit demand (and credit supply if interest rate is the dependent variable), firm balance sheet variables and firm characteristics.

employees), compared to medium-sized firms (50-249 employees). Younger firms did not benefit significantly more (panel b). The results across firm's sector do not yield a consistent picture (panel c). Hence, the PSPP particularly improved credit access for those firms, who needed the most support - namely small companies in the periphery of the euro area.

To further explore the channels, how the PSPP may be more effective in improving credit access in the periphery of the euro area, I interact the government bond purchases with macroeconomic

Table 6 — Sovereign risk and banks' balance sheet characteristics

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
a) Sovereign CDS						
PSPP	-0.520***	-0.453***	-0.256***	0.134	0.202**	0.088**
Log Sovereign CDS	-0.050***	-0.051***	-0.019***	0.012**	0.015***	0.003
Log Sovereign CDS × PSPP	0.207***	0.142***	0.111***	-0.058**	-0.066***	-0.043***
b) Banks' sovereign bond holdings						
PSPP	0.288***	0.186***	0.272***	0.030	0.183***	-0.038**
Sovereign debt	0.884***	0.272	0.941***	0.878***	1.658***	-0.216*
Sovereign debt × PSPP	2.977***	1.300*	-0.506	-2.933***	-4.742***	-0.909***
c) Banks' capital ratio						
PSPP	1.086***	0.476***	0.413***	-0.070	-0.146	-0.244***
Capital ratio	0.749***	0.759***	0.747***	0.158	0.217	-0.054
Capital ratio × PSPP	-4.045***	-1.680***	-1.433**	-0.536	-0.024	1.042***
d) Banks' CDS						
PSPP	-1.695***	-1.156***	-0.835***	0.083	0.320**	0.075
Log CDS	-0.095***	-0.062***	-0.051***	0.011*	0.015***	0.002
Log CDS × PSPP	0.423***	0.277***	0.206***	-0.042	-0.087***	-0.036**
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country level controls	YES	YES	YES	YES	YES	YES

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 3 with firm fixed effects and interaction terms: Banks' sovereign debt holdings (panel a), banks' capital ratio (panel b), banks' CDS (panel c) and sovereign CDS (panel d). Each panel is estimated separately. Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise. 4. interest rate charged on credit lines. PSPP is measured as share of government bond market size. The model is saturated with credit demand (and credit supply if interest rate is the dependent variable), firm balance sheet variables and firm characteristics.

variables measuring sovereign risk as well as banks' balance sheet health (table 6). We can see that the PSPP had a more positive impact on credit access by increasing credit supply, decreasing financial constraints and decreasing interest rates even more in countries with higher sovereign risks, as measured by the sovereign CDS spread (in log, panel a). However, the base effect of the PSPP switches signs. Interacting the PSPP with banks' sovereign bond exposure (as percent of total assets), we also see as expected an acceleration of the effect (panel b).[13] Firms in countries with lower bank capitalization also benefited relatively more from the QE in terms of perceived credit availability and

[13]Observations from the Netherlands is not included in the regression, since banks' exposure to sovereign debt is not available for the Netherlands.

lower interest rates.[14] Finally, banks' risk, as measured by banks' CDS spreads (in log), also signals a stronger effect of the PSPP on credit access. However, the base effect of the PSPP has the wrong sign, again (as in panel a). These findings can be seen as evidence for the bank lending channel of monetary policy. The ECB's QE programme may be particularly effective in improving balance sheets of banks in countries under stress and hence is able to improve credit access.

6.3 Firm's employment and investment

The recent literature on bank lending has shown that undercapitalized banks tend to lend to low-quality borrowers to prevent bailouts (zombie lending). These firms use these funds to build up cash-reserves rather than to boost their real activity and create employment - a credit misallocation (see i.e. Acharya *et al.* 2019). Therefore, I investigate whether the improved credit access by the PSPP positively influenced employment and investment growth. Table 7 summarizes the estimation results from equation 4. Panel a) illustrates the results using employment growth as dependent variable, while panel b) summarizes the effect on investment growth. Column 1-3 shows the effect by controlling for country-time-sector fixed effects. Column 4-6 show the impact of the PSPP on employment and investment growth.

Financial access has an effect on firm's employment and investments: Credit supply (willingness of banks to provide credit) has a positive and significant effect on employment and investment growth. Financial constraints are as expected negatively correlated, but the estimated coefficient is not significant. A 1 percentage point increase of the interest rate charged on credit lines reduces the probability that employment increases by 0.2-0.3 percentage points, and it reduces the probability that investment increases by 0.3-0.4 percentage points. Note that standard errors are clustered at the firm level, which is quite restrictive. If standard errors are clustered at the country level, the interest rate elasticity on employment growth is also statistically significant (table B.1).

The ECB's PSPP is as expected positively correlated with both employment and investment growth (column 4-6). A 1 percentage point increase of the PSPP's cumulative bond purchases as percent of

[14]The data on the tier 1 capital ratio by the IMF Financial Soundness Indicators is not available for all countries since survey wave 1. The start date for France, Ireland and Austria is survey wave 3.

Table 7 — Firm's employment and investments

a) Dependent variable: Firm's employment

	Firm's employment (0/0.5/1)					
	1	2	3	4	5	6
PSPP				0.184**	0.181**	0.170**
Interest rates	-0.233	-0.246	-0.254	-0.248	-0.268	-0.282
Credit supply	0.076***			0.071***		
Availability credit line		0.025			0.038*	
Financial constraints: credit lines			-0.031			-0.030
Need credit line increased	0.005	0.003	0.006	0.008	0.004	0.007
Need credit line decreased	0.010	0.008	0.010	0.004	0.003	0.005
Economic outlook improved	0.016	0.023	0.025*	0.022	0.027**	0.030**
Economic outlook deteriorated	-0.042**	-0.045***	-0.045***	-0.032**	-0.034**	-0.036**
N	8823	8851	8865	8823	8851	8865
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country × Time × Sector FE	YES	YES	YES	NO	NO	NO

b) Dependent variable: Firm's investments

	Firm's investments (0/0.5/1)					
	1	2	3	4	5	6
PSPP				0.220***	0.211**	0.204**
Interest rates	-0.399*	-0.459*	-0.474**	-0.479**	-0.559**	-0.569**
Credit supply	0.076***			0.070***		
Availability credit line		0.040*			0.042*	
Financial constraints: credit lines			-0.015			-0.015
Need credit line increased	0.035**	0.034**	0.034**	0.040***	0.037***	0.040***
Need credit line decreased	0.015	0.016	0.016	0.007	0.007	0.007
Economic outlook improved	0.014	0.019	0.023	0.023	0.028**	0.032**
Economic outlook deteriorated	-0.056***	-0.059***	-0.060***	-0.052***	-0.055***	-0.056***
N	8682	8708	8721	8682	8708	8721
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country × Time × Sector FE	YES	YES	YES	NO	NO	NO

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 4. Standard errors are clustered at the firm level. The dependent variables are firm's employment (panel a), respectively firm's investment (panel b), = 1 if it increased, = 0.5 if it remained unchanged and = 0 if it decreased over the past six months. The model is saturated with firm balance sheet variables (profit, leverage, credit history, capital position) as well as firm characteristics (size, age).

the government bond market is correlated with an increase of the probability that employment and investment growth increases by about 0.2 percentage points - irrespective of the measure of credit supply, which is controlled for (credit supply, availability of credit line of financial constraints with respect to credit lines). This is evidence that the ECB's PSPP has a stimulating effect on the real economy, at least for SMEs.

7 Robustness analysis

Table 8 — Robustness tests: Effect on credit access

	Credit supply	Availability		Financial constraints		Interest rate
		Credit	Bank loan	Credit	Bank loan	Credit line
a) Baseline						
PSPP	0.457***	0.263***	0.237***	-0.126***	-0.104***	-0.084***
b) Firms' assessment general economic outlook						
PSPP	0.364***	0.209***	0.171***	-0.116***	-0.080***	-0.085***
c) Wave 14 (March 2016 package)						
PSPP	0.460***	0.266***	0.240***	-0.126***	-0.104***	-0.083***
Wave 14	0.016***	0.016***	0.015***	-0.001	-0.004	-0.003***
d) Sample wave 1-19						
PSPP	0.510***	0.294***	0.277***	-0.126***	-0.111***	-0.092***
e) Time trend						
PSPP	0.092**	0.081*	-0.053	-0.198***	-0.262***	-0.085***

Notes: Panel a reports the baseline estimation from table 1. Panel b uses firm's assessment of the general economic outlook instead of GDP growth as control variable. Panel c includes a dummy variable for survey wave 14, which controls for the announcement of the CSPP and TLTRO 2, in March 2016. Panel d restricts the sample to survey wave 1-19 (in survey wave 20 and 21, the ECB re-invested the principal payment from maturing securities, but did not increase its stock of government bond holdings). Panel e includes a time trend. Standard errors are clustered at the firm level. The dependent variables are 1. Credit supply = 1 if banks' willingness to provide credit increased, = 0.5 if remained unchanged, = 0 if decreased. 2. Availability of credit lines/bank overdrafts and bank loans = 1 if increased, = 0.5 if remained unchanged and = 0 if decreased. 3. Financial constraints = 1 if firm is financially constraint with regards to credit lines/bank overdrafts or bank loans and = 0 otherwise (see table A.2). 4. interest rate charged on credit lines. PSPP is measured as share of government bond market size. The model is saturated with credit demand (and credit supply if interest rate is the dependent variable), firm balance sheet variables and firm characteristics.

The estimated effect of the PSPP on credit access as well as on employment and investment may be confounded by a recovery of the economy after the financial and European sovereign debt crisis. The estimation already controls for business cycle conditions (GDP growth and inflation). However, as a robustness test, I replace GDP growth, which varies at the country and time level,

with firm's assessment of the general economic outlook, which varies at the firm and country level. The estimation results are quite similar to the baseline (table 8). Furthermore, the estimation is robust to controlling for the announcement of the CSPP and the TLTRO 2, during survey wave 14 (panel c), as well as restricting the sample to survey wave 1-19 (panel d). During survey wave 20 and 21, the ECB only invested the principal payment from maturing securities, but did not expand the stock of government bonds. Furthermore, I add a time trend to the regression (panel d in table 8 and table 9), which should capture the economies' recovery or the upswing of the credit cycle. The effect of the PSPP on the interest rate is robust. The estimated coefficient of the PSPP on financial constraints is higher in magnitude. However, the effect on credit supply and the availability of credit is smaller than in the baseline, respectively and insignificant with respect to bank loan availability. The effect of the PSPP on firm's employment is smaller, and insignificant (table 9). However, the effect on firm's investment is stronger. The elasticity of credit access on firm's employment and investments is comparable to the baseline.

Table 9 — Robustness tests: Effect on employment and investment

	Employment growth			Investment growth		
	1	2	3	4	5	6
PSPP	0.077	0.069	0.063	0.534**	0.524**	0.502**
Interest rates	-0.247	-0.266	-0.280	-0.485**	-0.566**	-0.576**
Credit supply	0.071***			0.072***		
Availability credit line		0.038*			0.043*	
Financial constraints: credit lines			-0.030			-0.016
N	8823	8851	8865	8682	8708	8721
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES
Country × Time × Sector FE	NO	NO	NO	NO	NO	NO

Notes: Results of estimating equation 4, including a time trend. Standard errors are clustered at the firm level. The dependent variables are firm's employment (panel a), respectively firm's investment (panel b), = 1 if it increased, = 0.5 if it remained unchanged and = 0 if it decreased over the past six months. The model is saturated with credit demand, firm balance sheet variables (profit, leverage, credit history, capital position) as well as firm characteristics (size, age).

8 Conclusion

This paper analyzes the impact of the ECB's PSPP on SMEs' credit access as well as firm's employment and investment using firm-level data from the SAFE. Thereby, I distinguish between aggregate and heterogeneous effect of the PSPP across firm's country, size, age and sector.

The analysis shows that the PSPP is correlated with an improved access to finance of SMEs. An increase of the PSPP's government bond purchases is correlated with higher credit supply, higher credit availability for both credit lines and bank loans, lower financial constraints of credit lines and bank loans as well as a lower interest rate charged on credit lines. The transmission mechanism of the PSPP is amplified by banks holding a high level of sovereign debt, as well as lower capitalization. Micro firms with 1-9 employees and firms in the periphery of the euro area benefit the most from the PSPP. Both better credit access and the PSPP are correlated with higher firm employment and investment growth.

Hence, the ECB's quantitative easing programme was successful in improving credit access for firms which needed the most support, namely small firms in the periphery of the euro area, and in stimulating the real economy.

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Appendix

A Additional information on data

Table A.1 — ECB's monetary policy decisions

Wave	Date	DFR	MRO	MLF	Unconventional monetary policy measures
1	Jan 2009	1	2	3	
	Mar 2009	0.5	1.5	2.5	
	Apr 2009	0.25	1.25	2.25	
	May 2009	0.25	1	1.75	Covered bond purchase programme (CBPP1)
2					
3	May 2010				Securities Markets Programme (SMP)
4					
5	Apr 2011	0.5	1.25	2	
	Jul 2011	0.75	1.5	2.25	
	Aug 2011				Reactivation of SMP
6	Nov 2011	0.5	1.25	2	CBPP2
	Dec2011	0.25	1	1.75	Two 3-year LTRO
7	Jul 2012	0	0.75	1.5	
	Aug 2012				Outright monetary transcations (OMTs)
8					
9	May 2013	0	0.5	1	
10	Nov 2013	0	0.25	0.75	
11	Jun 2014	-0.1	0.15	0.4	Targeted long-term refinancing operations (TLTRO1)
	Sep 2014	-0.2	0.05	0.3	CBPP3, asset-backed securites purchase programme (ABSPP)
12	Jan 2015				Announcement APP/PSPP
	Mar 2015				Start purchases APP/PSPP (EUR 60 billion/month), until Sep 2016
13					
14	Dec 2015	-0.3	0.05	0.3	Extension APP/PSPP until Mar 2017
	Mar 2016	-0.4	0	0.25	Expansion APP/PSPP to EUR 80 billion/month, Corporate Sector Purchase Programme (CSPP)
					TLTRO II (four series, starting in June 2016)
15					
16	Dec 2016				Extension APP/PSPP with EUR 60 billion/month from Apr 2017 until Dec 2017
17	Apr 2017				Reduction APP/PSPP EUR 60 billion/month until December 2017
18	Oct 2017				Extension APP/PSPP EUR 30 billion/month from Jan 2018 - Sep 2018
19	Jun 2018				Extension and termination APP/PSPP 15 billion/month from Oct 2018 - Dec 2018
20	Mar 2019				Reinvestment of APP/PSPP principal payments from maturing securities; TLTRO III (starting Sep 2019)
21	Sep 2019	-0.5	0	0.25	

Notes: Based on Gambetti and Musso (2017). DFR: Deposit facility rate, MRO: Marginal refinancing operations, MLF: Marginal lending facility, APP: Expanded Asset Purchase Programme, PSPP: Public Sector Purchase Programme. Interest rates in percent.

Table A.2 — Variable definition

Variable	Definition
Dependent variables	
Credit supply	= 1 if firm reported in improved willingness of banks to provide credit to the firm, = 0.5 if firm reported an unchanged willingness and = 0 if firm reported a deteriorated willingness in the past six months.
Availability	= 1 if firm reported an improved availability, = 0.5 if firm reported an unchanged availability and = 0 if firm reported a deteriorated availability of...
Credit line	... credit line, bank overdraft or credit cards overdraft over the past six months. = 0 otherwise.
Bank loans	... bank loans (excluding bank overdrafts and credit lines) over the past six months. = 0 otherwise.
Financial constraints	Dummy variable = 1 if firm applied for/negotiated [credit type] and was rejected, received less than 75%, rejected because cost was too high or did not apply because of possible rejection in the past six months. = 0 otherwise.
Credit line	Credit line, bank overdraft or credit cards overdraft
Bank loan	Bank loans (excluding bank overdrafts and credit lines)
Interest rates	Interest rate (fix or variable) (numeric) charged for credit line or bank overdraft which the firm applied for in the past six months.
Control variables	
Credit demand	Categorical variable: Firm's need for [credit type] increased/remained unchanged/decreased over the past six months.
Credit line	... credit line, bank overdraft or credit cards overdraft.
Bank loans	... bank loans (excluding bank overdrafts and credit lines).
Economic outlook	Categorical variable: General economic outlook, insofar as it affects the availability of external financing, improved/remained unchanged/deteriorated over the past six months.
Profit	Categorical variable: Firm's profit increased/remained unchanged/decreased over the past six months.
Leverage	Categorical variable: Firm's debt compared to assets (leverage) increased/remained unchanged/decreased over the past six months.
Capital	Categorical variable: Firm's own capital improved/remained unchanged/deteriorated over the past six months.
Credit history	Categorical variable: Firm's credit history improved/remained unchanged/deteriorated over the past six months.
Size	
Micro	1-9 employees.
Small	10-49 employees.
Medium	50-249 employees.

Notes: Source: SAFE, survey wave 1-21. The reference period is the SAFE question's reference period (last six months). Refer to table A.5.

Table A.3 — Definition country-level control variables

Variable	Definition
PSPP	Cumulated ECB's government bond purchase per country from March 2015 until the end of the reference period as share of government bond market size. Source: ECB.
Government bond market size	Amount outstanding of debt securities issued by the general government in EUR at the end of the reference period. Source: European Central Bankt.
GDP growth	Average quarterly real GDP growth. Average over the question's reference period. Seasonally adjusted. Source: Eurostat.
Inflation	Monthly HICP. Aggregated to bi-annual growth rate as average over the question's reference period. Source: Eurostat.
Sovereign debt	Debt securities from general government (euro area) on MFI balance sheet, adjusted for the effects of factors that do not relate to transactions, as % of total assets. Reference period average. Source: ECB MFI statistic
Sovereign CDS	10 year sovereign CDS spread, USD. Reference period average. Source: Thomson Reuters
Banks' CDS	5 year bank CDS, EUR, divided by 1000. Country and reference period average. Source: Thomson Reuters
Capital ratio	Tier 1 capital ratio (Regulatory Tier 1 Capital to Risk-Weighted Assets). Reference period average. Source: IMF Financial Soundness Indicators

Notes: The reference period is the SAFE questions' reference period (last six months, refer to table A.5).

Table A.4 — Summary statistics

	N	Mean	St.Dev.	Min	Max
Banks' credit supply	110373	.503	.344	0	1
Availability credit lines	79880	.505	.284	0	1
Availability bank loans	94047	.51	.301	0	1
Financial constraints credit	84963	.114	.318	0	1
Financial constraints bank loans	108632	.107	.309	0	1
Interest rate credit line	9403	.035	.033	0	.34
Employment growth	93186	.58	.308	0	1
Investment growth	96850	.561	.304	0	1
PSPP	156591	.091	.108	0	.36
GDP growth	156591	.003	.009	-.03	.12
Inflation	156591	.012	.01	-.03	.04
Need credit line increased	81660	.25	.433	0	1
Need credit line decreased	81660	.152	.359	0	1
Need bank loans increased	99737	.22	.414	0	1
Need bank loans decreased	99737	.185	.388	0	1
Profit increased	153030	.293	.455	0	1
Profit decreased	153030	.366	.482	0	1
Leverage increased	139561	.188	.39	0	1
Leverage decreased	139561	.279	.448	0	1
Capital improved	146678	.255	.436	0	1
Capital deteriorated	146678	.106	.308	0	1
Credit history improved	154010	.278	.448	0	1
Credit history deteriorated	154010	.14	.347	0	1
Micro	156591	.392	.488	0	1
Small	156591	.333	.471	0	1
Medium	156591	.275	.446	0	1
More than 10 years	154225	.814	.389	0	1
5 to 9 years	154225	.118	.322	0	1
2 to 4 years	154225	.052	.223	0	1
Less than 1 years	154225	.016	.127	0	1
Sovereign debt	143601	.057	.024	.01	.1
Capital ratio	130769	.138	.032	.07	.25
Sovereign CDS	156591	4.448	.836	2.89	6.91
CDS	147947	4.906	.736	3.1	7.35

Notes: The variables' definition is given in tables A.2 and A.3.

Table A.5 — SAFE survey's reference period and publication dates

Wave	Round	Publication date	Reference period - last 6 months
1	2009H1	21.09.2009	January-June 2009
2	2009H2	16.02.2010	July-December 2009
3	2010H1	22.10.2010	March-September 2010
4	2010H2	27.04.2011	September 2010-February 2011
5	2011H1	01.12.2011	April-September 2011
6	2011H2	27.04.2012	October 2011-March 2012
7	2012H1	02.11.2012	April-September 2012
8	2012H2	26.04.2013	October 2012-March 2013
9	2013H1	14.11.2013	April-September 2013
10	2013H2	30.04.2014	October 2013-March 2014
11	2014H1	12.11.2014	April-September 2014
12	2014H2	02.06.2015	October 2014-March 2015
13	2015H1	02.12.2015	April-September 2015
14	2015H2	01.06.2016	October 2015-March 2016
15	2016H1	30.11.2016	April-September 2016
16	2016H2	24.05.2017	October 2016-March 2017
17	2017H1	29.11.2017	April-September 2017
18	2017H2	04.06.2018	October 2017-March 2018
19	2018H1	28.11.2018	April-September 2018
20	2018H2	29.05.2019	October 2018-March 2019
21	2019H1	29.11.2019	April-September 2019

B Additional results

Table B.1 — Country clustered standard errors

a) Dependent variable: Firm's employment

	Firm's employment (0/0.5/1)					
	1	2	3	4	5	6
PSPP				0.184***	0.181***	0.170**
Interest rates	-0.233***	-0.246***	-0.254***	-0.248**	-0.268***	-0.282***
Credit supply	0.076***			0.071***		
Availability credit line		0.025			0.038**	
Financial constraints: credit lines			-0.031			-0.030
N	8823	8851	8865	8823	8851	8865
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country × Time × Sector FE	YES	YES	YES	NO	NO	NO

b) Dependent variable: Firm's investments

	Firm's investments (0/0.5/1)					
	1	2	3	4	5	6
PSPP				0.220***	0.211***	0.204***
Interest rates	-0.399**	-0.459***	-0.474***	-0.479**	-0.559**	-0.569**
Credit supply	0.076**			0.070**		
Availability credit line		0.040**			0.042**	
Financial constraints: credit lines			-0.015			-0.015
N	8682	8708	8721	8682	8708	8721
Firm FE	YES	YES	YES	YES	YES	YES
Firm level controls	YES	YES	YES	YES	YES	YES
Country × Time × Sector FE	YES	YES	YES	NO	NO	NO

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results of estimating equation 4. Standard errors are clustered at the firm level. The dependent variables are firm's employment (panel a), respectively firm's investment (panel b), = 1 if it increased, = 0.5 if it remained unchanged and = 0 if it decreased over the past six months. The model is saturated with firm balance sheet variables (profit, leverage, credit history, capital position) as well as firm characteristics (size, age).