

ECB unconventional monetary policy and SME access to finance

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Abstract

Small and medium sized enterprises (SMEs) account for majority of employment and economic growth, which makes them a priority for the transmission of monetary policy to the real economy. However, SMEs experienced a credit crunch following the sovereign debt crisis. Since 2014, the ECB engaged in accommodative/unconventional monetary policy to restore funding conditions in the euro area, to support stronger economic growth and higher inflation. We examine the relationship between monetary policy and SME credit access in countries most affected by the sovereign debt crisis – Greece, Ireland, Italy, Portugal, and Spain. We show that as SMEs' debt to assets increased, they were more likely to be credit constrained. However, in the presence of expansionary monetary policy, firms with high debt to assets are less likely to be credit constrained. The unconventional monetary policy (UMP) effect dominates and reduces credit constraints for SMEs. Additionally, we find little evidence that risky firms are credit constrained even during periods of UMP. Our findings support the efficacy of UMP in influencing SME credit access. However, policy needs to further support the transmission of UMP to micro firms.

Keywords: Unconventional monetary policy, SMEs, credit access, bank lending, micro firms

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1. Introduction

The euro area sovereign debt crisis which began in 2010 adversely affected firms' access to finance, leading to lower economic growth and a prolonged period of low inflation ([Acharya et al. 2018](#)). Countries in the periphery¹ suffered disproportionately from higher sovereign rates, reflecting their deteriorated sovereign creditworthiness. Empirical studies show that small and medium sized enterprises (SMEs) in these countries that were mostly affected by the sovereign debt crisis suffered in terms of access to finance ([Ferrando & Mulier 2015](#), [Kaya & Masetti 2019](#), [Guercio et al. 2020](#)). The credit crunch that followed the crisis disrupted SMEs' business and investment activities ([Ferrando & Ruggieri 2018](#), [Bongini et al. 2021](#)) prolonging their low economic growth and subdued inflation.

In 2013-14, Euro-area inflation was still well below the European Central Bank's (ECB's) price stability target of below, but close to, 2% over the medium term due to the low inflation recovery following the 2007-08 financial crisis and 2010 sovereign debt crisis. Faced with zero bound interest rates in 2014, the ECB engaged in an even more accommodative monetary policy- commonly referred to as unconventional monetary policy (UMP)- aimed at returning inflation to levels consistent with its price stability target and incentivising banks to lend to the real economy.² This included tools such as negative interest rate policy, forward guidance, targeted long-term refinancing operations (TLTROs) and various asset purchase programmes (APPs) which worked together to restore funding conditions in the euro area and support higher inflation.

In this paper, we examine two related hypotheses to determine if UMP trickled down to SMEs. First, we assess if SMEs increase their debt to assets in the presence of UMP and if this leads to a decrease in the probability that a firm is credit constrained. Second, we investigate if there is a relationship between risky firms being less credit constrained due to UMP using firms' measures of risk. We measure UMP by the total assets of the ECB divided by euro area nominal GDP ([Peydró et al. 2021](#)). We use firm micro level data on 11,319 SME observations from the EU/ECB's "Survey on the Access to Finance of Enterprises" (SAFE) to evaluate the relationship between UMP and SME credit access during the time period 2014-19. Specifically, we focus on the five euro area countries - Greece, Ireland, Italy, Portugal, and Spain (hereafter denoted as "stressed countries") that experienced deteriorated credit access

¹Following [Acharya et al. \(2018\)](#), we define the peripheral countries as Greece, Ireland, Italy, Portugal and Spain.

²It should be noted that the ECB initiated UMP in 2012 with outright monetary transactions (OMT) whereby the ECB committed to buy risky sovereign debt and sterilizes the debt by selling other bonds or bills.

following the sovereign debt crisis.

This line of analysis is important for several reasons. SMEs are central to supporting economic growth, innovation, job creation and social integration in the European economy. SMEs accounted for 99.8% of all enterprises, 53% of the total value added and 65% of total employment in the EU in 2020 (EC 2021). Furthermore, bank credit is among the crucial determinants for SME survival and growth (Gerlach-Kristen et al. 2015, Kallandranis & Kalantonis 2020) as they are often unable to borrow in the corporate bond market or raise capital in the stock market (Bougheas et al. 2006, Kashyap & Stein 1994). Investigating the impact of UMP on SME's credit constraints is therefore a primary goal.

The literature on the transmission of monetary policy to the real economy generally focuses on the impact of monetary policy on the asset side of the bank balance sheet and how bank balance sheet health alters this impact (Bernanke & Blinder 1988, Kapoor & Peia 2021). However, given that firms in Europe are relatively bank dependent, the ECB's inflation target is also dependent on their firm-level decision process (Anastasiou & Giannoulakis 2021). Therefore, we focus on the impact of UMP on firm financing decisions using a micro firm-based survey that was designed to measure loan demand.

Our paper relates to the traditional interest rate channel of UMP, which suggests that the low interest rate environment decreases the cost of capital and increases the demand for firm borrowing and investment (Bernanke & Gertler 1995, Mishkin 1996). It is also related to the risk-taking channel of monetary policy which describes how banks can change their activities or appetites for risk due to monetary policy (Borio & Zhu 2012). Finally, it responds to the financial frictions literature that suggests the determinants of firm financing constraints are due to asymmetric information determined by firm characteristics such as age, size and ownership structure (Fazzari et al. 1987, Kirschenmann 2016).

We add to the literature by investigating the risk from a firm's viewpoint and consider if UMP impacts these risky firms in terms of being credit constrained. We use firms' objective (profit and turnover decreased in the previous six months) and subjective (credit history, own capital or own outlook deteriorated in the previous six months) measures of risk. Most monetary transmission literature that considers risk focuses on bank measures of firm risk and if banks reallocate their assets towards risky assets. For instance, Peydró et al. (2021) identifies riskiness by looking at the loan yields and the firm's Z-scores. Others focus on the substitution of banks towards more risky sovereign debt in the aftermath of the sovereign debt crisis (Acharya & Steffen 2015). The use of firm-based measures is important because if firms

view themselves as risky, they may be discouraged from applying for a loan due to fear of rejection despite UMP, and this may represent an efficient market outcome.

Such research is important from a policy perspective. In particular, the transmission of UMP to SMEs is vital given their bank dependence and importance in terms of economic activity. Furthermore, the ECB continues to use UMP tools such as asset purchases, negative interest rates and forward guidance in times of market stress and economic downturns, and these tools will continue to remain important (Schnabel 2020). Our findings provide some insights into the ability of UMP to provide credit to SMEs and contributes to the debate on the efficacy of these policies. The paper is structured as follows. Section 2 describes the data. Section 3 presents the empirical methodology. Section 4 discusses the results, while section 5 concludes.

2. Data

We employ half-yearly firm-level data from the ECB/EC SAFE for our analysis. There have been twenty-five SAFE waves conducted since 2009; the period when the financial crisis infected the euro area. Our data covers the period 2014:H1 to 2019:H1 for five stressed countries, i.e., Greece, Ireland, Italy, Portugal, and Spain. Our choice of starting date of the sample includes the introduction of negative policy rates and , first series of TLTROs (September 2014) and the ECB's announcement of the APPs (October 2014). Further, our sample covers data until September 2019; before SME credit access was confounded by the COVID-19 pandemic which arrived in Europe in January 2020. This allows us to focus on the impact of UMP on SME credit access over the time period from when the UMP began and before the pandemic impacted this picture. We omit observations with missing values for credit constrained. This leaves us with a final sample of 11,319 observations.

The firm-level SAFE includes information on non-financial firms' responses to questions regarding their characteristics in terms of age, size, turnover, ownership, legal form and sector as well as information on their credit access, whether they increased their debt to assets and the firm's own assessment of their credit risk.³ All survey-based percentages are weighted statistics that restore the proportions of the economic weight (in terms of employees) of each class size, economic activity and country (EC 2021). We use this data to construct our dependent as well as firm-level explanatory variables. The information in SAFE is qualitative and so all firm-level variables are categorical. Definitions of all our variables can be seen in Appendix

³SAFE's main results are published every six months. For more information on the survey see https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/index.en.html

B. Section 2.1 describes the dependent variable, while Section 2.2 describes the independent variables.

2.1 Dependent Variable

We use SAFE firm-level data to construct our dependent variable using firm responses to Q7a and Q7b on firms' credit access. Q7a and Q7b from the SAFE can be seen in Table 4 of Appendix A. The dependent variable '*credit constrained*' equals 1 if the firm reported (i) to have applied for bank loans in the previous six months but was rejected (Credit Denied) or (ii) to have applied but received less than 75% of its demand (Rationed) or (iii) to have refused credit because it was offered at too high a cost (Refused due to high cost) or (iv) not to have applied because of possible rejection (Discouraged). Alternatively, the variable equals 0 if the firm reported (i) to have applied for bank loans in the previous six months and received everything or received 75% and above.

This measure of credit constrained is commonly used in the literature as a dependent variable (Ferrando et al. 2017, Kaya & Masetti 2019, Corbisiero & Faccia 2020). The inclusion of discouraged borrowers is a major advantage of SAFE over credit registers data which has been used by many to measure loan supply. In particular, it captures informal credit constraints (Ferrando et al. 2019) and disregarding discouraged borrowers would risk measurement error in the supply of credit (McQuinn 2019).

Of the 11,319 firms in our sample, 4,581 or 40.5% were credit constrained - with discouraged borrowers making up 40% of these firms. Figure 1 shows the proportion of credit constrained firms in each country over the period 2014 to 2019. It shows that while credit constrained firms remain elevated in Greece, the proportion of credit constrained firms fall over the period 2014 to 2019 - which is happening at the same time as UMP.

2.2 Independent Variables

Firm characteristic controls such as size, age, turnover, sector, individual or family owned and stand-alone (autonomous profit-oriented enterprise - making independent financial decisions) are constructed from SAFE. We report summary statistics in Table 1 on all the firm variables included in the survey and employed in our tests. As averages over the sample, 94% of the firms are stand-alone, making independent financial decisions and not part of any other enterprise. 87% are individual or family owned. 40% of total firms are micro (less than 10 employees), 33% are small (between 10 and 50 employees), and 27% are medium (between 50 and 250 employees). Most firms – 86% are more than 10 years old - with only 0.8% less than two years

old. Almost 53% of firms have an annual turnover of less than €2 million.

We use the debt-to-assets ratio increased in the previous six months as our firm balance sheet variable and 30% of firms experienced this (see Table 1).⁴ We use five measures of firm credit risk from the firms' viewpoint, i.e., profit decreased, turnover decreased, credit history deteriorated, own capital deteriorated, and own outlook deteriorated since these affect the availability of external financing. Table 1 shows that in our sample, 40% of firms experience a reduction in profit and 27% witnessed a fall in turnover in the last six months. 15% of firms report their credit history deteriorated, while 15% report their own capital deteriorated. 86% firms witness a deterioration in their own outlook in the previous six months.

We measure monetary policy by the total assets of the ECB minus autonomous factors that are outside the direct control of the ECB- such as banknotes in circulation and government balances at the central bank divided by euro area nominal GDP. This data was sourced from the ECB. Table 1 shows that the average assets purchased were €1.237 trillion, ranging from €0.675 trillion to €2.291 trillion over the period 2014 to 2019. Figure 2 shows the evolution of ECB assets over the period of our sample.

We proxy bank balance sheet health using aggregate bank characteristics such as non-performing loans (NPL) and capital ratios sourced from the IMF Financial Soundness Indicators. NPLs vary from a low of 3.4% to a high of 45.8%, while capital ratios vary from a low of 10.6% to a high of 25.3% over the period. We use inflation and unemployment as macroeconomic controls and they are both sourced from Eurostat. Table 1 shows that unemployment went from a minimum of 5% to a maximum of 26.5% and inflation went from a minimum of -2.017% to a maximum of 2.050% over our sample period.

3. Empirical Methodology

We discuss in this section the empirical methodology for two related hypotheses about the probability that a firm will be credit constrained in the presence of unconventional monetary policy.

Hypothesis 1: An increase in firms' debt-to-assets reduces their probability of being credit constrained in the presence unconventional monetary policy

⁴The previous literature proxies higher leverage by employing the ratio of debt-to-assets ratios (Demoussis et al. 2017). In theory, the higher the ratio, the greater the degree of financial risk because more leveraged firms face a greater likelihood of insolvency (Lawless & McCann 2013, Ferrando & Mulier 2015). However, we look at whether firms have increased their debt to assets in the last six months based on UMP in the previous period to investigate if UMP is translating to firms increasing their bank loans in the short-term, assuming that this debt was in the form of a bank loan (Caglio et al. 2021).

To test *H1*, we interact monetary policy- measured by ECB assets, with firms increasing their debt-to-assets over the previous six months. This is modelled in Equation 1 as follows:

$$P(\textit{CreditConstrained} = 1|x) = \alpha_i + \beta' MP_{t-1} + \gamma' \textit{DebttoAssets}_{i,c,t} \quad (1) \\ \times MP_{t-1} + \delta' X_{i,c,t} + \theta' \textit{Macro}_{c,t-1} + \zeta' \textit{BankCh}_{c,t-1} + \eta_{c,s} + \epsilon_{i,s,c,t},$$

where $P(\textit{CreditConstrained} = 1|x)$ is a dummy variable equal to 1 if the firm is credit constrained and 0 otherwise. MP_{t-1} is a measure of monetary policy and is proxied by the logarithm of ECB assets minus autonomous factors that are outside the direct control of the ECB. We take the six-month lag since monetary policy can impact firms' decisions to apply for finance and banks' decisions to grant loans with a lag. We model $\textit{DebttoAssets}_{i,c,t}$ categorically as a dummy variable equal to 1 if the firm's debt-to-asset ratio increased in the previous six months, and 0 if it decreased or remained unchanged. γ' is our main coefficient of interest as it captures if firms with increased debt-to-assets decreased their probability of being credit constrained during UMP. A statistically significant negative result of the interaction between monetary policy and firms' increased debt-to-assets would suggest that there is a relationship between banks taking on more debt following periods of UMP leading to them being less credit constrained.

We control for confounding factors that might influence loan supply and loan demand such as bank characteristics, firm level heterogeneity and the stage of the economic cycle. $\textit{BankCh}_{c,t-1}$ measures banks' balance sheet health indicators at the country level which impacts credit supply and demand, with subscript c indicating country and t indicating time in half-year survey data frequency. $X_{i,c,t}$ is a set of firm level covariates to control for firm heterogeneity - with subscript i , c and t indicating firm, country and time respectively. $\textit{Macro}_{c,t-1}$ is a vector of macroeconomic variables to control for the economic cycle. Both macro and bank controls are lagged by six months to correspond with the six-month SAFE survey (Mc Namara et al. 2020). Finally, we include sector-country fixed effects ($\eta_{c,s}$) to eliminate any shocks common to all firms in the same sector in the same country. Since our panel is an unbalanced one with some firms being interviewed once, this limits our use of firm fixed effects which would further allow to isolate the impact of UMP on firm credit constraints by absorbing any firm-specific credit demand shocks.

We justify our controls in line with the literature. We control for bank characteristics using the six-month lag of the ratio of NPLs to total loans and capital ratios at the country level given the empirical evidence that the transmission of monetary policy to the real economy is based primarily on bank balance sheet health. In particular, the loan supply may be impaired

for banks with high NPLs or weak capital (Donnery et al. 2018, Altavilla et al. 2019). We control for the country specific economic cycle using the six-month lag of unemployment and inflation given the country specific macroeconomic impact on firms' access to finance directly and indirectly (Ferrando 2020).

We include firm characteristics using information on firm size, turnover, age and ownership structure in line with the financial frictions literature which suggests that firm financing constraints are due to firm characteristics which leading asymmetric information (Fazzari et al. 1987, Holton et al. 2014, Ferrando & Mulier 2015, Kirschenmann 2016). We expect younger and smaller firms – in terms of employees and turnover - to be more credit constrained than older and larger firms. In addition, family-owned firms usually have more durable banking relationships in comparison to non-family owned firms reducing asymmetric information (Calabrese et al. 2021). Therefore, we expect family-owned firms to be less credit constrained.

The empirical literature also suggests that sector and legal form may determine firm financing constraints. Firms in different sectors have different financing needs (Moritz et al. 2016) and may react differently to monetary policy (Durante et al. 2020). To examine the effect of sectors on demand for financing, we use the four categories applied in SAFE: manufacturing, construction, trade and services. In addition, different legal forms such as stand-alone firms – those not part of a subsidiary - may be less discouraged from applying for finance (and so less credit constrained) because they have a higher need for external financing (Freel et al. 2012, Mol-Gómez-Vázquez et al. 2019).

Hypothesis 2: The probability of a risky firm being credit constrained decreases during periods of UMP

To test *H2*, we regress $P(\text{CreditConstrained} = 1|x)$ on monetary policy interacted with firms' risk variables increasing over the previous six months. This is modelled in Equation 2 as follows:

$$P(\text{CreditConstrained} = 1|x) = \alpha_i + \beta' MP_{t-1} + \gamma' \text{FirmRisk}_{i,c,t} \quad (2) \\ \times MP_{t-1} + \delta' X_{i,c,t} + \theta' \text{Macro}_{c,t-1} + \zeta' \text{BankCh}_{c,t-1} + \eta_{c,s} + \epsilon_{i,s,c,t},$$

The interaction between monetary policy and firm risk variables is the main coefficient of interest as it captures the probability of a risky firm being credit constrained during periods of UMP. We model $\text{FirmRisk}_{i,c,t}$ categorically. Following the literature, we use two objective measures of firm credit risk: turnover and profit decreased in the previous six months. Additionally, we use three subjective measures of credit risk, i.e., deterioration of credit history,

own capital, and own outlook as it affects the availability of external financing.

The literature shows that decreased profits increase the probability of a firm being credit constrained (Holton et al. 2014, Ferrando & Mulier 2015, Beyhaghi et al. 2020). Mol-Gómez-Vázquez et al. (2019) shows that borrower discouragement increases for SMEs in a vulnerable situation (decreased turnover, decreased profit). However, Moro et al. (2020) show that turnover does not affect the probability of a firm applying for a loan or the firm being discouraged. Further, previous literature suggests that firms with worsened credit history should face greater difficulty in obtaining bank loans (Aristei & Angori 2021), and are more likely to be discouraged (Han et al. 2009, Moro et al. 2020) and rationed (Beyhaghi et al. 2020). Calabrese et al. (2021) find that firms that improve their risk indicators in terms of capital and own outlook perceive an increase in the availability of future bank financing funds. Holton et al. (2014) show that access to other sources of funds - in terms of the firm's own capital - reduce the probability of loan rejection. Moro et al. (2020) show that a positive firm outlook increases the probability of a firm obtaining a loan. Hence, evidence from previous literature on this is ambiguous.

A statistically significant and negative result in the interaction of monetary policy and credit risk increasing in the previous six months would suggest that there is a relationship between risky firms being less credit constrained following periods of UMP.

4. Results

Table 2 presents the estimation results for Equation 1 highlighting the impact of UMP on the probability of being credit constrained for firms with increased debt-to-assets. Reported estimates are conditional marginal effects drawn from probit regression models with sample selection for our pooled sample of SMEs.

Our findings show that as debt-to-assets increased in the previous six months, SMEs were more likely to be credit constrained. This is in line with the literature where Mac an Bhaird et al. (2016) find that increasing debt-to-asset ratios lead to an increase in discouraged borrowers- a component of our dependent variable. Demoussis et al. (2017) and Beyhaghi et al. (2020) show that when the debt-to-assets ratio increases, the probability of rationing for SMEs increases - a component of our credit constrained variable.

However, when we interact ECB assets with increased debt-to-assets over the previous six months, we find that firms are less likely to be less credit constrained. It is the UMP that is dominating here suggesting that firms are less credit constrained when their debt-to-assets

are increased over the previous six months during periods of UMP. The increased debt is most likely to be short-term loans from banks as the majority of SME debt is bank loan debt (Bongini et al. 2021, Caglio et al. 2021) and supports the interest rate channel. The relationship between debt and monetary policy is also evident in the literature. Prasad & Ghosh (2005), Bougheas et al. (2006) and De Haan & Sterken (2006) show that firms reduce their short-term debt in response to a monetary tightening. Bounader & Doukali (2019) show that SMEs substitute from long-term to short-term debt when monetary policy is expansionary.

4.1 Risky firms being credit constrained during periods of UMP

Table 3 presents the estimation results for Equation 2 showing the impact of UMP interacted with firms' credit risk variables, namely profit decreased (columns 1-2), turnover decreased (columns 3-4), credit history deteriorated (columns 5-6), own outlook deteriorated (columns 7-8) and own capital deteriorated (columns 9-10). Firm controls are added in column 2, 4, 6, 8 and 10. All the interaction terms of credit risk interacted with MP_{t-1} are insignificant in impacting on firms' credit constraints, with the exception of profit decreased. On balance, there is no evidence either way that banks are lending to risky firms- when risk is measured from the firm's own viewpoint during periods of UMP.

The risk-taking channel literature generally focuses on how monetary policy effects the portfolio rebalancing in bank balance sheets away from safe assets like government bonds and towards more risky assets like loans to SMEs (Albertazzi et al. 2021). When we measure risk from the firms' viewpoint, we find no significant relationship between UMP and the decreased probability that such risky firms are credit constrained. Peydró et al. (2021), Caglio et al. (2021) and Dell'Ariccia et al. (2017) find little evidence of risk-taking arising from bank behaviour due to UMP. Our paper complements this area of research suggesting that there is little evidence of risky firms being granted loans when risk is measured from the firm's viewpoint. A potential extension of this paper would require matching firm-bank observations and investigate which banks lent to which firms.

4.2 Firm control variables

We report firm controls including size in terms of employees and turnover, legal form and sector in our result tables. These firm characteristics remain statistically significant and similar in magnitude and direction across all specifications. Therefore, they are important in explaining the variation in the probability of a firm being credit constrained during this period of UMP and this reflects the financial frictions literature.

Stand-alone firms that make independent financial decisions are less likely to be credit constrained and discouraged because they have a higher need for external financing and this finding is reflected in the literature (Freel et al. 2012, Mol-Gómez-Vázquez et al. 2019). Firms in trade and industry are less likely to be credit constrained. This finding is also reflected in the literature with respect to firms in industry (Moritz et al. 2016, Beyhaghi et al. 2020, Guercio et al. 2020) and trade (Demoussis et al. 2017, Guercio et al. 2020). This could be because firms in industry have more fixed assets which increase collateral and reduces risk for banks (Moritz et al. 2016, Guercio et al. 2020).

In terms of size, micro firms which have fewer than 10 employees are more likely to face credit constraints. This is consistent with the literature that suggests smaller firms are more credit constrained (Masiak et al. 2019, De Jonghe et al. 2020). Size is also proxied by turnover where we find that firms with low turnover (up to 2 million) are more likely to face credit constraints, while firms with higher turnover are less likely to face credit constraints (McQuinn 2019, Guercio et al. 2020). This finding is important because even in periods of UMP, micro firms are more likely to be credit constrained.

4.3 Heterogeneous analysis

We also analyse *H1* and *H2* with respect to firm size, i.e., micro, small and medium (see Table 1). Figure 3 plots the coefficients for credit constrained regressed on debt-to-assets increased during periods of unconventional monetary policy. It shows that $MP_{t-1} \times Debttoassets_{i,c,t}$ is statistically insignificant for micro and small firms, however the coefficient is statistically significant for medium firms implying a decrease in probability that a firm is credit constrained at 5% significance level. This confirms our result that micro firms have difficulty accessing credit even during periods of UMP.

Figure 4 shows the coefficient plots for credit constrained regressed on firm risk during periods of unconventional monetary policy. All firm risk variables (profit decreased, turnover decreased, credit history deteriorated, own capital deteriorated, own outlook deteriorated) interacted with monetary policy are statistically insignificant for micro, small and medium firms. This confirms our results for *H2* that there is no evidence that banks are lending to risky firms during periods of UMP.

4.4 Robustness Checks

4.4.1 *Robustness by type of credit constraint*

Including discouraged lenders in our dependent variable credit constrained could lead to an overestimation of our estimates given that discouraged borrowers make up 40% of credit constrained firms in our sample. Therefore, we remove discouraged from our dependent variable to ensure that our *H1* and *H2* results are not driven by this definition. Table 6 and Table 7 in Appendix C show the results and they are similar to our main findings for *H1* and *H2*; whether or not we include discouraged in our dependent variable.

4.4.2 *Robustness by type of ECB asset*

ECB's total assets might be considered too broad a proxy for UMP given that ECB asset purchases did not directly impact on SME credit constraints. This is because ECB asset purchases mainly benefitted large companies by increasing the demand for their bonds and pushing down their yields (Albertazzi et al. 2021). Indeed, in our sample, 90% of firms indicated that they had not issued debt securities in the past or considered doing so in the future. Therefore, we take two separate sub-components of ECB's total assets: lending to euro area credit institutions related to monetary policy operations and ECB holdings of securities—both divided by nominal euro area GDP. The former measure reflects direct lending to banks while the latter better captures the UMP effect. ECB purchases of securities should reduce firm credit constraints as banks selling securities to the ECB can use the proceeds to extend credit to firms (EC 2015). In addition, banks can lend a proportion of their increased deposits, from investors who have sold securities to the ECB and lodged the proceeds in their bank accounts to firms (Butt et al. 2014).

Table 8 in Appendix C shows the results for *H1*. Lending to euro area credit institutions interacted with debt-to-assets increased is not significant. However, securities of euro area residents interacted with increased debt-to-assets is statistically significant and shows the same results as when ECB assets is used as a whole. This suggests that ECB asset purchases of securities is more important than lending to euro area institutions, when interacted with firms' debt-to-assets increasing, in reducing the likelihood that SMEs face credit constraints. Table 9 (MP_{t-1} proxied by lending) and Table 10 (MP_{t-1} proxied by securities) in the appendix show the results for *H2*. The interaction coefficients between monetary policy and risk variables are statistically insignificant for both sub-components of ECB assets: lending and securities. This confirms our *H2* results.

4.4.3 *Robustness by measure of monetary policy*

We use an alternative measure of monetary policy to ECB assets to see if our results are being driven by ECB assets as proxy for monetary policy. We use the six-month lag of the ‘shadow interest rate’ estimated by [Wu & Xia \(2017\)](#) to compensate for Eonia⁵ being zero bound. Table 11 in Appendix C shows that *H1* results hold and Table 12 shows that *H2* results hold when we proxy monetary policy using the [Wu & Xia \(2017\)](#) shadow rate.

5. Conclusions

SMEs account for two-thirds of employment in the euro area and this makes them a priority for the transmission of monetary policy to the real economy. We use a binary probit model to examine two related hypotheses on the relationship between UMP and SME access to finance in countries that were most affected by the sovereign debt crisis. We show that as SMEs’ debt-to-assets increased, they were more likely to be credit constrained. Further, when we interact ECB assets with increased debt-to-assets, we find that firms are less likely to be credit constrained. The UMP effect dominates and reduces credit constraints for SMEs. We find little evidence that risky firms are more or less credit constrained during periods of UMP. Our findings broadly support the efficacy of UMP in influencing SME credit access during periods of negative interest rates.

From a policy perspective, public policy needs to reduce information asymmetries that exist between lenders and micro firms. Public guarantee schemes can help overcome problems such as lack of track record and low collateral as they transfer some of the credit risk and potential credit losses from banks to governments ([Falagiarda et al. 2020](#)). Government credit guarantee schemes for SME loans, which were introduced in a number of countries during the COVID-19 pandemic are to be welcomed in this regard. Such schemes should be evaluated and redesigned in a post pandemic environment to increase micro firms’ access to credit. Public initiatives aimed at reducing information symmetries using blockchain or other technologies between lenders and small firms may also be effective in increasing micro firm access to finance. This becomes even more important in a post pandemic environment where micro firms may have experienced decreased profitability, increased debt levels and lower credit scores. There is room for more work. Future research could determine whether UMP led to an increase in firms’ activities or whether micro firms that were credit constrained even during periods of UMP reduced their investment and innovation activities.

⁵Eonia is the interbank overnight lending reference rate for the euro

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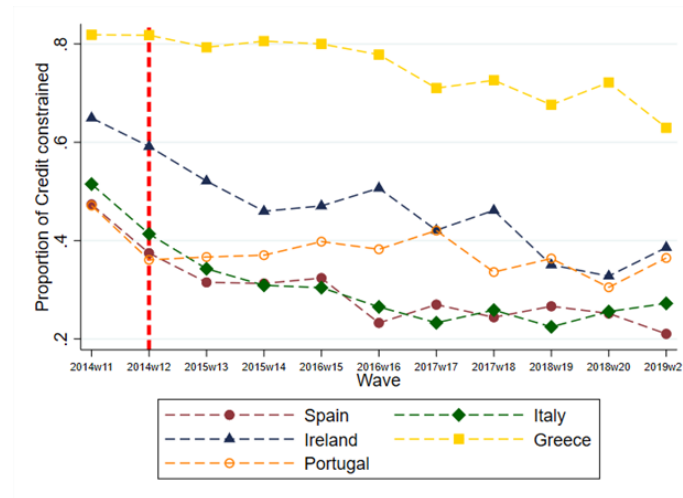
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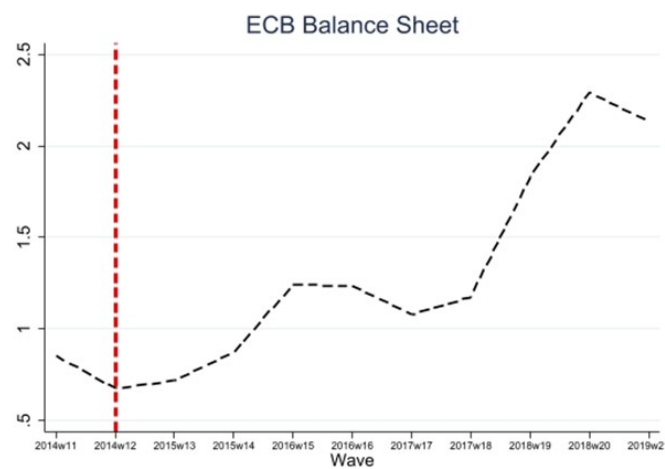
Figures

Figure 1: Proportion of credit constrained



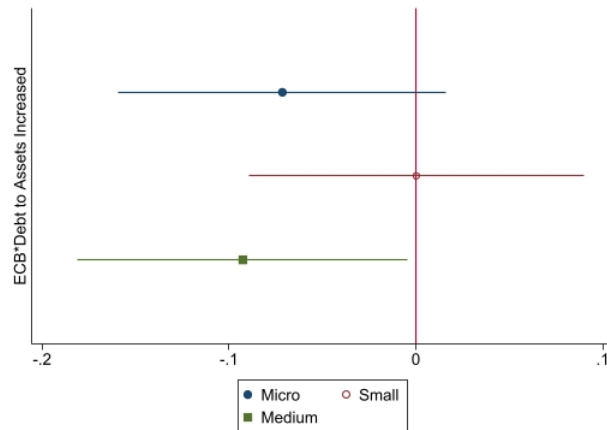
Credit constrained by country over time from 2014-2019 for Spain, Ireland, Portugal, Italy and Greece. The vertical red line indicates the beginning of UMP in the form of negative interest rate policy, forward guidance, TLRs and APPs.

Figure 2: ECB Balance Sheet



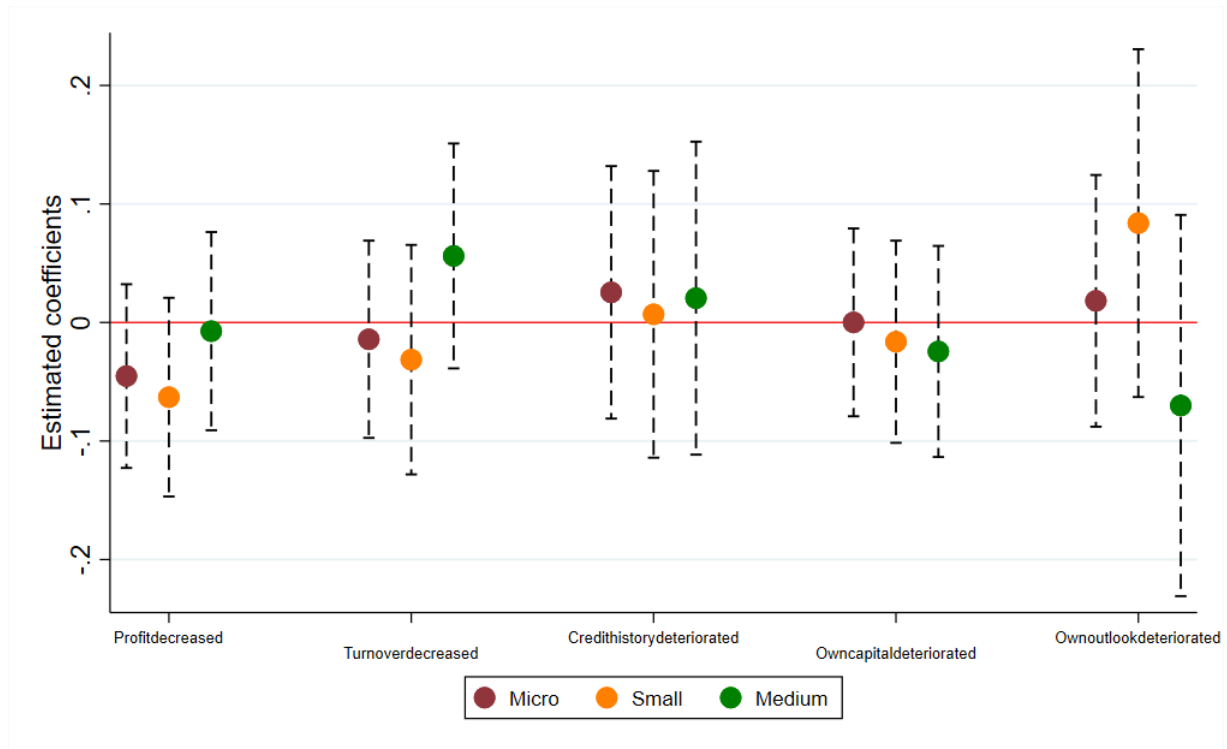
The evolution of ECB balance sheet divided by euro area nominal GDP, in trillions from 2014 to 2019. The vertical red line indicates the beginning of UMP in the form of negative interest rate policy, forward guidance, TLRs and APPs.

Figure 3: $H1: MP_{t-1} \times Debttoassets_{i,c,t}$



Notes: *Hypothesis 1*: Firms increase their debt to assets in the presence of UMP and this leads to a decrease in the probability that a firm is credit constrained. The dependent variable is the probability of being credit constrained. MP_{t-1} is the six-month lag of the logarithm the total assets of the ECB - minus autonomous factors -divided by the euro area GDP. Debt to assets increased is a categorical variable which measures if firm debts to assets increased, remained the same or decreased in the previous six months.

Figure 4: $H2: MP_{t-1} \times FirmRisk_{i,c,t}$



Notes: *Hypothesis 2*: The probability of a risky firm being credit constrained decreases during periods of UMP. The dependent variable is the probability of being credit constrained. MP_{t-1} is the six-month lag of the logarithm the total assets of the ECB - minus autonomous factors -divided by the euro area GDP. Debt to assets increased is a categorical variable which measures if firm debts to assets increased, remained the same or decreased in the previous six months.

Tables

Table 1: Summary Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent Variable:					
Credit constrained	11,319	0.405	0.491	0	1
Firm Characteristics:					
Micro	11,319	0.400	0.490	0	1
Small	11,319	0.330	0.470	0	1
Medium	11,319	0.270	0.444	0	1
More than 10 years	11,312	0.864	0.343	0	1
Between 5 and 10 yrs	11,312	0.095	0.294	0	1
Between 2 and 5 yrs	11,312	0.032	0.176	0	1
Less than 2 years	11,312	0.008	0.089	0	1
Stand-alone firm	11,319	0.941	0.236	0	1
Individual or family-owned	11,309	0.868	0.338	0	1
Turnover upto 2mn	11,176	0.536	0.499	0	1
Turnover between 2 and 10mn	11,176	0.256	0.437	0	1
Turnover between 10 and 50mn	11,176	0.177	0.382	0	1
Industry	11,319	0.576	0.494	0	1
Construction	11,319	0.093	0.289	0	1
Trade	11,319	0.331	0.471	0	1
Balance sheet variables:					
Debt-to-Assets decreased	11,116	0.307	0.461	0	1
Credit risk variables:					
Profit decreased	11,180	0.408	0.491	0	1
Turnover decreased	11,293	0.271	0.444	0	1
Credit history deteriorated	11,252	0.150	0.357	0	1
Own capital decreased	11,211	0.148	0.355	0	1
Own outlook decreased	11,181	0.315	0.465	0	1
Monetary policy variables:					
ECB BS Assets (trillion)	11,319	1.237	0.525	0.675	2.291
ECB Lending (trillion)	11,319	0.345	0.071	0.271	0.486
ECB Securities (trillion)	11,319	0.904	0.525	0.379	1.925
Wu & Xia (2017) Shadow rate (%)	11,319	-4.151	1.836	-7.207	-1.008
Macroeconomic variables:					
Unemployment (%)	11,319	15.32	5.617	5	26.54
Inflation (%)	11,319	0.433	0.880	-2.017	2.050
Bank characteristic variables:					
Non-performing loans (%)	11,319	16.01	11.26	3.390	45.81
Regulatory tier 1 capital (%) (share of risk-weighted assets)	11,319	13.99	2.99	10.59	25.31

Summary statistics recorded throughout the sample. Variable definitions are provided in Appendix B.

Table 2: Probability of being credit constrained on monetary policy and debt to assets

	Credit constrained		
	(1)	(2)	(3)
MP_{t-1}	-0.068*** (0.018)	-0.006 (0.024)	0.008 (0.023)
Debt-assets increased	0.924** (0.386)	0.952** (0.384)	0.800** (0.371)
$MP_{t-1} \times$ Debt-assets increased	-0.063** (0.028)	-0.065** (0.028)	-0.055** (0.027)
Non-performing loans $_{t-1}$	-0.001 (0.002)	0.000 (0.002)	0.001 (0.002)
Tier 1 Capital Ratio $_{t-1}$	-0.007 (0.005)	-0.004 (0.005)	-0.006 (0.004)
Unemployment $_{t-1}$		0.013*** (0.004)	0.012*** (0.004)
Inflation $_{t-1}$		0.002 (0.009)	0.002 (0.008)
Micro			0.099*** (0.017)
Small			0.022 (0.014)
Trade			-0.059** (0.027)
Industry			-0.098*** (0.027)
Turnover: 2-10 mn			0.192*** (0.035)
Turnover: 10-50mn			0.083** (0.035)
Stand alone firm			-0.106*** (0.020)
Observations	10,011	10,011	9,885
Country-Sector Fixed Effects	Yes	Yes	Yes
Macro Controls	No	Yes	Yes
Other Firm Controls	No	No	Yes

The dependent variable in columns (1) -(3) is the probability of being credit constrained. MP_{t-1} is the six-month lag of the logarithm the total assets of the ECB - minus autonomous factors -divided by the euro area GDP. Debt to assets increased is a categorical variable which measures if firm debts to assets increased, remained the same or decreased in the previous six months. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

Table 3: Probability of being credit constrained on monetary policy and debt to assets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP_{t-1}	0.009 (0.024)	0.012 (0.024)	-0.018 (0.023)	-0.005 (0.022)	-0.013 (0.022)	-0.002 (0.021)	0.003 (0.024)	0.012 (0.023)	-0.020 (0.022)	-0.009 (0.022)
Profit decreased	1.076*** (0.349)	0.723** (0.339)								
$MP_{t-1} \times$ Profit decreased	-0.065*** (0.025)	-0.043* (0.024)								
Turnover decreased			0.431 (0.388)	0.279 (0.377)						
$MP_{t-1} \times$ Turnover decreased			-0.019 (0.028)	-0.011 (0.027)						
Credit history deteriorated					0.212 (0.508)	0.024 (0.493)				
$MP_{t-1} \times$ Credit history					0.006 (0.037)	0.015 (0.036)				
Own outlook deteriorated							0.485 (0.360)	0.309 (0.349)		
$MP_{t-1} \times$ Own outlook							-0.016 (0.026)	-0.007 (0.025)		
Own capital deteriorated									0.058 (0.542)	-0.027 (0.533)
$MP_{t-1} \times$ Own capital									0.016 (0.039)	0.018 (0.038)
Non-performing loans $_{t-1}$	0.002 (0.002)	0.002 (0.001)	0.002 (0.002)	0.002 (0.001)	0.001 (0.002)	0.001 (0.001)	0.007*** (0.002)	0.006*** (0.001)	0.001 (0.002)	0.001 (0.002)
Tier 1 Capital Ratio $_{t-1}$	-0.002 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.005 (0.004)	-0.003 (0.004)	-0.004 (0.004)	-0.001 (0.004)	-0.002 (0.004)	-0.002 (0.004)	-0.004 (0.004)
Unemployment $_{t-1}$	0.012*** (0.004)	0.011*** (0.004)	0.011*** (0.004)	0.010*** (0.004)	0.012*** (0.004)	0.011*** (0.003)	0.015*** (0.004)	0.013*** (0.003)	0.012*** (0.004)	0.011*** (0.004)
Inflation $_{t-1}$	0.000 (0.008)	0.000 (0.008)	0.002 (0.008)	0.001 (0.008)	0.003 (0.008)	0.002 (0.008)	0.007 (0.008)	0.005 (0.008)	0.005 (0.008)	0.004 (0.008)
Micro		0.086*** (0.017)		0.084*** (0.017)		0.084*** (0.017)		0.080*** (0.016)		0.083*** (0.017)
Small		0.018 (0.014)		0.015 (0.014)		0.016 (0.014)		0.013 (0.014)		0.019 (0.014)
Trade		-0.057** (0.027)		-0.056** (0.026)		-0.051* (0.027)		-0.055** (0.026)		-0.049* (0.026)
Industry		-0.102*** (0.026)		-0.099*** (0.026)		-0.089*** (0.026)		-0.100*** (0.026)		-0.093*** (0.026)
Turnover: 2-10 mn		0.168*** (0.034)		0.176*** (0.034)		0.169*** (0.034)		0.153*** (0.034)		0.181*** (0.034)
Turnover: 10-50 mn		0.072** (0.034)		0.073** (0.034)		0.070** (0.034)		0.052 (0.034)		0.078** (0.034)
Stand alone firm		-0.104*** (0.020)		-0.104*** (0.020)		-0.101*** (0.019)		-0.104*** (0.020)		-0.098*** (0.020)
Observations	10,086	9,956	10,177	10,040	10,151	10,014	10,074	9,936	10,102	9,968
Country-Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Firm Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

The dependent variable in columns (1) -(10) is the probability of being credit constrained. MP_{t-1} is the six-month lag of the logarithm the total assets of the ECB - minus autonomous factors -divided by the euro area GDP. Profit decreased, Turnover decreased, credit history deteriorated, own outlook and own capital deteriorated are all categorical variables which proxy firm risk from the firm's viewpoint. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

A. Dependent variable questionnaire

Table 4: Dependent variable questionnaire

Survey Question	Survey Answer
Q7A. Have you applied for a bank in the past six months? Provide a separate answer in each case.	Applied Did not apply because of possible rejection Did not apply because of sufficient internal funds Did not apply for other reason Don't know
Q7B. If you applied and tried to negotiate bank loan over the past six months, what was the outcome? Please provide a separate answer in each case.	Received everything Received 75% and above Received below 75% Refused because the cost was too high Was rejected Application is still pending Don't know

B. Variables employed: construction and corresponding definition

Table 5: Variable Definition

Variable	Data source	Definition
Dependent variable		
Credit constrained	ECB/ECSAFE Q7a, Q7b	Binary variable = 1 if the firm reported (i) to have applied for bank loans in the previous six months but was rejected (Credit Denied) or (ii) to have applied but received less than 75% of its demand (Rationed) or (iii) to have refused credit because it was offered at too high cost (Refused due to high cost) or (iv) not to have applied because of possible rejection (Discouraged) 0 = if the firm reported (i) to have applied for bank loans in the previous six months and they received everything or (ii) they received 75 percent or more of their demand.
Firm variables		
Micro	ECB/EC SAFE QD1	= 1 if the firm has between 1 and 9 employees, 0 otherwise
Small	ECB/EC SAFE QD1	= 1 if the firm has between 10 and 49 employees, 0 otherwise
Medium	ECB/EC SAFE QD1	= 1 if the firm has between 50 and 249 employees, 0 otherwise
Stand-alone firm	ECB/EC SAFE QD2	= 1 if the firm is an autonomous profit-oriented enterprise, 0 otherwise
Individual or family owned	ECB/EC SAFE QD2	= 1 if the firm's owner is an individual or a family, 0 otherwise
Industry	ECB/EC SAFE QD3	= 1 if the firm's main activity is in industry, 0 otherwise
Construction	ECB/EC SAFE QD3	= 1 if the firm's main activity is in construction, 0 otherwise
Wholesale or Retail	ECB/EC SAFE QD3	= 1 if the firm's main activity is in wholesale or retail trade, 0 otherwise
Services	ECB/EC SAFE QD3	= 1 if the firm's main activity is in services, 0 otherwise
Turnover up to 2mn	ECB/EC SAFE QD4	= 1 if the firm's annual turnover is less than €2 million, 0 otherwise
Turnover b/w 2 and 10mn	ECB/EC SAFE QD4	= 1 if the firm's annual turnover is between €2 and €10 million, 0 otherwise
Turnover b/w 10 and 50mn	ECB/EC SAFE QD4	= 1 if the firm's annual turnover is between €10 mln. and €50 mln, 0 otherwise
Turnover over 50mn	ECB/EC SAFE QD4	= 1 if the firm's annual turnover is €10+ mln, 0 otherwise
More than 10 years	ECB/EC SAFE QD5	= 1 if the firm is 10+ years old, 0 otherwise
B/w 5 and 10 years	ECB/EC SAFE QD5	= 1 if the firm is between 5 and 10 years old, 0 otherwise
B/w 2 and 5 years	ECB/EC SAFE QD5	= 1 if the firm is between 2 and 5 years old, 0 otherwise
Less than 2 years	ECB/EC SAFE QD5	= 1 if the firm is less than 2 years old, 0 otherwise
Debt to assets increased	ECB/EC SAFE Q2	= 1 if the firm's debt to assets increased in the past 6 months, 0 if it remained unchanged or decreased
Credit risk variables		
Profits decreased	ECB/EC SAFE Q2	= 1 if firm's profit decreased in the past 6 months, 0 if unchanged or increased
Turnover decreased	ECB/EC SAFE Q2	= 1 if firm's turnover decreased in the past 6 months, 0 if unchanged or increased
Credit history deteriorated	ECB/EC SAFE Q2	= 1 if firm's credit history deteriorated in the past 6 months, 0 if unchanged or improved
Own outlook deteriorated	ECB/EC SAFE Q2	= 1 if firm's own outlook deteriorated in the past 6 months, 0 if unchanged or improved
Own capital deteriorated	ECB/EC SAFE Q2	= 1 if firm's own capital deteriorated in the past 6 months, 0 if unchanged or improved
Monetary Policy variables		
ECB BS Assets (million)	ECB Statistical Data Warehouse	Size of the ECB's balance sheet (after subtracting the autonomous factors that are beyond the direct control of the ECB including banknotes in circulation and government balances at central banks), deflated by Euroarea nominal GDP, in percentage.
ECB Lending to Credit Institutions (million)	ECB Statistical Data Warehouse	Size of the ECB's lending to euro area credit institutions related to monetary policy operations, deflated by Euroarea nominal GDP, in percentage.
ECB holdings of securities (million)	ECB Statistical Data Warehouse	Size of the ECB's securities of euro area residents, deflated by Euroarea nominal GDP, in percentage.
Shadow rate Wu & Xia (2017)	ECB Statistical Data Warehouse	Monthly data averaged over half years ending in March and September and expressed as decimals.
Macroeconomic variables		
Unemployment	Eurostat	Unemployment rate (share of active population), seasonally adjusted.
Inflation	Eurostat	Inflation rate measured by HICP monthly data (annual rate of change).
Bank characteristics		
Non-performing loans	IMF Financial Soundness Indicators	Quarterly non-performing loans as a share of total gross loans averaged over half years ending in March and September and expressed as decimals
Regulatory capital to risk-weighted assets ratio	IMF Financial Soundness Indicators	Quarterly regulatory tier 1 capital as a share of risk weighted assets averaged over half years ending in March and September and expressed as decimals.

C. Robustness Checks

Table 6: Robustness by type of credit constraint for H1

	Credit constrained including discouraged (1)	Discouraged (2)	Credit constrained excluding discouraged (3)
MP_{t-1}	0.026 (0.074)	-0.004 (0.089)	0.088 (0.091)
Debt-assets increased	2.574** (1.195)	1.998 (1.459)	2.893** (1.445)
$MP_{t-1} \times$ Debt-assets increased	-0.176** (0.086)	-0.142 (0.105)	-0.192* (0.104)
Non-performing loans $_{t-1}$	0.002 (0.005)	-0.001 (0.006)	0.008 (0.006)
Tier 1 Capital Ratio $_{t-1}$	-0.018 (0.014)	-0.017 (0.015)	-0.012 (0.019)
Unemployment $_{t-1}$	0.038*** (0.012)	0.041*** (0.014)	0.033** (0.014)
Inflation $_{t-1}$	0.006 (0.027)	0.008 (0.032)	-0.002 (0.032)
Micro	0.320*** (0.055)	0.345*** (0.067)	0.225*** (0.067)
Small	0.070 (0.047)	0.011 (0.059)	0.106* (0.054)
Trade	-0.189** (0.088)	-0.265** (0.109)	-0.127 (0.103)
Industry	-0.315*** (0.086)	-0.367*** (0.109)	-0.264*** (0.101)
Turnover: 2-10mn	0.619*** (0.113)	0.810*** (0.178)	0.437*** (0.122)
Turnover: 10-50mn	0.268** (0.113)	0.348* (0.179)	0.194 (0.121)
Stand alone firm	-0.340*** (0.065)	-0.378*** (0.081)	-0.265*** (0.077)
Observations	9,885	8,393	7,544
Country-Sector Fixed Effects	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
Other Firm Controls	Yes	Yes	Yes

The dependent variable in column (1) is the probability of being credit constrained (including discouraged), in column (2) is the probability of being discouraged and in column (3) is the probability of being credit constrained (excluding discouraged). The variable MP_{t-1} is the six-month lag of the logarithm the total assets of the ECB - minus autonomous factors -divided by the euro area GDP. Debt to assets increased is a categorical variable which measures if firm debts to assets increased, remained the same or decreased in the previous six months. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

Table 7: Robustness by type of credit constraint for H2

	Credit constrained				
	(1)	(2)	(3)	(4)	(5)
MP_{t-1}	0.029 (0.024)	0.009 (0.023)	0.016 (0.022)	0.022 (0.024)	
Profit Decreased	0.759** (0.346)				
$MP_{t-1} \times$ Profit decreased	-0.048* (0.025)				
Turnover decreased		0.302 (0.395)			
$MP_{t-1} \times$ Turnover decreased		-0.016 (0.028)			
Credit history deteriorated			0.264 (0.485)		
$MP_{t-1} \times$ Credi history			-0.005 (0.035)		
Own outlook deteriorated				0.259 (0.353)	
$MP_{t-1} \times$ Own outlook				-0.005 (0.025)	
Own capital deteriorated					-0.137 (0.543)
$MP_{t-1} \times$ Own capital					0.022 (0.039)
Observations	7,584	7,652	7,633	7,587	7,610
Country-Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes
Other Firm Controls	No	No	No	No	No

The dependent variable in columns (1)- (5) is the probability of being credit constrained, excluding discouraged borrowers. The variable MP_{t-1} is the six-month lag of the logarithm the total assets of the ECB - minus autonomous factors -divided by the euro area GDP. Profit decreased, Turnover decreased, credit history deteriorated, own outlook and own capital deteriorated are all categorical variables which proxy firm risk from the firm's viewpoint. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.¹

Table 8: Robustness by type of ECB asset- Lending and Securities - for H1

	Credit constrained					
	(1)	(2)	(3)	(4)	(5)	(6)
Debt to assets increased	0.045 (0.058)	0.039 (0.058)	0.068 (0.055)	0.031*** (0.012)	0.031*** (0.012)	0.030*** (0.011)
Lending in Euro Area $_{t-1}$	0.046 (0.030)	0.059** (0.029)	0.059** (0.028)			
Lending $\times$ Debt to assets increased	0.000 (0.052)	-0.005 (0.051)	0.024 (0.049)			
Securities in Euro Area $_{t-1}$				-0.043*** (0.012)	-0.006 (0.014)	-0.001 (0.014)
Securities $\times$ Debt to assets increased				-0.036* (0.019)	-0.037* (0.019)	-0.031* (0.018)
Observations	10,011	10,011	9,885	10,011	10,011	9,885
Country-Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls	No	Yes	Yes	No	Yes	Yes
Other Firm Controls	No	No	Yes	No	No	Yes

The dependent variable in column (1)- (6) is the probability of being credit constrained. Debt to assets increased is a categorical variable which measures if firm debts to assets increased, remained the same or decreased in the previous six months. We employ two measures of monetary policy. First, six-month lag of the logarithm of lending to euro area credit institutions related to monetary policy operations, divided by nominal euro area GDP. Second, six-month lag of the logarithm of securities of euro area residents, divided by nominal euro area GDP. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

Table 9: Robustness by type of ECB asset – ECB lending - for $H2$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$MP_{t-1}(ECBlending)$	0.059* (0.031)	0.060** (0.030)	0.042 (0.028)	0.047* (0.027)	0.047* (0.026)	0.054** (0.025)	0.062** (0.028)	0.068** (0.028)	0.045* (0.026)	0.053** (0.025)
Profit decreased	0.145*** (0.052)	0.120** (0.051)								
$MP_{t-1} \times$ Profit decreased	-0.026 (0.047)	-0.009 (0.045)								
Turnover decreased			0.187*** (0.058)	0.159*** (0.056)						
$MP_{t-1} \times$ Turnover decreased			0.019 (0.052)	0.030 (0.050)						
Credit history deteriorated					0.302*** (0.075)	0.259*** (0.073)				
$MP_{t-1} \times$ Credit History					0.009 (0.068)	0.020 (0.066)				
Own outlook deteriorated							0.233*** (0.053)	0.197*** (0.052)		
$MP_{t-1} \times$ Own outlook							-0.022 (0.048)	-0.017 (0.047)		
Own capital deteriorated									0.309*** (0.081)	0.235*** (0.080)
$MP_{t-1} \times$ Own capital									0.022 (0.073)	0.017 (0.072)
Observations	10,086	9,956	10,177	10,040	10,151	10,014	10,074	9,936	10,102	9,968
Country-Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Firm Controls	No	No	No	No	No	No	No	No	No	No

The dependent variable in columns (1) -(10) is the probability of being credit constrained. Monetary policy (MP_{t-1}) is measured six-month lag of the logarithm of lending to euro area credit institutions related to monetary policy operations, divided by nominal euro area GDP. Profit decreased, Turnover decreased, credit history deteriorated, own outlook and own capital deteriorated are all categorical variables which proxy firm risk from the firm's viewpoint. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

Table 10: Robustness by type of ECB asset – ECB securities - for $H2$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$MP_{t-1}(ECB\text{Securities})$	0.004 (0.015)	0.003 (0.015)	-0.014 (0.014)	-0.010 (0.014)	-0.006 (0.013)	-0.002 (0.013)	0.001 (0.014)	0.004 (0.014)	-0.015 (0.013)	-0.011 (0.013)
Profit decreased	0.160*** (0.010)	0.122*** (0.010)								
$MP_{t-1} \times$ Profit decreased	-0.040** (0.017)	-0.026 (0.017)								
Turnover decreased			0.166*** (0.012)	0.127*** (0.011)						
$MP_{t-1} \times$ Turnover decreased			-0.003 (0.019)	0.002 (0.019)						
Credit history deteriorated					0.284*** (0.015)	0.234*** (0.015)				
$MP_{t-1} \times$ Credit history					-0.019 (0.025)	-0.009 (0.024)				
Own outlook deteriorated							0.254*** (0.010)	0.215*** (0.010)		
$MP_{t-1} \times$ Own outlook							-0.012 (0.018)	-0.004 (0.017)		
Own capital deteriorated									0.294*** (0.017)	0.227*** (0.017)
$MP_{t-1} \times$ Own capital									0.022 (0.027)	0.025 (0.026)
Observations	10,086	9,956	10,177	10,040	10,151	10,014	10,074	9,936	10,102	9,968
Country-Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Firm Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

The dependent variable in columns (1) -(10) is the probability of being credit constrained. Monetary policy (MP_{t-1}) is measured six-month lag of the logarithm of securities of euro area residents, divided by nominal euro area GDP. Profit decreased, Turnover decreased, credit history deteriorated, own outlook and own capital deteriorated are all categorical variables which proxy firm risk from the firm's viewpoint. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

Table 11: Robustness by measure of unconventional monetary policy – Wu & Xia (2017) Shadow Rate
- for H1

	Credit constrained		
	(1)	(2)	(3)
MP_{t-1}	0.024*** (0.004)	0.026*** (0.006)	0.023*** (0.006)
Debt-assets increased	0.091*** (0.024)	0.091*** (0.024)	0.081*** (0.023)
$MP_{t-1} \times$ Debt-assets increased	0.013** (0.006)	0.013** (0.006)	0.011** (0.005)
Non-performing loans $_{t-1}$	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.001)
Tier 1 Capital Ratio $_{t-1}$	0.002 (0.005)	0.002 (0.005)	0.000 (0.004)
Unemployment $_{t-1}$		0.002 (0.004)	0.001 (0.004)
Inflation $_{t-1}$		0.012 (0.009)	0.011 (0.008)
Micro			0.100*** (0.017)
Small			0.022 (0.014)
Trade			-0.058** (0.027)
Industry			-0.097*** (0.026)
Turnover: 2-10 mn			0.189*** (0.035)
Turnover: 10-50mn			0.080** (0.035)
Stand alone firm			-0.106*** (0.020)
Observations	10,011	10,011	9,885
Country-Sector Fixed Effects	Yes	Yes	Yes

The dependent variable in columns (1) -(3) is the probability of being credit constrained. Monetary policy (MP_{t-1}) is measured by six-month lag of Wu & Xia (2017) shadow rate. Profit decreased, Turnover decreased, credit history deteriorated, own outlook and own capital deteriorated are all categorical variables which proxy firm risk from the firm's viewpoint. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.

Table 12: Robustness by measure of unconventional monetary policy– [Wu & Xia \(2017\)](#) Shadow Rate - for *H2*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP_{t-1}	0.020*** (0.006)	0.020*** (0.006)	0.023*** (0.006)	0.022*** (0.006)	0.023*** (0.006)	0.021*** (0.006)	0.020*** (0.006)	0.019*** (0.006)	0.025*** (0.006)	0.024*** (0.006)
Profit decreased	0.211*** (0.022)	0.150*** (0.021)								
$MP_{t-1} \times$ Profit decreased	0.010** (0.005)	0.006 (0.005)								
Turnover decreased			0.181*** (0.023)	0.135*** (0.023)						
$MP_{t-1} \times$ Turnover decreased			0.005 (0.006)	0.003 (0.005)						
Credit history deteriorated					0.287*** (0.029)	0.226*** (0.029)				
$MP_{t-1} \times$ Credit history					-0.000 (0.007)	-0.002 (0.007)				
Own outlook deteriorated							0.255*** (0.023)	0.204*** (0.023)		
$MP_{t-1} \times$ Own outlook							0.000 (0.005)	-0.002 (0.005)		
Own capital deteriorated									0.266*** (0.031)	0.194*** (0.030)
$MP_{t-1} \times$ Own capital									-0.004 (0.008)	-0.006 (0.008)
Observations	10,086	9,956	10,177	10,040	10,151	10,014	10,074	9,936	10,102	9,968
Country-Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Firm Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

The dependent variable in columns (1) -(10) is the probability of being credit constrained. Monetary policy (MP_{t-1}) is measured by six-month lag of [Wu & Xia \(2017\)](#) shadow rate. Profit decreased, Turnover decreased, credit history deteriorated, own outlook and own capital deteriorated are all categorical variables which proxy firm risk from the firm's viewpoint. Robust standard errors are in parentheses. ***, **, * represent significance at the 1%, 5% and 10%, respectively.