# Heterogeneity and firms' access to credit expectations

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**Abstract**

The transmission mechanism of monetary policy relies on the expectations agents have on future access to credit. We illustrate a simple dynamic model of firm's decision that relate access to credit expectations to current demand of bank loans and infer the conditions under which firm heterogeneity in formulating expectations and/or heterogeneity in forecast accuracy constitute a source of friction for the credit market. Then we document empirical relevance of both types of heterogeneity using a panel of German, Spanish, French and Italian firms. We find that access to credit expectations are heterogeneous and depend on: (i) structural characteristics of the firm; (ii) changes in balance sheet indicators; (iii) firm-specific private signals. Regarding heterogeneity in accuracy, we show that around 45% of firms fail to predict future availability of bank loans on average and that their forecast error components change over time. The tests we conduct reject the rationality of access to credit expectations. On the contrary, consistently with the hypothesis of adaptive expectations, we find that past access to credit forecast errors influence firms' current expectations, although with sizable cross-country differences.

JEL classification: E41; G01; G32

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# 1 Introduction

Expectations play a fundamental role in microbased dynamic economic models, as they influence agents' behaviour in the present. Despite the large theoretical effort conducted in this field, there is little empirical evidence on whether theory is supported by data (Bachmann et al., 2015; Coibion and Gorodnichenko, 2015b). However, the thesis of information frictions in the process of expectation formation has received a renewed academic attention over the last few years (Hur and Kim, 2016), thanks to the willingness of testing new hypothesis in the field (Malmendier and Nagel, 2015; Madeira and Zafar, 2015) and of appositely designed surveys (Cavallo et al., 2017; Coibion et al., 2015; Armantier et al., 2016). We focus on firms' expectations and study a variable that has received a wider media and research coverage during the recent recession: access to credit.

The transmission mechanism of a monetary policy relies on the expectations agents have on future economic conditions (Alvarez et al., 2016). To revive investment during the latest recession, the central banks implemented conventional and unconventional monetary policies whose success depended on the perception of an ease in access to credit. Measuring access to credit expectations and understanding how firm heterogeneity is involved in their formation - especially for small and medium firms (henceforth SMEs) - is required to enhance monetary policy effectiveness (Woodford, 2003b).

During a period of crisis the transmission mechanism of an expansionary monetary policy is likely to encounter frictions preventing its full effectiveness. Focusing on firms' access to credit, obstacles can arise from the supply side - i.e. bank loans may be restricted - or from the demand side - i.e. firms do not apply for new loans. Using the Survey on Access to Finance of Enterprises (SAFE) conducted biannually by the European Commission (EC) and the European Central Bank (ECB) we focus on the demand side of this issue. Although the figures around this theme had been largely cited and debated in institutional frameworks (Draghi, 2013, 2017), the process underlying these outcomes still needs to be investigated. Specifically, the role of firm heterogeneity in the monetary policy transmission mechanism has still to be identified.

We propose a simple dynamic model of firm's decision that relate access to credit expectations to current demand of bank loans and infer the conditions under which firms' heterogeneity in formulating expectations and/or in forecast accuracy is a non-negligible source of friction for the demand side of the credit market. In particular, only a fraction of the potential applicants for bank loans effectively apply, generating a friction on the

monetary policy transmission mechanism. According to the model, if a firm expects future access to credit to improve, it might prefer to defer its investment (and loan demand). Firm's forecast accuracy is involved in this process as well, allowing for the existence of companies which prefer temporise instead of investing immediately, although the latter option would be profitable as well. The hypothesis we provide can help interpreting the puzzle of a non-fully efficient monetary policy during the crisis.

Once identified the macroeconomic relevance of firms' access to credit expectations and of their accuracy, the research attempts to shed light on the heterogeneity in the two issues. Since the idea of access to credit is not fully represented by a continuous variable (the interest rate, for example, is just one of its components), we adopt the qualitative variable provided by the SAFE regarding the opinion that the surveyed firms have about future access to credit - will improve, deteriorate, remain unchanged. We investigate the determinants of expectations on future bank loans availability by means of a panel of German, Spanish, French and Italian companies which covers the most critical period concerning access to credit (2010-2016). We find that access to credit expectations depend on structural characteristics of the firm such as size, age, sector and country of activity; but also on changes in balance sheet indicators such as profits, labour costs and interest expenses. Private signals, detectable thanks to specific survey question, also appear to be determinant factors: changes in general economic and firm-specific outlook, credit reputation affect access to credit expectations positively.

Following to the most recent literature on survey-based forecasts (Bachmann et al., 2013b; Coibion et al., 2015; Dovern, 2015), we devote particular attention to the topic of predictive accuracy of the firms and find that around 45% of access to credit forecasts turned out to be incorrect on average. Our panel analysis shows that the components of the forecast error changed over time, suggesting a role for the monetary policy implemented by the ECB during the period. We use firms' forecast error to run a test for verifying whether firms' access to credit expectations are rational and find they are not. In line with the hypothesis of adaptive expectations, we estimate that forecast error is a determinant of access to credit expectations in the sense that firms seems to learn from their past predictive error. Error forecast learning seems to drive German and French firms' expectations more than Italian and Spanish ones.

This research provides an original contribution to the extant literature on several aspects. First of all, although the interest on access to credit has quickly increased during the last few years, especially into institutional frameworks (Berger et al., 2017; Ferrando

et al., 2017), studying its expectations is a novelty indeed. Focusing on the most recent recession period, this paper adds information to the empirical studies on credit frictions (Holton et al., 2014; Ferrando and Mulier, 2015b).

Secondly, the model we propose identifies the role of access to credit expectations in determining firms' loan demand, suggesting an original channel through which firm heterogeneity may drive frictions on the credit market. We focus on how heterogeneity in expectations and in forecast accuracy affect firm-level decision and propose a model that could be tested with appropriate dataset. Not the one we use, unfortunately, which is, however, extremely useful to measure heterogeneity in expectation and accuracy.

The third source of originality is the use of a panel of SMEs to assess the determinants of access to credit expectations. Despite the renewed interest in agents' expectation formation process, most of the literature has focused on professional forecasters' expectations, or consumers' expecations or those of other financial market participants, with very scant evidence on firms' beliefs. The existing empirical literature on firms' expectations focuses mainly on large firms (Coibion and Gorodnichenko, 2012, 2015a). In contrast, the SAFE includes both small and medium sized firms, allowing for a complete firm-level analysis which focuses on firms' heterogeneity. Although entirely composed by qualitative variables, it contains information on several features of the firm, as the ones related to the organisation structure, balance sheet entries, short term beliefs on own profitability and general economic outlook. In addition, since the data include information on firms across all European countries, a thorough cross country comparisons is provided. Despite literature has always looked at business survey analysis with suspicion (Lui et al., 2011), here we reaffirm the usefulness of business survey data to study relevant latent variables, i.e. a non-universally measurable economic entity, such as access to credit.

The paper proceeds as follows: Section 2 explores the main and most recent papers on the topics of firms' expectation formation, access to credit and forecast accuracy; Section 3 presents a model to identify the conditions under which access to credit expectations and their accuracy influence the demand of loans; Section 4 introduces the dataset and the sample used; Section 5 documents firms' heterogeneity in expectations and in accuracy estimate the determinants of firms'; Section 6 shows the main stylized facts about firms' forecast error components, tests the rationality of expectations and shows the results that suggest firms' access to credit expectations to be adaptive; Section 7 concludes, summing up the policy implications.

## 2 Related literature

***Survey-based models of heterogeneous expectations.*** Expectations have a pre-eminent role in modern macroeconomics. Although their importance has been widely reiterated in theoretical models, papers focused on survey-based heterogeneous expectations as a source of friction appeared only during the last few years. Surveys of professional forecasters were used to measure disagreement on future government spending, which seems to filter the effect of fiscal policy innovations (Ricco et al., 2016); but also to observe whether "undue optimism" among the professional forecasters contributes to business cycle fluctuations (Enders et al., 2017). Consumer confidence surveys were studied for several reason, e.g.: measuring the effect of household expected inflation on the promptness to spend in durables (Bachmann et al., 2015); explaining how changes in beliefs on house prices affect the business cycle (Lambertini et al., 2013; Piazzesi and Schneider, 2009); assessing the impact on economic activity of an innovation in consumer confidence (Barsky and Sims, 2012). To solve the lack of disinflation puzzle during the Great Recession, Coibion and Gorodnichenko (2015b) find evidence that the best proxy of firms' expectations are household ones and that the use of the latter into an expectations-augmented Phillips curve makes any missing disinflation disappear. Moreover, business survey data contain important information that helps account for economic fluctuations. Leduc and Sill (2013) find that firms' anticipation of good times leads to a drop in current unemployment and, as inflation rises, to a tighter monetary policy.

***Business surveys in forecasting.*** Although business surveys are accurately monitored by policymakers as a primary source of agent's perception of future economic activity, empirical work using survey data in the field of the analysis of economic fluctuations remains relatively scarce. On the contrary, in the field of economic forecasting (and nowcasting) the use of business survey data is well diffused. The main doubts preventing their larger use are related to the qualitative nature of the responses, as well as the effective ability of agents to anticipate future outcomes. Lui et al. (2011) suggest that qualitative business surveys perform better for nowcasting than for forecasting, and that introducing quantitative outcomes in the questions would results in an improvement for forecast models.

***Business surveys in economic analysis.*** Recently, scholars showed that the usefulness of qualitative business survey data for economic research goes beyond the forecast purpose. The idea is that business survey data incorporate information that are not

obtainable otherwise. Gennaioli et al. (2016) show that CFO's expectations of corporate earnings growth explain investment plans and their realisations, concluding that information in expectations data is not subsumed by standard variables, such as Tobin's Q or discount rates. Bachmann et al. (2013a) construct an indicator of time-varying business volatility using German firm-level data to further estimate the effect of idiosyncratic volatility on firms' price setting process. With the same business survey Bachmann et al. (2013b) construct an indicator of uncertainty using firm's forecast disagreement and forecast error on GDP. They find such an indicator to be a significant predictor of persistent reduction in production.

***New hypothesis of expectation formation.*** In addition to the purposes of forecasting and macroeconomic analysis, firms' expectations are also used for their microeconomic content. Understanding how firms' expectation are formed and testing the underlying theories is a growing field where business surveys have proven to be extremely useful. To justify the observed heterogeneity in agents' expectations, over the last 20 years, new concepts of expectation formation have come up beside the usual *static*, *adaptive* and *rational* hypothesis, focusing on the information set that the agents use. Evans and Honkapohja (2001) introduced the idea of *adaptive learning* where expectations derive from a set of exogenous variables referred to the period before the agent creates the expectation. According to the *sticky information* model of Mankiw and Reis (2002) only a share of agents rationally update their information set (and make identical forecasts), the remainder sticks to plans based on outdated information.[1] This happens because acquiring and processing information is costly. The same premise underpins the model of *rational inattention* by Sims (2003), according to which agents rationally decide to allocate a limited amount of resources to acquire and process information. Reis (2006) and Maćkowiak and Wiederholt (2009) adapt rational inattention hypothesis to the problem of firm price setting and inflation.[2] In his theory of *rationally heterogeneous* expectations, Branch (2004) suggests that agents have a model of rational selections for the predictors they use to form their expectations. Heterogeneity among agents depends on the cost and benefit of evaluating these predictors.

***Empirical studies on firms' expectation formation.*** Rather little is known

[1] In Carroll (2003)'s version of sticky information model - the *epidemiological* model - only a share of agents receive news at a given time, the remainder cling to the latest period's expectations, rather than to obsolete information.

[2] Rational inattention and the model of *imperfect common knowledge* by Woodford (2003a) can be ascribed to the category of *noisy information* models as opposed to the *sticky information* ones.

empirically about the firms' expectation formation. Although early study on the topic were conducted over the past century (Anderson et al., 1955; Figlewski and Wachtel, 1981; Nerlove, 1983), Pesaran and Weale (2006) considered the analysis of individual answers in business surveys underdeveloped. In the light of the new hypothesis of heterogeneous information setting, during the last 10 years rationality and forecast errors have been studied using business survey data. Karadeniz and Özçam (2010) study early-stage Turkish firms and conclude that entrepreneur's characteristics as education, gender, motivation, as well as size of their businesses are important determinants of firms' growth expectations. Interestingly, however, Bachmann and Elstner (2015) notice that one-third of the German firms interviewed by IFO Business Climate Survey systematically over- or underpredict their production growth. By means of an *ad hoc* survey, Coibion et al. (2015) identify the determinants of firm's inattention on inflation and present evidence of persistent inattention of New Zealand's companies to GDP growth, employment and (mainly) inflation. They also document that the way firms adjust their expectations is consistent with models of Bayesian learning. The same survey is used by Kumar et al. (2015) to show that if managers thought prices to rise more than what they are currently forecasting, they would change their mind on the level of wage, employment and investment of their firm.

***Firms' expectation rationality test.*** Tests of rationality of expectations can be conducted both on aggregate-level as well as on business survey data. Nonetheless Bonham and Cohen (2001) argued that these type of tests should be carried on exclusively on firm-level data, as they are able to capture "micro-heterogeneity".[3] Lui et al. (2011) test for the rationality of growth expectations collected in a business survey with both qualitative and quantitative responses. Their nonparametric test of "best case scenario", which follows the methodology in Das et al. (1999), finds that firms show rational expectations of the qualitative but not the quantitative variables. Using survey forecast data from US agents (also nonfinancial firms) Coibion and Gorodnichenko (2012) and Coibion and Gorodnichenko (2015a) find evidence supporting rejection of the full-information rational expectation hypothesis: after a macroeconomic shock, forecast errors have the same sign as the variable being forecasted. They argue that the rejection of the null is driven by departures from the assumption of full-information rather than rationality. Cloyne et al. (2016) finds that expectations of price increase raises current prices and reject the

[3]After proving that adaptive learning outperforms rational expectations in fitting aggregate and survey data together, Ormeño and Molnár (2015) conclude that professional forecast survey data include supplementary information which is absent in the aggregate figures.

hypothesis of rationality in a test of zero forecast errors conditional on the information available (Rossi and Sekhposyan, 2016).

***Access to finance of firms during recession.*** In the works cited above expectations are only related to prices, inflation, unemployment, interest rates, production and general economy. As far as we are concerned, there is neither theoretical nor empirical research in the literature focused on firms' access to credit expectations. Nonetheless, having access to credit been one of the most debated issue during the last ten years, a stream of literature on its causes and effects has flourished, thanks to the implementation of firm/household/bank-level surveys expressly designed to measure the problem. Many of the papers on the topic focused on the relationship between firms and lending banks. In the United States, the increased risk overhang effects and the reduced loan supply elasticities drove the decline in business credit during the Great Recession (DeYoung et al., 2015). The positive effect of the large presence of small banks, that yielded more lending and less firm failure rates before the crisis, disappeared (Berger et al., 2015). In the European Union much of the research on this topic was devoted to determining and quantifying the credit crunch (Holton et al., 2014). The role of external financial sources had been proven to be very significant during the crisis as a response to the severe credit crunch (Casey and O'Toole, 2014; Carbó-Valverde et al., 2016). However credit rationing was particularly hard in stressed European countries (Drakos, 2013; Ferrando et al., 2017), affecting employment, asset and investment growth (Gaiotti, 2013; Ferrando and Mulier, 2015b). Business survey data show that less profitable firms and those with higher short term debt to asset ratio are more likely to be affected by financial constraints (Brown et al., 2011; Ferrando and Mulier, 2015a).

# 3 How firms' access to credit expectations and their accuracy affect the demand of loans

This section provides a theoretical base for assessing the role of firms' access to credit expectations in defining the demand of loans. Using a framework similar to Kon and Storey (2003), we formulate a dynamic model for the loan application behaviour of the firms. The aforementioned model is a static adverse selection model that shapes the loan application behaviour of the firm, where the interaction between the bank and the firm

allows to verify the conditions under which the so called "discouraged borrowers" exist.[4] The model is particularly useful because it allows firms' heterogeneity in loan application cost to influence borrowing costs, and infer the conditions under which a firm decides to apply or not for a loan. We modify the setting into a dynamic one where the bank has no direct role in determining the demand of credit. Heterogeneity in borrowing costs is given by firm-specific access to credit expectations and by their accuracy.

## 3.1 A dynamic model for the loan demand of firms (preliminary)

We structure the model on two periods ($t$ and $t+1$) to make it more intuitive, but it can alternatively be thought as a repeated game with finite stages. At the beginning of each period the firm decides whether to apply for a loan immediately or wait for the next period to apply. Firms are assumed to be divided into two groups according to their access to credit expectations for $t+1$: (i) optimistic firms believe that access to credit will improve; (ii) pessimistic firms believe that access to credit will deteriorate. The number of firms for each type is exogenously given as, $N^+$ and $N^-$, respectively. Both types have to finance their investment plans by means of bank loans as the only source of funding. We also assume that:

*[A.1]* Both types know with certainty the return from their investment in each period ($X_t$ and $X_{t+1}$). For simplicity, we assume that the flow of returns from investment is constant over time for both types ($X_t = X_{t+1} = X$).

*[A.2]* The investment in period $t$ produces returns in both $t$ and $t+1$; the investment in period $t+1$ produces returns only in $t+1$ (and zero retroactive returns in $t$).

*[A.3]* The borrowing cost due by the firm for a bank loan in period $t$ is certain ($C_t$); the one in period $t+1$ is not certain ($E[C_{t+1}]$) and firms have expectations on it. For simplicity the borrowing cost includes the debt service and the application costs; it is assumed to be a one-off payment, paid at the end of the period in which the loan is obtained.

*[A.4]* Optimistic firms believe that borrowing cost will decrease by $\delta$: $E[C^+_{t+1}] = C_t(1-\delta)$

*[A.5]* Pessimistic firms believe that borrowing cost will increase by $\beta$: $E[C^-_{t+1}] =$

[4] Discouraged borrowers are defined as those firms who need loans but do not apply for fear of a rejection.

$C_t(1+\beta)$

*[A.6]* The probability for a firm to have accurate access to credit forecast is $\alpha$, where $0 \leq \alpha \leq 1$; i.e., the belief of an optimistic (pessimistic) firm about an decrease (increase) in the borrowing cost will occur with probability $\alpha$.

*[A.7]* Firms discount future returns by $\lambda$, where $0 \leq \lambda \leq 1$.

*[A.8]* Firm's return from investment in $t$ is lower than the borrowing cost due by the firm for a bank loan in period $t$: $X \leq C_t$; i.e., the cost of an investment in $t$ can be fully absorbed only after two periods of (certain) investment returns.

Given these assumptions, a firm applies for a bank loan in $t$ if:

$$X(1+\lambda) - C_t \geq \lambda X - E[C_{t+1}] \tag{1}$$

## 3.2 Modeling the application decision of optimistic firms

For simplicity, we introduce another assumption: $\delta \neq \beta$; which means that the increase and the decrease in borrowing cost have the same absolute value. We will relax this assumption in the Appendix.

Optimistic firms believe that borrowing cost will decrease by $\delta$ in $t+1$ and this will occur with probability $\alpha$. An increase in the borrowing cost of the same amount, instead, will occur with probability $1-\alpha$. Thus, the application condition in (1) becomes:[5]

$$X \geq \underbrace{C_t(2\alpha - 1)\delta}_{\gamma^+} \tag{2}$$

The LHS of equation (2) is one-period firm's return from investment and the RHS can be called "effective borrowing cost" ($\gamma^+$) as it includes the borrowing cost in $t$ modified to take into account the opportunity cost of demanding credit at better conditions in $t+1$. The optimistic firms which satisfy the condition in (2) constitute the group of applicants for a bank loan in $t$ ($N_t^+$).

The role of firm's access to credit expectations in determining current credit demand is then captured by the parameter $\delta$. When $\delta$ increases, the expected borrowing cost in $t+1$ for the optimistic firms decreases, making loan demand in $t+1$ more attractive.

[5]Find calculations and the model for the application decision of pessimistic firms in the Appendix.

The accuracy of firm's access to credit expectations has also a direct role in defining credit demand. Parameter $\alpha$, which represents the probability of realisation of firm's expectation, has a positive impact on the effective borrowing cost. When $\alpha$ increases, the firm is more certain that its optimism about future access to credit conditions is a correct prediction. This increases the number of firms which prefer to defer their investment plans (and credit demand) to the subsequent period.

We assume borrowing cost in $t$ ($C_t$) to be the same for every firm and let $\alpha$ and $\delta$ be the source of heterogeneity among firms, indicated with the subscript $i$ ($\alpha_i$ and $\delta_i$). We can write the firm-specific effective borrowing cost for optimistic firms as: $C_t(2\alpha_i - 1)\delta_i = \gamma_i^+$.

If $\alpha_i > 0.5$ and $\delta_i > \frac{X}{C_t(2\alpha_i - 1)}$ the firm prefers not to demand credit in $t$ because the expected credit conditions in $t+1$ would make the investment more profitable. If $\alpha_i \leq 0.5$ or if $\alpha_i > 0.5$ but $\delta_i \leq \frac{X}{C_t(2\alpha_i - 1)}$ all the firms find more profitable to demand credit in $t$.

Figure 1: The demand of credit for optimistic firms

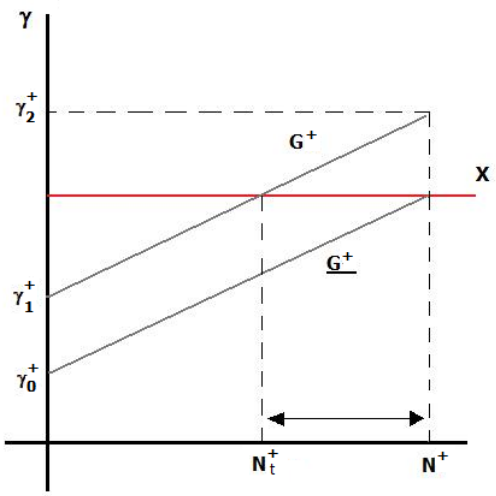



Figure 1 depicts the conditions under which firms decide to wait the subsequent period to apply for a loan when they expect that access to credit will improve. Optimistic firms are sorted in ascending order of $\gamma_i^+$ along the horizontal axis. The $\underline{G^+}$ line indicates the level of $\gamma_i^+$ for each firm under the condition in which all firms find more profitable to demand credit in $t$ ($N_t^+ = N^+$). The $G^+$ line indicates the level of $\gamma_i^+$ for each firm when the condition above is not satisfied by every firm. In this case $N_t^+$ represents the marginal firm whose $\gamma_i^+$ is just equal to $X$. To the left of $N_t^+$, $G^+$ is lower than the return, so these optimistic firms apply for a loan. To the right of $N_t^+$, $G^+$ is higher than the return, so these optimistic firms prefer to wait for $t+1$ to demand credit.

## 3.3 The importance of heterogeneity in firms' access to credit expectations and in forecast accuracy

The model points out the role of heterogeneous firms' access to credit expectations ($\delta_i$) and forecast accuracy ($\alpha_i$) in determining the demand of loans and investment. This generates a possible source of frictions for the credit market on the demand side, potentially preventing the full-effectiveness of monetary policy.

Recent evidences showed how the transmission mechanism from monetary policy to the credit market was far from being efficient during the first years of the Great Recession (Ferrando et al., 2017; Berger et al., 2017). Our model counterintuitively suggests that the perspective of an improvement in access to credit can contribute delaying the recovery. In this sense, firms could perceive the monetary policy implemented as credible and expect increasingly better access to credit conditions. In the concomitant presence of flat investment returns (very likely in times of stagnation), a firm may also decide to defer investment to a future period.

Our model provides a possible partial solution to the puzzle of the slackened investment recovery in the European Union after the Great Recession, by approaching it from the firm-level perspective on access to credit. It identifies the heterogeneity in expectations of firms' access to credit and the difference in their forecast accuracy as sources of friction for the credit demand.

The relevant research question stemming from the model is, then, related to the formation of firms' access to credit expectations. The first interesting aspect concerns the determinants of firms' expectations: which are the most relevant firm-level characteristics that shape those expectations? Are these characteristics structural or time-varying?

The second aspect that the model has shown to be relevant is the degree of accuracy of firms' expectations. Specifically we are interested in measuring the forecast ability of the firms, assessing whether access to credit expectations can be considered as rational, or to what extent forecast errors influence the expectation formation mechanism. The results of these analyses lead to a more ambitious question: is there room for a policy intervention aiming at influencing firms' access to credit expectation formation?

The following sections attempt to investigate the two aforementioned aspects. To do so we use the SAFE, which allows us to identify firm-level expectations on access to credit for a sample of European firms.

# 4 Data

## 4.1 The SAFE firms

The data source we use in our paper is the Survey on Access to Finance of Enterprises (SAFE) collected by the EC and the ECB twice a year from 2009. The survey predominantly covers micro, small and medium-sized companies, but also includes a small share of large firms. Interviewees belong to the sectors of manufacturing, construction, wholesale or retail trade and transport. The survey includes discontinuously up to 38 European countries. Its most interesting characteristic is to include many qualitative information about the conditions of access to finance of the firms. The part of the survey of particular interest for our purpose concerns firms' responses to the expected evolution of bank loans availability over the following six months. The survey also includes some qualitative information about the firm structure, as well as about the change in some balance sheet entries and in the business environment that the firm faces.

With the exception of the first two waves, starting from 2010 the survey is conducted in March and in September with reference periods April-September and October-March. The most recent wave of the SAFE, the 16th, was conducted in March 2017. Along those 16 waves the European economy faced, in sequence: the 2009 crisis, the sovereign debt crisis, the implementation of ECB's expansionary monetary policy, the recovery. The different economic phases documented by the SAFE make this dataset extremely interesting for studying access to credit in uncertainty frameworks. The questions are asked with a specific reference period. Questions on the status of the firm refers to the moment of the interview and are usually about the structure of the firm (age, number of employees, sector, and so on). Questions on the evolution of access to finance, balance sheet indicators and other qualitative opinions of the firm refer either to the six months before or the following six months.

In our analysis we include all German, Spanish, French and Italian firms observed in the survey from the 3rd wave (April-September 2010) to the 16th (October 2016-March 2017).[6] The total sample would be of 67,339 observations, however not all the firms

[6]The reason why we drop the first two waves from the sample is because one of our main variable of interest is the forecast error on the availability of bank loan. Since the second wave's reference period was July-December 2009 and not October 2009-March 2010, the periods do not overlap and do not allow us to construct our forecast error as specified in Section 5.2.

are asked to forecast the availability of bank loans for the following six months, as the question is addressed only to those which consider bank loans a relevant source of finance. We end up with 48,461 observations for 23,033 firms. 43% of them are interviewed at least twice, then the panel component of the survey is large enough to implement panel analysis techniques. The firms interviewed for two consecutive waves allow us to compute firm-level forecast errors, as we explain in Section 5.2.

Table 1 presents the main features our sample of "forecasting firms" in comparison to the total sample available in the SAFE. There are slightly more Italian and French firms in our sample, due to the fact that there are more firms considering bank loans to be a relevant source of finance in these two countries, with respect to Germany and Spain. Micro, small and medium firms are almost equally represented. Slightly less that 90% of the firms are autonomous and about 80% of them belong to a family (around 50%) or to a single owner (around 30%). Start-ups are a tiny component (1%), but around 18% of the firms are young (less then 10 years old). One quarter (27%) of the forecasting firms operate in the industrial sector, another quarter (22%) in trade, one third (31%) in transport and business (non financial) sector.

## 4.2 Stylized facts from the SAFE and our model of loan demand

The SAFE dataset is not useful to test the model we illustrated in Section 3, as it has no information on firms' investment or the amount of loan received. However, the information it provides about access to credit forecasts and the ancillary questions on the structure of the firm, balance sheet entries and firm-specific perceptions of the business environment, make this dataset a unique source to study heterogeneity in access to credit expectations.

In our model firm's demand of loans and investment are linked one-to-one. Although investment plans have actually different profitability over time and can be also financed by means of other sources, the statistics from the SAFE show that a large part of the firms who applied for bank loans used them for investment purposes, as indicated in Table 2. In addition, Table 2 shows that the demand of credit is also connected with other firm-specific activities which are directly linked to the economic growth, like hiring and training employees or developing new products or services.

In Europe the issue of non-fully efficient monetary policy during the first years of the Great Recession has been extensively documented by the reports of the SAFE. In

Table 1: Distribution of firms by structural features

| | Total sample | Forecasting firms |
|---|---|---|
| Country - SAFE variable: D0 | | |
| Germany | 25.0 | 22.1 |
| Spain | 24.4 | 24.2 |
| France | 25.3 | 27.7 |
| Italy | 25.3 | 26.0 |
| Employment - SAFE variable: D1 | | |
| from 1 to 9 | 34.2 | 31.4 |
| from 10 to 49 | 29.6 | 30.8 |
| from 50 to 249 | 26.6 | 27.9 |
| 250 or more | 9.6 | 9.9 |
| Autonomy - SAFE variable: D2 | | |
| subsidiary | 13.1 | 10.6 |
| autonomous | 86.9 | 89.4 |
| Sector - SAFE variable: D3 | | |
| industry | 25.7 | 27.1 |
| construction | 9.3 | 9.3 |
| trade | 22.0 | 22.1 |
| transport and business | 33.4 | 31.6 |
| other services | 9.6 | 9.9 |
| Turnover - SAFE variable: D4 | | |
| up to 2 mln | 46.9 | 44.6 |
| from 2 mln to 10 mln | 24.6 | 25.9 |
| from 10 mln to 50 mln | 19.0 | 19.8 |
| 50 million or more | 9.5 | 9.7 |
| Age - SAFE variable: D5 | | |
| less than 2 years | 1.2 | 1.2 |
| from 2 to 4 years | 5.2 | 5.1 |
| from 5 to 9 years | 12.0 | 12.0 |
| 10 years or more | 81.6 | 81.7 |
| Ownership - SAFE variable: D6 | | |
| public shareholders | 2.2 | 1.9 |
| family | 50.4 | 53.8 |
| association | 14.2 | 13.1 |
| venture capitalists | 0.9 | 0.9 |
| individual | 29.2 | 27.3 |
| other | 3.1 | 3.0 |

Source: Survey on Access to Finance of Enterprises, EC/ECB
Note: The values in each subcolumn sum to 100.

Table 2: How firms applying for a bank loan use their financing

| | Germany | Spain | France | Italy | total |
|---|---|---|---|---|---|
| Investment in property, plant or equipment | 72.8 | 46.6 | 77.5 | 50.1 | 63.8 |
| Hiring and training new employees | 11.5 | 9.0 | 3.6 | 10.9 | 8.7 |
| Developing and launching new products | 19.5 | 15.9 | 14.0 | 21.9 | 17.9 |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Share of firms using financing for the purpose indicated in the rows (question Q6_a in the SAFE) over the firms that applied for a bank loan (question Q7a_a in the SAFE).

the years between 2009 and 2014, in spite of the wide array of (conventional and not) policy instruments used by the ECB, the demand of credit in many European countries experienced an extremely slow and uncertain recovery. Our model suggests that optimistic access to credit expectations may have contributed to slacken the recovery. European firms could have believed in the "whatever it takes" policy and expect increasingly better access to credit conditions.

Table 3 shows that only 62.2% of the potential applicants for bank loans who believe that access to credit will improve in the following period, already applied in the six months before (in $T$). This implies that there is a consistent share of firms (37.8%) who could apply for a loan but did not, even in presence of optimistic forecast on future access to credit. Interestingly, the share of firms applying for a loan in $T+1$ among the potential applicants believing that access to credit would have improved in $T+1$ (67.2%) is higher than the share of optimistic firms applying in $T$ (62.2%). This may suggest that the decision of applying or not for a loan is taken in advance using firm's access to credit expectations. One explanation can be borrowed by the theories of imperfect information: application is costly, thus it can be optimal for a firm to decide whether to apply or not in advance.[7]

[7] Kon and Storey (2003) suggest that application costs for a bank loan cover: (i) paying someone to provide information required by the bank (*financial costs*); (ii) time for filling forms and meeting with the bank (*in-kind costs*); (iii) the entrepreneur's discomfort of sharing private information about themselves and their enterprise to a third party (*psychic costs*).

Table 3: Share of potential applicants who applied for credit

| | | Forecast in $t$ of access to credit in $T+1$ | | |
|---|---|---|---|---|
| | | will deteriorate | will remain unchanged | will improve |
| Apply in | $T$ | 56.5 | 58.4 | 62.2 |
| | $T+1$ | 55.8 | 60.8 | 67.7 |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Share of potential applicants demanding a bank loan in $T$ and/or in $T+1$, according to their $t$-period forecast of access to credit in period $T+1$. $t$ is the moment when the forecast is made; $T$ is the six-month period before $t$; $T+1$ is the six-month period after $t$. Total sample is composed by firms who are potential applicants for a bank loan, i.e. firms considering bank loans as a relevant source of funding for their firm (question Q4_d in the SAFE) and who did not declare to have sufficient internal funds (question Q7a_a in the SAFE).

# 5 Heterogeneous access to credit expectations and heterogeneous forecast accuracy

## 5.1 The determinants of firms' expectations

### 5.1.1 Empirical strategy

To estimate a model for the determinants of access to credit expectations we have to identify the variables of interest in the SAFE. Although ECB researchers have usually merged the SAFE with other sources to include balance sheets or other continuous variables into the econometric analysis, we follow Drakos (2013) whose dependent variable (bank loans terms and conditions) has the same shape of ours and use the SAFE as the only data source.

The dependent variable is derived from the response of the firm to the following question (Q23_b in the SAFE): "Looking ahead, for what matters bank loans (ed.), please indicate whether you think their availability will improve, deteriorate or remain unchanged over the next six months." Thus, we generate the variable "access to credit expectations" ($F_{i,T+1|t}$) as a trinomial variable:

$$F_{i,T+1|t} = \begin{cases} 1 \text{ if firm } i \text{ mentioned improve} \\ 0 \text{ if firm } i \text{ mentioned remain unchanged} \\ -1 \text{ if firm } i \text{ mentioned deteriorate} \end{cases}$$

The determinants of access to credit that we include among the regressors can be distinguished into three sets. The first is a set of dummy variables concerning the *structure* of the firm. The features for which we create dummies are those listed in Table 3, namely: country, number of employees, autonomy, sector, turnover, age and ownership. We express these dummy variables as vector $\mathbf{S}_{i,t}$.[8]

The second set of regressors concerns the change in some *balance sheet indicators* of the firm. In question Q2 firms are asked to say if in the past six months entries like turnover, labour costs, other costs, interest expenses and profit increased, decreased or remained unchanged. We collect these variables in vector $\mathbf{B}_{i,t|T}$ and, in the same way as the dependent variable, we set these variables to equal 1, 0 or -1 according to whether the entry, respectively, increased, remained unchanged or decreased.[9]

The third set of regressors $\mathbf{P}_{i,t|T}$ includes the firm's opinion about the evolution over the preceding six months of other business environment characteristics, like the general economic outlook, own enterprise-specific outlook, enterprises own capital and credit history. In question Q11 firms are asked to declare if those factors improved, deteriorated or remained unchanged. We can interpret them as *private signals* that the firm has about its business opportunity and set these variables as well to equal 1, 0 or -1 according to whether the factor, respectively, improved, remained unchanged or deteriorated.[10]

Table 4 summarizes the main statistics for the dependent and explanatory variables. More than 60% of the observations forecast that access to credit would remain unchanged, the remainder are divided between optimistic (21%) and pessimistic (17%) firms. With the exception of turnover, all the balance sheet indicators we introduced seem to have worsened over the period. Particularly relevant the difference between the ratio of the firms whose costs (labour, interests, other costs) increased and the ratio of the firms whose costs decreased. The period we are examining, which starts immediately after the 2008-2009 crisis, was characterized by high uncertainty. Although judgment on the general economy was far from being optimistic (the share of firms believing in improved macroeconomic condition was around half of the share of firms who argued the opposite), other private signals like firm-specific prospects, own capital and credit history generally improved. These results can be also due to a process of deleveraging which involved the companies of all the countries we focus on.

[8] Ferrando et al. (2017) find them to be significant determinants of credit restriction for a firm.

[9] Drakos (2013) find them to be relevant for explaining changes in interest rates and cost of finance.

[10] Holton et al. (2014) find that they explain part of the deterioration in firms' access to credit.

Table 4: Variables of interest

| | variable | question | outcome | observations | distribution | | |
|---|---|---|---|---|---|---|---|
| | | | | | -1 | 0 | 1 |
| $F_{i,T+1\|t}$ | access to credit expectations | Q23_b | 1=improves<br>0=remains unchanged<br>-1=deteriorates | 48,461 | 17.2 | 61.8 | 20.9 |
| $\mathbf{P}_{i,T\|t}$ | general economic outlook | Q11_a | 1=improves<br>0=remains unchanged<br>-1=deteriorates | 47,466 | 35.5 | 44.8 | 19.8 |
| | firm-specific outlook | Q11_c | | 47,227 | 25.5 | 47.9 | 26.5 |
| | own capital | Q11_d | | 48,141 | 17.2 | 57.3 | 25.5 |
| | credit history | Q11_e | | 47,437 | 14.8 | 58.1 | 27.0 |
| $\mathbf{B}_{i,T\|t}$ | turnover | Q2_a | 1=increases<br>0=remains unchanged<br>-1=decreases | 48,351 | 29.0 | 31.6 | 39.4 |
| | labour costs | Q2_b | | 48,244 | 7.3 | 38.4 | 54.3 |
| | other costs | Q2_c | | 48,274 | 7.0 | 31.0 | 62.0 |
| | interest expenses | Q2_d | | 46,259 | 21.1 | 46.1 | 32.8 |
| | profit | Q2_e | | 47,709 | 41.7 | 31.2 | 27.1 |
| $\mathbf{S}_{i,t}$ | country | D0 | 4 dummies | 48,461 | see Table 1 | | |
| | employment size | D1 | 4 dummies | 48,461 | see Table 1 | | |
| | autonomy | D2 | 2 dummies | 48,450 | see Table 1 | | |
| | sector | D3 | 5 dummies | 48,461 | see Table 1 | | |
| | turnover size | D4 | 4 dummies | 47,686 | see Table 1 | | |
| | age | D5 | 4 dummies | 47,326 | see Table 1 | | |
| | ownership | D6 | 6 dummies | 47,697 | see Table 1 | | |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Sample of forecasting firms. The column "question" refers to the question in SAFE from which the variable was derived. The multicolumn "distribution" shows the share of firms (percent) for every outcome.

The model we estimate is the following:

$$F_{i,T+1|t} = \alpha_0 + \alpha_{\mathbf{1}}\mathbf{P}_{i,T|t} + \alpha_{\mathbf{2}}\mathbf{B}_{i,T|t} + \alpha_{\mathbf{3}}\mathbf{S}_{i,t} + \mu_i + \theta_t + \epsilon_{i,T+1} \tag{3}$$

where $\mu_i$ is the firm-specific error component, $\theta_t$ is the set of biannual period dummies and $\epsilon_{i,T+1}$ is the idiosyncratic error component. Due to the ordered nature of the dependent variable equation (3) must be estimated by an Ordered Probit (OP). Panel techniques for estimating the OP use Random Effects to capture the unobservable heterogeneity of the firm. The assumption that agents dispose only of information for period $T$ when forming expectations for $T+1$ is, however, common in the adaptive learning literature (Evans and Honkapohja, 2001), as it permits to avoid simultaneity issues (Milani, 2011).

### 5.1.2 Results

Table 5 presents the results of the estimation of equation (3) with different econometric techniques. The first three columns include pooled OLS estimates. Not all structural dummies ($\mathbf{S}_{i,t}$ in equation (3)) are significant determinants of the expectations. Country dummies show that Italian and Spanish firms have systematically lower expectations than French and German ones. Employment and turnover size dummies, instead, suggest that the smaller is the firm, the more negative expectation it makes. Significance for turnover size dummies disappears as balance sheet indicators and private signals enter the specification (Column 2 and 3). The same occurs to ownership modalities, while being autonomous or a subsidiary is not relevant in the expectation formation. The significance of industry dummies highlights that constructions were severely hit by the recession. Interestingly, age seems to affect the expectations negatively.

The inclusion of balance sheet indicators ($\mathbf{B}_{i,T|t}$ in equation (3), Column 2) and of private signals ($\mathbf{P}_{i,T|t}$ in equation (3), Column 3) improves the model fit and the signs of the coefficient are the one expected.[11] An increase in turnover and profit affect positively firm's access to credit expectations, as firms can furnish proof of higher internal resources when apply for loans. For the same purpose, the increase in costs - labour, interest expenses and other costs - shrinks firm's expectations. An improved outlook on general economy and on firm's activity lead to more positive access to credit forecasts. The same effect is provided by improvements in own capital and in firm's credit history. Estimating the full specification by means of panel FE (Column 4) shows that indicators of change in turnover and other costs are no longer significant.[12]

Columns 5 and 6 of Table 5 estimate the full specification using an ordered probit (OP) estimator due to the discrete nature of the dependent variable. Column 5 provide estimates of equaiton (3) using pooled OP and the last column shows the results of a panel OP random effects (RE) estimates.[13] Signs and comments are almost the same as for Column 3.

[11] As all the variables are discrete there is small variability and R-squared remains low. This is a common feature of the literature on survey data.

[12] Structural dummies are not included as barely time invariant, then incompatible with the within transformation adopted in the FE estimator.

[13] Using the panel OP RE estimator structural dummies can be included into the specification.

Table 5: The determinants of access to credit expectations

| | (1) pooled OLS | (2) pooled OLS | (3) pooled OLS | (4) panel FE | (5) pooled OP | (6) panel OP RE |
|---|---|---|---|---|---|---|
| general economic outlook | | | 0.136*** | 0.097*** | 0.280*** | 0.290*** |
| | | | (0.005) | (0.007) | (0.010) | (0.011) |
| firm-specific outlook | | | 0.099*** | 0.069*** | 0.202*** | 0.213*** |
| | | | (0.005) | (0.008) | (0.011) | (0.011) |
| own capital | | | 0.054*** | 0.032*** | 0.109*** | 0.118*** |
| | | | (0.006) | (0.008) | (0.012) | (0.012) |
| credit history | | | 0.096*** | 0.058*** | 0.198*** | 0.204*** |
| | | | (0.005) | (0.008) | (0.011) | (0.011) |
| turnover | | 0.074*** | 0.012*** | 0.005 | 0.025*** | 0.027*** |
| | | (0.005) | (0.005) | (0.007) | (0.010) | (0.010) |
| labour costs | | -0.018*** | -0.016*** | -0.016** | -0.033*** | -0.033*** |
| | | (0.005) | (0.005) | (0.008) | (0.010) | (0.011) |
| other costs | | -0.020*** | -0.013*** | -0.001 | -0.027*** | -0.028** |
| | | (0.005) | (0.005) | (0.008) | (0.010) | (0.011) |
| interest expenses | | -0.079*** | -0.041*** | -0.027*** | -0.085*** | -0.089*** |
| | | (0.004) | (0.004) | (0.007) | (0.009) | (0.010) |
| profit | | 0.099*** | 0.027*** | 0.034*** | 0.056*** | 0.063*** |
| | | (0.004) | (0.005) | (0.007) | (0.010) | (0.010) |
| country dummies | Yes*** | Yes*** | Yes*** | No | Yes*** | Yes*** |
| employment size dummies | Yes*** | Yes*** | Yes** | No | Yes** | Yes** |
| autonomy dummy | Yes | Yes | Yes | No | Yes | Yes |
| sectoral dummies | Yes*** | Yes*** | Yes*** | No | Yes*** | Yes** |
| turnover size dummies | Yes*** | Yes | Yes | No | Yes | Yes |
| age dummies | Yes*** | Yes*** | Yes** | No | Yes** | Yes** |
| ownership dummies | Yes* | Yes* | Yes | No | Yes | Yes |
| biannual dummies | Yes*** | Yes*** | Yes*** | Yes*** | Yes*** | Yes*** |
| Constant | 0.042 | 0.228*** | -0.004 | 0.066*** | | |
| | (0.037) | (0.038) | (0.028) | (0.014) | | |
| Observations | 45,830 | 43,029 | 40,894 | 43,064 | 40,894 | 40,894 |
| R-squared | 0.048 | 0.099 | 0.165 | 0.145 | 0.096 | |

Source: Surey on Access to Finance of Enterprises, EC/ECB

Note: Standard errors in parentheses are consistent in the presence of heteroskedasticity and autocorrelation. Each set of dummy variables is jointly tested for significance (F-test).

Significance levels: *=10%, **=5%, ***=1%

Table 6: The determinants of access to credit expectations. Estimates by country

| | (1) Germany | (2) Spain | (3) France | (4) Italy |
|---|---|---|---|---|
| general economic outlook | 0.253*** | 0.257*** | 0.322*** | 0.256*** |
| | (0.025) | (0.022) | (0.021) | (0.021) |
| firm-specific outlook | 0.172*** | 0.222*** | 0.186*** | 0.237*** |
| | (0.026) | (0.023) | (0.021) | (0.023) |
| own capital | 0.101*** | 0.111*** | 0.152*** | 0.097*** |
| | (0.026) | (0.025) | (0.021) | (0.024) |
| credit history | 0.266*** | 0.228*** | 0.171*** | 0.183*** |
| | (0.026) | (0.023) | (0.021) | (0.022) |
| turnover | 0.035 | 0.019 | 0.018 | 0.039** |
| | (0.025) | (0.021) | (0.018) | (0.019) |
| labour costs | -0.057** | -0.023 | -0.052** | -0.020 |
| | (0.026) | (0.021) | (0.022) | (0.021) |
| other costs | -0.066*** | -0.019 | -0.036 | -0.037 |
| | (0.025) | (0.021) | (0.023) | (0.022) |
| interest expenses | -0.090*** | -0.094*** | -0.068*** | -0.085*** |
| | (0.023) | (0.019) | (0.019) | (0.019) |
| profit | 0.035 | 0.072*** | 0.062*** | 0.088*** |
| | (0.023) | (0.021) | (0.018) | (0.020) |
| employment size dummies | Yes*** | Yes | Yes | Yes |
| autonomy dummy | Yes | Yes | Yes | Yes |
| sectoral dummies | Yes* | Yes*** | Yes | Yes |
| turnover size dummies | Yes*** | Yes** | Yes | Yes |
| age dummies | Yes | Yes | Yes* | Yes |
| ownership dummies | Yes | Yes | Yes* | Yes |
| biannual dummies | Yes*** | Yes*** | Yes*** | Yes*** |
| Observations | 8,605 | 10,253 | 11,222 | 10,814 |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Panel Ordered Probit with Random Effects estimates. Standard errors in parentheses are consistent in the presence of heteroskedasticity and autocorrelation. Each set of dummy variables is jointly tested for significance (F-test).

Significance levels: *=10%, **=5%, ***=1%

As country dummies are very significant in every specification of our empirical model, Table 6 provides the results of a cross country comparison estimate. Private signals do not seem to vary their effect across countries, balance sheet indicators and structural dummies do. Turnover is significant only for Italian firms, while labour costs affect significantly only the expectations of German and French firms. Other costs are significant only in Germany while profit matters in all countries, but in Germany. Firm size seems to be a relevant determinant of access to credit expectations only for Germany and Spain, where also sectoral dummies are jointly significant. Age and ownership seem to be the only significant structural characteristics for French firms, but irrelevant for any other country. Italian firms' expectations are not related to company structural variables.

## 5.2 Forecast accuracy and its determinants

### 5.2.1 The forecast error

The second step consists on constructing a measure to evaluate firms' accuracy in forecasting access to credit. As shown by Bachmann et al. (2013b), which develops an accuracy index using GDP expectations of the firms, it is possible to measure the forecasting ability of a firm even in the presence of qualitative variable.

Firms' access to credit expectations are restricted to three options (improve, remain unchanged and deteriorate). The same three outcomes represent the possible answers to question Q9_a: "For what matters bank loans (ed.), would you say that their availability has improved, remained unchanged or deteriorated for your enterprise over the past six months." We build a qualitative measure of the forecast error by subtracting current change realisations (answers to Q9_a) from past change forecast (answers to Q23_b). So for a firm that expected an improvement in access to credit, the realisation of an improvement would be coded as 0 (zero forecast error), no change would be coded as +1 (the forecast was too optimistic), a deterioration would be coded as +2 (the forecast was definitely too optimistic). The possible forecast errors are summarized in Table 7 Panel (a), where columns correspond to past forecast for period $T$ ($F_{i,T|t-1}$) and rows to period $T$ realisation as assessed in $t$ ($R_{i,T|t}$). There are 9 possible combinations with 5 different outcomes: "large" optimistic or pessimistic error (+2 or -2), optimistic or pessimistic error (+1 or -1), no qualitative error (0).

Table 7: Access to credit forecast error

| Panel (a) Value for each case | | $F_{i,T\|t-1}$ | | |
|---|---|---|---|---|
| | | will deteriorate | will remain stable | will improve |
| $R_{i,T\|t}$ | deteriorated | 0 | +1 | +2 |
| | remained stable | -1 | 0 | +1 |
| | improved | -2 | -1 | 0 |

| Panel (b) Share of firms | | $F_{i,T\|t-1}$ | | | |
|---|---|---|---|---|---|
| | | will deteriorate | will remain stable | will improve | total |
| $R_{i,T\|t}$ | deteriorated | 6.1 | 7.6 | 2.5 | 16.2 |
| | remained stable | 8.8 | 40.6 | 11.6 | 60.9 |
| | improved | 1.9 | 12.0 | 9.0 | 22.9 |
| | total | 16.8 | 60.1 | 23.1 | 100.0 |

Source: Survey on Access to Finance of Enterprises, EC/ECB
Note: Panel (a): value taken by firm's forecast error ($F_{i,T|t-1} - R_{i,T|t}$) when the case occurs. Panel (b): share of firms (percent) for every type of forecast error.

Table 7 Panel (b) shows the share of firm's access to credit forecast error for each case. 55.7% of the forecast are correct, the largest share due to expectation and realisation of stability. "large" optimistic and pessimistic error jointly occur for 4.4% of all forecasts. Forecasts of non-stability (deterioration or improvement) of access to credit are likely to be incorrect: only 36.3% (39.0%) of forecast of deterioration (improvement) are fulfilled, while 52.4% (50.2%) happen to be too pessimistic (optimistic) as stability is realised.

### 5.2.2 The determinants of the firms' forecast error

To estimate the determinants of firms' access to credit forecast accuracy we use the same specification described in equation (3), but with the forecast error on the LHS. The results are shown in Table 8. Before commenting these result it is worth noting that the model fit is very poor, whatever estimator we use. Anyway, these estimates indicate the correlation between the variables and provide useful information on heterogeneity in accuracy.

The first four columns of Table 8 present the results of the regression with the forecast error committed in $T+1$ ($FE_{i,T+1|t} = F_{i,T+1|t} - R_{i,T+1|t+1}$) as dependent variable. Each of these columns shows the results of a different estimator. Among the private signals, general economic outlook and firm-specific outlook have positive and significant coefficient

Table 8: The determinants of access to credit forecast error

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | pooled OLS | panel FE | pooled OP | panel OP RE | panel OP RE | panel P RE |
| dependent variable | $FE_{i,T+1\|t}$ | $FE_{i,T+1\|t}$ | $FE_{i,T+1\|t}$ | $FE_{i,T+1\|t}$ | $\|FE_{i,T+1\|t}\|$ | $1[FE_{i,T+1\|t} \neq 0]$ |
| general economic outlook | 0.031** | 0.040** | 0.045*** | 0.049*** | 0.045** | -0.047** |
| | (0.012) | (0.018) | (0.017) | (0.017) | (0.018) | (0.021) |
| firm-specific outlook | 0.080*** | 0.083*** | 0.116*** | 0.120*** | 0.124*** | -0.002 |
| | (0.013) | (0.019) | (0.019) | (0.019) | (0.019) | (0.022) |
| own capital | -0.038*** | 0.011 | -0.055*** | -0.052*** | -0.046** | -0.007 |
| | (0.013) | (0.020) | (0.019) | (0.019) | (0.020) | (0.023) |
| credit history | 0.014 | 0.057*** | 0.021 | 0.028 | 0.030 | 0.029 |
| | (0.013) | (0.019) | (0.019) | (0.018) | (0.019) | (0.022) |
| turnover | -0.015 | -0.010 | -0.022 | -0.023 | -0.026 | -0.009 |
| | (0.011) | (0.017) | (0.016) | (0.016) | (0.017) | (0.020) |
| labour costs | -0.038*** | -0.024 | -0.054*** | -0.054*** | -0.050*** | -0.005 |
| | (0.012) | (0.019) | (0.017) | (0.018) | (0.018) | (0.022) |
| other costs | -0.019 | -0.022 | -0.028 | -0.028 | -0.025 | -0.030 |
| | (0.012) | (0.020) | (0.017) | (0.018) | (0.019) | (0.022) |
| interest expenses | 0.043*** | 0.007 | 0.062*** | 0.062*** | 0.063*** | 0.037** |
| | (0.011) | (0.016) | (0.015) | (0.016) | (0.016) | (0.019) |
| profit | -0.013 | -0.002 | -0.019 | -0.021 | -0.023 | 0.005 |
| | (0.011) | (0.016) | (0.016) | (0.017) | (0.017) | (0.020) |
| country dummies | Yes*** | No | Yes*** | Yes*** | Yes*** | Yes*** |
| employment size dummies | Yes | No | Yes | Yes | Yes | Yes |
| autonomy dummy | Yes | No | Yes | Yes | Yes | Yes |
| sectoral dummies | Yes** | No | Yes** | Yes** | Yes | Yes |
| turnover size dummies | Yes | No | Yes | Yes | Yes | Yes |
| age dummies | Yes | No | Yes | Yes | Yes | Yes |
| ownership dummies | Yes | No | Yes | Yes | Yes | Yes |
| biannual dummies | Yes*** | Yes*** | Yes*** | Yes*** | Yes** | Yes** |
| Constant | 0.194* | -0.088*** | | | | -0.112 |
| | (0.114) | (0.032) | | | | (0.103) |
| Observations | 12,044 | 12,545 | 12,044 | 12,044 | 12,044 | 12,044 |
| R-squared | 0.024 | 0.020 | 0.011 | | | |

Source: Surey on Access to Finance of Enterprises, EC/ECB

Note: In Column (1) to (4) the dependent variable is the *forecast error*: $FE_{i,T+1|t} = F_{i,T+1|t} - R_{i,T+1|t+1}$ which can take discrete values from -2 to +2. In Column (5) the dependent variable is the *absolute forecast error*: $|FE_{i,T+1|t}|$ which can take discrete values from 0 to +2. In Column (6) the dependent variable is a *dummy of forecast error*: $1[FE_{i,T+1|t} \neq 0]$ which takes value 1 when $FE_{i,T+1|t} \neq 0$ and 0 otherwise; the estimator is a panel (non-ordered) Probit with Random Effects. Standard errors in parentheses are consistent in the presence of heteroskedasticity and autocorrelation. Each set of dummy variables is jointly tested for significance (F-test).

Significance levels: *=10%, **=5%, ***=1%

across all four columns. Firms with better perspective are more optimistic and have more probability to fail the forecast because of a realised of stability in access to credit. Own capital is negatively and significantly correlated with forecast error, with the exception of the pooled Ordered Probit estimates. Firm debt overhang issues can help us give a possible explanation for this result which suggests that an improvement in firm's own capital is correlated with a pessimistic forecast error. A firm improving its own capital as a consequence of a deleveraging process may underestimate its credit bargaining power, while the bank may appreciate the effort and be actually more willing to provide a loan. An improvement in firm's credit history is accompanied by a more optimistic forecast error only in the pooled Ordered Probit estimates. Among the balance sheet indicators, only labour costs and interest expenses are significant along all four columns, but with opposed signs. Among the structural variables, only country, sectoral and time dummies are jointly significant.

Column (5) shows the results of the same specification as in the previous columns, but having the absolute forecast error in $T+1$ as dependent variable ($|FE_{i,T+1|t}|$), estimated by means of the panel Ordered Probit estimator with Random Effects. The coefficients are similar in signs and significance to those in Column (4). In Column (6) the dependent variable is a dummy taking value 1 if the forecast error in $T+1$ is not zero (i.e., if the forecast is not correct), and 0 otherwise. We estimate the specification using the panel Probit estimator with Random Effects and find that the only significant coefficient are those belonging to firm's general economic outlook and interest expenses.

The results in Table 8 suggest us that some degree of heterogeneity in firms' forecast accuracy can be detected among the observable variables we considered. In the next section we try to assess whether this information can be relevant for policy purposes.

# 6 Policy implications

In Section 5 we documented heterogeneity in access to credit expectations and in forecast accuracy. The model we proposed in Section 3 suggests these two variables to be a potential source of frictions for the monetary policy transmission, as they affect the credit demand of firms. We are now interested in assessing to what extent firms' forecast ability influence the expectation formation mechanism and understanding whether policy intervention can affect it. We proceed in three steps: (i) testing the hypothesis of ratio-

nality for access to credit expectations; (ii) identifying stylized facts of monetary policy influence on forecast accuracy; (iii) assessing the role of past forecast error in expectation formation in order to test the hypothesis of adaptive expectations.

## 6.1 Are firms' access to credit expectations rational?

We can verify the rationality of firms' access to credit expectations by means of a test introduced by Rossi and Sekhposyan (2016) and used in a discrete environment on business survey data by Cloyne et al. (2016). It is based on the implication of rational expectations assessing that, conditional on the information available, expected forecast errors are null. Using panel data, rationality can be tested with the following model:

$$F_{i,T|t-1} - R_{i,T|t} = \alpha_i + \beta F_{i,T|t-1} + \epsilon_{i,T} \tag{4}$$

where $F_{i,T|t-1} - R_{i,T|t}$ is firm's forecast error, $\alpha_i$ is firm-specific fixed effect and $\epsilon_{i,T}$ is the idiosyncratic error component. Equation (4) has to be estimated using panel fixed effects (FE) using standard errors which are robust to heteroskedasticity and autocorrelation. Expectations are rational if both $\alpha_i$ and $\beta$ are equal to zero. Table 9 presents the estimates of equation (4) and the result of the joint test of efficiency ($\alpha_i = 0$) and unbiasedness ($\beta = 0$). Rationality in access to credit expectations is rejected for every country.

Table 9: Rationality test of firms' access to credit expectations

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | All countries | Germany | Spain | France | Italy |
| access to credit expectations | 0.961*** | 0.979*** | 0.934*** | 0.965*** | 0.967*** |
| | (0.012) | (0.027) | (0.028) | (0.021) | (0.021) |
| Constant | -0.048*** | -0.094*** | -0.124*** | 0.028*** | -0.033*** |
| | (0.001) | (0.002) | (0.004) | (0.001) | (0.002) |
| Observations | 15,211 | 3,005 | 3,470 | 4,504 | 4,232 |
| R-squared | 0.523 | 0.523 | 0.473 | 0.550 | 0.534 |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Panel Fixed Effects estimates. The dependent variable is the *forecast error*: $F_{i,T|t-1} - R_{i,T|t}$ which can take discrete values from -2 to +2. The explanatory variable is the *access to credit expectations*: $F_{i,T|t-1}$ which can take discrete values from -1 to +1. Standard errors in parentheses are consistent in the presence of heteroskedasticity and autocorrelation.

Significance levels: *=10%, **=5%, ***=1%

## 6.2 Heterogeneous forecast accuracy and monetary policy

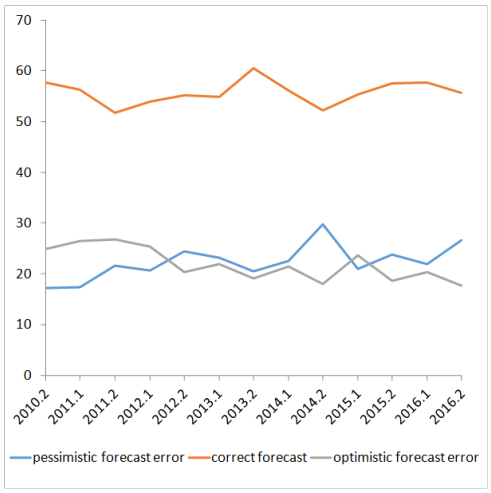
The contribution to forecast errors of the different cases shown in Table 7 changed over time (Figure 2). The share of firms forecasting correctly (Panel (a), orange line) fluctuated around a mean of 55%, but the contribution of its components changed: correct forecasts of improvement (Panel (b), grey line) doubled and correct forecasts of deterioration halved (Panel (b), green line). The share of pessimistic forecast error, instead, slightly increased in the period (Panel (a), grey line), mainly because of the contribution of the stability forecasts which were followed by an improvement in access to credit (Panel (c), green line). The share of optimistic forecast error dwindled over time (Panel (a), turquoise line), thanks to the decreasing contribution of the stability forecasts which were followed by a deterioration in access to credit (Panel (d), orange line). The series in Figure 2 suggest two main comments: (i) even after some years of generally stable improvement in access to credit conditions, firms continue to have heterogeneous (and largely incorrect) expectations; (ii) there is a period in time, between 2012.2 and 2013.1, where the trends of some forecast error components seem to change, and this period coincides with the implementation of the Outright Monetary Transaction (OMT) policy by the ECB.

Table 10 presents the forecast error distribution by country and firm's employment size. In terms of accuracy, firm size does not seem to be a discriminant factor as micro and large firms have closer probability of forecasting correctly. The direction of the forecast error, instead, appears to be related to firm size. The larger (smaller) the firm, the higher the share of pessimistic (optimistic) forecast error. This result can be explained by the fact that, although smaller firms expect and realise a higher share of access to credit deterioration, the share of firms that forecast a stability in access to credit (the large majority) is more likely to be disregarded by smaller firms than by larger ones. This combination generates a higher share of optimistic forecast error among the smaller firms, despite of the fact that smaller firms' forecast are not the most optimistic. German firms' access to credit predictions look more accurate than the ones of other countries' firms (especially Italy and Spain). There is a relevant gap in the share of optimistic forecast error between Germany and Italy due to the fact that Italian firms' stability expectations were more often disregarded by a realisation of deterioration. One important consideration has to be done with respect of the monetary policies implemented over the period. The earliest evidences about the effect of the OMT policy implemented by the ECB in August 2012 suggest that it helped improve access to credit (Ferrando et al., 2017). Our statistics on forecast error show that, although a clear improvement in forecast accuracy is not

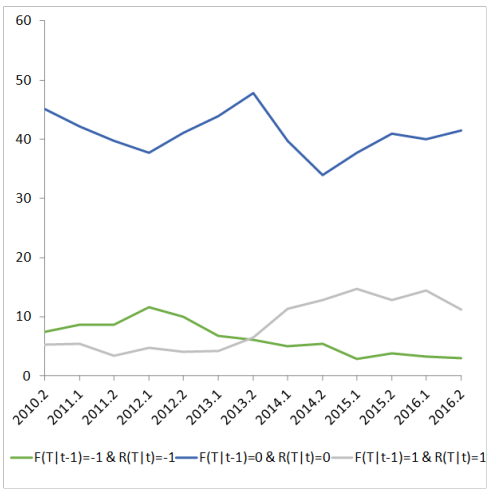
traceable, after the OMT announcement the share of firms making pessimistic (optimistic) forecast errors increased (decreased) in all countries. A sign that the actual situation in access to credit was better than expected after the OMT announcement.

Figure 2: Forecast error components

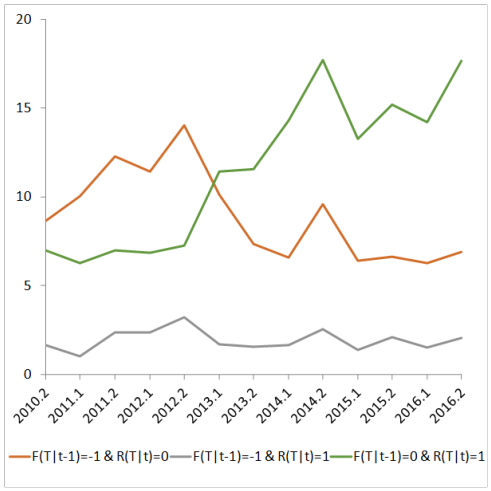
(a) All forecast errors



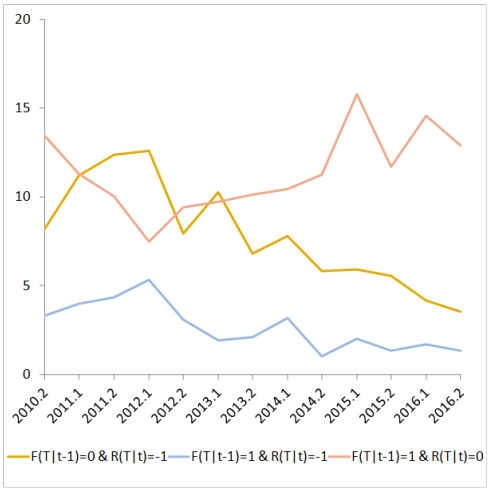

(b) Zero forecast error




(c) Pessimistic forecast error




(d) Optimistic forecast error




Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Panel (a): *correct forecast* is the sum of the diagonal entries of Table 7 Panel (b) for every wave of the survey; *pessimistic forecast error* is the sum of the lower triangular entries of Table 7 Panel (b) for every wave of the survey; *optimistic forecast error* is the sum of the upper triangular entries of Table 7 Panel (b) for every wave of the survey. Panel (b): all single entries in the diagonal of Table 7 Panel (b) for every wave of the survey. Panel (c): all single entries in the lower triangular part of Table 7 Panel (b) for every wave of the survey. Panel (d): all single entries in the upper triangular part of Table 7 Panel (b) for every wave of the survey.

Table 10: Forecast error by size and country

| | pessimistic forecast error | correct forecst | optimistic forecast error |
|---|---|---|---|
| From 1 to 9 employees | 21.5 | 54.4 | 24.0 |
| From 10 to 49 employees | 22.2 | 56.3 | 21.5 |
| From 50 to 249 employees | 23.5 | 56.0 | 20.5 |
| 250 or more employees | 24.7 | 56.0 | 19.3 |
| *Entire period (2010-2016)* | | | |
| Germany | 22.0 | 60.3 | 17.7 |
| Spain | 24.1 | 53.5 | 22.4 |
| France | 23.4 | 56.3 | 20.3 |
| Italy | 21.3 | 53.6 | 25.1 |
| total | 22.7 | 55.7 | 21.7 |
| *Before OMT announcement (2010-2012)* | | | |
| Germany | 20.3 | 59.5 | 20.3 |
| Spain | 22.9 | 50.9 | 26.1 |
| France | 20.8 | 55.8 | 23.4 |
| Italy | 18.0 | 53.2 | 28.7 |
| total | 20.3 | 54.9 | 24.8 |
| *After OMT announcement (2013-2016)* | | | |
| Germany | 22.8 | 60.7 | 16.5 |
| Spain | 24.6 | 54.5 | 20.8 |
| France | 25.1 | 56.6 | 18.3 |
| Italy | 23.0 | 53.7 | 23.3 |
| total | 23.9 | 56.1 | 20.0 |

Source: Survey on Access to Finance of Enterprises, EC/ECB
Note: The columns show the distribution of the forecast error in terms of the share of firms (percent) who committed pessimistic, zero or optimistic forecast error.

## 6.3 Adaptive expectations and learning

We can introduce the lagged error forecast into equation (3) in order to test whether firms' access to credit expectations depend on their forecasting ability. In this sense, the theory of adaptive expectations suggests that a firm takes into account the error committed in past forecasts to formulate expectations for the following period. If the predictions of this and other theories of learning are valid, the estimated coefficient of the forecast error will be negative, as becoming aware of an erroneous past forecast would help the firm straighten up the new forecasts towards the opposite direction with respect to the latest

prediction.

In Table 11 we present the estimates obtained when including lagged forecast error among the regressors in equation (3). Every column provides the results of a different estimator to assess the robustness of the findings. In all the estimation technique we adopted the forecast error has a negative and significant coefficient. This means that if a firm committed an optimistic (pessimistic) error in the period before - i.e. believed that access to credit would have improved (deteriorated), but it did not occurred - its new access to credit forecast would be lower (higher). This particular effect of error corrected forecast is explained by the theories of adaptive expectations and learning. Once the firm becomes aware of having failed the past forecast, it uses this information to reformulate its expectations for the next period. Briefly, firms learn from their mistakes, and this affects current expectations. Besides the slight improvement in the model fit, the inclusion of lagged forecast error in the specification is accompanied with a generalised lost of significance in balance sheet indicators such as turnover and other costs, as well as all structural dummies with the exception of country and sectoral ones. This occurs because part of the heterogeneity of the firm is already captured by the forecast error, confirming what we showed in Table 8: forecast accuracy deals with observable firm characteristics.

As, once again, country dummies are significant, Table 12 provides the results of a cross country comparison estimate, like in Table 6, but with the inclusion of the lagged forecast error. The latter variable has a negative and significant coefficient in all countries, however it is worth noting that the values are higher in absolute value for Germany and France: the estimation of the impact of the forecast error for Italian and Spanish firms is almost half the one estimated for France and one third of the one estimated for Germany. These results support the idea that Italian and Spanish firms learn less from past errors when they reformulate access to credit expectations. The remaining coefficients look similar to those in Table 6.

This section points out two main results: (i) firms' access to credit expectations are adaptive; (ii) ECB's monetary policy seems to have influenced firms' forecast accuracy during the crisis. So, which are the channels through which policy can lead firms' access to credit expectations? One intervention can be addressed towards the observable characteristics of the firms, as we indicated in Section 5.1. A second channel of action can be firms' perception of current access to credit, as past forecast error depends on it. Since the firm learns from its past incorrect expectations in order to shape the new ones, communication may be a powerful monetary policy instrument.

Table 11: The determinants of access to credit expectations.
The role of past forecast error

| | (1) pooled OLS | (2) panel FE | (3) pooled OP | (4) panel OP RE |
|---|---|---|---|---|
| (lagged) forecast error | -0.019** | -0.163*** | -0.039** | -0.108*** |
| | (0.007) | (0.010) | (0.016) | (0.016) |
| general economic outlook | 0.143*** | 0.074*** | 0.299*** | 0.310*** |
| | (0.009) | (0.013) | (0.019) | (0.020) |
| firm-specific outlook | 0.090*** | 0.036*** | 0.187*** | 0.199*** |
| | (0.010) | (0.013) | (0.020) | (0.021) |
| own capital | 0.054*** | 0.019 | 0.113*** | 0.124*** |
| | (0.010) | (0.014) | (0.021) | (0.023) |
| credit history | 0.107*** | 0.058*** | 0.224*** | 0.232*** |
| | (0.010) | (0.014) | (0.020) | (0.021) |
| turnover | 0.011 | 0.003 | 0.023 | 0.026 |
| | (0.008) | (0.011) | (0.017) | (0.019) |
| labour costs | -0.024*** | -0.013 | -0.050*** | -0.047** |
| | (0.009) | (0.014) | (0.019) | (0.021) |
| other costs | -0.009 | -0.013 | -0.018 | -0.023 |
| | (0.009) | (0.013) | (0.018) | (0.021) |
| interest expenses | -0.045*** | -0.019 | -0.096*** | -0.102*** |
| | (0.008) | (0.012) | (0.016) | (0.018) |
| profit | 0.028*** | 0.041*** | 0.060*** | 0.076*** |
| | (0.008) | (0.012) | (0.017) | (0.019) |
| country dummies | Yes*** | No | Yes*** | Yes*** |
| employment size dummies | Yes | No | Yes | Yes |
| autonomy dummy | Yes | No | Yes | Yes |
| sectoral dummies | Yes* | No | Yes* | Yes |
| turnover size dummies | Yes | No | Yes | Yes |
| age dummies | Yes | No | Yes | Yes |
| ownership dummies | Yes | No | Yes | Yes |
| biannual dummies | Yes*** | Yes*** | Yes*** | Yes*** |
| Constant | 0.207*** | 0.066*** | | |
| | (0.057) | (0.024) | | |
| Observations | 12,750 | 13,224 | 12,750 | 12,750 |
| (Pseudo) R-squared | 0.180 | 0.106 | 0.107 | |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: *(Lagged) forecast error* is calculated as: $F_{i,T|t-1} - R_{i,T|t}$ and can take discrete values from -2 to +2. Standard errors in parentheses are consistent in the presence of heteroskedasticity and autocorrelation. Each set of dummy variables is jointly tested for significance (F-test).

Significance levels: *=10%, **=5%, ***=1%

Table 12: The determinants of access to credit expectations. The role of past forecast error, by country

| | (1) Germany | (2) Spain | (3) France | (4) Italy |
|---|---|---|---|---|
| (lagged) forecast error | -0.215*** | -0.072** | -0.150*** | -0.066** |
| | (0.047) | (0.033) | (0.030) | (0.029) |
| general economic outlook | 0.255*** | 0.312*** | 0.317*** | 0.270*** |
| | (0.053) | (0.043) | (0.037) | (0.037) |
| firm-specific outlook | 0.229*** | 0.205*** | 0.129*** | 0.247*** |
| | (0.058) | (0.045) | (0.038) | (0.041) |
| own capital | 0.071 | 0.104** | 0.181*** | 0.116** |
| | (0.057) | (0.051) | (0.039) | (0.045) |
| credit history | 0.405*** | 0.271*** | 0.121*** | 0.213*** |
| | (0.058) | (0.045) | (0.038) | (0.040) |
| turnover | 0.082 | -0.011 | 0.023 | 0.034 |
| | (0.054) | (0.042) | (0.033) | (0.034) |
| labour costs | -0.110** | 0.033 | -0.139*** | -0.010 |
| | (0.056) | (0.042) | (0.041) | (0.038) |
| other costs | -0.087* | -0.041 | -0.031 | -0.023 |
| | (0.052) | (0.041) | (0.042) | (0.039) |
| interest expenses | -0.135*** | -0.123*** | -0.062* | -0.080** |
| | (0.049) | (0.038) | (0.034) | (0.033) |
| profit | 0.027 | 0.089** | 0.071** | 0.127*** |
| | (0.049) | (0.042) | (0.033) | (0.036) |
| employment size dummies | Yes | Yes | Yes | Yes |
| autonomy dummy | Yes | Yes | Yes | Yes |
| sectoral dummies | Yes | Yes** | Yes | Yes |
| turnover size dummies | Yes** | Yes | Yes | Yes |
| age dummies | Yes | Yes | Yes | Yes |
| ownership dummies | Yes | Yes | Yes | Yes |
| biannual dummies | Yes* | Yes*** | Yes*** | Yes*** |
| Observations | 2,376 | 2,900 | 3,824 | 3,650 |

Source: Survey on Access to Finance of Enterprises, EC/ECB

Note: Panel Ordered Probit with Random Effects estimates. *(Lagged) forecast error* is calculated as: $F_{i,T|t-1} - R_{i,T|t}$ and can take discrete values from -2 to +2. Standard errors in parentheses are consistent in the presence of heteroskedasticity and autocorrelation. Each set of dummy variables is jointly tested for significance (F-test).

Significance levels: *=10%, **=5%, ***=1%

# 7 Conclusion

Using a simple model of credit demand similar to that considered by Kon and Storey (2003), we show a possible channel through which heterogeneity in access to credit expectations and/or heterogeneity in forecast accuracy can prevent the full effectiveness of monetary policy. We proceed by focusing on both sources of heterogeneity. First, we estimate the determinants of firms' access to credit expectations using a panel of German, Spanish, French and Italian firms, and find that they depend on: (i) some structural characteristics of the firm (size, age, sector and country of activity); (ii) changes in balance sheet indicators (profits, labour costs and interest expenses); (iii) firm-specific private signals (changes in general economic and firm-specific outlook, and credit reputation). Second we adopt a method for measuring firms' forecast errors from business survey data and calculate that around 45% of firms fail to predict future availability of bank loans. Our estimates reveal heterogeneity in forecast accuracy as well.

Additional analysis suggest that monetary policy influenced the components of firms' forecast errors during the Great Recession and that past forecast errors influence firms' current expectations, consistently with the hypothesis of adaptive expectations and learning. Sizeable cross-country differences in the forecast error learning effect on expectations seem to exist.

Some implications concerning the effectiveness of monetary policy may stem from the findings of our research. First, showing that heterogeneous access to credit expectations and their accuracy affect the decision of the firm (and, consequently, the demand of loans), our model proposes a possible key to the interpretation of the slackening in the effect of monetary policy during recession. The perspective of a continuous improvement in access to credit, mainly if accompanied by flatness in returns, may induce the firm to delay its investment. A clear monetary policy with time or target revealed limitations may help firms to form more accurate short term expectations. Second, understanding that firms' access to credit expectations depend on agent-specific features, such as balance sheet indicators or privately available signals, can help the policy maker to design appropriate monetary policy instruments, possibly targeted to more specific firm-level needs.[14] Third, the adaptive nature of firms' expectations reveals another channel of monetary policy intervention: communicaiton. Since firms learn from their past forecast error, improving communication may affect firms' perception of current access to credit and, in this way,

[14] See Cúrdia and Woodford (2016) on optimal monetary policy in the presence of credit frictions.

influence expectations.[15]

Measuring firms' inability to correctly predict future access to credit conditions indicates the size of a potentially relevant source of frictions in the monetary policy transmission mechanism. Modeling this type of frictions in general equilibrium models, as well as introducing them into forecast models for investment, can help improving the predictability of the effect of monetary policy during a credit crunch.

[15] Ricco et al. (2016) study expectations on government spending and suggest that a clear fiscal policy communication can help form homogeneous expectations.

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# A Modeling firms' decision of applying for loans

Following the assumptions *[A.1-A.8]* in Section 3.1, firms' intertemporal net return for an investment undertaken in $t$ is given by:

$$X(1+\lambda) - C_t$$

Firms' intertemporal net return for an investment undertaken in $t+1$ is given by:

$$0 + \lambda X - E[C_{t+1}]$$

Thus, a firm applies for a bank loan in $t$ if:

$$X(1+\lambda) - C_t \geq \lambda X - E[C_{t+1}]$$

which is equation (1) in Section 3.1. A positive net return condition in $t$ has to be included:

$$X(1+\lambda) - C_t \geq 0$$

otherwise the firm will never consider the possibility to apply for loan in $t$ and will only consider to apply in $t+1$.

## A.1 Optimistic and pessimistic firms when $\delta = \beta$

In Section 3.2 we introduced a further assumption: $\delta \neq \beta$; i.e., the increase and the decrease in borrowing cost have the same absolute value. Then, optimistic firms believe that borrowing cost will decrease by $\delta$ in $t+1$ and this will occur with probability $\alpha$. An increase in the borrowing cost of the same amount, instead, will occur with probability $1-\alpha$. Thus, the application condition in (1) becomes:

$$X(1+\lambda) - C_t \geq \lambda X - C_t(1-\delta)\alpha - C_t(1+\delta)(1-\alpha)$$

Rearranging this yields:

$$X \geq \underbrace{C_t(2\alpha - 1)\delta}_{\gamma^+}$$

which is equation (2) in Section 3.2. Further comments on optimistic firms' behaviour are expressed in Section 3.2.

Pessimistic firms believe that the borrowing cost will increase by $\delta$ in $t+1$ and this will occur with probability $\alpha$. A decrease in the borrowing cost, instead, will occur with probability $1-\alpha$. Thus, the application condition in (1) becomes:

$$X(1+\lambda) - C_t \geq \lambda X - C_t(1+\delta)\alpha - C_t(1-\delta)(1-\alpha)$$

Rearranging this yields:

$$X \geq \underbrace{C_t(1 - 2\alpha)\delta}_{\gamma^-} \tag{5}$$

where RHS of equation (5) is the effective borrowing cost for the pessimistic firms ($\gamma^-$). Pessimistic firms which satisfy the condition in (5) enter the group of applicants for a bank loan in $t$. As in equation (2), firm's access to credit expectations (captured by the parameter $\delta$) affect positively the effective borrowing cost in $t$, making loan demand in $t+1$ more attractive.

When $\alpha$ increases, the firm is more certain that its pessimistic view about future access to credit conditions is a correct prediction. This increases the number of firms which prefer to demand credit and invest in $t$.

In this case as well we can assume borrowing cost in $t$ to be the same for every firm and let $\alpha$ and $\delta$ be the source of heterogeneity among firms. If $\alpha_i < 0.5$ and $\delta_i > \frac{X}{C_t(1-2\alpha_i)}$ the pessimistic firm prefers not to demand credit in $t$. If $\alpha_i \geq 0.5$ or if $\alpha_i < 0.5$ but $\delta_i \leq \frac{X}{C_t(1-2\alpha_i)}$ all the firms find more profitable to demand credit in $t$.

## A.2 Relaxing $\delta = \beta$ assumption

Now consider the more general case, where $\delta \neq \beta$; i.e., the increase and the decrease in borrowing cost have not the same absolute value. According to optimistic firms' beliefs, the probability that the borrowing cost will increase by $\beta$ in $t+1$ will occur with probability $1-\alpha$. Thus, the application condition in (1) becomes:

$$X(1+\lambda) - C_t \geq \lambda X - C_t(1-\delta)\alpha - C_t(1+\beta)(1-\alpha)$$

Rearranging this yields:

$$X \geq \underbrace{C_t[\alpha(\delta+\beta) - \beta]}_{\gamma^+} \tag{6}$$

The effect of accuracy ($\alpha$) and of expected borrowing cost reduction ($\delta$) have the same sign as in the $\delta = \beta$ case. The effect of an unexpected increase in borrowing cost ($\beta$) is negative if $\alpha \neq 1$, i.e., if the optimistic forecast is not perfectly accurate an increase in the unexpected borrowing cost would encourage firms to invest (and demand credit) in $t$.

For the pessimistic firms case the application condition in (1) becomes:

$$X(1+\lambda) - C_t \geq \lambda X - C_t(1+\beta)\alpha - C_t(1-\delta)(1-\alpha)$$

Rearranging this yields:

$$X \geq \underbrace{C_t[\delta - \alpha(\delta+\beta)]}_{\gamma^-} \tag{7}$$

The effect of accuracy ($\alpha$) and of expected borrowing cost increase ($\beta$) have the same sign as in the $\delta = \beta$ case. The effect of an unexpected decrease in borrowing cost ($\delta$) is positive if $\alpha \neq 1$, i.e., if the pessimistic forecast is not perfectly accurate an increase in $\delta$ would discourage firms to invest (and demand credit) in $t$.