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ABSTRACT

We use a unique design feature of a survey of Italian firms to study the causal effect of inflation expectations on firms' economic decisions. In the survey, a randomly chosen subset of firms is repeatedly treated with information about recent inflation whereas other firms are not. This information treatment generates exogenous variation in inflation expectations. We find that higher inflation expectations on the part of firms leads them to raise their prices, increase demand for credit, and reduce their employment and capital. However, when policy rates are constrained by the effective lower bound, demand effects are stronger, leading firms to raise their prices more and no longer reduce their employment.

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"With nominal short-term interest rates at or close to their effective lower bound in many countries, the broader question of how expectations are formed has taken on heightened importance. Under such circumstances, many central banks have sought additional ways to stimulate their economies, including adopting policies that are directly aimed at influencing expectations of future interest rates and inflation." Janet Yellen (2016)

"When we are at practically zero nominal rates, the real rates are being driven by the expectation of inflation. So lower expectations of inflation imply higher real rates… that's why we fight negative expectations of inflation." Mario Draghi (2015)

"The first element [of QE] was to dispel people's deflationary mindset and raise inflation expectations…" Haruhiko Kuroda (2014)

1 Introduction

Since the onset of the effective lower bound (ELB) on policy interest rates following the start of the Great Recession, there has been increasing interest among policy-makers and academics in policies that operate through expectations channels. Mainstream macroeconomic models, in particular, suggest that policies aimed at raising the inflation expectations of agents should lead to lower perceived real interest rates, thereby stimulating economic activity through increased demand for both durable and non-durable goods. Unconventional policies such as forward guidance and quantitative easing were in part motivated by the desire of central banks to raise inflation expectations. More generally, the fact that most economic decisions are forward-looking implies that changes in the expectations of households and firms about the future should exert immediate effects on their economic behavior. However, the endogeneity of economic expectations has made testing this channel a challenge.

In this paper, we report new empirical evidence on how changes in inflation expectations affect economic decisions using persistent and *exogenously* generated variation in the expectations of firms in Italy. In a quarterly survey of firms that has been running since 1999, the Bank of Italy introduced an information treatment in 2012 to a randomly selected subset of the panel of firms participating in the survey. These firms continued to receive this treatment for years thereafter. The treatment was to provide selected firms with recent and publicly available information about actual inflation in the Italian economy at the time of the survey, immediately prior to asking them about their inflation expectations. A control group was, in contrast, not provided with any information about recent inflation over the same time period. We show that this information treatment led to large and persistent differences in the inflation expectations of treated firms relative to those in the control

group. These exogenous and time-varying differences in expectations serve as a powerful instrument to characterize the effect of expectations on firms' decisions.

Exploiting this instrumental variable strategy, we document that higher inflation expectations on the part of firms translate into their economic decisions. When using the full sample period we find that firms with higher inflation expectations raise their prices somewhat and reduce both their employment and capital relative to firms with lower inflation expectations. The economic magnitudes involved for the employment and investment decisions are large, and declines in employment occur disproportionately among blue-collar and temporary workers. Consistent with higher prices and fewer inputs, sales decline when firms raise their inflation expectations. These responses appear to reflect a stagflationary view of inflation among Italian firms, as they tend to perceive higher inflation as being associated with worse macroeconomic conditions and lower demand for their firms, a perception which is largely consistent with the historical experience. Changes in inflation expectations also affect the financing decisions of firms. When firms raise their inflation expectations, they tend to utilize more of their credit lines and apply for loans with new financial institutions, which reflects fears of reduced access to funds in the future, and they also increase their leverage and slightly reduce their liquidity. When focusing solely on the ELB period, the effects of inflation expectations on prices and credit utilization are stronger, while the effects on employment disappear. This is consistent with firms perceiving a stronger demand-side channel of inflation at the ELB, a feature we confirm using their expectations of other economic variables. This mechanism is in line with the predictions of New Keynesian models at the ELB (e.g. Woodford 2011).

Strikingly, we document that firms in the treatment group ultimately earn modestly higher profit shares than firms in the control group, even though no such difference was present prior to the treatment period. The rise in profits is consistent with the fact that the provision of information about inflation helped firms make better decisions but the fact that the rise in profits is relatively small helps explain why most firms were choosing not to track this publicly available information in the first place. We interpret this finding as providing direct evidence for rational inattention models (Sims 2003, Mackowiak and Wiederholt 2009, Afrouzi 2016).

Our results build on a growing literature studying how inflation expectations of economic agents relate to their decisions. Much of this work has focused on households, in part due to the greater availability of household surveys reporting inflation expectations. For example, Bachmann et al. (2015) find little correlation between households' inflation expectations and their desired

consumption levels using the Michigan Survey of Consumers, but subsequent works have found stronger and positive correlations between expectations and consumption using the New York Fed's Survey of Consumer Expectations (Crump et al. 2015), a German survey of households (Dräger and Nghiem 2016), and a broader cross-section of European households (Duca, Kenny, and Reuter 2017).

This literature, however, has faced two sources of difficulty. One is the endogeneity of agents' economic expectations and the absence of clear sources of identifying variation to make causal statements.[1] The other is the lack of quantitative information on the macroeconomic expectations of firms, thereby restricting much of the literature to expectations of households.[2] Both issues are tackled in Coibion, Gorodnichenko and Kumar (2018, henceforth CGK), who use an experimental design in a quantitative survey of firms in New Zealand to assess how exogenous variation in inflation expectations of managers from an information treatment affects their subsequent choices over prices, wages, employment and investment. While closely related, the approach taken in this paper has a number of important advantages relative to this prior work. First, the breadth and duration of the Italian survey and information treatment are significantly larger. Whereas CGK have a single information treatment and a single follow-up survey to measure ex-post outcomes, the quarterly survey in Italy has a large panel of firms to whom the treatment is *repeatedly* applied over the course of more than six years. Since the treatment varies over time due to changes in the level of actual inflation, this delivers much more powerful identification. Second, we can characterize how expectations affect economic decisions over different time horizons and the results indicate that the effects of changing inflation expectations may take time to translate into actions. Third, the Italian survey also covers large firms (a quarter of firms in the survey have more than 500 employees) while CGK's survey in New Zealand had very few firms of more than 500 employees. Fourth, the Italian survey has questions about *why* firms plan to change their own prices which, when combined with questions about aggregate and firm-level economic outlooks, can help understand the channels underlying the causal effects of inflation expectations. Fifth, we can merge survey

[1] One notable exception to this in the literature on consumption and inflation expectations is D'Acunto, Hoang, and Weber (2016). They exploit the rise in expected inflation associated with the anticipation of VAT changes in Germany as an exogenous source of variation in inflation expectations relative to households in neighboring countries that did not have this policy change. Another is Coibion, Georgarakos, Gorodnichenko, and van Rooij (2019), who apply information treatments to a randomly selected subset of surveyed households in the Netherlands and study how the resulting exogenous variation in inflation expectations affects spending decisions.

[2] There are several notable papers on the expectations of firms. Gennaioli, Ma and Shleifer (2015) show that CFOs' expectations of earnings growth are highly predictive of their firms' investment plans and ex-post investment levels. Frache and Lluberas (2017) study the quantitative inflation expectations of firms in Uruguay. Boneva et al. (2016) study firms' pricing expectations in the U.K.

responses with administrative data to not only validate survey responses but also study treatment effects for a wide range of outcome variables. Finally, New Zealand avoided deflation and the ELB on nominal policy rates and one may be concerned that the effects of firms' inflation expectations could be different at the ELB period. Because the sample period for the Italian survey includes an ELB period, we can provide direct answers as to how central banks' attempts to raise inflation expectations influence the behavior of firms and, more generally, the macroeconomy.

Our paper is also closely related to recent work utilizing the same survey data. For example, Conflitti and Zizza (2018) study how inflation expectations of respondents in the Italian survey of firms respond to exogenous changes in wages arising from contract renewals. Bartiloro, Bottone, and Rosolia (2017) study how the cross-sectional variation in inflation expectations of firms depends on observable characteristics of firms and the availability of information. Using the randomized provision of information to firms, they assess whether the weight assigned to new information varies over time. Bottone and Rosolia (2019) study how Italian firms respond to monetary policy shocks. Relative to these papers, we provide causal evidence on how exogenous changes in inflation expectations affect the decisions of Italian firms.

This paper complements a growing literature which utilizes random control trial methods to characterize how information affects agents' macroeconomic expectations. Binder and Rodrigue (2018) and Coibion, Gorodnichenko and Weber (2019) are recent examples using U.S. households' expectations of inflation, Roth and Wohlfart (2018) do so with expectations of the real economy, while Armona, Fuster and Zafar (2017) apply this approach to house price expectations. Experiments on firms are less frequent. Besides CGK, Hunziker, Raggi, Rosenblatt-Wisch and Zanetti (2018) assess how Swiss firms' long-term inflation expectations change under various types of information treatments. Coibion, Gorodnichenko, Kumar and Ryngaert (2018) study how first and higher order beliefs of firms in New Zealand respond to different information treatments and how these affect firms' subsequent decisions. The experiment among Italian firms is similar in spirit to this prior work but differs significantly in its repeated nature and the fact that external data on firms' actions is brought to bear to study how their decisions are impacted by their beliefs.

Our results speak directly to whether policies that operate primarily through expectations channels can be effective. Providing exogenous information to firms clearly induces changes not just in their beliefs but also in their economic *behavior*, which supports the idea that policy-makers can affect economic outcomes through shaping agents' expectations of the future (see e.g. Wiederholt

(2015) for a model in which central banks communicate to rationally inattentive agents). These expectations channels can be important not just for monetary policy (e.g. forward guidance) but also for fiscal policies, as exemplified in recent discussion of anticipated VAT changes (D'Acunto, Hoang, and Weber 2016). Furthermore, because the European Central Bank (ECB) was facing the effective lower bound on interest rates during a sub-period of our analysis, our results speak directly to the expectations channel precisely in the circumstances when that channel is expected to be most relevant for policymakers. In particular, we find that firms interpret higher inflation during the ELB as being associated with much stronger demand side effects than outside the ELB period and change their behavior outside and inside the ELB, much as standard models would predict when nominal interest rates do not offset changes in expected inflation (Woodford 2011).

2 Data Description

We pool together four different sources of information to characterize how inflation expectations affect the economic decisions of firms. The first is the Survey on Inflation and Growth Expectations (SIGE, henceforth), which allows us to measure expectations and some firm decisions. The SIGE is also the source of the randomized information treatment that serves to generate exogenous variation in inflation expectations. Second, we match the SIGE with the Italian Central Credit Registry (CCR, henceforth), which is an information system operated by the Bank of Italy that collects data supplied by banks and financial companies on credit granted to customers and also other information. The third data source comes from the Italian National Social Security Institute (INPS, henceforth), which provides information on employment and wages at the firm level. Finally, we match the SIGE with the Company Accounts Data Service (CADS, henceforth), which contains balance sheet information on Italian limited liabilities firms. The latter allows us to measure profits, investment, liquidity, leverage and other financial characteristics of the firms. We discuss each of these in turn.

2.1 The Survey on Inflation and Growth Expectations

The SIGE is a quarterly business survey run since December 1999 by the Bank of Italy.[3] The reference universe consists of firms operating in industry excluding construction and non-financial private services[4] with administrative headquarters in Italy and employing 50 or more workers. Since

[3] Until October 2018 the survey was conducted jointly with the newspaper *Il Sole 24 Ore*.
[4] The following are excluded from the survey: financial intermediaries and insurance companies, general government and the educational and healthcare sectors as well as other community, social and personal services.

the first quarter of 2013, construction firms with at least 50 employees have been added. The sample is stratified by sector of economic activity (industry, non-financial private services and construction), geographical area (North-West, North-East, Centre, South and Islands) and number of employees (50-199, 200-999, 1000 and over). In recent years, each wave has about 1,000 firms (400 in industry excluding construction, 400 in non-financial private services and 200 in construction). Over the years, about 2,000 firms have participated in the survey. The list of firms used to extract the sample is drawn from the Bureau Van Dijk's Aida database and is updated on average every five years. Sampling weights are provided to ensure that the distribution of firms (in terms of employment) in the sample represents the distribution of firms in the population.

The survey is carried out by a specialist firm that distributes the questionnaire to company managers who are best informed about the topics covered in the survey. About 90 percent of the data is collected through computer assisted web interviews in the form of an online questionnaire featuring a purpose-designed interface, while the remaining 10 percent are collected through computer assisted telephone interviews. Data are collected in the first three weeks of March, June, September and December. The response rate is about 45 percent on average.

The purpose of the survey is to obtain information on firms' expectations concerning inflation, the general economic situation, own-product prices and demand, investment and employment. Most of the data—with the exception of own-product prices changes (past and expected), inflation expectations and current number of employees—are qualitative and relate to firms' assessments about their own business activity as well as about macroeconomic matters in the reference quarter and looking ahead. The qualitative questions in the questionnaire typically have three or more possible answers (for example: worse, the same, better). Most of the questions are repeated throughout the various waves. On occasion, the survey contains questions on specific aspects of the economy that warrant further investigation. A typical questionnaire is presented in Appendix 1. More information about the survey is provided in Grasso and Ropele (2018). Descriptive statistics are provided in the Appendix.

2.2 Central Credit Register (CCR)

The CCR is an information system managed by the Bank of Italy that collects information on lending activity of financial intermediaries (banks, other financial intermediaries, special purpose vehicles) that operate in Italy. It contains monthly detailed information on all individual loans

granted by financial intermediaries to borrowers for which the overall exposure is above 75,000 euros towards a single intermediary (this threshold was lowered to 30,000 in January 2009).[5] Loans are divided into three broad categories: overdraft loans (uncommitted credit lines), term loans (these include leasing, mortgages and committed credit lines), loans backed by receivables. In the present analysis we focus on the utilization rate of overdraft loans as this category of credit should be less contaminated by supply-side variation.[6]

From the CCR we also retrieve information on the number of loan applications as an alternative measure of credit demand. The CCR keeps track of the requests advanced by intermediaries to obtain preliminary information ("*servizio di prima informazione*") about the credit position of a potential borrower. Banks use this service only when the borrowing request originates from a *new* applicant, as the CCR regularly updates banks with information on the overall credit position of their existing clients. The preliminary information request can be precisely identified as an actual loan application because the bank lodging the inquiry has to report the reason for the request.

2.3 Data from the National Social Security Institute (INPS)

The Italian Social Security Institute INPS regularly compiles data archives on the national social security system and more generally on welfare-related issues by collecting administrative information that employers, operating in the private non-agricultural sectors, have to provide in order to pay pension contributions to their employees. Among other things, for each worker the employers report the gross take-home pay (which is the full net pay grossed up with labor income taxes and pension contributions levied on the employee), the broad occupational category (e.g. blue-collar or white-collar workers) and type of contract (e.g. open-ended or fixed-term). From this master data file, INPS constructs various datasets with information at the firm level where each firm is uniquely identified by the fiscal code (that can be used to link the information with the other data sources). In this study, we will use firm-level monthly information on the number

[5] If a loan is in default, the overall credit exposure of the firm is automatically registered in the CCR, even if the loan amount is below the threshold.

[6] Banks can at any time revoke (totally or partially) the amount of credit lines granted to firms and typically do so when the borrowers' creditworthiness deteriorates. In Italy the share of firms whose credit line was totally or partially cancelled was about 8 percent each year between 2012 and 2014. Then, it gradually declined reaching 5 percent in 2017 in line with the overall improvement the credit quality.

of employees, annual average gross wage by occupational category and annual average share of various types of workers. These data are available from 1990 to 2018.

2.4 The Company Accounts Data Service (CADS)

The CADS is a proprietary database owned by Cerved Group S.p.A., a leading information provider in Italy and one of the major credit rating agencies in Europe. CADS includes detailed information on balance sheet and income statements for almost all Italian limited liability companies since 1993. Information is drawn from official data recorded at the Italian Registry of Companies and from financial statements filed at the Italian Chambers of Commerce. Companies provide data on a compulsory basis. Each company's financial statement is updated annually. From this dataset, we collect yearly balance sheet information on various assets and liability items (e.g. fixed assets, cash, inventory, financial debt and net equity) as well as yearly information from income statement (e.g. sales and profits).

3 Information Treatment and Inflation Expectations

A unique feature of the Italian survey of firms is the randomized treatment of firms in terms of the information about recent inflation with which they are provided. In this section, we first describe this information treatment and then present evidence on how this treatment feeds into the inflation expectations of firms, which provides the basis for our identification strategy to assess the causal effect of inflation expectations on firms' economic decisions.

Before 2012Q3, all firms in the survey received information about recent inflation dynamics before being asked about their economic expectations. In 2012Q3 the survey was redesigned and participating firms were randomly split into two groups that were sent two versions of the survey. One group, corresponding to about one-third of the sample, received the following question about inflation:

> "*What do you think consumer price inflation in Italy, measured by the 12-month change in the Harmonized Index of Consumer Prices, will be…*"

over three different horizons: 6-month ahead, one-year ahead, and 2-year ahead. We refer to this group of firms as the control group. Starting in 2014Q1, firms were also asked about their expectation of annual inflation at a two-year horizon two years ahead (that is, average annual inflation rate in three and four years from the date of the survey), which we refer to as the 4-year

time horizon. The inflation expectations question comes at the beginning of the survey, immediately after verifying their industry classification and asking for their number of employees and their share of exports in revenues.

The remaining two-thirds of panelists were instead asked the following question:

> "*In [previous month], consumer price inflation measured by the 12-month change in the Harmonized Index of Consumer Prices was [X.X]% in Italy and [Y.Y]% in the Euro area. What do you think it will be in Italy …*"

over the same horizons as asked in the other version of the question. All other questions in the survey are identical. The treatment therefore consists of giving firms additional but publicly available information about the most recent rate of inflation in both Italy and the Euro area.[7] Since the inflation rate varies over time, the size of the treatment varies as well. Assignment into treatment and control groups was randomly redrawn in 2012Q4 and stayed fixed until 2017Q2.[8] At that point, there was a new randomized assignment of firms across the treatment and control groups, as well as the addition of another information treatment group which we do not include in our analysis.[9]

Prior to 2012Q3, all firms were in the treatment group, meaning that all firms were receiving the information about most recent inflation in Italy and the Euro area. As can be seen in Figure 1, the inflation expectations of both groups of firms closely tracked the actual inflation rate in Italy, which was reported to all firms at the time. Starting in 2012Q3 however, we begin to see large gaps appearing between the inflation expectations of the two types of firms. As the inflation rate fell sharply from late 2012 through mid-2015 (from 2.5 percent per year to below zero), the average forecast of the treated group fell much more rapidly than that of the control group. Despite starting off with the same average forecast at the end of 2012, the average forecast of the treated group was 0.5 percentage point lower by the end of 2014 than the control group's. This pattern reversed itself when inflation rose sharply in 2017: the average forecast of the treatment group rose rapidly, by more than one percentage point, while the average forecast of the control group rose by about half a

[7] The treatment provides potentially two different pieces of information: i) inflation rate in Italy and ii) inflation rate in the Euro area. However, the correlation between these two series in our sample is above 0.95 so we do not have enough variation to identify the effect of each inflation series separately.

[8] To verify that the selection of firms into treatment and control groups was actually random, we regress a dummy variable for whether a firm was treated on observable characteristics of each firm, including their size, their export share, the average absolute size of their price changes in the previous 12-month, as well as sector and geographic fixed effects. The results are reported in Appendix Table 2. None of the observable characteristics are statistically significantly correlated with being treated which is random assignment into treatment.

[9] The new treatment involved telling firms about the ECB's inflation target. These data have not yet been cleared by the Bank of Italy for research purposes. In the assignment of firms in 2017Q2, nearly 60 percent of firms from the control group moved into the original treatment group while nearly 20 percent of firms in the treatment group moved to the control group.

percentage point. Panel B of Figure 1 illustrates that the treatment also has a pronounced effect on the cross-sectional dispersion of beliefs: firms in the control group have systematically more dispersed expectations than those in the treatment group after 2012, even though no such difference was apparent before the differential provision of information began.[10]

To quantify the extent to which the information treatment affects firms' inflation expectations, we first create a dummy variable equal to one if firms are treated and zero otherwise. We then multiply that dummy by the level of inflation associated with that treatment. This creates a time-varying measure of the treatment given to a firm each quarter, which we denote T_t^i with *i* and *t* indexing firms and time (survey waves).[11] The time-variation reflects the fact that treated firms receive a different treatment each period (as the level of inflation varies over time). To quantify the effect of this time-varying treatment on the reported inflation forecast of firm *i* at time *t* for horizon *h* (i.e., $F_t^i\pi^{(h)}$), we then regress their expectations that quarter on the treatment variable for that quarter:

$$F_t^i\pi^{(h)} = \alpha_h + \beta_h T_t^i + error_{t,h}^i. \quad (1)$$

We use Driscoll and Kraay (1998) standard errors to account for cross-sectional and time correlation in the errors and include seasonal fixed effects for each sector of economic activity.

The results are presented in Table 1. Being provided with information about recent inflation has a significant and large effect on inflation expectations across horizons. We find that information about inflation being 1 percentage point higher raises the average forecast of firms by 0.59 percentage point at a six-month horizon, 0.55 percentage point at a one-year horizon, with effects falling at longer horizons to a low of 0.37 percentage point at the four-year horizon. The large weight being assigned to this information is consistent with experimental evidence in CGK, documenting that firms place a lot of weight to information presented to them about recent inflation dynamics. More generally, the fact that inflation expectations respond less than one-for-one to inflation is consistent with the under-reaction of inflation expectations to aggregate information documented in the literature (e.g. Coibion and Gorodnichenko 2012, 2015, Bordalo et al. 2018). As the horizon of

[10] Bartiloro et al. (2017) similarly find that the provision of information through the SIGE affects the 12-month ahead inflation expectations of recipients and reduces the dispersion in their beliefs.

[11] There are alternative ways to define the treatment. For example, we can measure the information received by treated firms as the difference between recent inflation and the 2 percent target (or just below 2 percent) of the ECB. Alternative definitions like this one yield almost identical results. Another possible way could be to use a simple 0-1 dummy variable (being zero for the uninformed firms and one for the informed ones) and include in the regression time fixed effects. Using such a specification for the treatment yields the result that, across forecasting horizons, informed firms report lower inflation expectations (on average by about 0.3 percentage points) compared with the uninformed firms (results are available upon request). This is in line with the patterns shown in Figure 3 Panel A.

expectations increases, the R^2 declines, consistent with the view that it may be harder to move firms' longer-term inflation expectations.[12] In short, these results show that expectations at longer horizons are affected as well, albeit to a smaller extent than at shorter horizons.[13]

Figure 2 plots the distribution of reported forecasts from the two groups for selected quarters. As can readily be seen, the distributions are quite different: beliefs are much more dispersed in the control group that receives no information, with much wider tails of very high or low forecasts of inflation. Figure 3 shows that this holds across forecasting horizons for a specific quarter. Consistent with the results presented in Table 1, these figures support the idea that information treatments have pronounced effects on the inflation forecasts of firms across horizons but the effect is strongest for short-term inflation expectations.

We can also use the survey data from SIGE to characterize the persistence of the treatment effect on expectations. Figure 1 indicates that treated firms have persistently different expectations than those in the control group. However, it is unclear whether this is because the information treatment has a persistent effect on beliefs or because the signals from recent inflation are themselves persistent. Since the signals received are time-varying due to changing level of the most recent inflation rate being reported to treated firms, we can differentiate between the persistent effects of a single signal and the persistence of the signals themselves by examining the effect of past information on current beliefs. Specifically, we estimate an expanded version of equation (1):

$$F_t^i \pi^{(h)} = \alpha_h + \beta_{h,0} T_t^i + \beta_{h,1} T_{t-1}^i + \beta_{h,2} T_{t-2}^i + \cdots + \beta_{h,q} T_{t-q}^i + error_{t,h}^i, \qquad (2)$$

which effectively estimates the dynamic response of expectations to signals (which are given by the coefficients $\beta_{h,0}, \beta_{h,1}, \ldots, \beta_{h,q}$). The results are reported in Table 2. While the effect of a contemporaneous treatment on inflation expectations is large ($\beta_{h,0}$), these effects seem to die out quickly, although the persistence and serial correlation in the treatments complicate interpretation of estimated duration effects.[14] The previous quarter's treatment has only a small effect on current

[12] Panel B of Appendix Table 3 assesses the response of expectations of different horizons to the treatment using a common sample (since 4-year ahead forecasts are available for a shorter sample) and documents similar results.

[13] There is little evidence indicating that firms respond differently to the signals provided. Specifically, we reproduce estimates of equation (1) for different subsets of firms, breaking them into groups based on observable characteristics. Because information about firms in the survey is somewhat limited, we restrict our attention to four specific dimensions along which firms can differ: sector (manufacturing, services, construction), their size (based on average number of employees), their exposure to other economies (exports as a share of revenues), and their location (North vs Center vs South and Islands). The results are presented in Appendix Table 4. We find very little variation in how information treatments affect inflation expectations.

[14] If treatments were uncorrelated shocks, one could interpret equation (2) as estimating a moving average representation so that $\beta_{h,0}, \beta_{h,1}, \ldots, \beta_{h,q}$ would directly provide an impulse response to treatment. In practice, year-on-year inflation (the

expectations, and older treatments have no discernible effect on current expectations after conditioning on more recent treatments. Hence, the effect of information treatment on inflation expectations largely dissipates within six months.[15,16] This is also consistent with the results in CGK, finding that firms which were followed-up six months after being provided information did not have inflation expectations that were much different from firms in the control group. But unlike their evidence from a one-time experiment, our results follow from repeated treatment of a much larger number of firms over the course of several years, yielding a much more precise identification of the dynamic effects on expectations of the provision of information to firms.

The evidence provided so far relates directly to the ability of policymakers to alter firms' inflation expectations. First, our results suggest that conditional on firms being exposed to information about inflation, their inflation expectations respond strongly. Hence, there is room for policies to significantly affect agents' expectations, if information can be transmitted to them in a direct and transparent manner. Second, our results indicate that the persistence of information treatments on inflation expectations is quite low: the effects of information treatments are small after three months and gone after six. Hence, generating persistent changes in agents' economic expectations would likely require persistent communication strategies on the part of policymakers. One-time announcements are unlikely to deliver persistent changes in beliefs, at least about inflation.

4 Expectations and Economic Decisions

In this section, we consider the *causal* effect of firms' inflation expectations on their economic decisions (price-setting, hiring and credit demand) exploiting the random information treatment to generate exogenous variation in inflation expectations. We rely on the following empirical approach. Letting y_{t+k}^{i} be the outcome variable for firm i at time $t+k$, we regress economic outcomes on inflation expectations formulated at time $t-1$ ($F_{t-1}^{i}\pi^{(12m)}$):

information treatment in the survey) is persistent and therefore $\beta_{h,0}, \beta_{h,1}, \dots, \beta_{h,q}$ combine persistence of the response and the persistence of treatments. In an extreme case of treatment being a random walk, coefficients on lags of treatment may be small because firms need to know only the most recent value of the treatment.

[15] When estimating equation (2), we restrict the sample to include only firms that are consistently present for q waves. Because firms may not participate in each wave of the survey, the sample size shrinks as q increases. An alternative is to assume that firms are not treated in the quarters when they do not respond to a survey. We can implement this alternative approach by setting past treatments to be equal to zero for periods when firms did not participate in the survey. As documented in Appendix Table 2, the results under this alternative assumption are almost identical.

[16] A weakly persistent information effect is also reported in Bartiloro et al. (2017). We also find that inflation expectations exhibit weak persistence in response to treatment when we use local projections.

$$y^i_{t+k} = \alpha_k + \gamma_k F^i_{t-1}\pi^{(12m)} + controls^i_{t-2} + error^i_{t-1,t+k}, \quad (3)$$

where $controls$ is a vector of firm-level controls. The vector includes the expectations of other economic variables such as firm i's expectations about firm-specific business conditions over the next three months, firm-specific employment growth in the next three months, firm-specific expected liquidity in the next three months, perceptions about current Italy's general economic situation, and perceptions about the probability of improvement in Italy's general economic situation over the next three months. These variables help us control for firms' expectations so that the coefficient γ may be interpreted as a response of outcome variable y to a surprise movement in inflation expectations. Note that controls are taken from wave $t-2$. We use this timing of the controls because these expectations and perceptions are elicited *after* the information treatment in each wave [17] and thus the contemporaneous expectations and perceptions can respond to changes in inflation expectations, which in turn react to the provided information. Because firms cannot change prices, employment or credit utilization contemporaneously in response to the information treatment, inflation expectations $F^i_{t-1}\pi^{(12m)}$ are taken from wave $t-1$ as we vary k from zero to horizon K. We instrument for the inflation expectations at time $t-1$ using the information treatment at time $t-1$, which is equal to zero for the control group and recent inflation for the treatment group. We focus on 12-month ahead inflation expectations since we do not have enough instruments to control for the term structure of inflation expectations. Our key identifying restriction is that there are no channels through which the information treatment affects economic decisions other than inflation expectations (or the other expectations we control for). We winsorize outcome variable y at bottom and top 2 percent. As in equation (1) we use Driscoll and Kraay (1998) standard errors to account for cross-sectional and time correlation in the errors and include seasonal fixed effects for each sector of economic activity. We first conduct our empirical analysis using the full sample length (2012Q3-2019Q1) and then in Section 6 we present the estimation results obtained using the subsample 2014Q3-2018Q2 data that cover the effective lower bound on policy rate period.

4.1 Effect on prices

We first turn to the effect of inflation expectations on firms' pricing decisions. To do so, we rely on survey questions that ask firms to report the percentage change in their prices over the last twelve

[17] In contrast, CGK elicit expectations before and after the treatment so that one can measure treatment effects directly in one wave.

months (dp_t^i) and use these responses at different horizons to characterize the evolution of price changes using equation (3).[18] We report results of these regressions in Panel A of Table 3. The instrument using the random assignment of firms to treatment/control groups is very strong (F-statistics of over 100). The results point toward only small and relatively transitory effects on prices. An exogenous increase in inflation expectations of 1 percentage point leads firms to report annual price changes that are 0.2 percentage point higher after a quarter, but these effects die out over the subsequent two quarters. One year later, there is no evidence that firms with higher inflation expectations raise their prices more than firms with lower expectations. Hence, these results point toward small effects of inflation expectations on price changes of firms. We also find little difference between IV and OLS estimates (reported in Appendix Table 6), indicating that the effects of potential endogeneity of inflation expectations with respect to firms' price setting decisions are limited. The absence of strong effects from inflation expectations on pricing decisions is also consistent with experimental results in CGK. They found that a 1 percentage point decrease in inflation expectations induced by an information treatment was followed by an approximately 0.1 percent decrease in prices after six months, broadly in line with the estimates found here albeit estimated less precisely and at a single time horizon.

4.2 Effect on Employment

Given that firms also report the number of their employees in each wave of the survey, we can also assess whether inflation expectations affect firms' employment decisions. To do so, we use the log change in employment between time $t-1$ and time $t+k$ as dependent variable in equation (3). The results are presented in Panel B of Table 3, using the same instrumental variable strategy as before. Unlike the results with prices, we find large and statistically significant effects of inflation expectations on firms' employment decisions, especially at longer horizons. Firms with 1 percentage point higher inflation expectations reduce their employment by 0.7 percent after 12 months, with the effects continuing to rise thereafter. Unlike the results with prices, there is now a pronounced difference between OLS and IV estimates. With OLS (Appendix Table 6), inflation

[18] We verify the quality of responses about reported price changes in two ways. First, we compute the rate of inflation based on price changes reported in the survey. We find that the correlation between this measure of inflation and the official inflation rate is high (0.75). Second, we compare responses about past price changes with responses about expected future price changes (which are also measured with quantitative questions). The correlation between these two measures is approximately 0.5, which points to strong consistency of responses over time.

expectations appear much less correlated with employment decisions of firms. Only with our instrument we recover large economic effects of inflation expectations on employment decisions.[19]

One may be concerned that our results are potentially driven by two confounding forces. First, managers could be choosing to not take the necessary time to report actual levels of employment. Second, managers could provide answers to conform to what they think might be expected of them or answers that are "anchored" by information treatments. To assess the quantitative significance of these concerns, we use end-of-quarter employment data from INPS for the firms covered in the SIGE.[20] We generally find high consistency of employment reported in the two sources (the correlation is 0.95) but occasionally there are considerable discrepancies largely due to differences in the definitions of a firm, as a result of which we drop outliers.[21,22] As documented in Panel C of Table 3, we find similar results using actual employment data from INPS as we do from employment numbers reported in the survey. Our results using this alternative source indicate that these forces are not behind our findings of persistently reduced employment after managers exogenously increase their inflation expectations.

4.3 Effect on Credit Utilization and Loan Applications

The Italian CCR maintained by the Bank of Italy allows us to construct for each firm at each quarter the utilization rate of credit lines (i.e. the ratio of the amount of credit line drawn at t to the total amount of credit line). We then use the change in the utilization rate between time $t-1$ and time $t+k$ as dependent variable in equation (3). The results are presented in Panel D of Table 3, using the same instrumental variable strategy as before.[23] We find large and statistically significant

[19] The very gradual response of employment may seem surprising. One interpretation is that it reflects regulations in the Italian labor market that severely restrict the ability of firms to fire workers, especially once their size exceeds 60 workers as almost of the firms in our sample do. In such a setting, firms may be forced to rely on attrition to reduce their employment rolls, which could explain why employment falls in such a persistent way.

[20] We merge the data from INPS with those from SIGE using as unique identifier the fiscal code of each firm and time variable (year-quarter). With this procedure nearly 85 percent of firms in the two datasets are matched.

[21] We manually verified a number of these cases and found that, in general, employment numbers reported in the survey were in line with total employment numbers reported in financial statements for the broader firm (e.g., a corporate group), indicating that the employment numbers in the data from INPS were for more narrow definitions of the firm (e.g. headquarters).

[22] Another important source of differences is that SIGE bottom-codes employment at 50. We verify in Panel A of Appendix Table 10 (restrict the sample to firms with more than 50 employees) and Panel B of Appendix Table 10 (replace SIGE employment growth rate with INPS employment growth rate for firms with exactly 50 employees) that our results are not driven by bottom-coding.

[23] In this case the sample size declines somewhat. This is mostly due to the fact that when merging the SIGE data with the Italian Credit Register using the identification key represented by the combination of firm fiscal code and time, there are some unmatched cases. To make sure that with this restricted sample the selection of firms into treatment and control groups remains random, we replicate Appendix Table 1 using only the observations for which we have

positive effects of inflation expectations on firms' credit utilization decisions, especially at longer horizons. Firms with one percentage point higher inflation expectations increase their credit utilization by approximately one percentage point after 3 months and longer horizons.

Using the Italian CCR, we can also examine how firms change their loan applications to new financial institutions in response to changes in their inflation expectations. Using specification (3) with the cumulative number of loan applications between time t and time $t + k$ as dependent variable, we find (Panel E of Table 3) that raising expected inflation leads to an increase in the number of loan applications to new potential lenders on the part of firms. As we do not observe loan applications to current lenders, we cannot directly identify whether this response reflects an increase in loan demand to finance e.g. investment or whether it is precautionary in nature, e.g. due to concerns that current lenders are likely to restrict their supply of credit to the firm. We provide evidence in section 5 that the precautionary motive is the more likely interpretation for the rising credit utilization and loan applications in the face of higher inflation expectations.

4.4 Effects on other economic decisions

There are a number of other economic variables that we can observe only at the annual frequency. Because our time series is already quite short however, we want to first verify that our estimation yields sensible results at this lower frequency. To do so, we estimate the same specification for select variables as before but at the annual frequency. For expectations variables on the right-hand side in the regression specification, we use inflation expectations from the fourth quarter of year $t - 1$ and other expectations as controls from the third quarter of year $t - 1$. Dependent variables are measured as (log) changes between year $t - 1$ and $t + 1$ of annual values. We present results from doing so with employment from both SIGE as well as INPS in rows 1 and 2 of Table 4. A one percentage point increase in inflation expectations leads to around a 0.5-1 percent decline in employment, consistent with results at the quarterly frequency. Our instrument remains strong at the annual frequency. Thus, these results indicate that annual data remains sufficiently informative for identifying the economic effects of changes in inflation expectations. We therefore apply this approach to study how other economic decisions of firms respond to changes in inflation expectations.

information on credit. We continue to find that none of the observable characteristics are statistically significantly correlated with being treated with the only exception being a slight over-representation of firms in the trading sector.

Fixed Assets

The financial reports of firms in CADS include a measure of year-end tangible fixed assets (net of amortization). We can therefore create a proxy for investment by firms using log changes in fixed assets. When these changes are regressed on inflation expectations using our IV procedure, we find (row 3, Table 4) sharp declines in the stock of fixed assets following exogenous increases in inflation expectations: more than 1 percent over two years for each 1 percentage point increase in inflation expectations. As with employment, this is in sharp contrast to the finding in CGK that higher inflation expectations are followed by rising employment and investment on the part of firms.

Sales

In Section 4.1 we documented that higher inflation expectations lead firms to increase the average prices of their products. We now explore how total revenues of firms respond to changes in inflation expectations. To do so, we use information on sales values from the income statements in CADS to construct the log changes in sales between year $t-1$ and $t+1$ and regress it on a number of control variables and inflation expectations instrumented as before. We find (row 4, Table 4) significant declines in sales growth in response to exogenous increases in inflation expectations: nearly 2 percent over two years for a 1 percentage point increase in inflation expectations. The fall in sales is consistent with the fact that firms raise prices and reduce employment and capital.

Balance Sheet Ratios

Using the financial statements compiled in CADS we next examine if exogenous changes in inflation expectations lead to changes in the composition of firms' balance sheets. We first look at the asset side of firms' balance sheets and then at the liability side.

We construct a broad measure of liquidity as the ratio of current assets (assets which can be converted or are expected to be converted to cash within a year) to total assets. Applying our empirical specification to the change of this variable between year $t-1$ and $+1$, we find (row 5, Table 4) that higher inflation expectations induce firms to change their composition of assets toward less liquid forms. The economic magnitude of the effect is small. To better understand the sources of this small effect, we look at the main components of current assets, namely trade credit

(or accounts receivables), inventories and cash, whose response to inflation expectations might be different. For each of these variables we construct the ratio of a given variable to total assets.

For trade credit (row 6, Table 4) we find a negative (and weakly significant) effect of inflation expectations indicating that firms respond to an exogenous rise in inflation expectations by reducing their trade credits. On the one hand, this result might mirror the fall in revenues and therefore the decrease in volumes of sales that mechanically may bring down trade credit. On the other hand, depending on the perceptions of firms on the sources of the increase in inflation expectations and thus on the economic outlook, firms may become more risk adverse and be less willing to grant trade credit to their customers.

Applying our empirical specification to the cash ratio (cash and liquid financial assets to total assets), we find (row 7, Table 4) limited evidence that changes in inflation expectations are associated with changes in the composition of assets. Turning instead to the annual value of inventories held by firms, we find (row 8, Table 4) that higher inflation expectations lead to increases in firms' inventories. Note that inventories include both stocks of intermediate materials as well as stocks of goods in production and produced. As documented in Section 5, firms that raise their inflation expectations also tend to expect higher raw material prices in the next 12 months, which could account for why firms would accumulate an inventory of these inputs before the expected price changes materialize.

We also consider whether a firm changes its leverage, calculated as the ratio of financial debt to the sum of financial debt and net equity at market prices, with inflation expectations instrumented as before. We find evidence (row 9, Table 4) that changes in inflation expectations lead to significant changes in leverage. Specifically, a 1 percentage point increase in inflation expectations increases leverage by 0.8 percentage points over two years. This result is thus consistent with the positive effect of higher inflation expectations on credit demand documented in Section 4.3. In short, our data indicate that exogenous changes in inflation expectations lead to statistically significant financial changes in the composition of firms' balance sheets.

Wages and Employment Composition

The data from INPS also include annual data on the total wage bills of firms, which can be combined with total employment numbers to create a measure of average wages for each firm. Following the same approach, we present the effects of inflation expectations on average wages in row 10 of Table

4. Average wages appear higher a year after the rise in inflation expectations but the effect is not statistically significant. The INPS data also include, at an annual frequency, decompositions of employment and wage bills between white-collar and blue-collar workers so we can therefore assess whether changes in inflation expectations are associated with changes in employment shares of each as well as changes in relative wages of the two types of labor. Results for how average wages of each group respond to exogenous variation in inflation expectations are presented in rows (11) and (12) of Table 4. The results for average wages within each group are just as noisy as those for average wages: we cannot reject the possibility that both are unchanged but confidence intervals encompass a wide range of possible responses when inflation expectations rise. However, we find small but statistically significant evidence of a change in the composition of firms' labor force, with the share of blue-collar workers falling when inflation expectations rise (row 13, Table 4). Since white-collar workers earn approximately 50 percent more on average, there is a composition effect pushing toward higher average wages. Given that the share of white-collar workers is rising by 0.27 percentage point for each 1 percentage point rise in inflation expectations, the composition effect therefore accounts for an approximately 0.135 percent increase in average wages.

Further evidence of a composition effect comes from the availability of information on the share of temporary workers in the employment of the firm. Row 14 of Table 4 indicates that higher inflation expectations by Italian firms cause a reduction in the share of temporary workers. Since the latter are the easiest to hire and fire, their declining share is consistent with the reduction in total employment following increases in inflation expectations. However, given that in our sample of firms temporary workers (as defined by INPS) account for only 7.5% of total employment, this composition effect alone cannot account for the total employment declines observed in Table 3.

4.5 Do all firms respond to inflation expectations in the same way?

While all of our results are obtained from utilizing the entire cross-section of firms, it could be that the response to information treatments or the effect of inflation expectations differs along a number of observable characteristics of firms. As discussed in Section 3, the effect of the treatment on inflation expectations itself does not vary along any of the four observable dimensions (sector, size, geography, export share). However, there are a number of channels through which equal revisions in inflation expectations could lead to differential economic responses by firms, such as

differential elasticities of demand with respect to real interest rates, different compositions of inputs, different export shares, etc.

Indeed, we find that some differences arise along firms' observable characteristics when we look at the effects of inflation expectations on actions. For ease of exposition, we focus on price, employment and credit utilization responses at the specific horizon of six months after treatment. We re-estimate equation (3) on sub-groups of firms, again using the information treatment as an instrument for inflation expectations. Table 5 reports results for price, employment and credit utilization responses (see Appendix Table 7 for other variables). While firms in service and manufacturing respond in approximately the same way for both prices and employment to changes in inflation expectations, firms in the construction sector are far more sensitive both in terms of pricing and employment decisions. Higher sensitivity for construction enterprises is also detected in terms of credit utilization. This could reflect the greater sensitivity of construction to real interest rates and also the willingness of these firms, generally perceived as more risky borrowers, to front load external financing in the advent of tighter credit conditions. We also find a much higher sensitivity of employment decisions to inflation expectations for firms that export little to none, which likely reflects the fact that exporters are less sensitive to business conditions in their home country since more of their revenues come from foreign sources. Finally, there is a striking difference in behavior of firms across regions: firms in the South of Italy are much more sensitive to inflation for their employment decisions than firms in the rest of the country, even after controlling for their sector, size and trade exposure. Economic and social differences between the South and North of Italy have long been identified in the literature (e.g., Tabellini 2010). These results present a new dimension along which economic behavior differs across these regions.

4.6 Summary

The provision of information about recent inflation to a randomized set of firms within the SIGE generated exogenous cross-sectional and time-series variation in inflation expectations across firms. By combining this variation with other survey and administrative data, we document how changes in inflation expectations on the part of Italian firms affect their behavior. When firms exogenously raise their inflation expectations, they tend to temporarily raise their prices but persistently decrease their employment and investment with employment changes happening disproportionately among blue-collar and temporary workers. We find some evidence that firms change their financial assets

in response to different inflation expectations. Furthermore, they utilize their available credit more and accumulate more inventories as their price expectations increase and their sales decrease. In the next section, we consider possible motives behind these reactions to changes in inflation expectations and discuss how they relate to models of information rigidities.

5 What Drives Firms' Responses to Changes in Inflation Expectations?

To shed light on the mechanisms behind firms' small and transitory price increases, long-lasting employment and investment declines and persistent credit utilization increases when their inflation expectations rise, we utilize other survey questions from the SIGE that can help understand what underlies firms' responses. In our analysis, we use the following econometric specification:

$$F_t^i y = \alpha + \gamma F_{t-1}^i \pi^{(12m)} + error_t^i \quad (4)$$

where $F_t^i y$ is the forecast of firm *i* at time t for variable y. Similar to specification (3), we instrument inflation expectations $F_{t-1}^i \pi^{(12m)}$ with the treatment variable at time $t-1$.[24] As in equation (1) we use Driscoll and Kraay (1998) standard errors to account for cross-sectional and time correlation in the errors and include seasonal fixed effects for each sector of economic activity.

Perceptions and Expectations of Aggregate Conditions

In addition to questions about aggregate inflation, firms in the SIGE are asked about other aggregate economic outcomes. Previous work has documented correlations between individuals' outlooks for inflation and other economic variables. For example, Carvalho and Nechio (2014) find that households in the U.S. believe that inflation is associated with stronger economic outlooks, consistent with a movement along a Phillips curve, while Dräger and Lamla (2015) find that household expectations are consistent with a Taylor rule, such that higher inflation expectations are associated with even higher expectations of nominal interest rates. In the same spirit, the SIGE asks respondents about whether they think Italy's general economic situation is better, worse, or the same compared with the previous three months. We create a variable equal to one if firms choose "better", zero if "the same", and negative one if "worse". Respondents are also asked about the probability of an improvement in Italy's economic situation over the next three months. This question has 6

[24] We find similar results for a specification in which the regressors and the regressand are taken from the same wave, that is, we use $F_t^i \pi^{(12m)}$ rather than $F_{t-1}^i \pi^{(12m)}$ as the regressor. With this alternative timing, we allow beliefs about other variables to move immediately in response to informational treatments (questions about these variables appear in SIGE after expectation questions are asked).

possible answers: zero, 1-25 percent, 26-50 percent, 51-75 percent, 76-99 percent and 100 percent. If respondents pick a bin with a range, we assign the midpoint of that range.

We characterize how these expectations change when firms change their inflation expectations by regressing these non-inflation beliefs on firms' 12-month ahead expectations, again using the information treatment as an exogenous source of variation about inflation expectations. As documented in rows 1 and 2 of Table 6, we find that higher expectations of inflation lead firms to become more *pessimistic* about the economic outlook: firms with higher inflation expectations think Italy's economic situation is worse and perceive lower probabilities of an improvement in the economy over the next few months. This result differs not only from Carvalho and Nechio (2014) but also from CGK. These latter authors find that New Zealand firms who raise their inflation expectations following an information treatment do not change their expectations of real economic variables in an economically meaningful way. This association of higher inflation with worse expected economic outcomes on the part of Italian firms could therefore rationalize why employment responses are so sharply negative when firms expect higher inflation expectations and why firms raise the utilization degree of their credit lines.

Expectations for Firm's Outlook

Because the SIGE also includes questions about managers' expected outlook for their own firm, we can assess whether this increased pessimism about the aggregate economic outlook in the face of higher inflation expectations also translates into greater pessimism about the outlook for the firm. Specifically, the survey asks respondents whether they think business conditions for their company will be "much better", "better", "the same", "worse", or "much worse" over the next three months, for which we assign values ranging from 2 (for "much better") to -2 (for "much worse"). A second question asks them whether they expect the total demand for their products to improve, worsen or stay the same over the next three months. A third set of questions we consider asks firms to rate if their liquidity situation in three months will be insufficient (-1), sufficient (0), or more than sufficient (+1) and if they think their current access conditions to credit market are worse (-1), the same (0) or better (+1) compared with previous three months.

To assess whether changes in inflation expectations affects firms' other economic expectations, we again re-estimate equation (4) using responses to these other survey questions as the dependent variable, using the information treatment to identify exogenous changes in inflation

expectations. As documented in rows 3 through 6 in Table 6, higher inflation expectations lead Italian firms to expect worsening business conditions for their company over the next 3 months including reduced demand as well as reduced liquidity and access to credit. This anticipation of reduced liquidity and access to credit could help explain why firms raise their prices, as in Gilchrist et al. (2017), and simultaneously reduce their employment and investment. It also provides a natural justification for the fact that firms are choosing to take out a larger share of their currently available credit lines and seek out new financing sources, as shown in Table 3.

The response of firm-specific uncertainty to inflation expectations is also consistent with this interpretation (rows 7 and 8). Firms are asked to assign probabilities to three possible outcomes for their business conditions over both the next three months and the next three years: "better", "worse", and "the same". From this assignment of probabilities to these three bins (which are assigned outcome values of +1, -1 and 0, respectively), we compute the implied standard deviation for their perceived outlook for the firm over each of the two horizons. When we regress these measures of firm-specific uncertainty on inflation expectations, instrumenting with the treatment, we find that higher inflation expectations generate higher uncertainty about the outlook. This suggests that higher inflation expectations have both first- and second-moment effects: they are associated with worse economic outlooks and higher levels of uncertainty. The heightened uncertainty may itself contribute to reductions in employment and investment (e.g., Bloom 2009) as well as higher prices (Ilut, Valchev and Vincent 2019) but we lack identifying variation to separate the two effects.

This worsened outlook for firms with higher inflation expectations is reflected in their planned actions. For example, firms are asked about their investment plans over the current or subsequent calendar year (relative to the previous year in the former case and the current year in the latter case).[25] Possible answers by firms are qualitative: "much higher", "a little higher", "about the same", "a little lower", and "much lower". We can use these quasi-year ahead forecasts in investment to assess whether and how inflation expectations affect investment plans using equation (4). We find (row 10, Table 6) that higher inflation expectations (again instrumented with information treatments) are associated with plans for lower investment over a one-year horizon. The survey also asks firms to provide qualitative forecasts about their expected changes in employment over the following three

[25] Which horizon they are asked about depends on the quarter in which the survey is held. Generally, in the first two quarters of the calendar year, firms are asked about how investment in the current calendar year will compare to the previous calendar year while in the last two quarters of the year, firms are instead asked about how investment will compare in the subsequent calendar year relative to the current calendar year.

months (possible responses are “lower”, “unchanged”, “higher”). When we use the latter as dependent variables, we again find evidence that higher expected inflation reduces employment of firms (row 9, Table 6). Hence, the results using expected future levels of investment and employment confirm the findings from actual levels of employment and investment.

In short, each of these results suggests that firms perceive higher inflation as associated not only with worse aggregate outcomes but also deteriorating conditions for their firms, which seemingly induce them to reduce their employment and investment.

Motivations for Price Changes

If firms perceive a diminished outlook for their business, why do they then tend to raise prices when their inflation expectations rise? Another useful dimension of the survey is that firms are asked about their expected price changes as well as the factors inducing them to either raise or lower prices. Specifically, in each wave, firms were asked to first predict their price changes over the next twelve months (with a quantitative answer in percent) then to characterize which forces were pushing them to change their prices. For the latter, firms were asked to indicate the direction and intensity through which the following four factors would affect their price-setting decisions over the following twelve months: total demand for their products, the price of raw materials, labor costs, and the pricing decisions of their competitors. Combining the qualitative answers for both the direction (up/down/no change) and intensity (low/average/high) allows us to apply a seven point scale (from -3 for a factor having a strong negative effect on prices to a 3 for a factor having a strong positive effect on prices) to their answers for each factor. In Figure 4 we report the time development of each factor together with the average expected price change over the next 12 months.

Using the expected change in prices and each of the factors accounting for price changes as dependent variables, in turn, in equation (4), we characterize in Table 6 to what extent and why higher inflation expectations on the part of firms lead them to change their expected path of futures prices.

First, we find a similar pattern of responses for the expected path of future prices as we did for actual prices: higher inflation expectations are initially associated with slightly higher expected prices on the part of firms (row 11, Table 6). Second, firms with higher inflation expectations perceive a reduction in demand for their goods, which puts downward pressure on their prices (row 12). Competitors’ pricing decisions also apply downward pressure to firms’ prices when their inflation expectations are higher (row 15). These two forces are consistent with the fact that firms with higher

inflation expectations anticipate a reduced level of economic activity (hence competitors reducing their prices) as well as a worsened outlook for their own firm (the reduction in demand for their goods). There is little change in perceptions of how labor costs will affect price pressures (row 14), indicating that firms do not view higher inflation as translating in a significant way into higher wages.

However, higher inflation expectations are associated with higher expectations of prices for raw materials on impact (row 13). It is this higher expectation that appears to account for the fact that firms initially raise their prices. These expectations of higher raw material prices dissipate over several quarters, which likely accounts for why firms' prices do not appear to be persistently higher after an increase in their inflation expectations. Together, these findings indicate that Italian firms seem to interpret news about recent inflation as reflecting *supply-side* shocks: they anticipate higher raw material prices but lower demand for their products. Consistent with this interpretation, we observe a much stronger negative correlation between inflation and unemployment for New Zealand than for Italy.[26] Structural decompositions of output and inflation in Italy also suggest an important role for supply-side shocks. For example, Albonico et al. (2017) find that TFP and investment risk premium shocks have played a much larger role in accounting for economic dynamics in Italy prior to the Great Recession than in France, Germany or Spain. The notion that firms in Italy and New Zealand may draw very different implications about the source of underlying changes in inflation depending on their historical experience, and therefore react very differently to changes in their expectations of future inflation, is formalized in Acosta and Afrouzi (2019). Intuitively, when firms are rationally inattentive, free signals about an endogenous variable like inflation will be used by firms to draw inferences about the shocks driving economic activity. Firms in different countries that have experienced different correlations between real economic activity and inflation will naturally interpret these signals differently and make different economic decisions.

Is this inattention costly for firms?

The fact that providing publicly available information about recent inflation to firms leads them to significantly revise their beliefs, as documented in Figure 3 and Table 1, suggests that managers and CEOs choose to be inattentive to inflation. One possible motivation for this could be that

[26] Between 1989 and 2007, the correlation between CPI inflation and the unemployment rate (both series are detrended with the Hodrick-Prescott filter) in New Zealand was -0.67 but was only -0.21 in Italy. Relatedly, when we regress CPI inflation on the unemployment rate, the R^2 is 0.45 for the New Zealand sample and 0.04 for the Italian sample. Both of these results are consistent with more supply-side shocks in Italy than in New Zealand.

inflation – especially when firms operate in a low and stable inflation environment – is largely irrelevant to their decisions. But the fact that exogenous changes in these expectations lead firms to change their behavior belies this interpretation: inflation expectations clearly matter for the decisions of firms. Reconciling these two facts—firms are inattentive to inflation but react to free information about inflation—can be done in a rational inattention context if profit functions are relatively flat with respect to inflation (which justifies inattention) but not completely flat (which justifies changing behavior when firms change their beliefs), as shown in Acosta and Afrouzi (2019). Providing rationally inattentive firms with free information about inflation should therefore lead to a positive, but small, change in their profits.

This prediction is testable in our data given that we know which firms are treated with this information and that we can observe the profits of firms in CADS data. Because there is a lot of idiosyncratic volatility in reported profit shares (i.e., the ratio of profits to sales), we winsorize top and bottom 2 percent of data and employ Huber-robust regressions to estimate the effect of treatment on profit shares. The results are presented in Panel A of Table 7. Column (1) utilizes firm-level controls as in specification (3), column (2) includes industry and year fixed effects, column (3) has no controls. Across specifications, we find that firms in the treatment group had higher profits during the period in which they were treated, which is consistent with the fact that they incorporated the information and made decisions that allowed them to improve their performance. However, the difference in profits across the two groups is quite small: estimates range from 0.1 to 0.3 percent of sales. Given that the Huber-robust standard deviation of the profit share in the cross-section is 8.5 percent per year, our estimates suggest that being treated raises the profit share by only 3.3 percent of one standard deviation of annual profit shares. Panel B of Table 7 shows that prior to 2012, when all firms received the same information, average profits were indistinguishable across the same two groups of firms. In short, consistent with rational inattention, the provision of free and publicly available information to firms has small positive effects on profits on average.

6 The Effective Lower Bound Period

Our evidence suggests that Italian firms might have interpreted news about recent inflation as reflecting *supply-side* shocks, thus driving prices and employment in opposite directions. Theoretical work has shown however that at the effective lower bound (ELB) on policy rates, negative supply-side shocks can have expansionary effects: the higher expected inflation induced

by a shock lowers the ex-ante real rate thus stimulating interest-sensitive sectors of the economy and possibly offsetting the usual recessionary effects of the shock.[27] More generally, the inability or unwillingness of policy-makers to change nominal interest rates at the ELB means that increases in expectations of inflation lead to declines in the real interest rate, rather than increases as when the Taylor principle is satisfied. Inflationary shocks should therefore have stronger positive demand-side effects than they normally would (e.g. Woodford (2001) for fiscal shocks). More generally, the presence of constraints on policy-makers' ability or willingness to respond to shocks implies that economic dynamics can change at the ELB.[28]

In light of these considerations, we consider to what extent our results change when we focus exclusively on the ELB period. While there is not a unique way to date the ELB in the Euro area, in what follows we let the ELB period begin in 2014Q4 and end in 2018Q2.[29] The smaller time sample means that weak instruments become an issue at longer horizons (since these further shorten the sample), so we restrict the set of horizons in our estimations to 3 quarters. The results are presented in Table 8, using the same instrumental variable strategy as before. Several remarks are in order. First, we find that the effects on firms' prices are *larger* and *more persistent* relative to the effects estimated on the full sample (Panel A). An exogenous increase in inflation expectations of one percentage point leads firms to report annual price changes that are 0.7 percentage points higher after a quarter as well as in the subsequent two quarters. Second, turning to firms' employment decisions,

[27] The evidence on whether negative supply-side shocks actually have expansionary effects at the ELB is mixed. Wieland (2019), for example, studies the Japanese earthquake of 2011 as well as oil price shocks during ELB episodes and finds no evidence of expansionary effects from negative supply shocks. In terms of the mechanism underlying the proposition, Bachmann et al. (2015) use the micro data from the Michigan Survey of Consumers conducted in the United States and document that the impact of expected inflation on the readiness to spend on durables is negative, small in absolute value, and statistically insignificant, regardless of whether the ELB binds or not. However, other evidence is more favorable to this hypothesis. For example, Ichiue and Nishiguchi (2015) use the micro data from the Opinion Survey on the General Public's Views and Behavior run by the Bank of Japan, which covers a low interest rate environment for a longer period than the United States and find that higher inflation expectations lead to greater current spending. D'Acunto et al. (2016) find that the higher inflation expectations in Germany following an anticipated increase in the VAT during the ELB led to a rise in consumption, consistent with the underlying mechanism that delivers expansionary effects of negative supply-side shocks.

[28] If Italian firms viewed Euro area policy as being independent of Italian economic conditions, then the ELB would not be expected to have any differential effect on expectations. However, the correlation between Italian inflation and Euro-area inflation was 0.95 over this time period, so this was unlikely to be the case.

[29] In September 2014 the Governing Council of the ECB decreased the fixed rate on the main refinancing operations by 10 basis points to 0.05 per cent. At the press conference following this decision, the President of the ECB Mario Draghi made clear that he viewed the ECB as having reached the ELB: "And now we are at the lower bound, where technical adjustments are not going to be possible any longer." Hence, we treat all subsequent quarters as being at the ELB. In 2018Q2, the ECB declared its intention to finish its quantitative easing program thus signaling a beginning of normalization. Similar results for ELB running from 2014Q2 to 2019Q1 (the last observation we have) are in Appendix Tables 8 and 9.

the results now indicate the lack of a statistically significant relationship with inflation expectations (Panels B and C). This change in response of employment reflects the fact that point estimates are now less negative (or even small and positive), not an increase in standard errors. Third, the effects of inflation expectations on firms' credit line utilization are even larger when the economy is at the ELB (Panel D). Specifically, firms with 1 percentage point higher inflation expectations increase their credit demand by 1 percentage points after 6 months and by nearly 2 percentage points after 9 months.[30] As for loan applications, we do not find significant effects of higher inflation expectations. This result could reflect the fact that when firms perceive better aggregate outcomes and improved business conditions they express their loan demand to their incumbent lenders.

As done before, in order to shed light on the mechanisms behind firms' responses to higher inflation expectations during the ELB period, we regress firms' non-inflation beliefs on firms' inflation expectations (exploiting the information treatment as an exogenous source of variation about inflation expectations) for this period and report results in Table 9. Interestingly, rows 1 and 2 show that firms with higher inflation expectations now exhibit a more *optimistic* outlook on Italy's current economic and perceive higher probabilities of an improvement in the economy over the next few months (in this latter case though the effect is not statistically significant). This association of higher inflation with better macroeconomic economic outcomes could therefore rationalize why Italian firms do not cut back on their workforce and increase more significantly their credit utilization.

As reported in rows 3 through 6, firms' increased optimism about the aggregate economic outlook in the face of higher inflation expectations transmits to a more buoyant outlook for their firms' business conditions. Firms with higher inflation expectations anticipate improved business conditions for their company over the next 3 months, increased demand for their products and a better liquidity position. Perceived access to credit is expected to improve with higher inflation, although in this case the estimated coefficient on inflation expectation is not statistically significant.[31]

Firms' improved business and economic outlooks when they have higher inflation expectations seemingly translate into their planned actions during the ELB. Contrary to our

[30] Similar results obtain when instrumenting firms' inflation expectations with a 0-1 dummy variable (and time fixed effects) to distinguish between uninformed and informed firms.

[31] The response of uncertainty to inflation expectations also differs from that in the full sample (rows 7 and 8). Whereas estimates in the full sample indicated that higher inflation expectations led to higher uncertainty in both in the short- and medium-term (with larger effects in the medium-term), during the ELB period we find instead that firms with higher inflation expectations only expect higher uncertainty in the short-term (the coefficient becomes nearly five times larger) but expect no more uncertainty in the medium-term than firms with lower inflation expectations.

findings over the entire sample, we now find that firms with higher inflation expectations (again instrumented with information treatments) plan higher investment expenditures over a one-year horizon and expect to expand their number of employees, consistent with them picturing a brighter outlook for the firm (rows 9 and 10).

Each of these results then points towards a stronger response for the expected path of future prices changes during the ELB period. And this is what we find (row 11): firms with 1 percentage point higher inflation expectations expect to raise their prices in the next 12 months by more than they did over the full sample. Furthermore, firms with higher inflation expectations now emphasize more than just raw materials prices as pushing them to raise their prices: they now cite a perceived increase in the demand for their goods (row 12) and their competitors' pricing decisions (row 15), in addition to even higher expectations of prices for raw materials (row 13). The first two forces are consistent with the fact that firms with higher inflation expectations anticipate an increased level of economic activity as well as improved outlook for their own firm (the increase in demand for their goods). Again, there is little change in perceptions of how labor costs will affect price pressures (row 14), indicating that firms do not view higher inflation as translating in a significant way into higher wages either in or out of the ELB.

Overall, these findings indicate that in the period from 2014Q4 to 2018Q2 when the official policy rates were at the effective lower bound, Italian firms associated higher inflation with better aggregate outcomes and also improved conditions for their business, seemingly inducing them to plan higher investment expenditures and hiring over the future, along with more pronounced price increases than outside the ELB. However, given that the treatment was applied to a small set of firms relative to the overall economy, the estimated effects on the actions of firms do not include the general equilibrium effects that would follow if all firms in the economy were acting this way and should therefore best be viewed as a lower bound of the effect of inflation expectations on firms' decisions at the ELB.

One interpretation of these results is that they confirm a central prediction of New Keynesian models, namely that the ELB leads to more positive demand-side effects of inflationary shocks since these are associated with declines rather than increases in the real interest rate, due to constraints on the central bank' interest rate setting. While most work has focused on the extent to which this applies for households, we provide new evidence that these differences extend to firms. However, this is not the only possible explanation. There could have been other factors changing

between 2014 and 2018 that could induce managers to respond differentially to news about inflation. For example, the ECB launched its Quantitative Easing program in 2015 (see Hartmann and Smets (forthcoming) for an overview of the ECB's policies during the sample period). More generally, if demand side shocks became more prevalent during the ELB period than previously, and if managers were aware of this and correctly incorporated this information into their forecasts and decisions, then we would expect to see a changing effect of inflation expectations on economic decisions of firms: information about higher inflation could reveal the presence of positive demand shocks during the ELB period rather than supply shocks prior to the ELB period, leading to differential effects on employment and investment decisions. These two possible explanations—there being a larger share of demand shocks during this time period versus supply shocks having more demand side effects due to the ELB—are observationally equivalent in our data. We cannot distinguish between these two possibilities.

7 Conclusion

Using a unique experiment that generates exogenous variation in the inflation expectations of firms in Italy, we provide new evidence on the causal effect of inflation expectations on firms' economic decisions. These results are useful along several dimensions. First, they speak directly to the causal effects of inflation expectations on economic behavior. While previous work has largely focused on how inflation expectations of households relate to their consumption decisions, we show that firms' inflation expectations directly affect their economic decisions as well. This suggests that communication policies of central banks may be able to directly affect firms' decisions through their inflation expectations, *if* these policies can reach firms (Kumar et al. 2015, Coibion et al. 2018).

Second, our results support predictions of New Keynesian models in which higher inflation expectations have more positive effects on economic activity during periods of fixed nominal interest rates. We find that firms with higher inflation expectations during the ELB raise their prices more, hire more workers, utilize their credit lines more, and plan to do more investment than firms with higher inflation expectations outside the ELB, likely due to the fact that the former expect higher demand for their goods.

More generally, our results also speak to the broader success of central banks' communication strategies and the degree to which inflation targeting regimes have "anchored" inflation expectations. Providing firms in Italy with recent information about inflation has large

effects on their forecasts and significantly reduces the disagreement in their beliefs, suggesting that they are largely unaware of recent inflation dynamics. This does not speak highly of their prior knowledge of this readily-available information and suggests that central banks in general, and the ECB in particular in this case, have a lot of room to improve the way they communicate with the public. The transitory effects of information treatments on inflation expectations further suggest that a successful communication strategy must not only be able to reach decision-makers within firms but do so in a persistent way. Furthermore, our results illustrate how the way in which individuals can interpret announcements about inflation may be context-dependent. One can see this in the difference between how Italian firms respond to information treatments relative to firms in New Zealand, as well as the differential response of Italian firms during the ELB. Communications strategies that aim to change agents' economic expectations therefore need to incorporate the fact that different agents, or agents at different times, may not always draw the same conclusions when faced with the same information. Understanding what drives this inference by agents should be addressed in future research.

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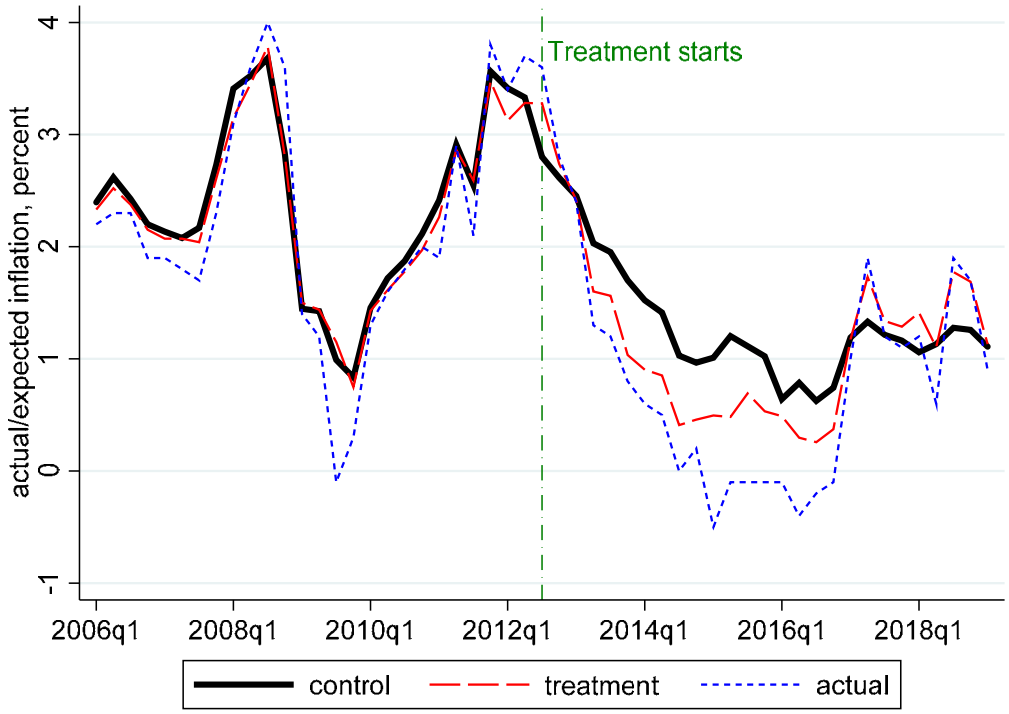
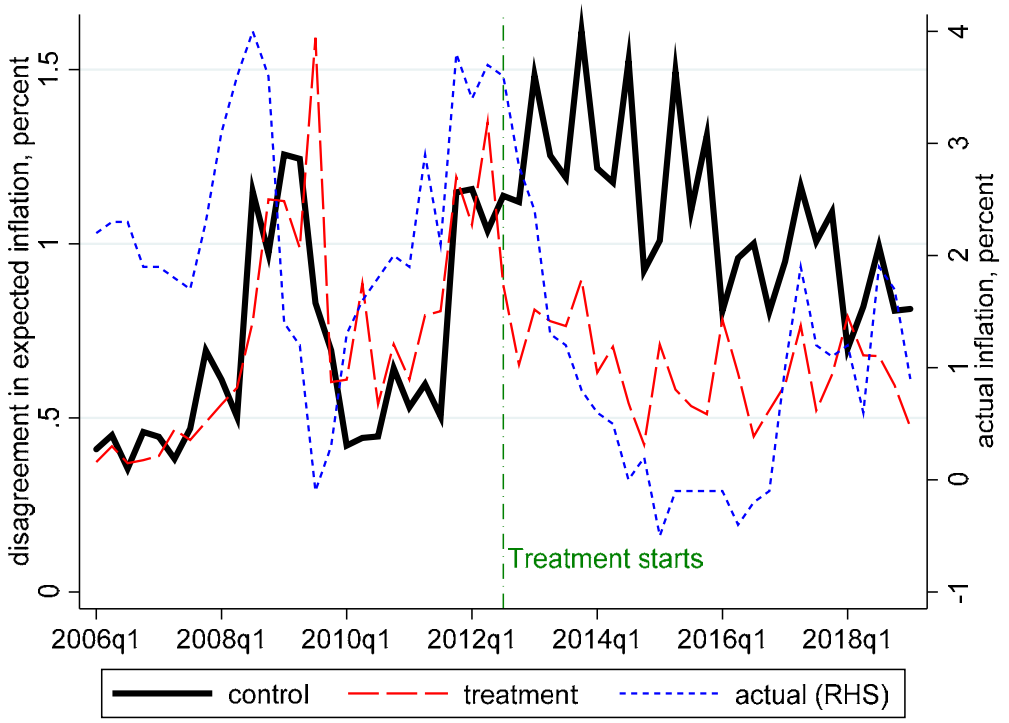
Figure 1. Time series of inflation expectations for treatment and control groups.

Panel A: Average Inflation Expectations

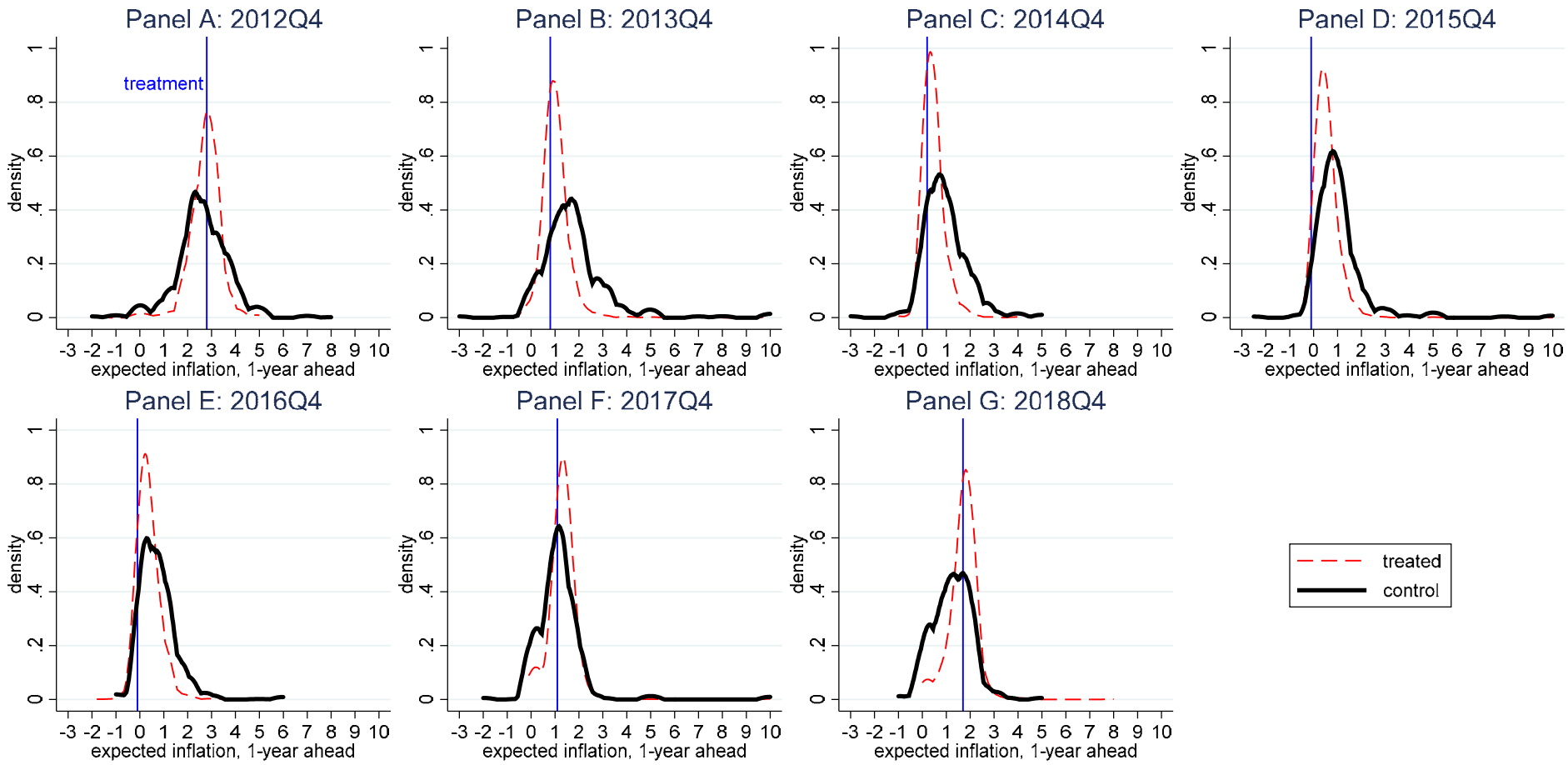


Panel B: Cross-sectional Dispersion in Inflation Expectations



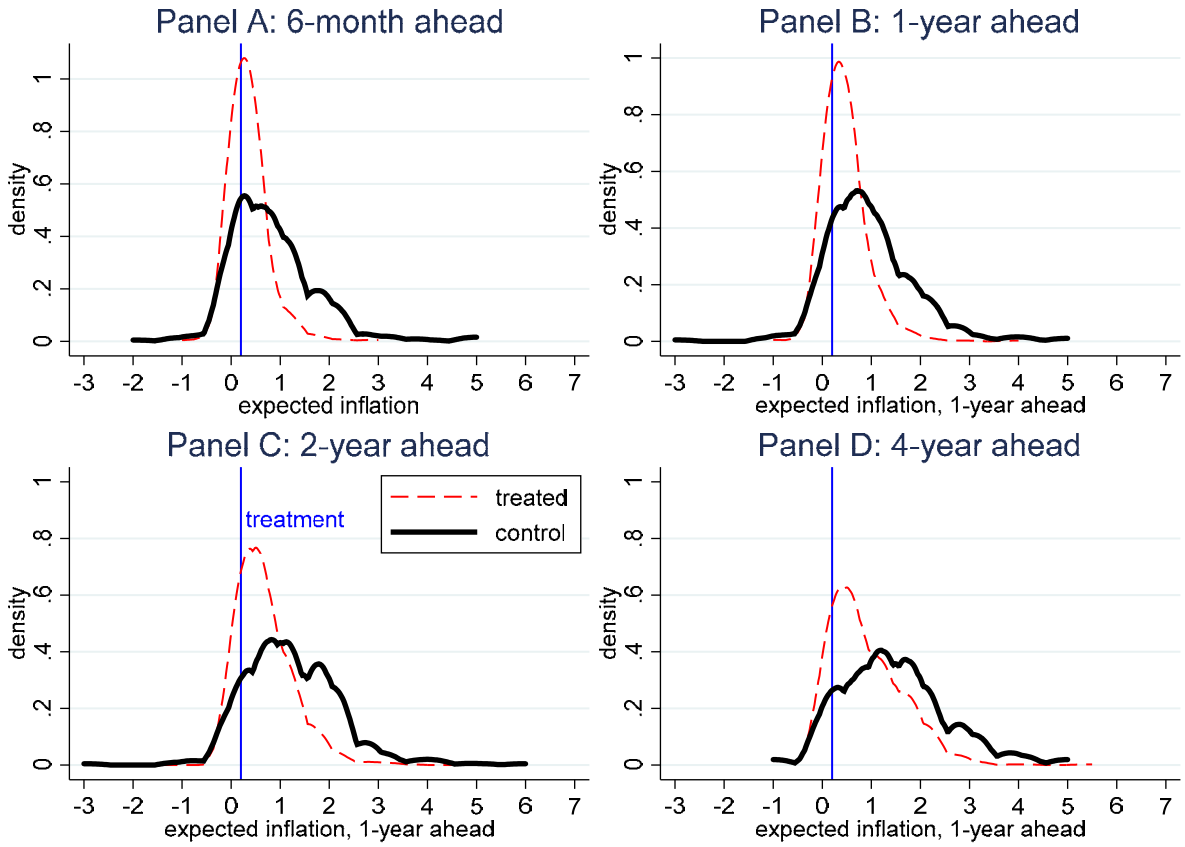
Notes: treated firms are presented with the most recent value of actual inflation, which is shown with blue, short-dash line. We use treatment assignment in 2012Q4 to classify firms into treatment and control groups for the period 2006Q1-2012Q2.

Figure 2. Distribution of inflation expectations for treated and control firms.



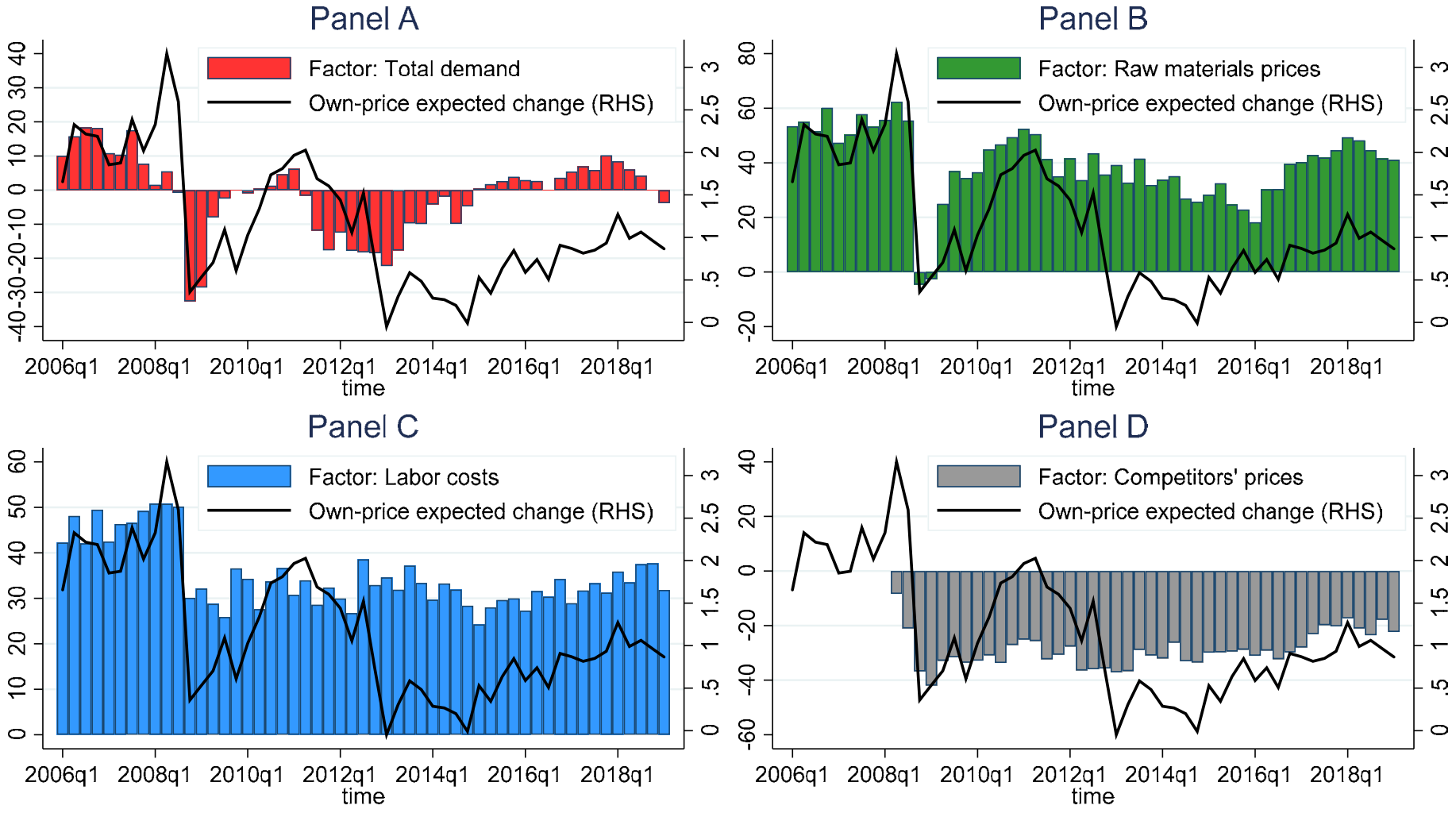
Notes: each panel plots kernel density of inflation expectations (one-year ahead) for treated and control firms in specific survey waves indicated in the title of each panel. Bandwidth is 0.2. The vertical, thin, blue line shows the inflation rate given to treated firms. To improve readability of the figure, we exclude a handful of firms reporting inflation expectations less than -3 percent.

Figure 3. Distribution of inflation expectations by horizon for treated and control firms, 2014Q4.



Notes: each panel plots kernel density of inflation expectations by forecast horizon (indicated in panel titles) for treated and control firms in the 2014Q4 wave of the survey. Bandwidth is 0.2. The vertical, thin, blue line shows the inflation rate given to treated firms.

Figure 4. Underlying factors to expected price changes.



Notes: contributions of each underlying factor to firms' expected price changes are expressed in terms of the net percentage between firms that report an upward contribution and those that report a downward contribution. Values are in percentage terms.

Table 1. Effect of the Treatment with Past Inflation on Inflation Expectations.

	Dependent variable: Inflation expectations by horizon, $F_t^i\pi^{(h)}$			
	6 months ahead	1 year ahead	2 years ahead	4 years ahead
	(1)	(2)	(3)	(4)
T_t^i	0.590***	0.548***	0.471***	0.369***
	(0.060)	(0.057)	(0.050)	(0.046)
Observations	25,531	25,531	25,531	20,007
R-squared	0.237	0.204	0.146	0.053
Sample	2012Q3-2019Q1	2012Q3-2019Q1	2012Q3-2019Q1	2014Q1-2019Q1

Notes: *i* and *t* index firms and time (survey waves). $F_t^i\pi^{(h)}$ is *horizon (h)*-ahead inflation expectation of firm *i* in wave t. T_t^i is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Seasonal dummies for each sector are included but not reported. Specification is given by equation (1). Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 2. Duration of Effects of Signals on Inflation Expectations.

	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$
	(1)	(2)	(3)	(4)	(5)
T_t^i	0.596***	0.358***	0.298***	0.319***	0.444***
	(0.048)	(0.053)	(0.065)	(0.085)	(0.053)
T_{t-1}^i		0.241***	0.125*	0.034	-0.082
		(0.087)	(0.070)	(0.057)	(0.106)
T_{t-2}^i			0.163*	0.053	-0.006
			(0.082)	(0.064)	(0.069)
T_{t-3}^i				0.152**	0.100
				(0.071)	(0.067)
T_{t-4}^i					0.075
					(0.083)
Observations	27,002	20,512	16,887	14,328	12,393
R-squared	0.308	0.285	0.244	0.196	0.158

Notes: *i* and *t* index firms and time (survey waves). $F_t^i\pi^{(12m)}$ is one-year ahead inflation expectation of firm *i* in wave t. T_t^i is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Seasonal dummies for each sector are included but not reported. Specification is given by equation (2). Sample period is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 3. Effects of Inflation Expectations on Firm Decisions.

	y_t^i	y_{t+1}^i	y_{t+2}^i	y_{t+3}^i	y_{t+4}^i	y_{t+5}^i
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Effect on Prices (Source: SIGE)						
$F_{t-1}^i\pi^{(12m)}$	0.205**	0.185*	0.063	0.008	0.020	-0.077
	(0.096)	(0.097)	(0.126)	(0.103)	(0.092)	(0.090)
Observations	16,227	13,765	12,878	12,011	11,208	10,419
R-squared	0.162	0.152	0.129	0.105	0.102	0.097
1st stage F stat	112.9	113.7	117.2	112.7	112.6	112.5
Panel B: Effect on Employment (Source: SIGE)						
$F_{t-1}^i\pi^{(12m)}$	-0.074	-0.277*	-0.489***	-0.712***	-0.755***	-1.037***
	(0.067)	(0.149)	(0.156)	(0.196)	(0.219)	(0.196)
Observations	16,227	13,765	12,878	12,011	11,208	10,419
R-squared	0.018	0.025	0.036	0.055	0.052	0.049
1st stage F stat	112.9	113.7	117.2	112.7	112.6	112.5
Panel C: Effect on Employment (Source: INPS)						
$F_{t-1}^i\pi^{(12m)}$	-0.186***	-0.232*	-0.609***	-1.081***	-1.195***	-1.522***
	(0.066)	(0.131)	(0.209)	(0.285)	(0.283)	(0.447)
Observations	15,062	12,764	11,907	11,090	10,321	9,570
R-squared	0.024	0.032	0.045	0.062	0.063	0.063
1st stage F stat	114.8	118.4	117.4	114.2	113.5	116.5
Panel D: Effect on Credit Utilization (Source: CCR)						
$F_{t-1}^i\pi^{(12m)}$	0.234	0.864***	0.730**	0.982**	1.128**	0.964
	(0.224)	(0.242)	(0.344)	(0.467)	(0.457)	(0.579)
Observations	13,336	11,261	10,501	9,773	9,085	8,409
R-squared	0.002	0.001	0.001	0.001	-0.001	-0.001
1st stage F stat	102.9	106.1	104.7	103.3	104.6	107.8
Panel E: Effect on Loan Applications (Source: CCR)						
$F_{t-1}^i\pi^{(12m)}$	0.028*	0.031	0.082***	0.072*	0.056	0.051
	(0.016)	(0.023)	(0.028)	(0.039)	(0.051)	(0.065)
Observations	14,361	12,173	10,501	9,153	8,012	7,037
R-squared	0.007	0.009	0.011	0.015	0.016	0.018
1st stage F stat	114.8	114.6	117	115.6	115.8	116.8

Notes: i and t index firms and time (survey waves). $F_{t-1}^i\pi^{(12m)}$ is one-year-ahead inflation expectation of firm i in wave $t-1$. In Panel A, the dependent variable is $y_{t+k}^i \equiv dp_{i,t+k}$ where $dp_{i,t+k}$ is the average change in firm i's prices over the previous 12 months in period $t+k$. In Panels B and C, the dependent variable is $y_{t+k}^i \equiv \log(L_{i,t+k}/L_{i,t-1})$ where L_{it} is the number of employees in firm i at time t. In Panel D, the dependent variable is $y_{t+k}^i \equiv u_{i,t+k} - u_{i,t-1}$ where u_{it} is the utilization rate of credit lines by firm i at time t. In Panel E, the dependent variable is $y_{t+k}^i \equiv App_{i,t+k} + \cdots + App_{i,t}$ where $App_{i,t}$ is the number of loan applications made by firm i at time t. Specification is given by equation (3). Seasonal dummies for each sector are included but not reported. Other controls are included but not reported. Estimation sample is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 4. Effects of Inflation Expectations on Firm Decisions, Annual Data.

Row	Outcome variable	Coef. on $F_{t-1}^{i}\pi^{(12m)}$ (std. err.)	Obs.	R^2	1st stage F-stat
		(1)	(2)	(3)	(4)
(1)	Employment (SIGE)	-1.140***	4,581	0.087	52.15
		(0.180)			
(2)	Employment (INPS)	-0.575***	4,413	0.135	51.71
		(0.227)			
(3)	Fixed assets (CADS)	-1.335***	3,142	0.049	35.52
		(0.368)			
(4)	Sales (CADS)	-1.850***	3,168	0.095	36.96
		(0.563)			
(5)	Liquidity (current assets to total assets) (CADS)	-0.079**	3,180	0.004	36.13
		(0.036)			
(6)	Trade credit to total assets (CADS)	-0.197*	3,180	0.006	36.13
		(0.104)			
(7)	Cash & liquid financial funds to total assets (CADS)	-0.018	3,180	0.011	36.13
		(0.126)			
(8)	Inventory to total assets (CADS)	0.224***	3,180	0.007	36.13
		(0.027)			
(9)	Leverage ratio (CADS)	0.844**	3,180	0.007	36.13
		(0.258)			
(10)	Average wages (INPS)	0.466	4,413	0.011	50.88
		(0.432)			
(11)	Average wages of white-collar workers (INPS)	0.277	4,375	0.007	53.07
		(0.273)			
(12)	Average wages of blue-collar workers (INPS)	-0.093	3,975	0.012	51.95
		(0.683)			
(13)	Employment share of white-collar workers (INPS)	0.271***	4,413	0.009	50.88
		(0.035)			
(14)	Employment share of temporary workers (INPS)	-0.589***	4,414	0.013	50.76
		(0.147)			

Notes: The table reports coefficient γ_k in specification (3) estimated at the annual frequency. The second column indicates the outcome variable (the source of each variable is indicated in parentheses). The dependent variable is $\log(Y_{i,t+k}/Y_{i,t-1}) \times 100$ where Y_{it} is the value of outcome variable for firm i in year t. Ratios and shares are measured in percent and the corresponding dependent variable is $Y_{i,t+k} - Y_{i,t-1}$. Horizon k is set at one. Driscoll and Kraay (1998) standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 5. Heterogeneity in Effects of Inflation Expectations on Prices, Employment and Credit.

	Dependent variable: $dp_{i,t+1}$			Dependent variable: $\log\left(\frac{L_{i,t+1}}{L_{i,t-1}}\right)$			Dependent variable: $u_{i,t+1}-u_{i,t-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A. Sector								
	Manufacturing	Services	Construction	Manufacturing	Services	Construction	Manufacturing	Services	Construction
$F^i_{t-1}\pi^{(12m)}$	0.145	0.186**	0.620***	-0.494	-0.893***	-0.371	-0.477	0.602	0.483
	(0.136)	(0.080)	(0.218)	(0.365)	(0.296)	(0.842)	(0.374)	(0.493)	(0.851)
Observations	5,648	5,665	2,452	5,648	5,665	2,452	5,331	5,209	2,224
R-squared	0.099	0.157	0.218	0.016	0.009	0.016	0.004	0.011	0.004
1st stage F stat	105	123.3	51.86	105	123.3	51.86	107.9	130.9	48.57
	Panel B. Number of employees								
	50-99	100-299	300 or more	50-99	100-299	300 or more	50-99	100-299	300 or more
$F^i_{t-1}\pi^{(12m)}$	0.160	0.149**	0.260**	-0.708**	-0.566	-0.735*	1.040**	0.709*	1.085**
	(0.151)	(0.068)	(0.112)	(0.340)	(0.464)	(0.428)	(0.427)	(0.410)	(0.439)
Observations	4,767	4,009	4,989	4,767	4,009	4,989	3,895	3,523	3,736
R-squared	0.160	0.131	0.198	0.003	0.025	0.018	0.003	0.003	0.001
1st stage F stat	94.68	134.5	119.9	94.68	134.5	119.9	93.29	120	101.1
	Panel C. Export share, percent								
	0	1-33	34 or more	0	1-33	34 or more	0	1-33	34 or more
$F^i_{t-1}\pi^{(12m)}$	0.137	0.173	0.248	-1.121**	-0.583	-0.093	0.962***	1.235**	0.551
	(0.093)	(0.109)	(0.167)	(0.428)	(0.414)	(0.277)	(0.324)	(0.496)	(0.422)
Observations	6,360	2,905	4,500	6,360	2,905	4,500	5,048	2,399	3,814
R-squared	0.168	0.184	0.113	0.005	0.029	0.012	0.002	0.011	0.001
1st stage F stat	115.3	109.1	100	115.3	109.1	100	99.74	104.9	97.77
	Panel D. Geography								
	North	Center	South	North	Center	South	North	Center	South
$F^i_{t-1}\pi^{(12m)}$	0.174*	0.078	0.307***	-0.635*	-0.039	-1.156**	0.903**	0.079	1.702***
	(0.097)	(0.187)	(0.105)	(0.332)	(0.439)	(0.548)	(0.359)	(0.617)	(0.459)
Observations	8,007	2,939	2,819	8,007	2,939	2,819	6,584	2,428	2,249
R-squared	0.155	0.191	0.107	0.014	0.018	0.015	-0.001	0.012	0.004
1st stage F stat	109.3	106.7	108	109.3	106.7	108	106.1	77.79	112

Notes: i and t index firms and time (survey waves). $F^i_{t-1}\pi^{(12m)}$ is one-year-ahead inflation expectation of firm i in wave t. Treatment is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Seasonal dummies for each sector are included but not reported. Other controls from Table 3 are included but not reported. Estimation sample is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 6. Effects of Inflation Expectations on Other Expectations and Plans.

Row	Outcome variable	Coef. on $F^i_{t-1}\pi^{(12m)}$ (std. err.)	Obs.	R^2	1st stage F-stat
		(1)	(2)	(3)	(4)
	Macroeconomic conditions				
(1)	General economic situation relative to 3 months ago	-0.235***	20,256	-0.021	144.30
		(0.039)			
(2)	Probability of improved situation in the next 3 months	-2.287***	20,432	-0.009	145.16
		(0.553)			
	Firm-specific conditions				
(3)	Expected business conditions for company, next 3 months	-0.160***	20,421	-0.003	146.28
		(0.023)			
(4)	Expected demand for products, next 3 months	-0.104***	19,033	-0.008	95.45
		(0.026)			
(5)	Expected liquidity for company, next 3 months	-0.073***	20,181	0.000	146.33
		(0.018)			
(6)	Access condition to credit relative to 3 months ago	-0.118***	20,115	0.001	146.1
		(0.012)			
	Uncertainty				
(7)	3-month ahead	0.005**	20,110	0.001	145.50
		(0.003)			
(8)	3-year ahead	0.009***	20,122	0.001	147.84
		(0.002)			
(9)	Expected employment change, next 3 months	-0.066***	20,379	0.002	144.29
		(0.014)			
(10)	Expected investment change, next calendar year	-0.117***	18,282	-0.004	114.17
		(0.041)			
(11)	Expected price change, next 12 months	0.100*	20,512	0.003	146.31
		(0.057)			
	Factors affecting future price changes				
(12)	Expected change in demand	-0.134***	19,956	-0.002	147.08
		(0.020)			
(13)	Expected raw material prices	0.083***	19,894	0.003	147.99
		(0.026)			
(14)	Expected labor costs	0.018	19,912	0.001	147.03
		(0.013)			
(15)	Expected prices of competitors	-0.033	19,870	0.001	147.75
		(0.022)			

Notes: i and t index firms and time (survey waves). Specification is given by equation (4). $F^i_{t-1}\pi^{(12m)}$ is one-year-ahead inflation expectation of firm i in wave $t-1$. The right column reports the dependent variables. $F^i_{t-1}\pi^{(12m)}$ is instrumented with the treatment variable. Seasonal dummies for each sector are included but not reported. Estimation sample is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 7: Profits of Treatment and Control Group Firms.

Dependent variable: Profit share in sales	Controls	Year and industry fixed effects	No controls
	(1)	(2)	(3)
Panel A. Treatment period, 2012Q3-2019Q1			
$Treatment_{t-1}^{i}$	0.284***	0.172**	0.179**
	(0.076)	(0.085)	(0.080)
Observations	4,077	4,046	4,033
R-squared	0.120	0.001	0.001
Panel B: Pre-treatment period, 2006Q1-2012Q2			
$Treatment_{t-1}^{i}$	-0.023	-0.065	-0.027
	(0.045)	(0.065)	(0.065)
Observations	2,032	2,026	2,036
R-squared	0.063	0.000	0.000

Notes: The dependent variable is the profit share in sales (profits/sales×100). $Treatment_{t}^{i}$ is a dummy variable equal to one if a firm i in year t is provided with information about past inflation and zero otherwise. Column (1) includes controls as in Table 3. Column (2) includes only industry fixed effects and year fixed effects. Column (3) has no controls. Panel A report results for the sample period when treatment was implemented. Panel B reports results when we use treatment assignment in 2012Q4 to classify firms into treatment and control groups for the period 2006Q1-2012Q2. Driscoll-Kraay (1998) standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 8. The ELB Period: Effects of Inflation Expectations on Firm Decisions.

	y_t^i	y_{t+1}^i	y_{t+2}^i
	(1)	(2)	(3)
Panel A: Effect on Prices (SIGE)			
$F_{t-1}^i \pi^{(12m)}$	0.694***	0.677***	0.698***
	(0.161)	(0.102)	(0.194)
Observations	9,398	7,761	7,004
R-squared	0.143	0.129	0.092
1st stage F stat	121	118	88.02
Panel B: Effect on Employment (SIGE)			
$F_{t-1}^i \pi^{(12m)}$	0.218	0.286	-0.100
	(0.142)	(0.201)	(0.168)
Observations	9,398	7,761	7,004
R-squared	0.013	0.023	0.034
1st stage F stat	121	118	88.02
Panel C: Effect on Employment (INPS)			
$F_{t-1}^i \pi^{(12m)}$	-0.249	-0.072	-0.664
	(0.178)	(0.272)	(0.388)
Observations	9,057	7,488	6,767
R-squared	0.024	0.030	0.037
1st stage F stat	125.2	118.3	88.35
Panel D: Effect on Credit Utilization (CCR)			
$F_{t-1}^i \pi^{(12m)}$	-0.099	1.018	1.925**
	(0.546)	(0.615)	(0.793)
Observations	7,720	6,340	5,704
R-squared	0.003	0.002	-0.005
1st stage F stat	114.4	119.4	78.42
Panel E: Effect on Loan Applications (CRR)			
$F_{t-1}^i \pi^{(12m)}$	0.016	-0.016	0.036
	(0.035)	(0.047)	(0.062)
Observations	8,706	7,189	6,034
R-squared	0.007	0.012	0.015
1st stage F stat	123.4	119.6	102.6

Notes: *i* and *t* index firms and time (survey waves). $F_{t-1}^i \pi^{(12m)}$ is one-year-ahead inflation expectation of firm *i* in wave $t-1$. In Panel A, the dependent variable is $y_{t+k}^i \equiv dp_{i,t+k}$ where $dp_{i,t+k}$ is the average change in firm *i*'s prices over the previous 12 months in period $t+k$. In Panels B and C, the dependent variable is $y_{t+k}^i \equiv \log(L_{i,t+k}/L_{i,t-1})$ where L_{it} is the number of employees in firm *i* at time t. In Panel D, the dependent variable is $y_{t+k}^i \equiv u_{i,t+k} - u_{i,t-1}$ where u_{it} is the utilization rate of credit lines by firm *i* at time *t*. In Panel E, the dependent variable is $y_{t+k}^i \equiv y_{t+k}^i \equiv App_{i,t+k} + \cdots + App_{i,t}$ where App_{it} is the number of loan applications made by firm *i* at time *t*. Specification is given by equation (3). Seasonal dummies for each sector are included but not reported. Other controls are included but not reported. Estimation sample is 2014Q4-2018Q2. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Table 9. The ELB Period: Effects of Inflation Expectations on Other Expectations and Plans.

Row	Outcome variable	Coef. on $F^i_{t-1}\pi^{(12m)}$ (std. err.)	Obs.	R^2	1st stage F-stat
		(1)	(2)	(3)	(4)
	Macroeconomic conditions				
(1)	General economic situation relative to 3 months ago	0.116	11,991	-0.007	91.05
		(0.110)			
(2)	Probability of improved situation in the next 3 months	2.211	12,136	0.010	88.23
		(1.677)			
	Firm-specific conditions				
(3)	Expected business conditions for company, next 3 months	0.076	12,125	-0.006	88.60
		(0.047)			
(4)	Expected demand for products, next 3 months	0.039*	11,971	0.000	85.23
		(0.022)			
(5)	Expected liquidity for company, next 3 months	0.100***	11,989	-0.017	88.95
		(0.040)			
(6)	Access condition to credit relative to 3 months ago	-0.004	11,918	-0.000	91.74
		(0.023)			
	Uncertainty				
(7)	3-month ahead	0.030***	11,902	0.002	87.52
		(0.006)			
(8)	3-year ahead	0.002	11,918	0.001	88.58
		(0.005)			
(9)	Expected employment change, next 3 months	0.091***	12,111	-0.011	88.78
		(0.026)			
(10)	Expected investment change, next calendar year	0.119***	12,008	-0.002	90.16
		(0.038)			
(11)	Expected price change, next 12 months	0.384***	12,177	0.012	89.75
		(0.096)			
	Factors affecting future price changes				
(12)	Expected change in demand	0.102**	11,819	0.000	87.46
		(0.048)			
(13)	Expected raw material prices	0.275***	11,790	-0.026	87.78
		(0.066)			
(14)	Expected labor costs	-0.003	11,798	-0.000	85.78
		(0.046)			
(15)	Expected prices of competitors	0.171***	11,760	-0.009	89.54
		(0.038)			

Notes: i and t index firms and time (survey waves). Specification is given by equation (4). $F^i_{t-1}\pi^{(12m)}$ is one-year-ahead inflation expectation of firm i in wave $t-1$. The right column indicates the dependent variables. $F^i_{t-1}\pi^{(12m)}$ is instrumented with the treatment variable lagged 1-quarter. Seasonal dummies for each sector are included but not reported. Estimation sample is 2014Q4-2018Q2. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

ONLINE APPENDIX

Appendix Table 1. Descriptive statistics of selected variables

Variable	N obs.	Mean	St.dev.
Panel A. Survey of Inflation and Growth Expectations (SIGE)			
Employment	25,633	260.86	1785.74
Export share	25,634	0.53	0.32
Inflation expectations (treated firms)			
6-month ahead	17,553	1.01	0.99
12-month ahead	17,553	1.13	0.99
24-month ahead	17,553	1.29	0.99
48-month ahead	13,832	1.24	0.93
Inflation expectations (control firms)			
6-month ahead	8,081	1.19	1.26
12-month ahead	8,081	1.33	1.26
24-month ahead	8,081	1.52	1.29
48-month ahead	6,208	1.49	1.24
Percent change of prices over the last 12 months	25,634	0.02	5.30
Access conditions to credit over the previous 3 months	25,116	-0.07	0.46
Macroeconomic expectations			
General economic situation now relative to 3 months ago	25,301	-0.11	0.58
Probability of improved situation in the next 3 months	25,518	13.20	16.94
Expectations about firm-specific conditions			
Expected demand for products, next 3 months	24,482	0.11	0.60
Expected employment change, next 3 months	25,447	-0.04	0.57
Expected liquidity for company, next 3 months	25,255	-0.03	0.62
Expected business conditions for company, next 3 months	25,521	-0.06	0.57
Expected investment expenditure, current or next calendar year	23,513	0.05	0.92
Uncertainty			
3-month ahead	25,066	0.50	0.27
3-year ahead	25,067	0.36	0.28
Expected price change, next 12 months	25,634	0.65	4.68
Factors affecting future price changes			
Expected change in demand	24,859	-0.06	1.03
Expected raw material prices	24,795	0.59	1.13
Expected labor costs	24,815	0.54	1.05
Expected prices of competitors	24,757	-0.51	1.20
Panel B. National Institute for Social Security (INPS)			
Employment	23,726	193.33	702.03
Panel C. Italian Credit Register			
Utilization rate of credit line	21,146	0.32	0.45

Notes: descriptive statistics are reported for 2012Q3-2019Q1 sample. All statistics are computed with sampling weights.

Appendix Table 2. Assignment of Firms into Treatment and Control Groups.

	Dependent variable: Treatment dummy						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of employees (in logarithm)	0.000	0.000	0.000		0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Exports as a share of revenues		0.025	0.026			0.062	0.062
		(0.041)	(0.041)			(0.050)	(0.050)
Average absolute size of price changes			0.001				0.000
			(0.002)				(0.002)
Geographic area [omitted category "North-West"]							
North-East				0.008	0.007	0.006	0.006
				(0.031)	(0.031)	(0.031)	(0.031)
Centre				0.036	0.036	0.033	0.033
				(0.034)	(0.034)	(0.034)	(0.034)
South and Island				0.029	0.029	0.022	0.022
				(0.032)	(0.033)	(0.033)	(0.033)
Sector [omitted category "Manufacturing"]							
Services				-0.025	-0.025	-0.046	-0.046
				(0.029)	(0.029)	(0.033)	(0.033)
Construction				-0.021	-0.020	-0.043	-0.042
				(0.029)	(0.031)	(0.036)	(0.036)
Constant	0.654***	0.631***	0.632***	0.672***	0.657***	0.626***	0.626***
	(0.056)	(0.066)	(0.066)	(0.027)	(0.068)	(0.072)	(0.072)
Observations	2,014	2,014	2,014	2,015	2,014	2,014	2,014
R-squared	0.000	0.000	0.000	0.001	0.001	0.002	0.002
p-value (F stat)	0.999	0.990	0.998	0.903	0.943	0.851	0.891

Notes: the table reports results for the linear regression where the dependent variable is dichotomous and equal to one if a firm is treated and zero otherwise. Since assignment into treatment and control groups is fixed (that is, firms cannot be re-assigned from one group to another after initial assignment), all regressors are averages over the survey period. *p-value (F stat)* reports the probability value of all regressors (other than the constant) having zero coefficients. *Average absolute size of price changes* is the average absolute value of responses to the following question: "In the last 12 months, what has been the average change in your firm's prices?". Estimation sample is 2012Q3-2019Q1. ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 3. Effect of the Treatment with Past Inflation on Inflation Expectations, Consistent Sample.

	Dependent variable: Inflation expectations by horizon, $F_t^i\pi^{(h)}$			
	6 months ahead	1 year ahead	2 years ahead	4 years ahead
	(1)	(2)	(3)	(4)
T_t^i	0.545***	0.507***	0.442***	0.369***
	(0.051)	(0.050)	(0.049)	(0.046)
Observations	20,007	20,007	20,007	20,007
R-squared	0.167	0.138	0.091	0.053
Sample	2014Q1-2019Q1	2014Q1-2019Q1	2014Q1-2019Q1	2014Q1-2019Q1

Notes: *i* and *t* index firms and time (survey waves). $F_t^i\pi^{(h)}$ is *horizon (h)*-ahead inflation expectation of firm *i* in wave t. T_t^i is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Seasonal dummies for each sector are included but not reported. The sample is restricted to the period for which 4-year-ahead inflation forecasts are available. Specification is given by equation (1). Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 4. Heterogeneity in Effects of Information Treatment.

	Dependent variable: $F_t^i\pi^{(12m)}$		
	(1)	(2)	(3)
	Panel A. Sector		
	Manufacturing	Services	Construction
T_t^i	0.603***	0.613***	0.473***
	(0.047)	(0.044)	(0.065)
Observations	10,763	11,193	5,093
R-squared	0.367	0.330	0.102
	Panel B. Number of employees		
	50-99	100-299	300 or more
T_t^i	0.600***	0.602***	0.567***
	(0.055)	(0.040)	(0.044)
Observations	10,219	7,823	9,006
R-squared	0.272	0.349	0.369
	Panel C. Export share, percent		
	0	1-33	34 or more
T_t^i	0.593***	0.624***	0.581***
	(0.051)	(0.050)	(0.045)
Observations	13,007	5,676	8,366
R-squared	0.286	0.353	0.309
	Panel D. Geography		
	North	Center	South
T_t^i	0.603***	0.547***	0.626***
	(0.046)	(0.050)	(0.054)
Observations	15,394	5,755	5,900
R-squared	0.359	0.228	0.252

Notes: *i* and *t* index firms and time (survey waves). $F_t^i\pi^{(12m)}$ is one-year-ahead inflation expectation of firm *i* in wave t. T_t^i is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Seasonal dummies for each sector are included but not reported. Specification is given by equation (1). Sample period is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 5. Dynamic effects of treatment on inflation expectations, treatment with "imputation".

	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$	$F_t^i\pi^{(12m)}$
	(1)	(2)	(3)	(4)	(5)
$Treatment_t^i$	0.596***	0.441***	0.368***	0.372***	0.445***
	(0.048)	(0.048)	(0.049)	(0.066)	(0.050)
$Treatment_{t-1}^i$		0.187**	0.120*	0.044	-0.038
		(0.069)	(0.060)	(0.049)	(0.067)
$Treatment_{t-2}^i$			0.146**	0.065	0.010
			(0.064)	(0.056)	(0.056)
$Treatment_{t-3}^i$				0.125**	0.071
				(0.059)	(0.050)
$Treatment_{t-4}^i$					0.079
					(0.065)
Observations	27,002	24,907	23,523	22,205	20,917
R-squared	0.308	0.278	0.232	0.186	0.154

Notes: i and t index firms and time (survey waves). $F_t^i\pi^{(12m)}$ is one-year-ahead inflation of firm i in wave t. $Treatment$ is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Seasonal dummies for each sector are included but not reported. Treatment with "imputation" is implemented as follows: if a firm does not participate in a given wave, impute "no treatment" for this firm even if this firm was assigned to the treatment group. Note that irrespective of whether we impute treatment or not, we use only actual (not imputed) values of inflation expectations. Estimation sample is 2012Q3-2018Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 6. Effects of Inflation Expectations on Firm Decisions, OLS estimates.

	y_t^i	y_{t+1}^i	y_{t+2}^i	y_{t+3}^i	y_{t+4}^i	y_{t+5}^i
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Effect on Prices (SIGE)						
$F_{t-1}^i\pi^{(12m)}$	0.170***	0.112***	0.022	0.051	0.003	0.019
	(0.051)	(0.039)	(0.047)	(0.044)	(0.044)	(0.049)
Observations	16,227	13,765	12,878	12,011	11,208	10,419
R-squared	0.162	0.153	0.129	0.105	0.102	0.098
Panel B: Effect on Employment (SIGE)						
$F_{t-1}^i\pi^{(12m)}$	-0.046	-0.038	-0.134	-0.246**	-0.328**	-0.367***
	(0.043)	(0.067)	(0.104)	(0.103)	(0.119)	(0.121)
Observations	16,227	13,765	12,878	12,011	11,208	10,419
R-squared	0.018	0.027	0.038	0.058	0.053	0.052
Panel C: Effect on Employment (INPS)						
$F_{t-1}^i\pi^{(12m)}$	-0.016	-0.031	-0.243**	-0.492***	-0.531***	-0.642***
	(0.050)	(0.073)	(0.094)	(0.095)	(0.110)	(0.161)
Observations	15,062	12,764	11,907	11,090	10,321	9,570
R-squared	0.025	0.033	0.046	0.064	0.065	0.065
Panel D: Effect on Credit (CCR)						
$F_{t-1}^i\pi^{(12m)}$	0.147	0.244	0.204	0.174	0.157	-0.161
	(0.134)	(0.216)	(0.223)	(0.221)	(0.225)	(0.291)
Observations	13,336	11,261	10,501	9,773	9,085	8,409
R-squared	0.002	0.003	0.002	0.003	0.002	0.003
Panel E: Effect on Loan Applications (CCR)						
$F_{t-1}^i\pi^{(12m)}$	0.012**	0.016	0.027*	0.037**	0.021	0.003
	(0.006)	(0.011)	(0.014)	(0.017)	(0.018)	(0.024)
Observations	14,361	12,173	10,501	9,153	8,012	7,037
R-squared	0.007	0.009	0.012	0.015	0.016	0.019

Notes: i and t index firms and time (survey waves). $F_{t-1}^i\pi^{(12m)}$ is one-year-ahead inflation expectation of firm i in wave $t-1$. In Panel A, the dependent variable is $y_{t+k}^i \equiv dp_{i,t+k}$ where $dp_{i,t+k}$ is the average change in firm i's prices over the previous 12 months in period $t+k$. In Panels B and C, the dependent variable is $y_{t+k}^i \equiv \log(L_{i,t+k}/L_{i,t-1})$ where L_{it} is the number of employees in firm i at time t. In Panel D, the dependent variable is $y_{t+k}^i \equiv u_{i,t+k} - u_{i,t-1}$ where u_{it} is the utilization rate of credit lines by firm i at time t. In Panel E, the dependent variable is $y_{t+k}^i \equiv App_{i,t+k} + \cdots + App_{i,t}$ where App_{it} is the number of loan applications made by firm i at time t. Specification is given by equation (3). Ordinary Least Squares (OLS) is the estimation method. Seasonal dummies for each sector are included but not reported. Other controls are included but not reported. Estimation sample is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 7. Heterogeneity in Effects of Inflation Expectations on Prices, Employment and Credit.

	Dependent variable: $\log\left(\frac{L_{i,t+1}}{L_{i,t-1}}\right)$			Dependent variable: $\log\left(\frac{W_{i,t+1}}{W_{i,t-1}}\right)$		
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Sector					
	Manufacturing	Services	Construction	Manufacturing	Services	Construction
$F^i_{t-1}\pi^{(12m)}$	-0.165	-0.441**	0.411	-0.020	0.053**	0.307***
	(0.133)	(0.200)	(0.594)	(0.031)	(0.025)	(0.080)
Observations	5,331	5,209	2,224	5,044	4,897	2,232
R-squared	0.042	0.026	0.055	0.019	0.016	-0.002
1st stage F stat	107.9	130.9	48.57	105.2	122.7	51.42
	Panel B. Number of employees					
	50-99	100-299	300 or more	50-99	100-299	300 or more
$F^i_{t-1}\pi^{(12m)}$	-0.258	-0.260	-0.293	0.002	-0.000	0.137
	(0.240)	(0.212)	(0.227)	(0.043)	(0.033)	(0.092)
Observations	4,362	3,758	4,644	4,328	3,600	3,961
R-squared	0.038	0.035	0.023	0.011	0.015	0.018
1st stage F stat	101.3	134.2	123.8	105.2	130.2	101.4
	Panel C. Export share, percent					
	0	1-33	34 or more	0	1-33	34 or more
$F^i_{t-1}\pi^{(12m)}$	-0.197	-0.290	-0.171	0.059***	0.043	-0.007
	(0.201)	(0.316)	(0.184)	(0.016)	(0.028)	(0.060)
Observations	5,823	2,733	4,208	5,522	2,616	4,035
R-squared	0.028	0.054	0.044	0.012	0.013	0.023
1st stage F stat	118.6	109.8	105.1	112.8	108.4	105.9
	Panel D. Geography					
	North	Center	South	North	Center	South
$F^i_{t-1}\pi^{(12m)}$	-0.216	0.050	-0.581	0.058*	-0.098*	0.063
	(0.141)	(0.385)	(0.502)	(0.032)	(0.052)	(0.038)
Observations	7,441	2,669	2,654	7,030	2,579	2,564
R-squared	0.038	0.035	0.045	0.009	0.014	0.017
1st stage F stat	111.7	111.9	119.6	108.7	114.0	98.61

Notes: *i* and *t* index firms and time (survey waves). $F^i_{t-1}\pi^{(12m)}$ is one-year-ahead inflation expectation of firm *i* in wave t. Treatment is equal to the most recent inflation rate presented to a firm for treated firms and zero for control firms. Employment in columns (1)-(3) is from INPS. Loan applications in columns (4)-(5) are from CCR. Seasonal dummies for each sector are included but not reported. Other controls from Table 6 are included but not reported. Estimation sample is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 8. The ELB Period (alternative definition): Effects of Inflation Expectations on Firm Decisions.

	y_t^i	y_{t+1}^i	y_{t+2}^i
	(1)	(2)	(3)
Panel A: Effect on Prices (SIGE)			
$F_{t-1}^i \pi^{(12m)}$	0.577***	0.587***	0.636***
	(0.141)	(0.144)	(0.184)
Observations	11,057	9,220	8,450
R-squared	0.158	0.141	0.112
1st stage F stat	143	115	93.93
Panel B: Effect on Employment (SIGE)			
$F_{t-1}^i \pi^{(12m)}$	0.191*	0.464***	0.296
	(0.097)	(0.134)	(0.333)
Observations	11,057	9,220	8,450
R-squared	0.015	0.022	0.033
1st stage F stat	143	115	93.93
Panel C: Effect on Employment (INPS)			
$F_{t-1}^i \pi^{(12m)}$	-0.243	-0.134	-0.552
	(0.149)	(0.276)	(0.339)
Observations	10,108	8,412	7,667
R-squared	0.023	0.028	0.034
1st stage F stat	117	100	119.4
Panel D: Effect on Credit Utilization (CCR)			
$F_{t-1}^i \pi^{(12m)}$	0.433	1.320**	2.220**
	(0.556)	(0.568)	(0.819)
Observations	9,076	7,541	6,888
R-squared	0.002	-0.001	-0.007
1st stage F stat	138.7	119.7	88.11
Panel E: Effect on Loan Applications (CCR)			
$F_{t-1}^i \pi^{(12m)}$	0.073	0.038	0.141*
	(0.052)	(0.078)	(0.080)
Observations	9,744	8,107	6,851
R-squared	0.004	0.012	0.015
1st stage F stat	114.6	99.71	135.5

Notes: *i* and *t* index firms and time (survey waves). $F_{t-1}^i \pi^{(12m)}$ is one-year-ahead inflation expectation of firm *i* in wave $t-1$. In Panel A, the dependent variable is $y_{t+k}^i \equiv dp_{i,t+k}$ where $dp_{i,t+k}$ is the average change in firm *i*'s prices over the previous 12 months in period $t+k$. In Panels B and C, the dependent variable is $y_{t+k}^i \equiv \log(L_{i,t+k}/L_{i,t-1})$ where L_{it} is the number of employees in firm *i* at time t. In Panel D, the dependent variable is $y_{t+k}^i \equiv u_{i,t+k} - u_{i,t-1}$ where u_{it} is the utilization rate of credit lines by firm *i* at time *t*. In Panel E, the dependent variable is $y_{t+k}^i \equiv App_{i,t+k} + App_{i,t}$ where App_{it} is the number of loan applications made by firm *i* at time *t*. Specification is given by equation (3). Seasonal dummies for each sector are included but not reported. Other controls are included but not reported. Estimation sample is 2014Q4-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 9. The ELB Period (alternative definition): Effects of Inflation Expectations on Other Expectations and Plans.

Row	Outcome variable	Coef. on $F^i_{t-1}\pi^{(12m)}$ (std. err.)	Obs.	R^2	1st stage F-stat
		(1)	(2)	(3)	(4)
	Macroeconomic conditions				
(1)	General economic situation relative to 3 months ago	-0.086	13,981	-0.020	121.75
		(0.147)			
(2)	Probability of improved situation in the next 3 months	-0.322	14,136	-0.003	119.42
		(2.001)			
	Firm-specific conditions				
(3)	Expected business conditions for company, next 3 months	-0.002	14,111	-0.000	118.82
		(0.058)			
(4)	Expected demand for products, next 3 months	-0.015	13,953	-0.001	116.98
		(0.036)			
(5)	Expected liquidity for company, next 3 months	0.081***	13,973	-0.010	119.76
		(0.031)			
(6)	Access condition to credit relative to 3 months ago	-0.029	13,892	-0.002	122.99
		(0.024)			
	Uncertainty				
(7)	3-month ahead	0.020***	13,869	0.003	117.90
		(0.007)			
(8)	3-year ahead	-0.001	13,891	-0.000	119.94
		(0.004)			
(9)	Expected employment change, next 3 months	0.070***	14,105	-0.005	120.10
		(0.022)			
(10)	Expected investment change, next calendar year	0.029	13,993	0.001	121.30
		(0.056)			
(11)	Expected price change, next 12 months	0.283***	14,180	0.010	120.82
		(0.103)			
	Factors affecting future price changes				
(12)	Expected change in demand	0.023	13,770	0.001	118.20
		(0.058)			
(13)	Expected raw material prices	0.219***	13,733	-0.011	119.30
		(0.064)			
(14)	Expected labor costs	0.010	13,736	0.000	116.51
		(0.035)			
(15)	Expected prices of competitors	0.147***	13,701	-0.007	121.04
		(0.031)			

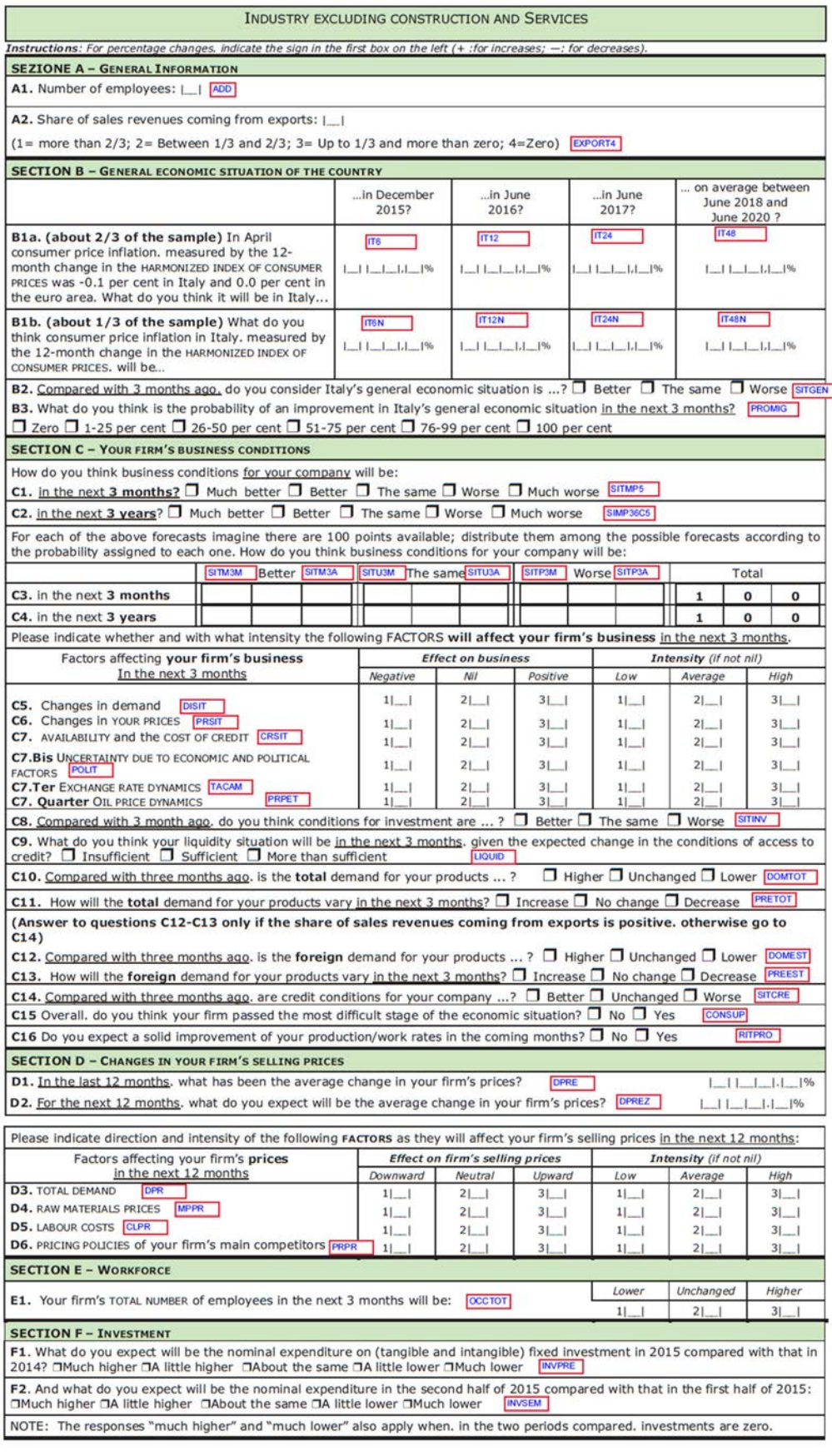
Notes: i and t index firms and time (survey waves). Specification is given by equation (4). $F^i_{t-1}\pi^{(12m)}$ is one-year-ahead inflation expectation of firm i in wave $t-1$. The right column indicates the dependent variables. $F^i_{t-1}\pi^{(12m)}$ is instrumented with the treatment variable lagged 1-quarter. Seasonal dummies for each sector are included but not reported. Estimation sample is 2014Q4-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Table 10. Effects of Inflation Expectations on Employment, alternative assumption.

	y_t^i	y_{t+1}^i	y_{t+2}^i	y_{t+3}^i	y_{t+4}^i	y_{t+5}^i
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Effect on Employment (SIGE), restrict to firms with more than 50 employees						
$F_{t-1}^i \pi^{(12m)}$	-0.077	-0.264	-0.508**	-0.739***	-0.776***	-1.074***
	(0.083)	(0.168)	(0.195)	(0.224)	(0.221)	(0.214)
Observations	13,545	11,559	10,841	10,159	9,483	8,842
R-squared	0.023	0.034	0.050	0.073	0.069	0.069
1st stage F stat	109.2	110.3	118.9	115.6	115.2	112
Panel B: Effect on Employment (SIGE), impute employment growth using INPS data for firms with exactly 50 employees in SIGE						
$F_{t-1}^i \pi^{(12m)}$	-0.049	-0.237	-0.609**	-1.027***	-1.062***	-1.380***
	(0.076)	(0.152)	(0.245)	(0.280)	(0.273)	(0.364)
Observations	15,920	13,499	12,626	11,776	10,978	10,194
R-squared	0.026	0.034	0.047	0.065	0.062	0.065
1st stage F stat	113	114.8	117.1	113.1	112.8	113

Notes: *i* and *t* index firms and time (survey waves). $F_{t-1}^i \pi^{(12m)}$ is one-year-ahead inflation expectation of firm *i* in wave $t-1$. In Panels A and B, the dependent variable is $y_{t+k}^i \equiv \log\left(L_{i,t+4}/L_{i,t-1+}\right)$ where L_{it} is the number of employees in firm *i* at time t. Panel A: the sample is restricted to include only firms with more than 50 employees as reported in SIGE (the survey bottom-codes employment at 50). Panel B: employment growth is taken from INPS (administrative social security records) for firms in SIGE that are coded to have exactly 50 employees. Estimation sample is 2012Q3-2019Q1. Standard errors reported in parentheses are as in Driscoll and Kraay (1998). ***, **, * denote statistical significance at 1, 5 and 10 percent level.

Appendix Figure 1. Survey Form in SIGE



INDUSTRY EXCLUDING CONSTRUCTION AND SERVICES

Instructions: For percentage changes, indicate the sign in the first box on the left (+ :for increases; —: for decreases).

SEZIONE A – GENERAL INFORMATION

A1. Number of employees: |__| ADD

A2. Share of sales revenues coming from exports: |__|

(1= more than 2/3; 2= Between 1/3 and 2/3; 3= Up to 1/3 and more than zero; 4=Zero) EXPORT4

SECTION B – GENERAL ECONOMIC SITUATION OF THE COUNTRY

	...in December 2015?	...in June 2016?	...in June 2017?	... on average between June 2018 and June 2020 ?
B1a. (about 2/3 of the sample) In April consumer price inflation, measured by the 12-month change in the HARMONIZED INDEX OF CONSUMER PRICES was -0.1 per cent in Italy and 0.0 per cent in the euro area. What do you think it will be in Italy...	IT6 |__|__|__|,|__|%	IT12 |__|__|__|,|__|%	IT24 |__|__|__|,|__|%	IT48 |__|__|__|,|__|%
B1b. (about 1/3 of the sample) What do you think consumer price inflation in Italy, measured by the 12-month change in the HARMONIZED INDEX OF CONSUMER PRICES, will be...	IT6N |__|__|__|,|__|%	IT12N |__|__|__|,|__|%	IT24N |__|__|__|,|__|%	IT48N |__|__|__|,|__|%

B2. Compared with 3 months ago, do you consider Italy's general economic situation is ...? ❒ Better ❒ The same ❒ Worse SITGEN

B3. What do you think is the probability of an improvement in Italy's general economic situation in the next 3 months? PROMIG

❒ Zero ❒ 1-25 per cent ❒ 26-50 per cent ❒ 51-75 per cent ❒ 76-99 per cent ❒ 100 per cent

SECTION C – YOUR FIRM'S BUSINESS CONDITIONS

How do you think business conditions for your company will be:

C1. in the next **3 months**? ❒ Much better ❒ Better ❒ The same ❒ Worse ❒ Much worse SITMP5

C2. in the next **3 years**? ❒ Much better ❒ Better ❒ The same ❒ Worse ❒ Much worse SIMP36C5

For each of the above forecasts imagine there are 100 points available; distribute them among the possible forecasts according to the probability assigned to each one. How do you think business conditions for your company will be:

	SITM3M Better SITM3A	SITU3M The same SITU3A	SITP3M Worse SITP3A	Total
C3. in the next **3 months**				1 0 0
C4. in the next **3 years**				1 0 0

Please indicate whether and with what intensity the following FACTORS **will affect your firm's business** in the next 3 months.

Factors affecting **your firm's business** In the next 3 months	*Effect on business*			*Intensity (if not nil)*		
	Negative	*Nil*	*Positive*	*Low*	*Average*	*High*
C5. Changes in demand DISIT	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C6. Changes in YOUR PRICES PRSIT	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7. AVAILABILITY and the COST OF CREDIT CRSIT	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7.Bis UNCERTAINTY DUE TO ECONOMIC AND POLITICAL FACTORS POLIT	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7.Ter EXCHANGE RATE DYNAMICS TACAM	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7. Quarter OIL PRICE DYNAMICS PRPET	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|

C8. Compared with 3 month ago, do you think conditions for investment are ... ? ❒ Better ❒ The same ❒ Worse SITINV

C9. What do you think your liquidity situation will be in the next 3 months, given the expected change in the conditions of access to credit? ❒ Insufficient ❒ Sufficient ❒ More than sufficient LIQUID

C10. Compared with three months ago, is the **total** demand for your products ... ? ❒ Higher ❒ Unchanged ❒ Lower DOMTOT

C11. How will the **total** demand for your products vary in the next 3 months? ❒ Increase ❒ No change ❒ Decrease PRETOT

(Answer to questions C12-C13 only if the share of sales revenues coming from exports is positive. otherwise go to C14)

C12. Compared with three months ago, is the **foreign** demand for your products ... ? ❒ Higher ❒ Unchanged ❒ Lower DOMEST

C13. How will the **foreign** demand for your products vary in the next 3 months? ❒ Increase ❒ No change ❒ Decrease PREEST

C14. Compared with three months ago, are credit conditions for your company ...? ❒ Better ❒ Unchanged ❒ Worse SITCRE

C15 Overall, do you think your firm passed the most difficult stage of the economic situation? ❒ No ❒ Yes CONSUP

C16 Do you expect a solid improvement of your production/work rates in the coming months? ❒ No ❒ Yes RITPRO

SECTION D – CHANGES IN YOUR FIRM'S SELLING PRICES

D1. In the last 12 months, what has been the average change in your firm's prices? DPRE |__|__|__|.|__|%

D2. For the next 12 months, what do you expect will be the average change in your firm's prices? DPREZ |__|__|__|.|__|%

Please indicate direction and intensity of the following **FACTORS** as they will affect your firm's selling prices in the next 12 months:

Factors affecting your firm's **prices** in the next 12 months	*Effect on firm's selling prices*			*Intensity (if not nil)*		
	Downward	*Neutral*	*Upward*	*Low*	*Average*	*High*
D3. TOTAL DEMAND DPR	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D4. RAW MATERIALS PRICES MPPR	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D5. LABOUR COSTS CLPR	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D6. PRICING POLICIES of your firm's main competitors PRPR	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|

SECTION E – WORKFORCE

E1. Your firm's TOTAL NUMBER of employees in the next 3 months will be: OCCTOT	*Lower*	*Unchanged*	*Higher*
	1|__|	2|__|	3|__|

SECTION F – INVESTMENT

F1. What do you expect will be the nominal expenditure on (tangible and intangible) fixed investment in 2015 compared with that in 2014? ❒Much higher ❒A little higher ❒About the same ❒A little lower ❒Much lower INVPRE

F2. And what do you expect will be the nominal expenditure in the second half of 2015 compared with that in the first half of 2015: ❒Much higher ❒A little higher ❒About the same ❒A little lower ❒Much lower INVSEM

NOTE: The responses "much higher" and "much lower" also apply when, in the two periods compared, investments are zero.