The Curve of Inflation Expectations and Firms' Investments

By

Giuditta Perinelli

BSc Economics and Finance, Bocconi University (Milan, IT), 2015
MSc Economics, Bocconi University (Milan, IT) and Keio University (Tokyo, JP), 2018

SUBMITTED TO THE DEPARTMENT OF MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN MANAGEMENT RESEARCH

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

September 2024

Authored by: Giuditta Perinelli
Department of Management
August 9th, 2024

Certified by: David Thesmar
Department of Management
Thesis supervisor

Accepted by: Eric So
Professor, Global Economics and Finance
Faculty Chair, MIT Sloan PhD Program

The Curve of Inflation Expectations
and Firms' Investments

By

Giuditta Perinelli

Submitted to the Department of Management on August 9th, 2024
in Partial Fulfillment of the Requirements for the Degree of Master of Science in Management Research

ABSTRACT

Using rich survey data on Italian firms, this paper studies the formation mechanisms of inflation expectations at different forecasting horizons. Starting from empirical evidence embedded in firms' inflation expectation curve, we obtain 3 main findings: (1) firms extrapolate for long forecasting horizons, (2) inflation forecasts overreact (underreact) at long (short) forecasting horizons, (3) long-term inflation expectations impact investment decisions. Specifically, we find that a 1% wedge between the 4-year and 1-year ahead expected inflation is associated with a 0.8% increase in the probability of investing. What motivates this result? After ruling out alternative channels of (1) an increase in expected demand, (2) a decrease in supply of input goods, and (3) an improvement in financing conditions, we claim that a decrease in the perceived cost of capital is the main driver.

Thesis supervisor: David Thesmar

Title: Franco Modigliani Professor of Financial Economics

Contents

1 Introduction **3**

2 Data Description **6**
2.1 SIGE . . . 6
2.1.1 What we measure in SIGE . . . 7
2.2 CADS . . . 8

3 Formation Mechanisms along the Curve **9**
3.1 Empirical Evidence . . . 9
3.2 Findings . . . 10
3.2.1 Extrapolation for long-horizons . . . 10
3.2.2 Overreaction at long forecast horizons . . . 12

4 Inflation Curve and Real Effects **13**
4.1 Specification . . . 13
4.2 Main Results . . . 14

5 Understanding the Results on Investments **15**
5.1 Good or Bad Inflation? . . . 15
5.2 Aggregate Demand, Inputs Supply and Financing channels . . . 16
5.3 Perceived Cost of Capital . . . 18
5.4 Modigliani-Cohn money illusion . . . 19

6 Robustness Checks **19**

7 Conclusions **20**

List of Figures

1 Average firms' inflation expectations at different horizons . . . 23
2 Firms' price expectations - by sector of activity . . . 23
3 Inflation Expectation Curve . . . 24
4 Inflation Expectation Slope . . . 24
5 Persistence Coefficients . . . 25
A1 Number of participating firms over time . . .
A2 Sample composition by firm characteristics . . .

List of Tables

1 Persistence Coefficients and Constants . . . 26
2 Investments and inflation expectations . . . 27
3 Probability of positive investments and inflation expectations . . . 28
4 Drivers of inflation expectations . . . 29

5 Channels: demand and supply . . . .
6 Channels: demand and supply, with inputs' cost . . . .
7 *Real* Investments and inflation expectations, firms that do not decrease employment . . . .
8 *Real* Investments and inflation expectations, balance sheet variables . . . . .

1 Introduction

Firms' beliefs about inflation at the long-horizon are pivotal for their economic decisions, which often have a long-term impact. Beyond the mere relation to firms' choices, long-term inflation expectations are a central variable for policy considerations (Bernanke et al., 2007, Bernanke and Blanchard, 2023). Literature has explored expectations of households and professional forecasters at various horizons (Candia et al., 2022). But firms' inflation expectations at longer horizons are missing from the picture. Indeed, recent studies have not gone beyond the 1-year horizon, by exploring formation of firms' forecasts over different horizons up to one year (Goldstein and Gorodnichenko, 2022, Gorodnichenko et al., 2023), and the impact of short-term inflation expectations on firms' economic decisions (Coibion et al., 2018, Coibion et al., 2020, Ropele et al., 2023, Kumar et al., 2023).

In this paper, we study the formation mechanisms of firms' inflation expectations curve and its real impact on investments. Specifically, formation mechanisms are studied across different forecasting horizons, from the very short of 6 months up to the very long of 5 years. We assume that inflation expectations follow an AR(1) process, and we explore whether this is the case. Moreover, we compare persistence of inflation expectations to that of realized inflation. Finally, we explore whether greater long-term inflation expectations impact investment decisions. We conclude by analysing whether long-term inflation was perceived by firms as a good or bad shock, and whether long-term inflation expectations have a real impact *per se*. Our analyses are conducted on a sample of Italian firms between 2014 and 2023, which are surveyed by the Bank of Italy at a quarterly frequency.

We obtain three main findings regarding inflation expectations' term structure: (1) firms extrapolate for long forecasting horizons, (2) inflation forecasts overreact (under-react) at long (short) forecasting horizons, (3) long-term inflation expectations impact investment decisions. Findings (1) and (2) show that firms commit mistakes in forecasting long-term inflation. These biases matter for firms' investments decisions, as shown by result (3).

The first finding, i.e. firms extrapolate for long forecasting horizons, sheds light on formation mechanisms along the inflation expectations' curve. If inflation forecasts were to follow an AR(1) process, the persistence coefficient that is obtained by regressing inflation forecasts at horizon $h + 1$ on inflation forecasts at h should be the same for all h. Instead, we find that the persistence coefficient is greater the longer the forecasting horizon. This finding is coherent with a joint rejection of AR(1) process and of Full Information Rational Expectations (FIRE) assumptions.

Our second finding still on formation mechanisms concerns the higher persistence of inflation forecasts than actual inflation for long forecasting horizons. We are able to show that persistence coefficients obtained by regressing inflation forecasts at horizon h on realized inflation are always higher than persistence coefficients of actual inflation when the forecasting horizon is greater than 2 years. The opposite is true for 1-year horizon. This finding indicates that firms, in the short-term, expect inflation to be more temporary than it turns out to be. On the contrary, they lack in acknowledging that inflation does in fact mean-revert in the long-run. In other words, inflation forecasts overreact at long horizons. This finding is in line with Afrouzi et al. (2023) who claim that overreaction is stronger for longer forecast horizons.

Regarding real effects, the main finding is that an increase in the slope of inflation expectation curve (i.e. inflation expectations at 4 years minus those at 1-year horizon) is related to an increase in expected investments - after controlling for business sentiment, macroeconomic outlook, and financing conditions. We estimate that a 1% wedge between the 4-year and the 1-year ahead expected inflation is associated with a 0.8% increase in the probability of increasing investments.

In order to shed light on this last finding, we explore whether firms perceived long-term inflation to be good or bad. We find that an increase in the slope of the term structure is demand-driven, hinting at the fact that firms perceive long-term inflation as a good shock.

Four channels may explain the positive relationship between the slope of inflation expectations' curve and investments: (1) increase in expected demand, (2) decrease in supply of input goods, (3) improvement in financing conditions, (4) decrease in perceived cost of capital. We find evidence of channels (1), (2), and (3). Nonetheless, after controlling for the first three channels, the slope is still significant for investments. Another channel must exist and it is the perceived cost of capital, we claim.

Finally, to dispel any doubts that we are capturing real rather than nominal changes in investments, we perform two robustness checks. First, we restrict the sample to firms that claim to keep employment unchanged or to increase it, and we still find a positive correlation between the slope and investments. Then, by recurring to balance sheet data, we employ two variables as proxies of real change in investments, i.e. the annual change of tangible investments and the annual change of intangible investments, both as ratios of firm's size. Despite intangible investments not showing any significant relation with long-term expectations, tangible investments do positively move with the slope. This result is in line with the logic that tangible investments tend to be less reversible than intangible ones, hence they are more influenced by considerations on long-horizon inflation.

Literature review. Our paper builds on two main strands of literature. First, we refer to the existing studies that use survey data to characterise formation mechanisms of firms' inflation expectations. Building on Coibion et al. (2018) that describe novel facts about firms' inflation expectations, previous works have provided important empirical evidence by investigating measurement, determinants and economic implications of expectations. Weber et al. (2022) and Candia et al. (2023) document some key facts across surveys for different countries. More recently, Weber et al. (2023) provide new cross-country evidence on the determinants of inflation expectations in a context of relatively high inflation. Our focus is not on the determinants of the *level* of inflation expectations at different horizons, but rather on the formation of the entire *inflation curve* of these expectations, with the scope of understanding the properties embedded along the term structure. While the inflation curve of market participants and of professional forecasters has already been investigated (see, for example, Andrade et al., 2016, Goldstein and Gorodnichenko, 2022 and Crump et al., 2023), we still have limited knowledge on firms' perspective. A first attempt has been made by Mello et al. (2023) who use survey data on Uruguayan firms, but with the relevant shortcoming of disposing of only two forecast horizons. We instead can exploit four different horizons (short, medium, and long), a unique feature in the field.

Second, we refer to the literature that examines how firms' inflation expectations affect their economic decisions. Coibion et al. (2020) use SIGE data to provide a comprehensive view of the causal effects of an exogenous variation in inflation expectations on firms' economic decisions, such as their pricing, demand for credit, employment and capital. Ropele et al. (2022) focus on the relationship between inflation expectations and borrowing decisions, while Ropele et al. (2023) document misallocations of resources in the economy. In contrast, we focus on how the inflation curve derived from firms' expectations affects their expected investment decisions. Only a few studies have shown how inflation expectations interact with investment decisions.[1] Among those, Grasso and Ropele (2018) examine the relationship between firms' inflation expectations at 1 year and their investment plans using Italian business survey data over the period 2012-2016. Compared to theirs, our paper differs along two dimensions. First, despite considering also the level of inflation expectations at 1 year, our focus is the slope of inflation expectations' curve. Second, we use a sample period in which inflation expectations and the slope move considerably, and thus we are able to exploit this variation to better study real effects.

The rest of the paper is organized as follows. In Section 2 we present an overview of survey and balance sheet data employed in the empirical analysis. Section 3 focuses on formation mechanisms and the related findings. In Section 4 we expose our main finding on

[1] One of the building blocks in economics is that expectations influence decisions. In the past, the attention has tended to focus on the role of other types of expectations on investment and not particularly on inflation beliefs. One example is Gennaioli et al. (2016) that use micro-data from US to show how corporate investment plans as well as actual investment are well explained by Chief Financial Officers' expectations of earnings growth.

investment decisions, and in Section 5 we provide a deeper discussion of underlying drivers. Section 6 contains robustness checks of investment-related findings. Section 7 concludes. The (online) appendix contains omitted statistics on the sample covered in SIGE, and an example of the questionnaire.

2 Data Description

In this section we provide a description of the two databases employed in this study. We rely on two different databases which contain the same firms' identifier, and hence can be easily linked. The first one is the Survey of Inflation and Growth Expectations (SIGE), which allows us to accurately measure inflation expectations and their expected decisions. This survey conducted by Bank of Italy at a *quarterly* frequency. The second is the Company Accounts Data Service (CADS), which is a proprietary database owned by Cerved Group S.p.A., a leading information provider in Italy. CADS contains detailed balance sheet information, such as liquidity, leverage, and debt, at a *yearly* frequency. Due to the lower frequency of CADS, we mainly rely on this database to provide robustness checks of the results found in SIGE.

2.1 SIGE

SIGE has been run quarterly by the Bank of Italy since 1999 on a nationally-representative sample of firms operating in manufacturing, (non-financial) services, and construction sectors with at least 50 employees. The number of participating firms has increased over time, reaching around 1500 in recent years. The composition of the sample is stratified according to three characteristics: sector, size class in terms of number of employees, and geographical area based on firm's administrative headquarters.[2]

The survey collects detailed information on firms' beliefs about aggregate economic variables as well as on their own business conditions.[3] What makes this survey powerful and well suited to the scope of our research is the inclusion of four different forecast horizons for the question on expected inflation. Indeed, participating firms are asked to provide their inflation forecasts at six, twelve, twenty-four and between thirty-six and sixty months ahead.[4]

[2]For additional information, Figure A1 in the Appendix shows the number of firms participating in each survey and Figure A2 shows the composition of the sample by firm characteristics.

[3]An example of the questionnaire is provided in the Appendix.

[4]The survey includes a randomised controlled trial (RCT) in which firms are divided in groups and are provided specific information treatment on realised inflation and on the ECB's inflation target (see e.g. Coibion et al., 2020 and Bottone et al., 2022). In this paper we do not specifically focus on the effects of the

The wording of the question is as follows:

> "*What do you think consumer price inflation in Italy, measured by the 12-month change in the harmonized index of consumer prices, will be in [6 months, 1 year, 2 years, on average between 3 and 5 years]?*".

The availability of these expectations varies depending on the horizon considered: those at 12 months have been available since the very beginning of the survey, while those at 24 months were introduced in 2009; those at 6 months in 2010Q4 and those between 3 and 5 years in 2014Q1. Given our interest in examining the entire term structure, we restrict our sample period to the years 2014Q1-2023Q4.

Figure 1 hints at two main characteristics of the behaviour followed by these expectations. First, firms' beliefs about aggregate inflation closely follow realised inflation. This fact has already been documented in other studies using SIGE data (see, for example, Coibion et al., 2020 and Bottone et al., 2022) and it also holds true in a context of higher inflation, such as in the period 2022-23. Second, expectations at different horizons tend to move together over time. This point has received less attention in the literature due to the scarcity of the data and will be explored further in the rest of the paper.

[FIGURE 1 ABOUT HERE]

2.1.1 What we measure in SIGE

In this context, it is important to clarify what our measures of inflation expectations capture. We define $F_t(\pi_6)$ as the inflation expectation in 6 months as measured by the 12-month change in HICP. The same is true for $F_t(\pi_{12})$, $F_t(\pi_{24})$, and $F_t(\pi_{48})$ which respectively represent inflation expectations at 1 year, at 2 years, and the average at 3-5 years.

In considering these measures, two possible issues emerge. First of all, $F_t(\pi_6)$ does contain not only expectations between t and $t+6$ but also observed inflation between $t-6$ and $t-1$. The second issue is that $F_t(\pi_6)$ and $F_t(\pi_{12})$ overlap. Indeed, both $F_t(\pi_6)$ and $F_t(\pi_{12})$ contain, at time t, inflation expectations between t and $t+6$.

Our solution is to not correct the raw variables. Instead, we acknowledge the measurement issues and relegate $F_t(\pi_6)$ to descriptive analyses, while $F_t(\pi_{12})$ is employed as the measure representing short-term inflation expectations in the rest of the paper.

Another important point to be made pertains how expectations about aggregate inflation relate to expectations about firms' own prices. Even if the literature shows that expectations on aggregate inflation do affect firms' choices (see e.g. Coibion et al., 2020 and Ropele et al.,

RCT since its effect appears strong on the *level* of inflation expectations but it does not seem to alter the formation mechanism of the inflation curve.

2022), one might wonder whether expectations about own selling prices and on input prices are the ones that should matter the most for their economic decisions. Unfortunately, SIGE contains rich data on the term structure of expectations for aggregate inflation but not for firms' input and selling prices. Indeed, these expectations are only available for the 12-months horizon and in the case of input prices only starting from 2016Q3.[5]

[FIGURE 2 ABOUT HERE]

Figure 2 shows the dynamics of these expectations over time by sector. It can be seen that all three measures move quite closely together until the end of 2021. Then, the outbreak of Russian invasion of Ukraine, which was accompanied by an energy crisis that led to a sharp rise in oil and gas prices, drove a large increase in expected input prices.[6] The magnitude of the increase in price expectations was heterogeneous across sectors depending on the energy exposure of the activity in that particular sector: it was indeed higher in manufacturing and construction, while it was more muted for firms in the services sector.

Overall, Figure 2 provides an empirical support to the idea that firms' expectations about aggregate inflation move together with their expectations about input and output prices and are therefore a key component in their economic decisions.

2.2 CADS

CADS is a proprietary database owned by Cerved Group S.p.A., a leading information provider in Italy. This data source contains detailed information on balance sheet and income statements for almost all Italian limited liability companies since 1993. The information is drawn from official data recorded at the Italian Registry of Companies and from financial statements filed with the Italian Chambers of Commerce. Each company submits its financial statement at an *annual* frequency. More importantly for our scope, CADS collects yearly balance sheet information on various asset and liability items, such as fixed assets, cash, inventories, financial debt, and net equity.

We focus on a subset of variables which can provide helpful insights on the interaction between inflation expectations and investments. Specifically, we consider total assets, ratio of long-term debt over total liabilities, and a categorical variable equal to 1 if the firm has ever issued bonds since it becomes part of the database. Furthermore, CADS features two

[5] Riggi and Tagliabracci (2022) use SIGE to study how these expectations affect firms' pricing decisions and to shed light on the presence of different channels for the formation of firms' prices.

[6] In this respect, Ropele and Tagliabracci (2024) use SIGE data to document the immediate reaction of firms' beliefs to the Russian invasion of Ukraine. In particular, it shows that firms revised upward their inflation expectations and their own expected price changes and became more pessimistic about the general macroeconomic outlook and their business conditions.

distinct nominal variables for yearly changes in tangible fixed investments, $\Delta I^{T}_{i,t-1,t}$, and in intangible fixed investments, $\Delta I^{InT}_{i,t-1,t}$. By taking the ratio to total assets at time t, we obtain *Ratio* $\Delta I^{T}_{i,t-1,t}$, and *Ratio* $\Delta I^{INT}_{i,t-1,t}$, real variables that capture changes in investments proportional to firm's size.

3 Formation Mechanisms along the Curve

3.1 Empirical Evidence

Previous literature has ignored differences across inflation expectations at various horizons. This has often been due to lack of data [7]. More interestingly, before the 2022-23 inflationary trends, inflation expectations have been fairly similar across forecast horizons. Nonetheless, in Figure 1 we document that, as inflation rises, expectations start diverging. Forecasts at shorter-horizons are more reactive to inflation dynamics than forecasts at longer horizons. At the 12% inflationary peak in the third quarter of 2022, 6-months expectations were at 9% while 48-months expectations sightly exceeded 5%.

The inflation expectation curve, which represents the relationship between the percent of expected inflation and forecast horizons, provides a similar insight. Figure 3 displays an inversion in the curve at the kickoff of the inflationary phase. Before 2022, forecasts at 6-months horizons have been in a neighborhood of 1% and forecasts at longer horizons have been converging towards 2%, despite interestingly staying well below the ECB inflation target. After 2022 instead short-term forecasts show a substantial increase and long-run forecasts stand between 4% and 5%, hinting at firms' disbelief in a quick reversion to a lower inflation environment.

[FIGURE 3 ABOUT HERE]

To better understand how forecasts at different horizons change over time, we provide a synthetic measure, "slope", of the divergence between long-term and short-term forecasts. The slope, computed as difference between inflation forecasts at 48 months and at 12 months, move in the opposite direction of inflation (Figure 4).

[FIGURE 4 ABOUT HERE]

[7] Angeletos et al. (2020) clearly mention that their intention to analyse longer forecast horizon is curbed by data limitations.

3.2 Findings

3.2.1 Extrapolation for long-horizons

We follow Woodford (2001) in defining a standard noisy information framework where firms face imperfect signals about realized inflation and remove the noise trough a Kalman filter. After observing the signal, agents first form forecasts regarding inflation at 12 months. Then they compute longer horizon predictions by iterating on the shorter-horizon forecasts. We assume that actual inflation follows an AR(1) process with persistence parameter ρ. If firms' expectation are FIRE, persistence in expectations should reflect persistence in inflation. In other words, if we regress inflation forecast at time horizon $h+1$ on inflation forecast at horizon h, we should retrieve a coefficient β_h which is equal to ρ for all the forecast horizons h.

In formula, we assume that inflation follows an AR(1) process

$$\pi_{t+1} = \rho\pi_t + \epsilon_t \tag{1}$$

Agents form 12-months inflation expectations as

$$F_{it}(\pi_{t+12}) = (1-\rho)\bar{\pi} + \rho\pi_t + \epsilon_{it} \tag{2}$$

where ρ is the persistence coefficient of actual inflation and $\bar{\pi}$ is long-term inflation.

Under the assumption that forecasts follow an AR(1), inflation expectations at 24 months and at 48 months are given by

$$\begin{aligned} F_{it}(\pi_{t+24}) &= (1-\rho)\bar{\pi} + \rho F_{it}(\pi_{t+12}) + \epsilon_{it} \\ F_{it}(\pi_{t+48}) &= (1-\rho)\bar{\pi} + \rho F_{it}(\pi_{t+24}) + \epsilon_{it} \end{aligned} \tag{3}$$

In other words, long-horizon forecasts can be retrieved by iterating shorter-horizon forecasts under the joint assumptions of (a) inflation following an AR(1) process and of (b) firms' expectations being FIRE.

By exploiting the richness of our expectation measures, we can analyse this null hypothesis.[8] We perform the following regressions:

$$\begin{aligned} F_{it}(\pi_{t+12}) &= \alpha_{12} + \beta_{12}\pi_t + \epsilon_{it} \\ F_{it}(\pi_{t+24}) &= \alpha_{24} + \beta_{24}F_{it}(\pi_{t+12}) + \epsilon_{it} \\ F_{it}(\pi_{t+48}) &= \alpha_{48} + \beta_{48}F_{it}(\pi_{t+24}) + \epsilon_{it} \end{aligned} \tag{4}$$

[8]We remit the formal test to future versions of this project.

Differently from forecasts at 12 and 24 months for which β_h captures an "annual" persistence coefficient, for 48-months expectations the coefficient is computed on an average forecast horizon of 2 years. Hence, in order to obtain an annualized coefficient, we need to correct β_{48} in the following way:

$$\hat{\beta}_{48} = (\beta_{48})^{1/2} \tag{5}$$

Under the null, we should find that:

$$\beta_{12} = \beta_{24} = \hat{\beta}_{48} = \rho \tag{6}$$

Furthermore, for each forecast horizon h we can obtain the implied long-run inflation as

$$\bar{\pi}_h = \frac{\alpha_h}{1 - \beta_h} \tag{7}$$

From Equation (6), it follows that under the null

$$\bar{\pi}_{12} = \bar{\pi}_{24} = \hat{\pi}_{48} = \bar{\pi} \tag{8}$$

where

$$\hat{\pi}_{48} = \frac{\alpha_{48}}{1 - \hat{\beta}_{48}}$$

[TABLE 1 ABOUT HERE]

Table 1 reports the results of regression (4). The persistence coefficient for inflation expectations at 12 months is 0.6 and significant at the 1% confidence level (column 1). As it is evident from columns (2) and (3), the longer the forecast horizon the greater the coefficient.

Given that β_{12} is 0.6, β_{24} is 0.8, and $\hat{\beta}_{48}$ equals $(0.846)^{1/2} = 0.91$, equation (6) is clearly violated. In other words, persistence coefficients are not the same across forecast horizons.

In a similar fashion we can show that implied long-run inflation differs across forecast horizons. Indeed, $\bar{\pi}_{12} = 1.61$, $\bar{\pi}_{24} = 1.66$, and $\bar{\pi}_{48} = 3.45$, results which violate equation (8).

Despite having not yet tested the null hypothesis, these findings support a joint rejection of (a) inflation expectations following an AR(1) process and of (b) inflation expectations being FIRE. The joint nature of the null hypothesis opens the door to a dual interpretation. On one hand, if inflation violates the AR(1) process, firms can still have Full Information Rational Expectations. Indeed, in making inflation forecasts firms do not use an AR(1) model but rather a model with a temporary and a long term components, coherent with the logic that inflation follows a moving average process with time-varying parameters (see e.g. Stock and Watson, 2007).

An alternative explanation is that, despite inflation following an AR(1) process, expectations do not, and hence violate FIRE as claimed by Goldstein and Gorodnichenko (2022). The intuition behind this story is simple: the shorter the forecast horizon, the more firms rely on current information at their disposal. Instead, in making forecasts at longer horizons, they rely more and more on the AR(1) prediction model.

3.2.2 Overreaction at long forecast horizons

After having shown evidence in support of a joint rejection of FIRE and AR(1) assumptions, we try to analyse the two assumptions separately.

Do firms expect inflation to be more or less persistent than it happens to be in reality? If so, is this overreaction or under-reaction the same for all forecast horizons? Overreactions as well as under-reactions would imply that FIRE are violated.

Second, what process does inflation follow? Is it an AR(1)?

In order to address these questions, we regress inflation expectations at 12, 24, 48 months on actual inflation as follows

$$F_{it}\pi_{t+h} = \alpha_i + \beta_h \pi_t + \epsilon_{it} \tag{9}$$

where t is the time at which the survey is administered and $h = 12, 24, 48$ months is the forecast horizon. In a similar fashion, we regress realised inflation at time $t + h$ on realized inflation at t for each h. As measures of realized inflation, we employ 12-month variation of HICP

$$\pi_{t+h} = \beta_h \pi_t + \epsilon_{t+h} \tag{10}$$

where $h = 12, 24, 48$ months.

[FIGURE 5 ABOUT HERE]

The left-hand side plot of Figure 5 shows coefficients β_h for expectations and HICP that we obtain from regressions (9) and (10). It clearly emerges that coefficients for expectations are lower than coefficients for realized inflation when considering 12-months forecasts. The opposite is true for long-run forecasts, with horizon greater than one year. This finding indicates that firms, in the short-term, expect inflation to be more temporary than it turns out to be. On the contrary, they lack in acknowledging that inflation does in fact mean-revert in the long-run. In other words, inflation expectations under-react at the short horizons and overreact at long horizons.

On the right-hand side of Figure 5, we plot the coefficients that inflation expectations and HICP would have, were they AR(1) processes. By comparing the dashed line on the right plot to the solid line on the left, it emerges that HICP does not follow an AR(1) process.

In conclusion, we gained evidence that is not one or the other assumption which drives the joint rejection of the null hypotheses. Indeed, the rejection is due to the fact that inflation expectations are not-FIRE *and* do not follow an AR(1) process, since inflation does not.

4 Inflation Curve and Real Effects

In this section we analyse how the term structure of inflation expectations is related to firms' investment decisions. Our goal is to provide evidence that, along with short-term expectations, long-term expectations matter.

4.1 Specification

We run different specifications of the following regression with firm i, quarter t, sector s fixed effects

$$\begin{aligned} E_{it}(\Delta I_{i,t,t+12}) &= \alpha_i + \beta_t + \sigma_s \\ &+ \gamma(F_{it}\pi_{t+12}) + \delta(F_{it}\pi_{t+48} - F_{it}\pi_{t+12}) \\ &+ X_{it} + \epsilon_{it} \end{aligned} \tag{11}$$

where $E_{it}(\Delta I_{i,t,t+12})$ is expected change in *nominal* expenditure on fixed investment in one year, $F_{it}\pi_{t+12}$ is expected inflation in one year, $F_{it}\pi_{t+48} - F_{it}\pi_{t+12}$ is computed as inflation expected on average between 3 and 5 years minus inflation expectations at 1 year - what we call "slope", X_{it} are controls for firms' liquidity and credit access, business sentiment, and expected macro-economic conditions. The inclusion of these controls allows to rule out any endogeneity concerns which may bias our results. Typical concerns are, for example, that optimism regarding macroeconomic outlook may increase inflation expectations, or that more sophisticated firms have better forecasting ability. Our controls are able to address a wide range of endogenous links, such as those mentioned above. Shocks are clustered at firm×quarter level. We also run a specification with sector×quarter clusterization, and we obtain robust results.

In this context, it is important to provide more details about our dependent variable, $E_{it}(\Delta I_{i,t,t+12})$. In SIGE, firms are asked what they expect *nominal* expenditure on (tangible and intangible) fixed investment will be in the current year with respect to the previous one. Firms' answer takes values between 1 (much lower) to 5 (much higher), where 3 stands for unaltered expected investments. A clear concern is that firms are asked for a *nominal* value. Hence, a positive correlation between $E_{it}(\Delta I_{i,t,t+12})$ and $F_{it}\pi_{t+12}$ may be simply mechanic. In stressing that our goal is not to evaluate the impact of short-term expectation and investments but rather to understand the role of long-term expectations, we claim that finding a positive correlation is a sanity check. Indeed, when inflation expectations are high, nominal expected investments should be mechanically higher. Furthermore, we perform regression (11) with *real* balance sheet variables (Section 6). We do find robust results.

4.2 Main Results

Table 2 reports results of equation (11) for different sets of controls and type of clusterization. Column (1) includes only firm and time fixed effects. For an increase of 1% in the difference between long and short term inflation expectations, expected investments in one year increase by 1.72%. The coefficient is significant at the 1% confidence level. In other words, when firms forecast inflation in 3-5 years to be higher than inflation in 1 year, they expect to increase investments within the same year. As a sanity check, we also observe that expected investments increase with one-year inflation expectations.

[TABLE 2 ABOUT HERE]

Column (2) adds controls for firms' liquidity and credit access. In SIGE, firms are indeed asked whether they expect their liquidity in three months to be sufficient, and whether their current access to credit has improved with respect to three months ago. The coefficient become 1.6%, still significant at the 1% confidence level.

In column (3), we include three more variables that are indicative of business sentiment and expected macro-economic outlook, namely (a) whether firms expect their own business conditions to improve in the next three months, (b) in the next three years, and (c) whether they perceive that Italian general economic conditions have improved in the last three months. The coefficient for the slope slightly decreases again to 1.39% but remains significant at the 1% level. It is important to notice that by adding controls for liquidity and credit access, the explanatory power reaches its peak of 24.8%. The inclusion of more controls in the other columns will not push the adjusted R^2 over this value.

Column (4) adds sector fixed effects to the specification in column (3). Still significant at the 1% confidence level, the slope coefficient increases to 1.40%. Clustering standard errors at the sector×quarter level in column (5) does not alter our estimates.

[TABLE 3 ABOUT HERE]

To provide our results with deeper economic insights, we analyse the *probability* of increasing investments. In particular, we create a dummy equal to 1 if firm expects to increase investments in the next year and equal to 0 otherwise, which we employ as dependent variable in equation (11). From column (6) of Table 3, it emerges that, after controlling for liquidity, credit access, business sentiment, and expected macro-economic outlook, still an increase in 1% of the slope is associated with an increase of 0.8% in the probability of investing. In summary, we tried to rule out any other possible drivers of an increase in investments and to show that long-run inflation expectations *per se* play a role in determining firms' decisions.

5 Understanding the Results on Investments

Why do firms expect to increase investments? Is it because they foresee an increase in demand, or do they rather forecast a negative shock in supply, or both? Do financing conditions play a role? After taking into account these traditional channels, is there still a role played by long-term inflation expectations?

In this Section, we propose four channels that can explain the positive relationship between long-term inflation expectations and investments, namely (1) increase in demand, (2) decrease in supply of inputs, (3) improvement in financing conditions, (4) decrease in perceived cost of borrowing.

5.1 Good or Bad Inflation?

In line with the recent work of Cieslak and Pflueger (2023), we first try to understand whether Italian firms perceived recent inflationary dynamics to be demand- or supply-driven. Clearly, increasing investments are compatible with both the channels. A firm may decide to boost investments both because it expects an increase in demand of its own goods and because it forecasts a decrease in supply of inputs.

We first aim at understanding the drivers of inflation expectations at one-year by employing SIGE's questions regarding factors which influence firms' prices in the next 12 months, namely (a) aggregate demand, and (b) intermediate inputs. We run different specifications of the following firm i and time t fixed effects equation

$$F_{it}(\pi_{12}) = \alpha_i + \theta_t + \beta F_{it}(DPR_{it+12}) + \gamma F_{it}(IICT_{it+12}) + \epsilon_{it} \tag{12}$$

where DPR_{it+12} and $IICT_{it+12}$ capture whether aggregate demand and intermediate inputs, respectively, are expected to decrease or increase firms' prices in the next 12 months. The variables take value between -3, for a steep decrease, and +3, steep increase.

[TABLE 4 ABOUT HERE]

Panel A of table 4 reports estimates of equation (12). In column (1), where the entire sample in employed, we can see that an increase of 1% in expected aggregate demand is reflected in a 1.98% increase in inflation expectations at 1 year (significant at the 5% confidence level), while a 1% increase in input costs is correlated with a 8.95% rise in inflation expectations. Hence, we find that it is a matter of both good and bad inflation in line with Candia et al. (2023).

Nonetheless, the heterogeneity across sectors is striking. Manufacturing firms have perceived inflation to be mainly driven by an expected increase in input costs, i.e. supply-driven (column (2)). For the construction sector, column (4) shows the opposite narrative: an increase in aggregate demand is what matters for higher inflation expectations, significant at the 10% confidence level. Instead, expectations about input costs are not significant. Finally, for the services sector (column (3)) both demand and supply channels are significantly correlated with inflation expectations. A more granular classifications of the firms contained in the services sector may help to shed further lights on what firms actually perceived inflation to be good or bad.

In order to understand whether an increase in the slope of inflation expectations' term structure is due to a demand or to a cost-push shock, we use the slope as dependent variable in regression (12). In formula

$$F_{it}(\pi_{48}) - F_{it}(\pi_{12}) = \alpha_i + \theta_t + \beta F_{it}(DPR_{it+12}) + \gamma F_{it}(IICT_{it+12}) + \epsilon_{it} \tag{13}$$

Panel B of table 4 reports the results. An increase in the wedge between 4-year and 1-year inflation expectations is associated with higher expected aggregate demand but not with higher inputs' prices (column (1)). Interestingly, firms that expect that intermediate inputs will drive up their own prices forecast that inflation in the long run will be lower than inflation at one year. In other words, firms expect the cost-push shock to only have a temporary effect on inflation, which will not last beyond the year. Across sectors, our results remain significant for manufacturing firms (column (2)), while the coefficients for aggregate demand are not significant for the services and constructions sectors (column (3)-(4)).

In conclusion, while inflation at 1-year is perceived to be either good or bad depending on the sector, long-term inflation is demand-driven and hence good.

5.2 Aggregate Demand, Inputs Supply and Financing channels

Once explored the possible drivers of inflation expectations, we try to better understand the link between inflation expectations and investments. We estimate again equation (11) using a set of specifications, each controlling for a given channel.

[TABLE 5 ABOUT HERE]

Column (1) of Table 5 reports the baseline specification without controls. Column (2) includes expected aggregate demand at 3 months. The explanatory power of the regression increases from 0.209 to 0.224, hinting at the role played by demand in shaping investment decisions. When firms expect aggregate demand to decrease (increase) of 1%, the average decrease (increase) in investments is 27.8% (13.9%). The coefficients are significant at the 1% confidence level.

Column (3) aims at exploring the "decrease in supply" channel. It adds a variable which captures whether the cost of raw materials is expected to result in an increase in firms' prices in 12 months. Rather than employing input cost (IICT in equation (12)), we chose this variable in order to preserve the sample size. Indeed, IICT was introduced in SIGE only in 2015. Nonetheless, we acknowledge the shortcomings of this measure: for retailers of raw materials, an increase in the price of raw materials coincides with an increase in selling prices rather than in input costs. The positive and significant coefficients would well suit the retailer's story: when prices of raw materials increase, the retailer experiences a "good" inflation, and aims at boosting investments. Instead, we entertain the assumption that raw materials are a good proxy of input goods, and we aim at telling an alternative story: expecting higher input prices, firms decide to internalize a part of the production chain. To do so, they increase investments. The estimates of column (3) are compatible with both the narratives. Table 6 shows that the same results hold when we employ inputs rather than prices of raw material.

[TABLE 6 ABOUT HERE]

Finally, the last column shows that firms' credit access is positively related to expected investments. A finding that hints at the importance of the financing channel: having access to credit impacts firms' expectations on whether they will increase investments.

The takeaway of Table 5 is that aggregate demand as well as supply of intermediate inputs evidently influence investment decisions. Furthermore, credit access is unsurprisingly pivotal for investments. Nonetheless, after controlling for these channels, the effect of long-term inflation expectations - captured by the slope - remain strong and significant. These findings support our prior that another driver, along with the classic demand, supply, and financing channels, must exist. This is the perceived cost of capital, we claim.

5.3 Perceived Cost of Capital

In this section, through an easy example inspired by the classical corporate finance literature, we convey the meaning of what we call "perceived cost of capital" channel.

There is an economy with two discrete periods, $t = 1, 2$. Consider a firm that decides whether to invest in a project, which has an initial cost k. In period 2, the return from the investment is

$$k^\theta + (1 - \delta)k \tag{14}$$

where $\theta < 1$ are the returns to scale, and $\delta < 1$ is the rate of obsolence of capital. The discount rate between period 1 and 2 is r.
The net present of the investment is NPV

$$V(r) = \frac{1}{1+r}(k^\theta - (r + \delta)k) \tag{15}$$

Firm chooses k in order to maximize the net return from the investment

$$\max_k \left\{ -k + \frac{1}{1+r}(k^\theta - (r + \delta)k) \right\} \tag{16}$$

Solving the optimization problem, the optimal capital is

$$k^* = \left(\frac{\theta}{r + \delta} \right)^{\frac{1}{1-\theta}} \tag{17}$$

Assume that firm employs real discount rates to compute $V(r)$. The real discount rate is defined as

$$r = r^\$ - E(\pi) = r^\$ - F(\pi) \tag{18}$$

where $r^\$$ is the nominal rate, and $F(\pi)$ are inflation expectations.
By substituting equation (18) into equation (17), we can easily show that

$$\frac{\partial k^*}{\partial F(\pi)} > 0 \tag{19}$$

In words, the higher the inflation expectations, the lower the perceived cost of capital, and the higher the optimal investments.

So far, we intentionally have not specified $F(\pi)$. Following our results in Section 3, $F(\pi)$ are likely to be not-FIRE. Furthermore, one may wonder what forecasting horizon characterizes $F(\pi)$. As shown by Table 2, inflation forecasts at long horizons enter firms' decision model. Intuitively, if a project pays out in 4 years, firms try to forecast what the inflation will be at the payoff-relevant time.

5.4 Modigliani-Cohn money illusion

Modigliani and Cohn (1979) state the influential theory of "money illusion": "in inflationary periods, investors capitalize equity earnings at a rate that parallels the nominal interest rate, rather than the economically correct real rate". In terms of real effects, their theory predicts that in period of high inflation firms should invest less. Clearly, our findings cannot be explained by a "money illusion" channel in that they contradict the main prediction of the theory.

As it is shown by the example in Section 5.3, our findings are reconcilable with firms capitalizing cash flows at a *perceived* real rate. Indeed, our real rate does not need to be the correct one, as mentioned by Modigliani and Cohn (1979), and does not need to be unique across firms. Each firm has a specific real rate deriving from its inflation expectations (equation (18)). Since expectations are likely not-FIRE, they do differ across firms and real rates do differ accordingly.

6 Robustness Checks

As pointed out at the beginning of the section, $E_{it}(\Delta I_{i,t,t+12})$ represents the change of investments' *nominal* expenditure. The fact that our dependent variable concerns a nominal variable may cast doubts on the validity of our results. The most straightforward solution would be to deflate by inflation the expected change in investments. Nonetheless, due to the categorical nature of $E_{it}(\Delta I_{i,t,t+12})$ this is not an attainable solution.

[TABLE 7 ABOUT HERE]

To address this issue, we perform the same regression as in table 5 but we restrict the sample to only firms that claim that will keep unaltered or increase their workforce. Indeed, in a traditional New-Keynesian model, in response to lower inflation, firms should decrease both employment and capital. By excluding firms that plan to decrease employment, we are left with all the firms that decided to keep unaltered or increase a *real* variable, which is employment. Hence, we claim that we are also left with a good proxy of *real* investments. Table 7 points out that results in Section 4.2 are robust to specifications of investments in *real* terms.

[TABLE 8 ABOUT HERE]

Furthermore, we resort to balance sheet variables from CADS. We estimate equation (11) using as dependent variables (1) change in tangible investments divided by total assets, *Ratio* $\Delta I^{T}_{i,t-1,t}$, (2) change in intangible investments divided by total assets, *Ratio* $\Delta I^{INT}_{i,t-1,t}$. The ratios are winsorised at the 1 and 99 percentiles. Table 8 reports the estimates of equation 11 with *Ratio* $\Delta I^{INT}_{i,t-1,t}$ and *Ratio* $\Delta I^{T}_{i,t-1,t}$ as dependent variables. Column (2) shows that for an increase in 1% of the slope, tangible investments increase by 0.06% of the firm's size. The coefficient is significant at the 1% confidence level. This result is in line with the logic that tangible investments tend to be less reversible than intangible investments and hence they should be impacted by long-horizon inflation expectations.

7 Conclusions

Firms make mistakes in forecasting inflation at long-horizons. Indeed, not only inflation expectations,- likewise realised inflation, do not follow an AR(1) process. Also, inflation expectations overreact at long forecast horizons. This result is relevant in that long-term inflation expectations impact investment decisions. A 1% wedge between the 4-year and 1-year ahead expected inflation is associated with a 0.8% increase in the probability of investing. More work has to be done in nailing the channels. Developing an asset pricing model centered on the covariance between the stochastic discount factor and long-term inflation expectation may provide the paper with a solid theoretical framework. Furthermore, a structural analysis aimed at exploring the impact of biased long-term inflation expectations on investments may enrich the study with welfare considerations. We hope to tackle these questions in future research.

References

Afrouzi, H., S. Y. Kwon, A. Landier, Y. Ma, and D. Thesmar (2023): "Overreaction in Expectations: Evidence and Theory," *The Quarterly Journal of Economics*, 138, 1713–1764.

Andrade, P., R. K. Crump, S. Eusepi, and E. Moench (2016): "Fundamental disagreement," *Journal of Monetary Economics*, 83, 106–128.

Angeletos, G.-M., F. Collard, and H. Dellas (2020): "Business-cycle anatomy," *American Economic Review*, 110, 3030–3070.

Bernanke and O. Blanchard (2023): "What caused the US pandemic-era inflation?" *Hutchins Center Working Papers*.

Bernanke et al. (2007): "Inflation expectations and inflation forecasting," in *Speech at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts*, vol. 10, 11.

Bottone, M., A. Tagliabracci, and G. Zevi (2022): "Inflation expectations and the ECB's perceived inflation objective: Novel evidence from firm-level data," *Journal of Monetary Economics*, 129, S15–S34.

Candia, B., O. Coibion, and Y. Gorodnichenko (2022): "The Macroeconomic Expectations of Firms," NBER Working Papers 30042, National Bureau of Economic Research.

——— (2023): "The macroeconomic expectations of firms," in *Handbook of Economic Expectations*, Elsevier, 321–353.

Cieslak, A. and C. Pflueger (2023): "Inflation and asset returns," *Annual Review of Financial Economics*, 15, 433–448.

Coibion, O., Y. Gorodnichenko, and S. Kumar (2018): "How Do Firms Form Their Expectations? New Survey Evidence," *American Economic Review*, 108, 2671–2713.

Coibion, O., Y. Gorodnichenko, and T. Ropele (2020): "Inflation Expectations and Firm Decisions: New Causal Evidence," *The Quarterly Journal of Economics*, 135, 165–219.

Crump, R. K., S. Eusepi, E. Moench, and B. Preston (2023): "The term structure of expectations," in *Handbook of Economic Expectations*, ed. by R. Bachmann, G. Topa, and W. van der Klaauw, Academic Press, 507–540.

Gennaioli, N., Y. Ma, and A. Shleifer (2016): "Expectations and Investment," *NBER Macroeconomics Annual*, 30, 379–431.

Goldstein, N. and Y. Gorodnichenko (2022): "Expectations Formation and Forward Information," NBER Working Papers 29711, National Bureau of Economic Research.

Gorodnichenko, Y., R. Melnick, and A. Kutai (2023): "Information and the Formation of Inflation Expectations by Firms: Evidence from a Survey of Israeli Firms," Tech. rep., National Bureau of Economic Research.

Grasso, A. and T. Ropele (2018): "Firms' inflation expectations and investment plans," Temi di discussione (Economic working papers) 1203, Bank of Italy, Economic Research and International Relations Area.

Kumar, S., Y. Gorodnichenko, and O. Coibion (2023): "The effect of macroeconomic uncertainty on firm decisions," *Econometrica*, 91, 1297–1332.

Mello, M., J. Ponce, and J. P. Medina (2023): "The term structure of firms' inflation expectations," Documentos de trabajo 2023004, Banco Central del Uruguay.

Modigliani, F. and R. A. Cohn (1979): "Inflation, rational valuation and the market," *Financial Analysts Journal*, 35, 24–44.

Riggi, M. and A. Tagliabracci (2022): "Price rigidities, input costs, and inflation expectations: understanding firms' pricing decisions from micro data," Questioni di Economia e Finanza (Occasional Papers) 733, Bank of Italy, Economic Research and International Relations Area.

Ropele, T., Y. Gorodnichenko, and O. Coibion (2022): "Inflation Expectations and Corporate Borrowing Decisions: New Causal Evidence," Working Paper 30537, National Bureau of Economic Research.

——— (2023): "Inflation Expectations and Misallocation of Resources: Evidence from Italy," Tech. rep., National Bureau of Economic Research.

Ropele, T. and A. Tagliabracci (2024): "Perceived economic effects of the war in Ukraine: survey-based evidence from Italian firms," *Applied Economics Letters*, 31, 275–280.

Stock, J. H. and M. W. Watson (2007): "Why has US inflation become harder to forecast?" *Journal of Money, Credit and banking*, 39, 3–33.

Weber, M., B. Candia, T. Ropele, R. Lluberas, S. Frache, B. H. Meyer, S. Kumar, Y. Gorodnichenko, D. Georgarakos, O. Coibion, G. Kenny, and J. Ponce (2023): "Tell Me Something I Don't Already Know: Learning in Low and High-Inflation Settings," NBER Working Papers 31485, National Bureau of Economic Research.

Weber, M., F. D'Acunto, Y. Gorodnichenko, and O. Coibion (2022): "The Subjective Inflation Expectations of Households and Firms: Measurement, Determinants, and Implications," *Journal of Economic Perspectives*, 36, 157–84.

Woodford, M. (2001): "Imperfect Common Knowledge and the Effects of Monetary Policy," NBER Working Papers 8673, National Bureau of Economic Research.

Figures

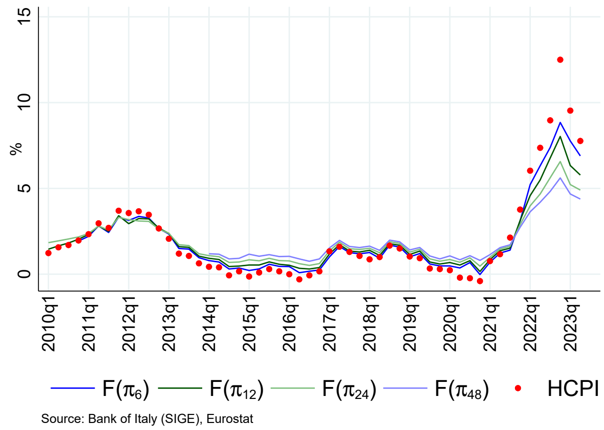
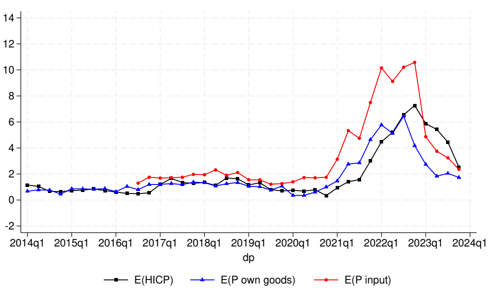


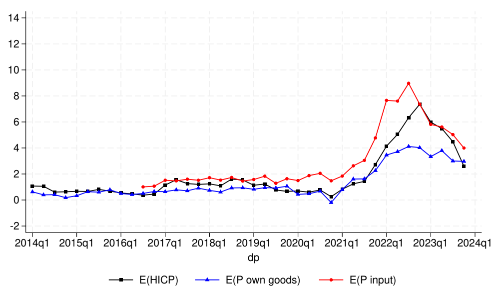
Figure 1: Average firms' inflation expectations at different horizons

The figure plots quarterly average inflation expectations at 6, 12, 24, and 48 months as well as the Harmonized Index of Consumer Prices for Italy between 2010 and 2023. The sample is restricted to firms covered in SIGE.

(a) Manufacturing



(b) Services



(c) Constructions

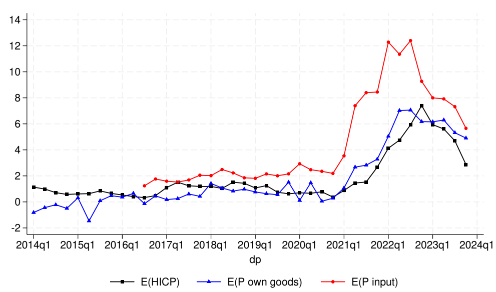


Figure 2: Firms' price expectations - by sector of activity

The plot shows quarterly average expected HICP at 12 months, expected price change of own goods, as well as of inputs by (a) manufacturing, (b) services, and (c) constructions sectors. The sample is restricted to firms covered in SIGE between 2014 and 2023.

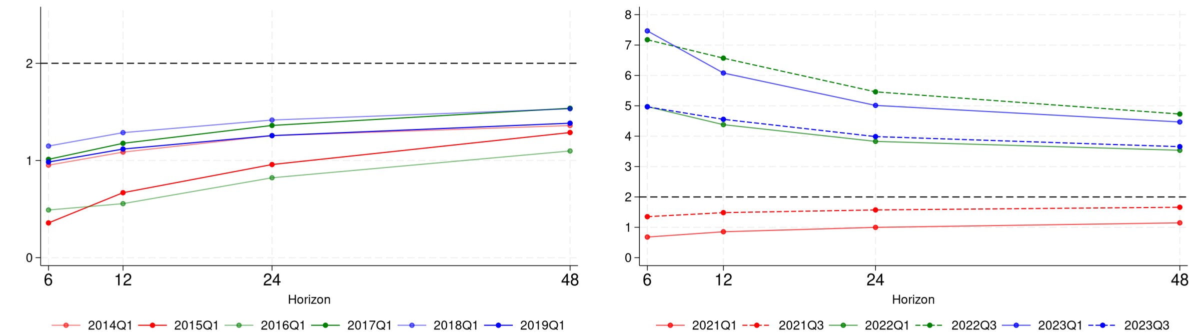


Figure 3: Inflation Expectation Curve

The figure shows inflation expectations' curve across the times at which the survey is undertaken. The LHS plot focuses on non-inflationary periods, i.e 2014-2020, while the RHS plot concerns inflationary period from 2021 onward.

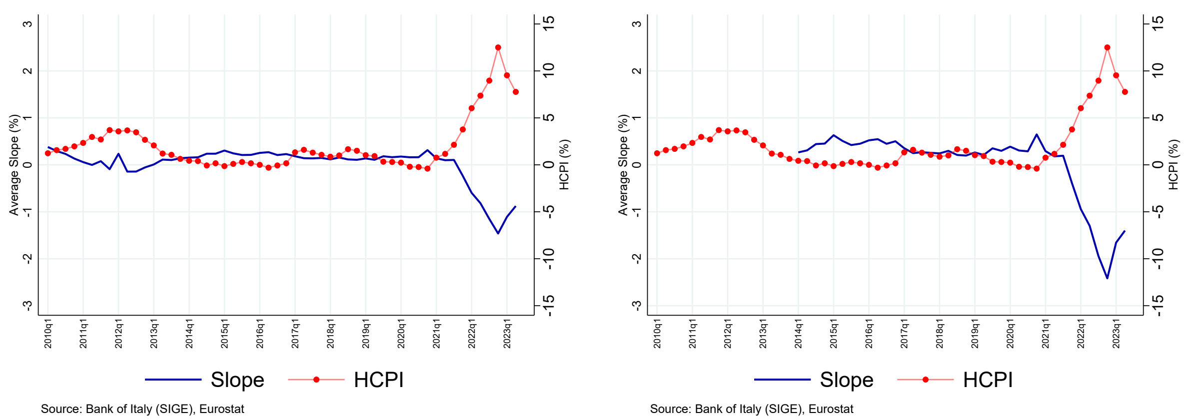


Figure 4: Inflation Expectation Slope

The figures plot quarterly HICP and average slope which is computed as 24-months minus 12-months inflation expectations (LHS panel), and as 48-months minus 12-months inflation expectations (RHS panel). The time horizon analysed goes from 2010Q1 to 2023Q4.

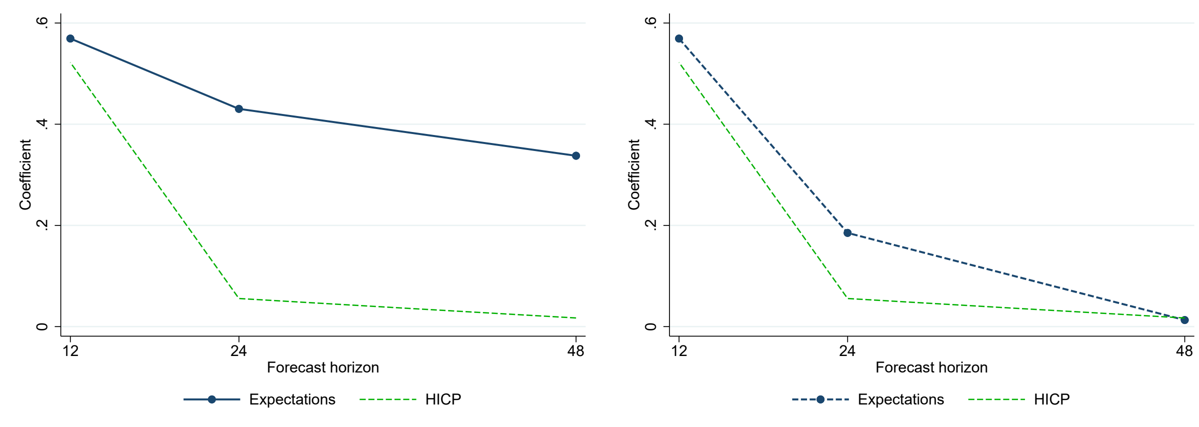


Figure 5: Persistence Coefficients

The LHS figure plots in blue persistence coefficients computed by regressing inflation expectations at different horizons on realized inflation. The green line represents persistence coefficients obtained by regressing HICP in t+12, t+24, and t+48 months on HICP at time t. The RHS plot represents the persistence coefficients that expectations (in blue) and HICP would have if they followed an AR(1) process. The time horizon for expectations is 2014-2023, while it is 1991-2023 for HICP.

Tables

	$F_{i,t}\pi_{t+12}$	$F_{i,t}\pi_{t+24}$	$F_{i,t}\pi_{t+48}$
	(1)	(2)	(3)
π_t	0.551***		
	(0.004)		
$F_{i,t}\pi_{t+12}$		0.808***	
		(0.004)	
$F_{i,t}\pi_{t+24}$			0.846***
			(0.004)
Constant	0.722***	0.318***	0.311***
	(0.008)	(0.006)	(0.007)
Observations	41097	41097	41097
Adj R-squared	0.715	0.911	0.901

Table 1: Persistence Coefficients and Constants

The table contains persistence coefficients and constants obtained from regressing inflation expectations at 12 months on actual inflation (column (1)), inflation expectations at 24 months on inflation expectations at 12 months (column (2)), and inflation expectations at 48 months on inflation expectations at 24 months (column (3)). Firm and time FEs are included. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	$E(\Delta I_{t,t+12})$				
	(1)	(2)	(3)	(4)	(5)
F(π_{12})	0.0126***	0.0124***	0.0114***	0.0114***	0.0114***
	(0.00365)	(0.00366)	(0.00369)	(0.00369)	(0.00377)
F(π_{48})-F(π_{12})	0.0172***	0.0155***	0.0139***	0.0140***	0.0140**
	(0.00518)	(0.00518)	(0.00523)	(0.00523)	(0.00542)
Observations	39668	39030	38462	38462	38462
Adj R-squared	0.237	0.246	0.248	0.248	0.248
Firm and Time FE	Yes	Yes	Yes	Yes	Yes
Liquidity, Credit access	No	Yes	Yes	Yes	Yes
Macro-economic outlook	No	No	Yes	Yes	Yes
Business sentiment	No	No	Yes	Yes	Yes
Sector FE	No	No	No	Yes	Yes

Table 2: Investments and inflation expectations

The table contains estimates obtained by regressing change in expected investments at 12-months on inflation expectations at 12-months as well as on the slope of inflation expectations' curve. Controls include firm's liquidity, credit access, macro-economic outlook, business sentiment at 3 months and at 3 years. Firm, time, and sector FEs are included. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	$Pr(\Delta I > 0)$				
	(1)	(2)	(3)	(4)	(5)
$F(\pi_{12})$	0.00623***	0.00619***	0.00551***	0.00554***	0.00554***
	(0.00186)	(0.00186)	(0.00188)	(0.00188)	(0.00180)
$F(\pi_{48}) - F(\pi_{12})$	0.00810***	0.00772***	0.00695***	0.00701***	0.00701***
	(0.00257)	(0.00258)	(0.00260)	(0.00260)	(0.00264)
Observations	39969	39314	38739	38739	38739
Adj R-squared	0.225	0.230	0.231	0.231	0.231
Firm, Time FE	Yes	Yes	Yes	Yes	Yes
Credit-Liquidity	No	Yes	Yes	Yes	Yes
Macro-economic outlook	No	No	Yes	Yes	Yes
Business sentiment	No	No	Yes	Yes	Yes
Sector FE	No	No	No	Yes	Yes

Table 3: Probability of positive investments and inflation expectations

The table contains estimates of regressing probability of having positive investments in the next 12-months on inflation expectations at 12-months as well as on the slope of inflation expectations' curve. Controls include firm's liquidity, credit access, macro-economic outlook, business sentiment at 3 months and at 3 years. Firm, time, and sector FEs are included. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

		Sector		
	All	Manufacturing	Services	Constructions
	(1)	(2)	(3)	(4)
Panel A:		$F_{it}(\pi_{12})$		
Aggregate demand	0.0198**	-0.00674	0.0395***	0.0334*
	(0.00871)	(0.0137)	(0.0141)	(0.0188)
Intermediate inputs	0.0895***	0.112***	0.0744***	0.0265
	(0.0117)	(0.0165)	(0.0206)	(0.0279)
Constant	1.896***	2.010***	1.895***	1.789***
	(0.0459)	(0.0683)	(0.0784)	(0.104)
Observations	32616	13107	13689	5691
Adj R-squared	0.732	0.746	0.726	0.731
Firm, Time FE	Yes	Yes	Yes	Yes
Panel B:		$F_{it}(\pi_{48}) - F_{it}(\pi_{12})$		
Aggregate demand	0.0196***	0.0211**	0.00989	0.0193
	(0.00640)	(0.0101)	(0.0105)	(0.0135)
Intermediate inputs	-0.0421***	-0.0481***	-0.0316**	-0.0153
	(0.00817)	(0.0120)	(0.0140)	(0.0190)
Constant	-0.0802**	-0.125**	-0.0769	-0.0527
	(0.0323)	(0.0491)	(0.0536)	(0.0731)
Observations	33878	13640	14230	5884
Adj R-squared	0.468	0.512	0.454	0.419
Firm, Time FE	Yes	Yes	Yes	Yes

Table 4: Drivers of inflation expectations

Panel A reports estimates of regressing inflation expectations at 12-months on two categorical variables that captures whether firms expect aggregate demand to increase and whether cost of inputs is expected to increase firms' own prices. The estimates are run using the entire sample (column (1)) and by sectors (columns (2)-(4)). Firm and time fixed effects are included. Panel B reproduces the same analysis, using the slope as dependent variable. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	$E(\Delta I_{t,t+12})$			
	(1)	(2)	(3)	(4)
$F(\pi_{12})$	0.00912**	0.00866**	0.00782**	0.00782**
	(0.00355)	(0.00354)	(0.00358)	(0.00358)
$F(\pi_{48})$-$F(\pi_{12})$	0.0206***	0.0173***	0.0178***	0.0151***
	(0.00508)	(0.00506)	(0.00511)	(0.00511)
Aggregate Demand$_{t+3}$				
Decrease		-0.278***	-0.274***	-0.253***
		(0.0161)	(0.0163)	(0.0163)
Increase		0.139***	0.137***	0.129***
		(0.0110)	(0.0112)	(0.0112)
Cost of raw materials will make firm's prices$_{t+12}$				
Steeply decrease			-0.128**	-0.131**
			(0.0562)	(0.0568)
Decrease			-0.0535	-0.0444
			(0.0347)	(0.0345)
Mildly decrease			-0.0898***	-0.0835***
			(0.0253)	(0.0254)
Mildly increase			0.0479***	0.0477***
			(0.0140)	(0.0140)
Increase			0.0380***	0.0413***
			(0.0147)	(0.0147)
Steeply increase			0.0791***	0.0867***
			(0.0193)	(0.0193)
Credit Access$_{t,t-3}$				
Worse				-0.241***
				(0.0177)
Better				0.187***
				(0.0193)
Constant	3.117***	3.111***	3.096***	3.108***
	(0.00814)	(0.00911)	(0.0111)	(0.0113)
Observations	41943	41586	40747	40292
Adj R-squared	0.209	0.224	0.223	0.231

Table 5: Channels: demand and supply

The table reports estimates of regressing expected change at 12-months on expected inflation at 12-months and on the slope of inflation expectations' curve (column (1)). Column (2) includes a categorical variable for expectations on aggregate demand. A categorical variable that examines how prices of raw materials impact firm's own prices is included in column (3). Column (4) captures the financing channel by adding firms' perception of how their access to credit has changed in the past 3 months. The sample contains all firms covered in SIGE between 2014Q1 and 2023Q4. Firm, time, and sector fixed effects are included. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	$E(\Delta I_{t,t+12})$			
	(1)	(2)	(3)	(4)
F(π_{12})	0.00912**	0.00866**	0.00858**	0.00865**
	(0.00355)	(0.00354)	(0.00370)	(0.00370)
F(π_{48}) -F(π_{12})	0.0206***	0.0173***	0.0168***	0.0148***
	(0.00508)	(0.00506)	(0.00533)	(0.00535)
Aggregate Demand$_{t+3}$				
Decrease		-0.278***	-0.259***	-0.239***
		(0.0161)	(0.0176)	(0.0177)
Increase		0.139***	0.123***	0.116***
		(0.0110)	(0.0124)	(0.0124)
Intermediate inputs will make firm's prices$_{t+12}$				
Steeply decrease			-0.377***	-0.353***
			(0.115)	(0.117)
Decease			-0.0799	-0.0714
			(0.0514)	(0.0510)
Mildly decrease			-0.138***	-0.134***
			(0.0377)	(0.0376)
Mildly increase			0.0373**	0.0349**
			(0.0166)	(0.0166)
Increase			0.0337*	0.0367**
			(0.0175)	(0.0175)
Steeply increase			0.0343	0.0396
			(0.0289)	(0.0288)
Credit Access$_{t,t-3}$				
Worse				-0.240***
				(0.0197)
Better				0.189***
				(0.0224)
Constant	3.117***	3.111***	3.128***	3.142***
	(0.00814)	(0.00911)	(0.0111)	(0.0113)
Observations	41943	41586	33633	33312
Adj R-squared	0.209	0.224	0.233	0.240

Table 6: Channels: demand and supply, with inputs' cost

The table reports estimates of regressing expected change at 12-months on expected inflation at 12-months ad on the slope of inflation curve (column (1)). Column (2) includes a categorical variable for expectations on aggregate demand in 3 months. A categorical variable that examines how cost of inputs impact firm's own prices is included in column (3). Column (4) captures the financing channel by adding firms' perception of how their access to credit has changed in the past 3 months. Firm, time, and sector fixed effects are included. The sample contains all firms covered in SIGE between 2014Q1 and 2023Q4. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	$E(\Delta I_{t,t+12})$			
	(1)	(2)	(3)	(4)
$F(\pi_{12})$	0.0100***	0.00977***	0.00883**	0.00868**
	(0.00369)	(0.00369)	(0.00372)	(0.00371)
$F(\pi_{48})$ -$F(\pi_{12})$	0.0190***	0.0165***	0.0163***	0.0142***
	(0.00526)	(0.00527)	(0.00531)	(0.00531)
Aggregate Demand$_{t+3}$				
Decrease		-0.217***	-0.215***	-0.200***
		(0.0186)	(0.0187)	(0.0188)
Increase		0.132***	0.130***	0.123***
		(0.0116)	(0.0118)	(0.0118)
Cost of raw materials will make firm's prices$_{t+12}$				
Steeply decrease			-0.0532	-0.0568
			(0.0614)	(0.0616)
Decrease			-0.0444	-0.0382
			(0.0382)	(0.0382)
Mildly decrease			-0.0876***	-0.0844***
			(0.0272)	(0.0273)
Mildly increase			0.0404***	0.0417***
			(0.0148)	(0.0149)
Increase			0.0451***	0.0476***
			(0.0154)	(0.0155)
Steeply increase			0.0830***	0.0886***
			(0.0205)	(0.0204)
Credit Access$_{t,t-3}$				
Worse				-0.202***
				(0.0201)
Better				0.190***
				(0.0202)
Constant	3.181***	3.161***	3.143***	3.149***
	(0.00865)	(0.00971)	(0.0119)	(0.0120)
Observations	35754	35466	34755	34387
Adj R-squared	0.193	0.204	0.204	0.211

Table 7: *Real* Investments and inflation expectations, firms that do not decrease employment

The table reports estimates of regressing expected change at 12-months on expected inflation at 12-months ad on the slope of inflation curve (column (1)). Column (2) includes a categorical variable for expectations on aggregate demand. A categorical variable that examines how cost of raw materials impact firm's own prices is included in column (3). Column (4) captures the financing channel by adding firms' perception of how their access to credit has changed in the past 3 months. Firm, time, and sector fixed effects are included. The sample is restricted to firms that expect to either increase or keep employment unchanged. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Ratio $\Delta I^{INT}_{i,t+1}$	*Ratio* $\Delta I^{T}_{i,t+1}$
	(1)	(2)
$F_{it}(\pi_{12})$	-0.000390***	0.000188
	(0.000116)	(0.000252)
$F_{it}(\pi_{48}) - F_{it}(\pi_{12})$	-0.000185	0.000609*
	(0.000145)	(0.000331)
Observations	21883	21883
Adj R-squared	0.281	0.283
Firm, time, sector FEs	Yes	Yes
Business sentiment	Yes	Yes
Macro-economic outlook	Yes	Yes
Credit access, Liquidity	Yes	Yes

Table 8: *Real* Investments and inflation expectations, balance sheet variables

The table contains estimates of regressing ratio of changes in intangible investments in the next year over firm's side (column (1)), and ratio of changes in tangible investments in the next year over firm's side (column (1)). Controls include macro-economic outlook, business sentiment at 3 months and at 3 years, as well as firm's liquidity and credit access. Firm, time, and sector fixed effects are included. Standard errors, in parentheses, are clustered at firm×quarter level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix

Survey composition

Figure A1: Number of participating firms over time

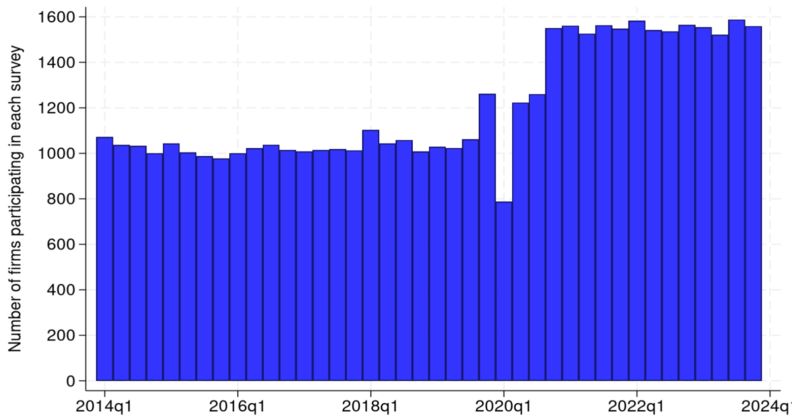


Figure A2: Sample composition by firm characteristics

Source: Author's calculations on SIGE data over the period 2014Q1-2023Q4.

Example of the questionnaire

SURVEY ON INFLATION AND GROWTH EXPECTATIONS
BANCA D'ITALIA

September 2019

Company Name ____

A0. Which is your firm's main sector? |__| SETTON5

(1) **Manufacturing**

(2) **Other Industry**
- Mineral extraction from mines
- Elettrical. gas. vapour. air conditioning supply
- Water supply
- Sewerage, waste management, and redevelopment

(3) **Trading**

(4) **Other Servicies**

→ Fill in GREEN questionnaire

(5) **Construction**
- Buildings
- Engineering
- Special construction works
(demolition and preparation of building sites,
plant installation, completion and finishing. etc.)

→ Fill in LIGHT BLUE questionnaire

INDUSTRY EXCLUDING CONSTRUCTION AND SERVICES

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

SECTION 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 March 2019? **IT6**	…in September 2020? **IT12**	…in September 2021 **IT24**	… on average between September 2022 and September 2024? **IT48**
B1a. (about 3/5 of the sample) In July consumer price inflation, measured by the 12-month change in the harmonized index of consumer prices was +0.3 per cent in Italy and +1.0 per cent in the euro area. What do you think it will be in Italy...	|__| |__|__|,|__|%	|__| |__|__|,|__|%	|__| |__|__|,|__|%	|__| |__|__|,|__|%
B1b. (about 1/5 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…	|__| |__|__|,|__|%	|__| |__|__|,|__|%	|__| |__|__|,|__|%	|__| |__|__|,|__|%
B1c. (about 1/5 of the sample) The European Central Bank has the maintenance of the 12-month change in the harmonized index of consumer prices in the euro area close but below 2 per cent in the medium term. What do you think consumer price inflation in Italy, measured by the 12-month change in the harmonized index of consumer prices, will be…	|__| |__|__|,|__|%	|__| |__|__|,|__|%	|__| |__|__|,|__|%	|__| |__|__|,|__|%

B2. Firms working in other sectors of the economy also take part in this survey. You stated you expected a consumer price inflation rate of [**IT12**] in Italy in September 2020. In your opinion, what inflation rate did the other firms taking part in the survey expect for Italy in September 2020?
IT12ALT |__| |__|__|,|__|%

B3. Compared with 3 months ago, do you consider Italy's general economic situation is …? **SITGEN** ☐ Better ☐ The same ☐ Worse

B4. 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 **SITIMP5**

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:

	Better **SITM3M SITM3A**	The same **SITU3M SITU3A**	Worse **SITP3M 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|__|
C7.1 Uncertainty due to econ. and political factors **POLIT**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7.2 Exchange rate dynamics **TACAM**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7.3 Oil price dynamics **PRPET**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
C7.4 Tensions on liberalization policies of international trade **POLIB**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|

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

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 ... ? **DOMTOT** ☐Higher ☐Unchanged ☐Lower

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

(Answer to questions C12-C13.2.1 only if the share of sales revenues coming from exports is positive. otherwise go to C14)

Compared with three months ago, is the foreign demand for your products…?	*Higer*	*Unchanged*	*Lower*	*not applicable*
C.12 Total **DOMEST**	|__|	|__|	|__|	
C.12.1 In Germany **RTEU_GE**	|__|	|__|	|__|	|__|
C.12.2 In Cina **RTNEU_CI**	|__|	|__|	|__|	|__|
How will the foreign demand for your products vary **in the next 3 months**?	*Increase*	*No change*	*Decrease*	*not applicable*
C.13 Totale **PREEST**	|__|	|__|	|__|	
C.13.1 In European Union (excluding Italy) **ETEU**	|__|	|__|	|__|	|__|
C.13.1.1 In Germany **ETEU_GE**	|__|	|__|	|__|	|__|
C.13.2 Outside European Union **ETNEU**	|__|	|__|	|__|	|__|
C.13.2.1 In Cina **ETNEU_CI**	|__|	|__|	|__|	|__|

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

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**:

	Effect on firm's selling prices			***Intensity*** *(if not nil)*		
Factors affecting your firm's prices in the next 12 months	*Downward*	*Neutral*	*Upward*	*Low*	*Average*	*High*
D2.1. Total demand **DPR**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.2. Raw materials prices **MPPR**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.3. Intermediate Input **IICT**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.4. Labour costs **CLPR**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.5. Pricing policies of your firm's main competitors **PRPR**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.6 Exchange rate dynamics **TCPR**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.7 Inflation expectations dynamics **AINF**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|
D2.8 Financial conditions **CFIN**	1|__|	2|__|	3|__|	1|__|	2|__|	3|__|

D3. In the last 12 months, what has been the average change in your firm's prices of goods and services bought in Italy and abroad ?
|__| |__|__|.|__|% **DPRE_INT**

D4. In the next 12 months, what has been the average change in your firm's prices of goods and services bought in Italy and abroad?
|__| |__|__|.|__|% **DPREZ_INT**

SECTION E – Workforce

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

SEZIONE F – Investment

F1. What do you expect will be the nominal expenditure on (tangible and intangible) fixed investment in 2019 compared with that in 2018?
☐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 2019 compared with that in the first half of 2019:
☐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.