

What's behind firms' inflation forecasts?

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Abstract

On what do firms base their expectations about future inflation? We investigate this by exploiting the Survey of Inflation and Growth Expectations carried out by Banca d'Italia and *Il Sole 24 Ore* on a sample of Italian firms. Several sources of information contribute to shaping short- and long-term expectations, such as media reports, professional forecasts, personal shopping experience, the inflation experienced when dealing with suppliers, and the contract collective bargaining agreements. Given the way in which wages are set in Italy, we are able to assess the reaction of inflation expectations to exogenous variations in the labour costs borne by firms. We find that firms' inflation expectations are significantly affected by wage increases. As to the prices of goods for own consumption, proxied by house and fuel prices, only the latter affect inflation expectations; official inflation data and professional forecasters' expectations also play a part. Our results are robust to all the specifications and to the use of panel and cross-section estimates.

JEL classification: C23, E24, E31.

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“How should we measure inflation expectations, and how should we use that information for forecasting and controlling inflation? I certainly do not have complete answers to those questions, but I believe that they are of great practical importance..... Information on the price expectations of businesses – who are, after all, the price setters in the first instance – is particularly scarce”. (Ben Bernanke, 2007)

1 Introduction

Inflation expectations are a key indicator of monetary policy credibility and effectiveness; understanding inflation expectations’ formation by private agents is therefore crucial for policy makers. Survey data on expectations are increasingly available for different economic agents, as for example consumers, professional forecasters and businesses, even though quantitative information based on firms’ survey is relatively scarce. In this paper we tackle the following question: *what drives businesses’ inflation expectations?* This issue is particularly relevant given that, compared with the attention paid in the literature to inflation expectations of consumers and professional forecasters, firms’ expectations have been less frequently investigated; this is surprising, given that firms set prices and wages. Drawing from the Banca d’Italia and *Il Sole 24 Ore* Survey on Inflation and Growth Expectations (SIGE), and combining this source with other information such as macroeconomic variables, personal shopping experience and the evolution of wages as determined by collective labour negotiations, we study how Italian firms form their inflation expectations. As shown in Kumar et al. (2015), several sources of information matter in the expectations’ formation process; among others, media reports, professional forecasters’ reports, personal shopping experience, perceived inflation when dealing with suppliers and outcomes of wage bargaining. As far as personal shopping experience is concerned, the literature has argued that the answers by managers and owners of firms are likely affected by their consumption habits, in that the answer mostly refer to the prices of goods that they, as consumers, purchase on a regular basis, such as fuel and food, as well as to purchases of big items, for example houses (Kumar et al., 2015; Coibion and Gorodnichenko, 2015; Richards and Verstraete, 2016). As showed in Coibion and Gorodnichenko (2015), households adjust their inflation forecasts in response to oil price changes more than professional forecasters, because fuel prices matter more for consumers. They document that more than half of the difference between professional forecasters and households is accounted for by the changes of oil prices: using the Michigan Survey they show that people who on average spend more money on gasoline are those that more often adjust their inflation expectations.¹ Also the

¹In this paper, the authors analyzed the relation between inflation expectations and the Phillips Curve using data from the Michigan Survey on households. The motivation lies on the fact that in the US at that time quantitative information on firms’ beliefs was not available; nevertheless, since many prices are set by small and medium-sized firms, the authors assumed that households expectations’ can well proxy

outlook for wages and input prices (e.g. energy and prices set by suppliers) is an important determinant of firms' expectations: entrepreneurs draw on their firm/sector-specific experience to make generalisations about aggregate activity. As shown in Richards and Verstraete (2016), firms' inflation expectations increase with an anticipated acceleration of paid hourly wages and input prices, as well as with movements in oil prices. Obviously it might be the case that firms' wage-setting behaviour is influenced by their inflation expectations, as shown for Japan in Kaihatsu and Shiraki (2016). Finding an exogenous source of variation in paid wages is thus crucial to assess the direction of causality.

This paper is closely related to empirical works such as Kumar et al. (2015), Richards and Verstraete (2016), that we have already mentioned, as well as to Bartiloro et al. (2017) and Coibion et al. (2018), which rely on the same firm-level survey. However, Bartiloro et al. (2017) investigate how the cross-sectional heterogeneity of firms' inflation expectations reflects information availability and awareness of recent macroeconomic developments, observable firm characteristics and broader macroeconomic developments, while Coibion et al. (2018) looks at the role of harmonized consumer price inflation expectation for several outcomes including the setting of own prices. In particular, using exogenously generated variation in the expectations of firms in Italy, they found that higher inflation expectations lead the firms to raise their prices, increase their credit's utilization, and reduce their employment. We focus instead on the determinants of inflation expectations at the firm level, and in particular contribute to the literature by assessing the influence of an exogenous change in the cost of labour, as well as of fuel prices at the local level. As for the cost of labour, we exploit the characteristics of the Italian wage bargaining system, an approach that has been also followed by Frache and Lluberas (2018) for Uruguay. The combination of micro and macro data helps us to overcome the reverse causality and omitted-variable issues that usually plague studies based on time series, thus ensuring consistency of OLS estimates.

The remainder of the paper is organized as follows. Section 2 briefly summarizes the salient characteristics of the data and the relations with the literature. Section 3 presents our empirical strategy and the main results. Section 4 digs further into the process of inflation expectation formation by exploiting the institutional setting of wage bargaining in Italy and Section 5 concludes.

2 Which factors contribute to form firms' beliefs on inflation? Hints from literature and data

We focus on firms' inflation expectations as collected in the SIGE, conducted quarterly by the Banca d'Italia and *Il Sole 24 Ore* since 1999, and currently covering about 1000 Italian

those of the owner of a small-medium sized firm.

firms in the manufacturing, service and construction sectors with 50 or more employees.² This survey is particularly valuable as it provides quantitative point expectations for inflation (as measured by the harmonized index of consumer prices, HICP) as well as for own selling price changes. In SIGE respondents are also asked to provide their assessment on the general economic situations, as well as on their own business activity. Standard firm's characteristics (sector, size, geography) are also collected. To the best of our knowledge SIGE is one of the few surveys of firms with these characteristics. Kumar et al. (2015) implemented a quantitative survey of managers in New Zealand between 2013 and 2015 to fill this information gap, but SIGE has the advantage of being available far back in the past. The quarterly Business Outlook Survey carried out by the Bank of Canada was started in 1997Q3 but includes only intervals for inflation expectations over a 24-month horizon (Richards and Verstraete, 2016). The US Business Inflation Expectations survey conducted by the Federal Reserve Bank of Atlanta hosts a question which elicits inflation expectations from the firm's probability assessment of one-year-ahead price changes (Bryan et al., 2015).³ In Japan a survey carried out by the Economic and Social Research Institute since the Sixties allows to derive forecasts for GDP deflator at different time horizons; consumer price index-based inflation expectations are only available since 2013, when the Bank of Japan also began collecting data on firms' inflation expectations in short-term and medium- to long-term horizons as a part of the 'Short-Term Economic Survey of Enterprises in Japan' (*Tankan*; see Kaihatsu and Shiraki (2016)). Boneva et al. (2016) exploit quarterly data from the Confederation of British Industry to assess the effect of quantitative easing on price and wage growth of UK manufacturing firms; inflation expectations are collected using buckets and over a 12-month horizon only. In Uruguay a monthly longitudinal survey has been commissioned to INE by the Central Bank since 2009, asking for the expected annual change of the Consumer price index for the current year, for the next 12 months and the monetary policy horizon (18-24 months; see Frache and Lluberas (2018)).

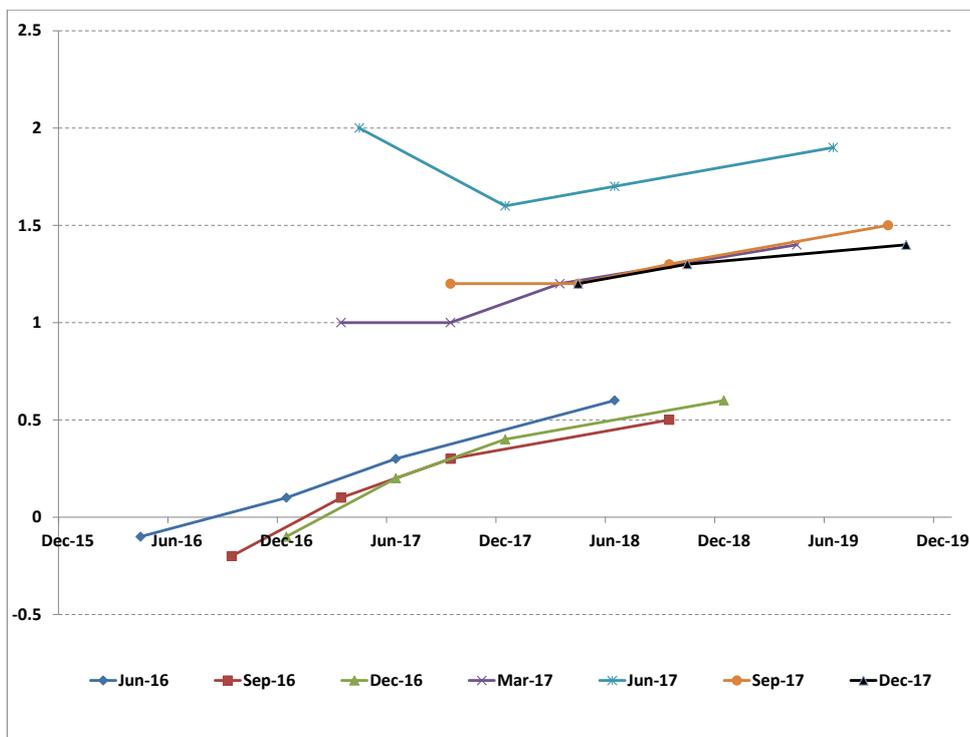
Our analysis focuses on firms' inflation expectations over 6, 12 and 24 months horizon (defined thereafter as short-, medium-, and long-term expectations, respectively) and rely on the replies to the following question: *What do you think consumer price in Italy, measured by the 12-month change in the harmonized index of consumer prices, will be in 6, 12 and 24 months?* Figure 1 displays the changes in inflation expectations comparing various survey's rounds. In the last survey of December 2017 the consumer price inflation expectations of the firms interviewed were broadly the same as in the previous survey, above the lows recorded at the end of 2016. Expectations gathered in June 2017 were instead

²For more information on the survey and questionnaire refer to <https://www.bancaditalia.it/publicazioni/indagine-inflazione/index.html>.

³Also the Federal Reserve of New York runs two surveys: the Business Leaders Survey of service and retail firms and the Empire State Manufacturing Survey using a probabilistic framework.

strongly affected by an unusually high official figure released by Istat for April 2017. This suggests that the information available to the respondent plays a major role.

Figure 1: HICP INFLATION EXPECTATIONS: COMPARISON AMONG THE LATEST SURVEYS



Notes: The first point of each curve is the definitive figure available at the time of the survey that is provided to interviewees in the questionnaire to be used as the basis for formulating their expectations; the second point represents the average of the forecasts for the subsequent 6 months; the third point is the average of the forecasts for the subsequent 12 months; the fourth point is the average of the forecasts for the subsequent 24 months.

The question above is collected splitting the sample in two groups: two out of three respondents (“informed/anchored firms”) are provided a nominal anchor – the latest available official figure before the questionnaire is sent - while the remaining firms are not informed/anchored.⁴ As emphasized in Bartiloro et al. (2017) and Bryan et al. (2015), the role played by the information provided to the panelists and the framing of the sentence can influence their answer; the first paper in particular shows that on average about half of the cross-sectional dispersion of expectations is traceable to a lack of information about the most recent price developments. Therefore we check in our analysis if the reference to an anchor matters. In the survey conducted in December 2016 a specific questions was asked,

⁴Since the beginning of 2017, the share of informed and non-informed respondents has been changed as follows: for 3 out of 5 firms in the sample the standard nominal anchor is provided; for 1 out of 5 there is no nominal anchor and for the remaining fraction the information on the ECB inflation target (i.e. below but close to 2% in the medium term) is given.

worded as follows: *Could you indicate which is the most important source of information you make reference to in order to assess your expectations about Italian consumer prices inflation?* **Answers:** (a) *The news of the media*, (b) *Professional forecasters' reports*, (c) *Prices set by your suppliers*, (d) *Prices of goods for own consumption*, (e) *Contract renewals*.

Table 1: SOURCES OF INFORMATION USED BY ITALIAN FIRMS TO FORM EXPECTATIONS ABOUT ITALIAN HICP INFLATION

	The news of the media	Professional forecasters' reports	Prices set by your suppliers	Prices of goods for own consumption	Contract renewals
<i>No. employees</i>					
50-199	35.0	21.9	23.9	7.8	11.5
200-999	34.9	38.2	16.1	2.6	8.3
Over 999	24.8	44.8	12.8	4.0	13.6
<i>Geographical area</i>					
North West	36.0	27.4	18.4	5.6	12.5
North East	33.4	26.8	23.8	6.3	9.8
Centre	34.0	24.8	22.2	8.3	10.8
South and Islands	34.7	16.1	29.8	9.4	10.0
Total	34.7	24.9	22.4	6.9	11.1

Source: SIGE 2017

As reported in Table 1, for Italian firms the most important sources of information are the news from media and the report of professional forecasters; the less relevant one is the prices of goods from own consumption. The sources related to the cost of production factors (input and labour) account for about 33 per cent, taken together. For the sake of comparison, narrative responses provided by surveyed firm managers in New Zealand as reported in Kumar et al. (2015) show that media and personal shopping experience are mentioned roughly by the same proportion of managers as the source of information that is typically processed to form inflation expectations, with gasoline and house prices as the most cited items. As also Coibion and Gorodnichenko (2015) argue, managers indeed answer the inflation question with the mindset of consumers/households and thus refer mostly to the prices of the items that they purchase. This is corroborated by the fact that in Kumar et al. (2015) managers state that they use the inflation forecasts primarily for their own consumption and saving decisions and secondarily for their business decisions.

We exploit the SIGE to explicitly test the role played by the above factors in shaping firms' belief on future inflation; in several cases we rely on external data sources, which are properly matched to each firm included in each quarterly wave of SIGE. The combination of microeconomic data with macroeconomic variables allows to tackle both the reverse causality issue - as none of the aggregate variable is directly caused by individual firms'

expectations - and the omitted variable issue, as controlling for macroeconomic factors ensures that there are no common factors affecting both the dependent variable and the outcome of wage renewals (Boneva et al., 2016).

First, we introduce further firm-specific characteristics at the individual level such as the year of birth (to measure firm age) and the geographical location (province) as available in the Cerved database, a proprietary firm-level panel database owned by Cerved Group S.p.A., which collects balance sheet information for a representative sample of non-financial corporations at a yearly frequency. This data source is combined to SIGE using the tax code as matching key. As to the factors under exam, we proceed as follows:

- (i) the news in the media are proxied by the official HICP inflation released by the Italian Statistical Institute (Istat); each firm in each quarter is assigned the latest monthly figure available at the time of the interview;⁵
- (ii) professional forecasters' reports are accounted for by augmenting the SIGE dataset with professional forecasts from Consensus Economics;⁶ also in this case the latest monthly figure available at the time of the interview is considered;
- (iii) as to the cost of inputs, since the SIGE questionnaire hosts an explicit question on the change in the prices of goods and services bought in Italy and abroad only since September 2016, we have to resort to a reasonable proxy, given by the reply to a question on how (and by how much) raw materials prices affect the firm's selling prices in the following 12 months;⁷
- (iv) the role of prices of goods for own consumption (personal shopping experience) is investigated using fuel and house prices as proxies. Fuel prices are average prices in the province where the firm is located, provided by Istat. As far as house prices are concerned, we rely upon the semiannual survey conducted for a special review published by the *Il Sole 24 Ore* media group (*Consulente Immobiliare*) on the largest Italian municipalities; data are available up to 2016, and have been widely used to study house price developments in the Italian real estate market (Modena and Rondinelli, 2011; Muzzicato et al., 2008). Each firm in our sample is assigned the house prices of the municipality which is the capital of the province where the firm is located; semiannual values have been either linearly interpolated or repeated to match with the quarterly frequency of the SIGE. We express house prices in real terms by means of the national HICP;

⁵While answering the questionnaire firms can get an updated figure of this data either on the Istat website or listening or reading economic news.

⁶http://www.consensuseconomics.com/download/G7_Economic_Forecasts.htm.

⁷A question on whether intermediate inputs matter for selling prices is available in the questionnaire only since December 2015.

- (v) finally, to assess the role of the outcome of contract renewals we exploit the index of negotiated wages released each month by Istat; this index measures the evolution of wages and salaries determined by contractual provisions set by collective labour agreements.

The institutional features of the Italian bargaining system are particularly suitable for our purposes (for further details on the institutional context see Adamopoulou and Zizza (2017)): collective bargaining takes place within each sector at the national level between the social partners (trade unions and employers' associations), and conditions agreed apply to all the employees in that sector in the whole Italian territory; wage setting is staggered, thus the timing of the expiration of the contracts is uncorrelated across sectors; there is no leading contract in Italy, i.e. renewals in one sector affecting those in other sectors (as it happens in Germany and Austria); firms know in advance the month, and hence the quarter, in which wage increases enter into force. Given these characteristics, pay increases can be considered as exogenous shocks to the firms and to the workers, as the actions of a single worker/firm are unlikely to determine the outcome of the collective bargaining. Moreover, in our specific context, pay increases are anticipated (as they were agreed in the past), thus current firms' beliefs cannot impact on them. Monthly wage indices are aggregated at the quarterly level and assigned to each firm using the sector of economic activity as matching key. Table 2 reports descriptive statistics of the SIGE and the other main variables used in our estimates:

Table 2: DESCRIPTIVE STATISTICS

<i>Variable</i>	Obs	Mean	Median	Std. Dev.	Min	Max
HICP short-term expectations	26,040	1.33	1.0	1.29	-10	10
HICP medium-term expectations	28,880	1.44	1.2	1.23	-10	10
HICP long-term expectations	28,880	1.61	1.5	1.22	-10	15
negotiated wages	28,900	106.42	106.6	4.30	95	113.63
prices of raw materials	27,970	.59	0	1.13	-3	3
house prices	22,150	98.32	99.2	4.06	87.64	116.27
no. employees	28,910	1184.16	171.5	6244.50	50	180000
price of fuel	22,650	102.16	101.7	4.49	92.07	116.80
firm's age	26,120	34.98	32	20.13	1	160
own prices	28,051	-.076	0	1.04	-3	3
role of demand	28,912	.139	0	5.51	-90	80
anchor	21,950	.68	1	.47	0	1

3 Empirical strategy and main results

In this section we examine the role of several sources of information in the expectations' formation process of Italian firms moving from the following linear panel data model:

$$y_{it} = \alpha_{it} + \beta_{it}\mathbf{X}_{it} + u_{it} \quad (1)$$

for $i = 1, \dots, N$ and $t = 1, \dots, T$; where y_{it} is a scalar dependent variable (inflation expectations), \mathbf{X}_{it} is a $K \times 1$ vector of independent variables. The model in equation 1 is firstly estimated with period (*yearXquarter*) and firm fixed-effects, the latter needed to control for unobserved heterogeneity:

$$y_{it} = \alpha_i + \gamma_t + \beta\mathbf{X}_{it} + u_{it} \quad (2)$$

We estimate the model using quarterly data spanning from 2009 to 2017. We start with a *baseline* specification in which the vector \mathbf{X}_{it} of equation 2 comprises just few variables such as negotiated wages and firms' size (number of employees); then, other regressors are included such as prices of raw materials (cost of inputs), house prices and fuel prices. In order to assess the role of the news from the media and of professional forecasters' reports - which do not vary by sector and geography and in the other specifications are absorbed by time dummies - we need to get rid of the time fixed effects and estimate a model including Consensus expectations and HICP inflation, as well as linear and quadratic time trends to account for other time-varying factors not explicitly included in the regression. Since the survey structure allows us to distinguish between *anchored* and *not-anchored* firms we run the regression including prices of raw materials and a dummy equal to one if the anchor has been provided. Moreover, since in the period in exam inflation was characterized by different patterns, we also run the model that includes negotiated wages, firms' size and raw materials splitting the sample in *high* and *low* inflation periods, assuming 2014Q1 as the separation quarter. Finally, we use the survey weights to ensure the representativeness of the sample (results without weights are broadly the same and are available from the authors upon request).

Results of all specifications are presented in Tables 3, 4 and 5, respectively for inflation expectations at short-, medium- and long-term horizons. In Table 3 we report the estimates of eight specifications of equation 2 for the 6-month horizon inflation expectations. The first baseline specification includes as regressors only negotiated wages and firms' size. The second specification adds the prices of raw materials taken from the question in SIGE; we consider it our benchmark model. In specifications three and four we add house and fuel prices as regressors to the benchmark model, respectively. The fifth specification accounts for the 'anchoring' of the respondents. The following two columns report the model estimated in the two sub-periods of *high* and *low* inflation. Finally specification eight, starting

from the benchmark model, includes the macroeconomic variables (Consensus forecasts and HICP inflation), the linear and quadratic time trends, and excludes time fixed effects.

In all specifications the β coefficient for negotiated wages is always positive and significant, meaning that when firms pay wage increases as set by collective contracts to their workers, this induces a revision of their inflation expectations. The coefficient is quite stable across specifications. It remains significant also when macroeconomic information is considered. By contrast, the number of employees as measure of firms' size is never significant; this is not surprising due to the use of firm fixed effects: the size of the firm is unlikely to change dramatically over two adjacent quarters. Raw materials' prices play an important role in affecting inflation expectations as their β coefficients are positive and significant in the different models. The same holds also when considering the respondents' characteristics as being informed or not regarding the latest available number of inflation. House prices do not affect inflation expectations, possibly because of low variability from quarter to quarter, while fuel prices, which are characterised by wider swings, do. Entrepreneurs are more likely to be influenced by changes in prices for the items that they purchase at high frequency; this is consistent with previous literature that has argued that, among possible psychological mechanisms underlying the formation of inflation perceptions, there is a disproportionate effect of frequent purchases (see Del Giovane et al. (2009)). Disentangling between *high* and *low* inflation periods suggests that for short-term inflation forecasts the negotiated wages are important just in periods of *low* inflation.

Considering the one-year ahead forecast horizon, as shown in Table 4, results of the short-term horizon regressions hold in almost all the specifications. A notable exception is when we divide the sample period in *high* and *low* inflation regimes: in this case negotiated wages matter in both periods, even though in the second regime both the value and the significance level of the coefficients are lower. Looking at the two-year ahead forecast horizon, reported in Table 5, results remain unchanged and also in this case the role of wages matters both in the *high* and *low* inflation periods, being more relevant in the former. Putting together the evidence on the role of wage increases in the two different inflation regimes, it might be that entrepreneurs in a context of high inflation hold that current wage increases are not sufficient to compensate the worker for the loss of purchasing power and thus anticipate future wage increases and hence future inflation. This is not the case for short-term inflation forecast, as it takes time for high inflation to feed into new contract renewals. Our results could be also related to insights from 'behavioral economics', and in particular to the so called 'salience heuristic', which entails that people only pay attention to information that stands out. In our context, it implies that agents process information about future inflation only when it becomes more relevant, i.e. in a high inflation environment (Gnan et al., 2010).

We implement a series of robustness checks; results are reported in Table 6. First, we run our benchmark regression including the change of firms' own selling prices in the last

year (reported in SIGE) as a further determinant of HICP inflation expectations; results are broadly confirmed (in sign and statistical significance), with the coefficient of the change in own prices being higher in level and significance for the short and medium horizons than for the long one. Second, we exclude from the sample firms with more than 10,000 employees, to rule out the possibility (conceivably remote given the productive structure of the Italian economy) that in highly concentrated industries very big firms could play a role in the sectoral bargaining, which would weaken the exogeneity argument: this does not change what has been previously found. Third, we run the benchmark regression including the firms' assessments on the general economic situation and on their own business activity as available in SIGE and, fourth, we take care of outliers by winsorizing the dependent variables at 1st and 99th percentiles: in both exercises results are confirmed and are available from the authors upon request.

Finally, we also perform a repeated cross-section exercise. This requires controlling for sectoral and provincial dummies, as well as for firm's size (in classes); firm's age is also included. Estimates reported in Table 7 confirm that pay increases determined at the collective level influence the firm's belief on inflation, in particular over longer forecast horizons. Also these specifications show that prices of raw materials are deemed important by the respondents. Firm age is found to be significant only for short-term inflation expectations: the lower the age, the higher expectations are, other things being equal.

4 Digging further into the role of contract renewals

Estimates presented in the previous section show that wages set at the collective level matter in shaping inflation expectations. Some specific institutional features of the wage bargaining system enable us to gather insight into the mechanisms that lie behind the expectation formation process. In particular, in the contract agreed upon by the social partners the pay increase is usually implemented in the form of several tranches, which represents a permanent (nominal) wage increase over time as it is regularly paid every month; in case of significant contract hiatus (i.e. long delays in renewals), the agreement may also envisage a lump-sum (*una tantum*) payment in addition to the tranches, which has a transitory nature as it takes place only in a certain month.

We use a unique database hand-collected by Banca d'Italia that includes detailed information on collective agreements reached in the private sector during the period 1997-2016 (for further details see Adamopoulou and Zizza (2017)). On average, each tranche amounts to 35 euros per month while a lump-sum wage increase amounts to 310 euros, both deflated using the monthly consumer price index (Adamopoulou and Zizza, 2017). We repeat our estimation exercise (both fixed-effect and cross-section specifications) for inflation expectation at the three forecast horizons replacing the Istat index of negotiated wages with these

two separate components defined by collective agreements. It must be specified that *una tantum* do not enter in the definition of negotiated wages according to the methodology adopted by Istat, despite the fact that they are defined at the sectoral level by the same national contract and can be thus likewise held exogenous to the firm.

Table 8 shows that inflation expectations respond to the payment of both *una tantum* payments and tranches. In particular *una tantum* impact more on expectations at shorter horizons (6- and 12-months ahead, according to both fixed effects and cross-section estimates) while tranches affect more expectations at longer-horizons, with a coefficient that is higher and more precisely estimated for two-year-ahead forecasts. This is consistent with the nature of the two payment types (temporary and permanent for *una tantum* payments and tranches, respectively). Borrowing upon Adamopoulou and Zizza (2017), we have also checked whether firms react at the date of the announcement of the wage increase, i.e. when the contract is signed; in this case the firm receives a ‘news’, whose timing is a priori uncertain. We have both augmented the baseline specification with tranches and *una tantum* payments with a dummy ‘news’, that takes the value 1 in the quarter of the renewal and 0 otherwise, as well as replaced the two types of payments with the same dummy. The estimated coefficient is never statistically significant⁸: thus, it is ‘cash-out-of-hand’ that matters for entrepreneurs when forming their inflation beliefs based on information from contract renewals.

We further corroborate this evidence by regressing the change of firms’ own selling prices in the last year - which in our robustness checks are significantly associated with HICP expectations - on wage increases, as well as on the firm’s assessment of the role of demand in shaping prices plus the standard controls (Table 9). *Ceteris paribus*, a one per cent increase in negotiated wages translates into a 0.2 point increase in the own prices’ growth. The estimated price pass-through of wages is slightly higher (0.3 points) if we include lags for wage increases (up to the fourth), which are however not significant; demand is also relevant for price setting. These values are in line with the micro-econometric literature on the pass-through (see, for Sweden, Carlson and Skan (2012)). The estimated pass-through is slightly higher (0.4 points) in periods of high inflation, consistently with evidence for the euro area as a whole (Bobeica et al. (2018)). If inflation is high, firms expect interest rates to stay high or to be even raised, translating into a worsening of their borrowing conditions; in this context, firms should be less willing to reduce their profit margins, thus favouring the pass-through of wages to prices. Indeed, empirical results for Italian firms confirm that in a low demand environment, other things being equal, firms with limited access to external finance tend to charge higher markups than unconstrained firms (Duca et al. (2018)). As a whole, this evidence suggests that one possible channel influencing the view of entrepreneurs on consumer prices at the macro level is the process of prices’

⁸Results are available from the authors upon request.

adjustment following a contract renewal at their own firms' level. In this respect we differ from Frache and Lluberas (2018), who show that when firms adjust wages - following what envisaged by the collective bargaining - they revise their expectations downwards and have more accurate forecasts, pointing to the idea that it is the acquisition of information by firms that shapes their beliefs about future inflation.

5 Conclusions

Understanding inflation expectations' formation by private agents is crucial for policy makers and even more is important to understand this process for firms as they are the price setters of goods and services and actively participate (through employers' associations) in the collective wage bargaining process. In this paper we exploit business survey inflation expectations drawn from the Survey of Inflation and Growth Expectations carried out by Banca d'Italia and *Il Sole 24 Ore* on a sample of Italian firms. This data source is particularly valuable as it includes point forecasts on inflation expectations over different time horizons for a long quarterly time span; in particular we concentrate on the period between 2009 and 2017, characterised by episodes of high and low inflation. We match data at the firm level with external data sources and obtain a unique dataset which consents to evaluate the role of different factors behind the formation of inflation beliefs, namely the news from the media, the professional forecasters' reports, the prices set by suppliers, the personal shopping experience and the outcome of collective wage bargaining. Given the way in which wages are set in Italy, we are able to assess the reaction of inflation expectations to exogenous variations in the cost of labour borne by firms.

We find that firms' inflation expectations are significantly affected by wage increases set by contract renewals and by prices of raw materials: thus, individual firms do take their own perceived pressures at the origin at the firm level to form expectations about the change in the overall consumption price index. For what concerns the prices of goods for own consumption, proxied by house and fuel prices, we find that only the second impact inflation expectations as managers are influenced more by goods purchased at 'high frequency'. The information on the official inflation data and from professional forecasters is also influential for firms when forming their beliefs. A further investigation in the role of contract renewals reveals that shorter-term forecasts are influenced by *una tantum* payments, which are large and temporary, while longer-term forecasts respond to permanent nominal wage increases only. By estimating a price pass-through of wages at the firm level we argue that the process of prices' adjustment following a contract renewal matters for shaping the view of entrepreneurs on consumer prices at the macro level. Results are robust to all the specifications and to the use of panel and cross-section estimates.

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Table 3: DETERMINANTS OF INFLATION EXPECTATIONS 6-MONTH AHEAD

	baseline	raw materials	house prices	fuel prices	raw materials anchor	High inflation	Low inflation	macro variables and trend
negotiated wages	0.0136** [0.00623]	0.0157** [0.00640]	0.0153** [0.00758]	0.0149** [0.00711]	0.0248*** [0.00759]	-0.00198 [0.0223]	0.0257** [0.0131]	0.0243*** [0.00617]
no. employees	-9.17e-07 [4.42e-06]	-7.13e-07 [4.70e-06]	-1.48e-06 [5.99e-06]	8.04e-09 [4.80e-06]	2.45e-06 [6.72e-06]	-7.78e-07 [8.09e-06]	4.94e-06 [6.71e-06]	-1.14e-06 [4.76e-06]
prices of raw materials	0.0260*** [0.00494]	0.0260*** [0.00494]	0.0268*** [0.00581]	0.0276*** [0.00537]	0.0205*** [0.00539]	0.0351*** [0.00920]	0.0206*** [0.00590]	0.0234*** [0.00498]
consensus								0.264*** [0.0136]
hicp								0.533*** [0.0118]
trend								0.000749 [0.00668]
trend2								-0.000598*** [0.000110]
house prices			5.71e-05 [0.000196]					
price of fuel				0.0171** [0.00671]				
anchor					0.00998 [0.0197]			
Constant	-0.326 [0.695]	-0.584 [0.714]	-1.382 [0.850]	-2.235** [1.049]	-1.606* [0.847]	1.408 [2.374]	-1.728 [1.458]	-1.855*** [0.586]
Observations	26,043	25,206	18,256	20,832	21,196	9,484	15,722	25,206
R-squared	0.722	0.726	0.755	0.730	0.655	0.600	0.528	0.719

Notes: Standard errors in brackets *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: DETERMINANTS OF INFLATION EXPECTATIONS 12-MONTH AHEAD

	baseline	raw materials	house prices	fuel prices	raw materials anchor	High inflation	Low inflation	macro variables and trend
negotiated wages	0.0195*** [0.00563]	0.0220*** [0.00580]	0.0259*** [0.00717]	0.0151** [0.00705]	0.0217*** [0.00779]	0.0444*** [0.0154]	0.0219** [0.0133]	0.0185*** [0.00564]
no. employees	3.73e-07 [3.43e-06]	8.09e-07 [3.60e-06]	1.72e-06 [4.24e-06]	-3.04e-07 [3.85e-06]	4.89e-07 [6.89e-06]	4.57e-06 [5.45e-06]	5.42e-06 [6.93e-06]	2.66e-07 [3.65e-06]
prices of raw materials	0.0264*** [0.00491]	0.0280*** [0.00577]	0.0269*** [0.00540]	0.0269*** [0.00540]	0.0219*** [0.00553]	0.0335*** [0.00813]	0.0209*** [0.00611]	0.0258*** [0.00495]
consensus								0.232*** [0.0141]
hicp								0.505*** [0.0112]
trend								0.0106** [0.00481]
trend2								-0.000708*** [7.35e-05]
house prices			3.62e-05 [0.000216]					
price of fuel				0.0112* [0.00696]				
anchor					-0.0187 [0.0202]			
Constant	-0.457 [0.543]	-0.707 [0.560]	-1.073* [0.691]	-1.538 [1.067]	-1.113 [0.869]	-2.863* [1.484]	-1.142 [1.510]	-1.212** [0.538]
Observations	28,882	27,937	20,627	21,973	21,196	12,215	15,722	27,937
R-squared	0.649	0.655	0.679	0.677	0.624	0.614	0.515	0.644

Notes: Standard errors in brackets *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: DETERMINANTS OF INFLATION EXPECTATIONS 24-MONTH AHEAD

	baseline	raw materials	house prices	fuel prices	raw materials anchor	High inflation	Low inflation	macro variables and trend
negotiated wages	0.0221*** [0.00624]	0.0256*** [0.00645]	0.0353*** [0.00794]	0.0231*** [0.00765]	0.0267*** [0.00834]	0.0593*** [0.0164]	0.0227* [0.0146]	0.0207*** [0.00625]
no. employees	3.69e-07 [3.79e-06]	9.25e-07 [4.00e-06]	2.57e-06 [4.70e-06]	8.59e-09 [4.19e-06]	1.49e-06 [7.38e-06]	6.37e-06 [6.25e-06]	8.35e-06 [7.51e-06]	2.03e-07 [4.05e-06]
prices of raw materials	0.0195*** [0.00546]	0.0195*** [0.00546]	0.0205*** [0.00639]	0.0191*** [0.00582]	0.0183*** [0.00593]	0.0268*** [0.00910]	0.0126* [0.00661]	0.0172*** [0.00548]
consensus								0.213*** [0.0156]
hicp								0.380*** [0.0124]
trend								-0.0304*** [0.00533]
trend2								0.000135* [8.14e-05]
house prices			2.94e-05 [0.000239]					
price of fuel				0.0159** [0.00756]				
anchor					-0.0435** [0.0216]			
Constant	-0.202 [0.601]	-0.554 [0.622]	-1.480** [0.766]	-2.720*** [1.158]	-1.477 [0.931]	-3.784** [1.661]	-1.080 [1.632]	-0.680 [0.596]
Observations	28,882	27,937	20,627	21,973	21,196	12,215	15,722	27,937
R-squared	0.566	0.570	0.594	0.603	0.566	0.508	0.510	0.559

Notes: Standard errors in brackets * * * $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: ROBUSTNESS CHECKS

	6M own price	12M own price	24M own price	6M no big firms	12M no big firms	24M no big firms
negotiated wages	0.0159** [0.00711]	0.0157** [0.00705]	0.0234*** [0.00765]	0.0147** [0.00723]	0.0139** [0.00716]	0.0217*** [0.00777]
no. employees	1.67E-07 [4.80e-06]	-3.13E-07 [3.86e-06]	2.66E-09 [4.19e-06]	1.76E-05 [2.63e-05]	2.38E-06 [1.99e-05]	-5.56E-06 [2.16e-05]
prices of raw materials	0.0267*** [0.00537]	0.0263*** [0.00540]	0.0187*** [0.00587]	0.0277*** [0.00543]	0.0267*** [0.00546]	0.0191*** [0.00593]
price of fuel	0.0168** [0.00671]	0.0111 [0.00696]	0.0158** [0.00756]	0.0178*** [0.00683]	0.0115 [0.00708]	0.0174** [0.00769]
own prices	0.00480*** [0.00123]	0.00349*** [0.00120]	0.00236* [0.00130]			
Constant	-2.335** [1.056]	-1.589 [1.067]	-2.755** [1.158]	-2.302** [1.077]	-1.423 [1.087]	-2.717** [1.180]
Observations	20832	21973	21973	20514	21632	21632
R-squared	0.73	0.677	0.604	0.728	0.677	0.604

Notes: Standard errors in brackets * * * $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7: CROSS-SECTION ESTIMATES

	6M ahead infl. expec.	6M high inflation	6M low inflation	12M ahead infl. expec.	12M high inflation	12M low inflation	24M ahead infl. expec.	24M high inflation	24M low inflation
negotiated wages	0.0110 [0.00673]	0.0200 [0.0248]	0.0306* [0.0162]	0.0241*** [0.00598]	0.0536*** [0.0177]	0.0246 [0.0169]	0.0271*** [0.00673]	0.0680*** [0.0202]	0.0254 [0.0186]
no. employees	-3.27e-06** [1.30e-06]	-3.38e-06 [2.14e-06]	-3.12e-06* [1.63e-06]	-1.27e-06 [1.18e-06]	-1.81e-06 [1.69e-06]	1.67e-07 [1.70e-06]	-2.36e-06* [1.32e-06]	-4.21e-06** [1.92e-06]	1.44e-06 [1.87e-06]
prices of raw materials	0.0351*** [0.00487]	0.0446*** [0.00817]	0.0246*** [0.00605]	0.0403*** [0.00487]	0.0512*** [0.00755]	0.0268*** [0.00629]	0.0395*** [0.00547]	0.0492*** [0.00861]	0.0262*** [0.00692]
firm age	-0.000709** [0.000285]	-0.00124** [0.000494]	-0.000107 [0.000343]	-0.000178 [0.000280]	-0.000495 [0.000443]	0.000297 [0.000356]	-0.000374 [0.000315]	-0.00111** [0.000505]	0.000557 [0.000392]
firm size	0.0275** [0.0128]	0.0113 [0.0222]	0.0408*** [0.0154]	0.0240* [0.0127]	-0.0103 [0.0201]	0.0635*** [0.0160]	0.0327** [0.0142]	-0.00443 [0.0230]	0.0754*** [0.0176]
(200-1000 empl.)	-0.0210 [0.0178]	-0.0708** [0.0300]	0.0154 [0.0220]	-0.0168 [0.0174]	-0.0706*** [0.0268]	0.0340 [0.0229]	0.00306 [0.0195]	-0.0586* [0.0306]	0.0595** [0.0252]
firm size (beyond 1000 empl.)	1.332* [0.775]	-0.0747 [2.670]	-0.368 [1.857]	0.321 [0.597]	-2.855* [1.725]	0.468 [1.931]	0.496 [0.671]	-3.815* [1.967]	0.575 [2.123]
Observations	23,007	8,603	14,404	25,388	10,984	14,404	25,388	10,984	14,404
R-squared	0.612	0.400	0.208	0.522	0.435	0.182	0.394	0.259	0.144
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Standard errors in brackets *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 8: ROLE OF PAYMENTS ENVISAGED IN CONTRACT RENEWALS

	6M	12M	24M	6M	12M	24M
una tantum	0.00337* [0.00193]	0.00431** [0.00198]	0.00360 [0.00222]	0.00508* [0.00260]	0.00497* [0.00260]	0.00302 [0.00285]
tranches	0.000878*** [0.000296]	0.00132*** [0.000273]	0.00153*** [0.000305]	9.82e-05 [0.000398]	0.000842*** [0.000365]	0.00118*** [0.000401]
no. employees	-1.41e-06 [5.71e-06]	1.39e-06 [4.05e-06]	1.72e-06 [4.53e-06]	-3.07e-06** [1.51e-06]	-8.84e-07 [1.38e-06]	-1.54e-06 [1.52e-06]
prices of raw materials	0.0263*** [0.00533]	0.0279*** [0.00528]	0.0212*** [0.00590]	0.0411*** [0.00565]	0.0447*** [0.00554]	0.0435*** [0.00608]
firm age				-0.000477 [0.000339]	-6.41e-05 [0.000328]	-0.000174 [0.000360]
firm size (200-1000 empl.)				0.0347** [0.0151]	0.0352** [0.0147]	0.0455*** [0.0161]
firm size (beyond 1000 empl.)				-0.00179 [0.0219]	-0.00489 [0.0210]	0.0121 [0.0231]
Constant	-0.283 [0.218]	0.709*** [0.149]	1.103*** [0.167]	3.435*** [0.299]	2.427*** [0.260]	2.656*** [0.286]
Observations	21,303	24,034	24,034	19,445	21,826	21,826
R-squared	0.757	0.683	0.596	0.595	0.522	0.411
Firm FE	YES	YES	YES	NO	NO	NO
Quarter FE	YES	YES	YES	YES	YES	YES

Notes: Standard errors in brackets ** $p < 0.01$, * $p < 0.05$, * $p < 0.1$.

Table 9: PRICE PASS-THROUGH OF WAGES

	Whole sample		Whole sample		High inflation		High inflation		Low inflation	
	Own prices	Own prices with lags	Own prices	Own prices with lags	Own prices	Own prices with lags	Own prices	Own prices with lags	Own prices	Own prices with lags
neg. wages	0.161*** [0.0622]	0.267*** [0.0942]	0.195 [0.142]	0.425** [0.194]	0.174*** [0.0608]	0.159* [0.0952]				
neg. wages (lag 1)		-0.122 [0.112]		-0.255 [0.205]						
neg. wages (lag 2)		-0.0555 [0.105]		-0.175 [0.188]						
neg. wages (lag 3)		0.0483 [0.0963]		0.0781 [0.152]						
neg. wages (lag 4)		0.0121 [0.0789]		0.171 [0.128]						
role of demand	0.339*** [0.0365]	0.338*** [0.0365]	0.229*** [0.0621]	0.225*** [0.0622]	0.166*** [0.0450]	0.167*** [0.0450]				
no. employees	4.28e-06 [2.27e-05]	4.56e-06 [2.27e-05]	1.30e-05 [3.44e-05]	1.42e-05 [3.44e-05]	-0.000227*** [4.11e-05]	-0.000225*** [4.11e-05]				
prices of raw materials	0.123*** [0.0323]	0.122*** [0.0323]	0.0944* [0.0553]	0.0955* [0.0553]	0.0703* [0.0390]	0.0666* [0.0391]				
price of fuel	0.0439 [0.0411]	0.0444 [0.0411]	0.0655 [0.0690]	0.0652 [0.0690]	-0.0365 [0.0517]	-0.0371 [0.0517]				
Constant	-3.914 [4.216]	-3.985 [4.216]	-6.903 [6.917]	-6.967 [6.916]	4.640 [5.298]	4.769 [5.300]				
Observations	22,035	22,035	8,972	8,972	13,063	13,063				
R-squared	0.401	0.401	0.534	0.534	0.417	0.417				
Firm FE	YES	YES	YES	YES	YES	YES				
Quarter FE	YES	YES	YES	YES	YES	YES				

Notes: Standard errors in brackets * * * $p < 0.01$, * * $p < 0.05$, * $p < 0.1$.