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Serafin Frache[a*], Rodrigo Lluberas[b**]

a *Universidad de Montevideo*
b *Banco Central del Uruguay*

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Resumen

La evidencia empírica acerca del valor social de la información pública es escasa. En este trabajo se provee evidencia acerca de cómo las expectativas de inflación de las firmas reaccionan a la publicación de información pública (el Índice de Precios al Consumo o IPC) en un país con una historia de inflación alta y volátil. Mostramos que las firmas que responden la encuesta luego de la publicación de información pública es más probable que revisen sus expectativas de inflación, tienen menores errores de predicción y menor desacuerdo acerca de la inflación futura que aquellas firmas que contestan la encuesta antes de la publicación oficial del IPC. En ese sentido, a pesar de que la evidencia para países con baja inflación sugiere que los agentes no reaccionan a los anuncios públicos se muestra que este podría no ser el caso en países con inflación media o alta.

Abstract

The empirical evidence on the social value of public information is scarce. In this paper, we provide evidence on how firms' inflation expectations react to the publication of public information, i.e. the monthly Consumer Price Index (CPI) in a country with a history of high and volatile inflation. We show that firms that answer the survey after the release of public information are more likely to revise their current year inflation expectations, have lower forecast errors, and lower disagreement about future inflation than firms that answer the survey before the publication of the official CPI monthly statistics. In that sense albeit the existing evidence for low-inflation countries suggests that agents do not react to monetary policy announcements or the publication of public information, we show that might not be the case in medium or high-inflation countries.

JEL: D22, D84, E31
Keywords: national accounts, agricultural sector, methodology, regions, employment, structure

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* Correo electrónico: *sfrache@um.edu.uy*

** Correo electrónico: *rlluberas@bcu.gub.uy*

1 Introduction

The literature has emphasized the importance of information frictions in the formation of expectations. It has been found that agents depart from full-information rational expectations and suffer from information frictions in their expectations formation process. Most of the literature has been focused on consumers and professional forecasters expectations and thus current available evidence about firms' expectations formation is scarce due to data availability. Notable exceptions are Coibion et al. (2018) and Coibion et al. (2018) using firm level data from New Zealand, and several papers using data from Uruguay; among them Licandro and Mello (2014), Licandro and Mello (2015), Borraz and Orlik (2016) and Frache and Lluberas (2018).

Agents have access to, basically, two types of sources of information about fundamentals, some of these sources are private and some are public. Governments' release of public information could be key to diminish information frictions and help to allocate resources more efficiently and, in principle, increase social welfare. Then, for instance, the publication of official statistics by government agencies or monetary policy communications by the central bank are potential instruments to help agents learn about fundamentals and coordinate their actions with the fundamentals and the actions of other agents. In that sense, public information can serve as a coordination device.

There has been a theoretical discussion in terms of the welfare effects of public information. For instance, assuming that coordination is socially negative, Morris and Shin (2002) argue that the release of public information reduces welfare. In that line, Amador and Weill (2010), state that a positive implication of their model is that the publication of economic statistics can result in less accurate forecasts and conclude that, based on its welfare consequences, official agencies have to publish "'all or nothing"'. On the other hand, there are several papers that relativize Morris and Shin (2002) results and suggest that not always more public information is harmful for social welfare (see for instance Angeletos et al. (2016), Angeletos and Pavan (2007), Hellwig (2005), Svensson (2006)).

Discussing the role of central bank communications as a policy tool from an empirical perspective, Coibion et al. (2018) argue that the existing evidence points to the fact that neither consumers' nor firms' inflation expectations react to monetary policy announcements in low-inflation economies. In this paper, we study if the release of official statistics, a type of public information, affects firms' inflation expectations in Uruguay, a country with historically high and volatile inflation. For that, we use data from a unique monthly firm

survey that has been ran since October 2009. Although the information is not available for all the months, having the exact day and time the firm finished answering the survey is key for our empirical strategy. Then, for this paper we use data for the period between April 2017 and September 2018 (see Frache and Lluberas (2018) for more details about the survey). Although the period of analysis covers only 18 months, it is particularly interesting because of the evolution of observed inflation during that time span.

We test whether the official Consumer Price Index (CPI) monthly publication has an effect on firms' inflation expectations by studying whether there are differences in terms of inflation expectations, forecast errors, disagreement and expectation revisions between firms answering the survey before and after the release of the monthly CPI by the National Statistical Institute. We show that firms that answer the survey after the release of the monthly Consumer Price Index (CPI) information are more likely to revise their current year inflation expectations, have lower forecast errors, and lower disagreement about future inflation than firms that answer the survey before the National Statistical Office publish the official CPI monthly statistics. In that sense albeit the existing evidence for low-inflation countries suggests that agents do not react to public information, we show that might not be the case in medium or high-inflation countries, a result also found in Licandro and Mello (2015) for monetary policy communications.

The rest of the paper is organized as follows. In the next section, we present a summary of the relevant literature on the topic. In section 3 we present the data used in the empirical analysis and the notation and definitions that follow in the paper. Section 4 presents the main results of our empirical analysis in terms of inflation expectations, forecast errors, revisions and disagreement across firms. Finally, section 6 presents the conclusion of the paper.

2 Literature review

There is a growing body of theoretical literature concerned with information problems faced by economic agents. Several explanations have been proposed to explain information frictions. One type of model is, the noisy information model proposed by Woodford (2003), Sims (2010) and Maćkowiak and Wiederholt (2009). In this model agents continuously update their information set, but get the information with a noisy signal. Another set of models, for example Mankiw and Reis (2002), assumes that agents update their information sets infrequently, but that when they do, they behave as fully rational.

The different information friction models have been tested empirically. For instance, Coibion and Gorodnichenko (2012) find that the degree of information rigidities is large and is likely to have important consequences on the dynamics of macroeconomic variables as well as in the optimal policy. Moreover, they test the different information rigidity models and conclude that the noisy-information model is the one that best matches the expectations of economic agents. Similarly, Coibion and Gorodnichenko (2015) using inflation expectations from the U.S Survey of Professional Forecasters, reject the full information rational expectations hypothesis due to the existence of information frictions.

Carroll (2003) and Carroll (2005) present an epidemiological based model of macroeconomic expectations and study the transmission of information and its impact on the formation of inflation and unemployment expectations. In particular, Carroll looks at how households' expectations derive from news reports based on the opinion of professional forecasters. Consequently, households are not expected to be constantly updating their information to form expectations of macroeconomic variables, but rather rely on the views of economic analysts and commentators to, probabilistically and sometimes with delay, adjust their expectations. He derives an empirical equation from the model to estimate the evolution of mean inflation and unemployment expectations using data from the Michigan Survey of Consumers. Results suggest that the expectation formation mechanism is in-between the fully rational expectation and adaptive expectation models.

Despite the role of firms as price setters, survey data on firms' inflation expectations is scarce, Coibion et al. (2015) being a notable exception. They implement a novel survey of firms' expectations about a set of macroeconomic variables in New Zealand, including expectations on future inflation and beliefs about recent inflation. They demonstrate how despite New Zealand's status as the first country to implement an inflation targeting regime almost 20 years ago and its recent history of low inflation close to the central bank target, firms' average inflation expectations are systematically above observed inflation. Moreover, they find that disagreement across firms is larger than among professional forecasters; this results from a dispersion of beliefs about recent macroeconomic conditions. They also study firms' incentives to gather macroeconomic information and find patterns consistent with rational inattention. In particular, they find that firms make smaller errors and have less uncertainty about macroeconomic variables that are important for their business.

Andrade and Bihan (2013) analyze the expectation formation process of professional forecasters in the European Central Bank Survey. First, they find that there is stickiness in professional forecasters expectations, each quarter 25% of professional forecasters do not update their one-year or two-year ahead forecasts.

Second, consistent with Sims' noisy information model, they find evidence that those who update their information set do not agree on their forecasts. Finally, they develop a model with both sticky and noisy information and show that matching the professional forecasters expectations smoothness would imply a higher degree of inattention than that estimated amount from the microdata.

Mankiw et al. (2004) study the disagreement about inflation expectations across households, professional forecasters, and economists working in the industry. They find that the amount of disagreement is important, it varies over time, and correlates with other macroeconomic variables. The authors also state that the sticky information model can explain the evolution of the median and the dispersion of inflation expectations over time. However, they claim the model is not able to explain, for example, the positive correlation between the level of inflation and the level of disagreement across agents.

Most of the literature on expectations is based on data from developed countries; Carrillo and Emran (2012) being a notable exception. They look at how public information affects the inflation expectation formation process in Ecuador by using a natural experiment. They claim public information aggregates dispersed information and provides a hint about the actions of others. Carrillo and Emran (2012) take into consideration that for a period of time the official statistics agency in Ecuador made a mistake in its inflation statistics due to a programming error. When the error was detected, the series of official inflation was revised downward for 14 months starting in January 2005. They use households' inflation expectations and find that the public information about prices is key in explaining households' inflation expectation formation process.

There are also several papers that, using the same firm level survey we use in this paper, study firms' inflation expectations in Uruguay. Borraz et al. (2013) study wage and price setting by introducing specific questions about price setting, the frequency of price adjustments and the main factors behind price increases. They find that there is no specific frequency for price adjustment and that firms adjust their prices immediately after a wage increase. The three papers that are more related to our work are Licandro and Mello (2014), Licandro and Mello (2015) and Borraz and Orlik (2016). In the first paper, the authors study how monetary policy affects firms' inflation expectation formation process. They find that a 1% increase in the interest rate results in a reduction of 0.3% in firms inflation expectation, showing the importance of the expectations channel of monetary policy in Uruguay. Licandro and Mello (2015) study how inflation expectations react to news about monetary policy. They find that monetary policy news affects firms' inflation expectations, particularly, an expansionary (contractionary) change in monetary policy increases (decreases)

inflation expectations, suggesting that the communication of monetary policy is key in the formation of inflation expectations in Uruguay. Borraz and Orlik (2016) study the degree of attentiveness of firms in Uruguay using specific questions about past inflation. They find that firms make smaller forecast errors than professional forecasters and that they are well aware of past and future inflation. Finally, Frache and Lluberas (2018) study how firms' inflation expectations react to information acquisition by exploiting the variation in the time of wage adjustment across firms in Uruguay. They find that firms that adjust wages are better forecasters, have lower disagreement and revise more their inflation expectations than firms that do not adjust their wages. This suggest infrequent information acquisition among firms.

3 Data

3.1 Firm survey

Our empirical analysis is based on two main data sources. First, we use a novel firm level survey carried out by the National Institute (INE) commissioned by the Central Bank of Uruguay (BCU), to measure firms' inflation and own cost expectations at different time horizons. The logistics of the survey are arranged by INE, a well-respected Uruguayan public agency and in charge of several regular household and firm level surveys.

Each month since October 2009 a representative sample of around 500 firms with at least 50 employees are questioned about their expectations. The firms receive the questionnaire electronically by e-mail the first day of each month and have until the end of the month to answer it. If there are doubts about an answer, it is followed-up by a telephone call by members of INE. Even though it is not compulsory to answer the questionnaire, the response rate ranges between 54% and 88%. The resulting sample is an unbalanced panel and representative of all the sectors in the economy, except for the financial, agricultural, and public sectors. More details about the survey are presented by Frache and Lluberas (2018)

Firms are asked about their expected annual change in the Consumer Price Index for the current year, for the next 12 months, and for the monetary policy horizon, which was 18 months until July 2013 and has been 24 months since then. For example, in August 2013 firms were asked about the expected change in the CPI during the year 2013, between August 2013 and July 2014 and between August 2014 and July 2015.

The specific wording of the question is: *What do you believe is going to be the change in the CPI?* [1]. From the wording of the question we interpret that firms are asked about their expectations about the general CPI and not their specific prices [2].

Moreover, the questionnaire also digs into the expected change of firms' own costs for the same time horizons. Then, firms are also asked *What do you believe is going to be the average change in your firm's costs in local currency?* [3] For the same time horizon, we have both the firm inflation and own costs expectations.

On top of the regular questions about inflation and own cost expectations, firms are asked special questions in certain months. We asked firms about financial decisions, access to credit, price setting decisions, uncertainty about inflation expectations, and currency of invoicing, among other topics.

Table 3.1 shows the day of the publication in each month and the number of firms answering the survey each month splitted between firms answering before and after the CPI information release.

Of the 403 firms that appear at least once in our sample, 87 answered always after the release of the CPI, while only 10 answered the survey always before the publication of the inflation data by the national statistical institute. Thus, there is variation on the date of survey answering within firms. Figure 3.1 reinforce the idea by showing the proportion of times that firms answer before the release of the CPI monthly information.

[1] In Spanish, the original wording is: *¿Cuál cree usted que será la variación del IPC (Indice de Precios al Consumo)?*.

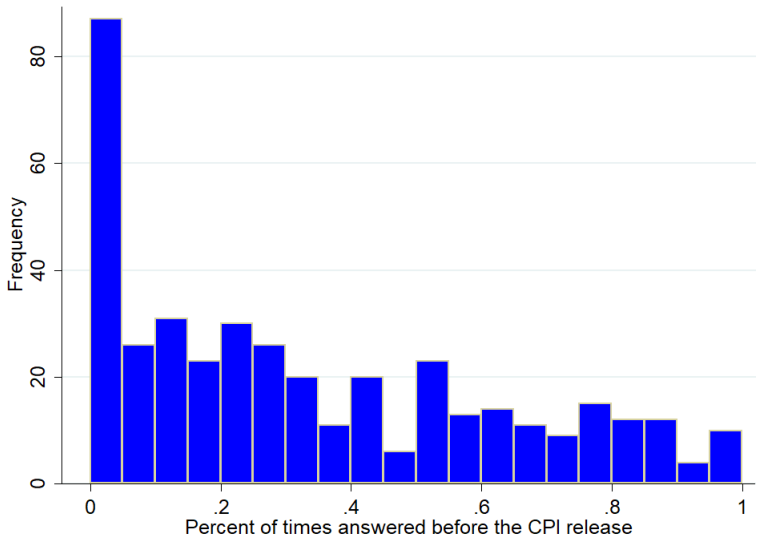
[2] The wording of the questions is important. For instance, de Bruin et al. (2012) find that expectations were lower and there was less disagreement if households in the Michigan Survey of Consumers are asked about "inflation" instead of "prices in general" or "prices you pay". On the other hand, Coibion et al. (2015) find no difference in expectations if firms in New Zealand are asked about "changes in prices" or directly "inflation".

[3] In Spanish, the original wording is: *¿Cuál cree usted que será la variación promedio de los costs de su empresa en pesos uruguayos?*.

Table 3.1: *Publication day and number of firms answering before/after the CPI release*

		Number of firms answering	
	Publication day	Before	After
April-17	5	191	133
May-17	4	182	153
June-17	5	133	205
July-17	5	129	209
August-17	3	127	155
September-17	5	128	187
October-17	4	128	208
November-17	3	50	276
December-17	5	115	202
January-18	4	97	215
February-18	5	125	162
March-18	5	107	199
April-18	4	56	257
May-18	4	107	194
June-18	5	95	205
July-18	4	103	199
August-18	3	102	192
September-18	5	86	204

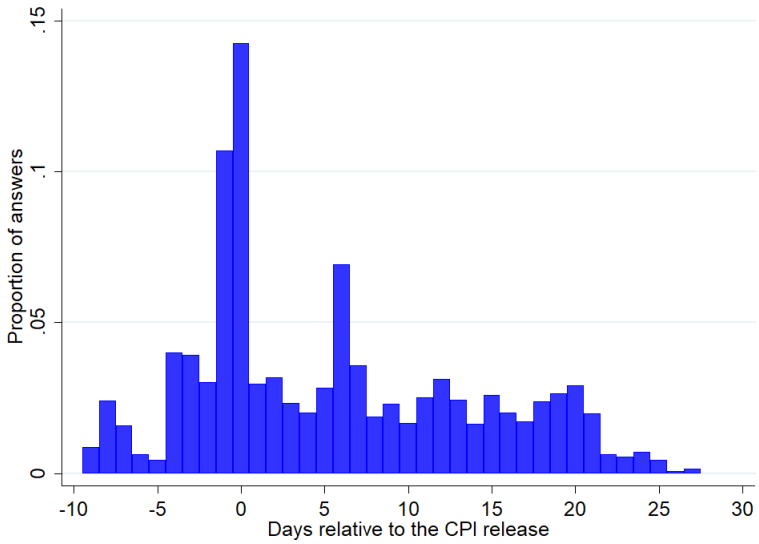
Figure 3.1: *Histogram: proportion of times answering before the CPI release*



Not only there is variation within firms answering before/after the CPI release but also across the month.

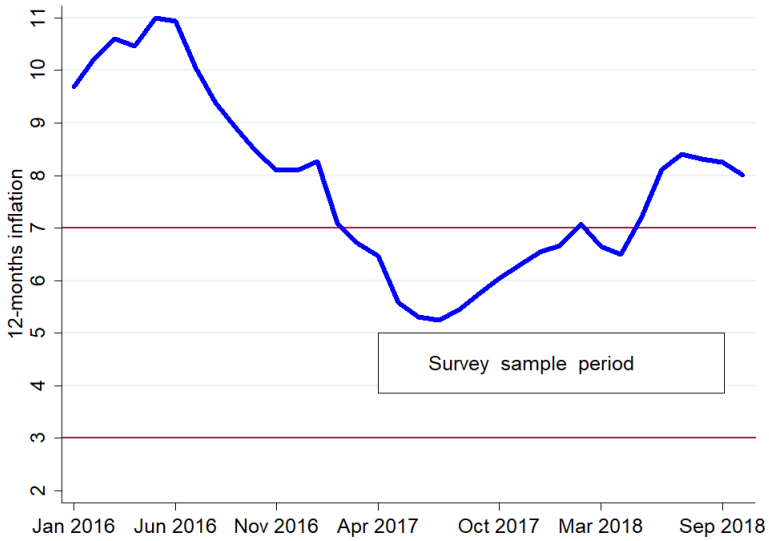
Figure 3.2 shows the proportion of answers relative to the day of the CPI information release. About 14% of the answers are the day of the CPI release, and then answers are dispersed over the month.

Figure 3.2: *Proportion of answers relative to the day of the CPI release*



The specific time span we analyze is in itself interesting because there are important fluctuations in annual inflation rate and thus represents a completely different environment to the ones already studied in the literature. Figure 3.3 shows official 12-months inflation between January 2016 and October 2018. The survey sample period we are working with is between April 2017 and September 2018, during which the observed inflation rate ranges between 5.2% in July 2017 and 8.4% in July 2018. Before our sample period, inflation rate peaked at 11% in June 2016, above the Central Bank of Uruguay inflation target range of between 3% and 7%, to decline thereafter and stay within the target range for 11 months starting in February 2017.

Figure 3.3: *Observed inflation: January 2016 to October 2018*



It could be argued that firms answering after the release of the CPI information are not necessarily informed about the latest inflation data. Anecdotal data suggests the idea that firms, or more generally individuals, in Uruguay are aware of the official inflation information released by the national statistics institute. We asked firms in March 2016 and March 2017 to rank by level of importance the sources of information they use to forecast future inflation. More than 55% of firms in 2016 and 46% in 2017 answered that the information provided by the National Statistical Office is the most or second most important source of information to form their inflation expectations [4].

4 Empirical evidence

In this section we summarize our empirical results of the effect of official statistics release on inflation expectations among firms in Uruguay. We then look at inflation expectations, disagreement, forecast errors and inflation expectations revisions. In what follows we explain how we define each variable and present the results.

[4]Other alternatives given to firms were: news media, Central Bank communications, wage councils, Ministry of Economics and Finance communications, consultants, personal experience and others

4.1 General framework

Assume that firms have access to two types of information sources: a public and a private one. For instance, we can think of the publication of the main macroeconomic statistics by statistical agencies or the central bank communication about the monetary policy as sources of public information. On the other hand, there are idiosyncratic signals that are gathered by the firm to form its inflation expectations and are not shared, at least until private information is revealed in the market, with other firms. For instance, firm specific costs and the evolution of input prices could be considered as private information.

Let ω_t^i be firm i private information at time t and let ω_t be public information, in principle available to all firms, at time t. Then, firm i information set is composed by its private and public information, $\Omega_t^i = (\omega_t^i; \omega_t)$.

In general, we define $F_t^i \pi_{t+h}$ as the h-month ahead inflation expectation of firm i at time t. Then, for instance, $F_t^i \pi_{t+12}$ is firm's i 12-month ahead inflation expectation formed with the information available at time t. Alternatively, $F_t^i \pi_y$ is defined as the expected inflation at time t for the current year.

Let assume that firms' inflation expectations are a function of their information set available at time t. Then,

$$F_t^i \pi_{t+h} = f(\Omega_t^i) = f(\omega_t^i; \omega_t)$$

In our empirical models, we are going to assume that public information is captured by monthly aggregate effects and the publication of the CPI by the national statistical institute. On the other hand, private information is captured by a firm specific time-invariant fixed effect, the expected change in firm's own costs and a random disturbance assumed, after controlling for the previous variables, uncorrelated with public information, ω_t.

4.2 Inflation expectations

Although we have information on inflation expectations in different horizons - current year, 12-months ahead and 24-months ahead -, the focus of this paper is in current year inflation. We will see that the release of the CPI does not seem to have an effect in long-term inflation expectations but affects only short-term expectations.

We first want to study if there is any effect of the CPI publication on firms' inflation expectations. If firms acquire new information with the publication of the most recent inflation information, then we should expect differences in inflation expectations between firms that answer the survey before or after the release of the CPI data. To test this hypothesis, we estimate the following fixed effect panel data model [5], controlling also for month seasonality, γ_m:

$$F_t^i \pi_y = \alpha_i + \beta B_{it} + \delta F_t^i C_y + \gamma_m + \epsilon_{it}$$

Where $F_t^i \pi_y$ was already defined and B_{it} is a dummy variable that takes the value 1 when firm i answers the survey before the publication of the CPI at time t and 0 otherwise and $F_t^i C_y$ is the expected own cost change for the current year. Results are summarized in Table 4.1. According to our estimates, over the whole sample period there is no statistical significant difference in current year inflation expectations between firms that answer before or after the CPI publication. Moreover, we neither find an effect on longer term inflation expectations, particularly for 12-months ahead and 24-months ahead inflation expectations.

We investigate this further and split the sample in two time periods. A first period between April 2017 and December 2017 in which observed inflation was within the central bank 3% to 7% target range and a second period between January 2018 and September 2018 in which inflation started to accelerate and surpassed the upper bound of the central bank target range. If more informed firms are more likely to revise their inflation expectations we should see differences in inflation expectations as observed inflation starts to increase or decrease. Then, more informed firms - those answering after the publication of the CPI - should report a higher expected inflation when inflation starts to increase and expect lower inflation when observed inflation starts to decelerate.

We find that firms answering the survey before the CPI release in the first sub-sample period in which inflation was declining and relatively stable within the central bank target range expect higher inflation than firms answering after the CPI publication (column (2) in Table 4.1). Moreover, on average, expected current year inflation declined over time, as captured by the negative coefficients associated with the monthly dummies. Although with a lag, firms reacted to the decline in observed inflation by reducing their inflation expectations for the current year, more so if they were more informed about the evolution of observed

[5] In all the fixed effects panel data models we used Driscoll-Kraay standard errors to take into account the potential cross-sectional and temporal dependence of regression disturbances. See Driscoll and Kraay (1998) and Hoechle (2007).

inflation.

On the other hand, when we look at the period between January 2018 and September 2018 in which inflation started to accelerate and surpassed the central bank target range upper bound we find that less informed firms expect lower inflation. Again, on average, firms reacted to the increase in inflation by increasing their inflation expectations; but firms answering after the publication of the CPI expect higher inflation than those answering after the official publication of the monthly inflation statistics. Overall, we find that firms answering after the publication of the CPI react more to changes in observed inflation than those answering the survey without knowing the latest inflation figure.

4.3 Forecast errors

If more informed firms react more to changes in observed inflation, then we should expect them to make smaller forecast errors. To analyze this, we define the forecast error of firm i at time t as the difference between its current year inflation expectation at time t and the actual inflation during that year. :

$$FE_t^i \pi_y = \pi_y - F_t^i \pi_y$$

Note that even though the expectation and the actual inflation refer to the same time period, whilst $F_t^i \pi_{t+h}$ is observed at time t, inflation between t and $t+h$, π_{t+h}, is observed at time $t+h$, once it is realized. Given that the survey data runs from April 2017 to September 2018 we do not have enough information on forecast errors. In particular, we only have forecast errors for 12-months ahead inflation from April 2017 and October 2018 and forecast error in current year inflation for 2017 (April to December). Then, due to data availability we can only study forecast errors for expected inflation during the 2017 calendar year and thus estimate the following model for the absolute value of the forecast error in 2017:

$$|FE_t^i \pi_{2017}| = \alpha_i + \beta B_{it} + \delta F_t^i C_y + \gamma_m + \epsilon_{it}$$

Results are summarized in Table 4.2. First, we confirm that less informed firms make larger forecast errors. On average for 2017 inflation firms answering before the publication of the CPI make, in absolute value, a forecast error 0.144 percentage points larger than firms answering after the release of monthly inflation data. Also, as already shown in Frache and Lluberas (2018), as the year passes and more information on current

Table 4.1: *Inflation expectations and CPI publication*

	$F_t^i\pi_y$	$F_t^i\pi_y$	$F_t^i\pi_y$	$\mathrm{F}_t^i\pi_{t+12}$	$\mathrm{F}_t^i\pi_{t+24}$
	(1)	(2)	(3)	(4)	(5)
	Apr17-Sep18	Apr17-Dec17	Jan18-Sep18	Apr17-Sep18	Apr17-Sep18
Before	0.083	0.117	-0.074	0.063	0.014
	(0.074)	(0.052)*	(0.018)***	(0.070)	(0.052)
$F_t^iC_y$	0.249	0.228	0.172	0.225	0.198
	(0.025)***	(0.047)***	(0.018)***	(0.021)***	(0.028)***
February	-0.005		0.002	0.143	0.105
	(0.008)		(0.008)	(0.011)***	(0.008)***
March	0.052		0.066	0.163	0.101
	(0.007)***		(0.006)***	(0.007)***	(0.009)***
April	0.423		0.059	0.558	0.470
	(0.240)*		(0.010)***	(0.216)**	(0.162)***
May	0.441	-0.063	0.198	0.599	0.459
	(0.173)**	(0.004)***	(0.012)***	(0.153)***	(0.135)***
June	0.417	-0.229	0.308	0.554	0.408
	(0.074)***	(0.023)***	(0.008)***	(0.056)***	(0.066)***
July	0.354	-0.456	0.439	0.536	0.386
	(0.043)***	(0.038)***	(0.007)***	(0.019)***	(0.033)***
August	0.328	-0.600	0.528	0.522	0.398
	(0.117)**	(0.050)***	(0.009)***	(0.060)***	(0.063)***
September	0.341	-0.723	0.735	0.537	0.377
	(0.237)	(0.057)***	(0.014)***	(0.203)**	(0.148)**
October	0.012	-0.744		0.222	0.154
	(0.005)**	(0.053)***		(0.010)***	(0.005)***
November	-0.129	-0.874		0.127	0.025
	(0.013)***	(0.060)***		(0.012)***	(0.010)**
December	-0.124	-0.875		0.172	0.122
	(0.005)***	(0.065)***		(0.011)***	(0.008)***
Constant	5.732	6.675	6.501	5.981	6.489
	(0.250)***	(0.512)***	(0.173)***	(0.215)***	(0.265)***
N	5,615	2,910	2,705	5,615	5,615

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

year inflation is released, forecast error declines. Then, for instance, the forecast error for inflation during calendar year 2017 is 1 percentage point lower in December than in April (omitted category).

Given that we know the exact day (and time) that the firm finished answering the survey we can look at whether there are differences not only between firms answering before and after the CPI publication but also firms answering just after the publication and those answering closer to the end of the month. We then define a set of 6 dummy variables representing the response day relative to the publication of the CPI. Results for this exercise are shown in column (2) of Table 4.2 where the omitted category is before the publication of the CPI and then we have 5 additional dummies capturing those answering: right after the publication of the CPI and up to 5 days after, 6 to 10 days after, 11 to 15 days after, 16 to 20 days after and 20 or more days after.

The effect of the publication of the CPI on the accuracy of the inflation forecast is short lived and vanished after a few days. Our results suggest that those answering the survey within 10 days after the publication of the CPI make smaller forecast errors than those answering before the release. On the other hand, there is no statistically significant differences in forecast errors between those answering before and those answering after 11 or more days the publication of the CPI.

4.4 Revisions

Given the panel dimension of our data and the fact that firms are asked about their inflation expectations for the current year each month, we can also look at firms' expectation revisions. For instance, in every month of 2017 firms were asked about their expected inflation for the year 2017. This gives us up-to 11 observations per firm in each year and allows us to look at how firms revise their expectations throughout the year. Define the current year (y) inflation revision of firm i at time t as $R_t^i\pi_y$. Then, for instance, for two consecutive months t and $t-1$, we define the revision of inflation expectations for year y as $R_t^i\pi_y = F_t^i\pi_y - F_{t-1}^i\pi_y$.

We then have data on current year inflation expectations for each month between April and December of year 2017 and for each month between February and September 2018 allowing us to estimate the following regression:

$$|R_t^i\pi_y| = \alpha_i + \beta B_{it} + \delta F_t^i C_y + \gamma_m + \epsilon_{it}$$

Table 4.2: *Forecast error and CPI publication*

	$\lvert FE_t^i \pi_{2017} \rvert$ (1)	$\lvert FE_t^i \pi_{2017} \rvert$ (2)
Before	0.107	
	(0.054)*	
$F_t^i C_y$	0.195	0.195
	(0.047)***	(0.047)***
May	-0.051	-0.051
	(0.003)***	(0.002)***
June	-0.187	-0.186
	(0.023)***	(0.023)***
July	-0.409	-0.408
	(0.038)***	(0.038)***
August	-0.459	-0.459
	(0.048)***	(0.052)***
September	-0.520	-0.519
	(0.056)***	(0.055)***
October	-0.569	-0.569
	(0.055)***	(0.055)***
November	-0.745	-0.745
	(0.058)***	(0.059)***
December	-0.799	-0.800
	(0.064)***	(0.063)***
0-5 days after		-0.106
		(0.060)
6-10 days after		-0.111
		(0.057)*
11-15 days after		-0.099
		(0.041)**
16-20 days after		-0.117
		(0.069)
20+ days after		-0.102
		(0.072)
Constant	0.479	0.588
	(0.508)	(0.469)
N	2,910	2,910

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Results are shown in column (1) of Table 4.3. Firms answering after the CPI publication revise more their current year inflation expectations than those answering before the monthly CPI is known. We also split those answering after the release of official statistics according to the number of days passed after the publication to complete the survey. Our results suggest that the effect vanished after 20 or more days of the official publication. Then, as for forecast errors, firms answering a few days after the publication of the CPI data revise more their expectations than those answering before.

Finally, we study if changing the day of survey completion from in adjacent months have an effect on expectations revisions. If the effects we have found on inflation expectations and expectations revisions of answering after the CPI publication is due to having more information about recent inflation, we should expect firms that in a given month answer the survey before the CPI publication and in the following month answer after the CPI information is released. Then we divide the firms in four groups. A first group, which is the omitted category in the regression, is comprised by those firms that answer in two consecutive months before the publication of the CPI. The rest of the groups are: firms answering before and then after (Before-After), firms answering after and then before the publication (After-Before) and firms answering always after (After-After).

Results are summarized in column (3) of Table 4.3 and are with respect to firms answering before the publication of the CPI in the two adjacent months. Our results suggest that firms that answered before the publication of the CPI in the past month and answer after the CPI release in the following month revise more their inflation expectations. This is consistent with the idea that the publication of CPI gives firms additional information about current inflation and that is used in the process of expectations formation.

4.5 Disagreement

Let $D^e_{t,y}$ be the disagreement across firms about current year inflation expectations measured by the standard deviation. Note that disagreement is defined across firms, and it is not the same as firms uncertainty about future inflation. Unfortunately we only have 18 months of data and thus a small sample to run regressions so we present evidence of difference in the standard deviation of current year inflation expectations between firms answering before and after the CPI public release.

Under rational expectations with no cost of acquiring information and all firms having the same information set there is no room for disagreement on future inflation across firms. Table 4.4 shows that, on average

Table 4.3: *Expectations revision and CPI publication*

	$\lvert R_t^i \pi_y \rvert$	$\lvert R_t^i \pi_y \rvert$	$\lvert R_t^i \pi_y \rvert$
	(1)	(2)	(3)
Before	-0.072		
	(0.013)***		
$F_t^i C_y$	0.023	0.023	0.024
	(0.023)	(0.023)	(0.025)
March	0.008	0.011	-0.005
	(0.003)**	(0.003)***	(0.005)
April	-0.084	-0.081	-0.121
	(0.027)***	(0.029)**	(0.006)***
May	-0.036	-0.031	-0.042
	(0.029)	(0.032)	(0.018)**
June	0.061	0.065	0.046
	(0.099)	(0.100)	(0.091)
July	0.040	0.045	0.038
	(0.058)	(0.059)	(0.054)
August	-0.022	-0.011	-0.027
	(0.058)	(0.055)	(0.056)
September	-0.010	-0.005	-0.017
	(0.030)	(0.032)	(0.028)
October	0.002	0.008	-0.001
	(0.007)	(0.010)	(0.006)
November	0.014	0.016	0.005
	(0.011)	(0.011)	(0.012)
December	0.062	0.065	0.079
	(0.005)***	(0.006)***	(0.006)***
0-5 days after		0.081	
		(0.030)**	
6-10 days after		0.069	
		(0.022)***	
11-15 days after		0.064	
		(0.026)**	
16-20 days after		0.084	
		(0.023)***	
20+ days after		0.026	
		(0.044)	
Before-After			0.131
			(0.033)***
After-Before			-0.051
			(0.030)
Before-Before			0.033
			(0.024)
Constant	0.241	0.165	0.180
	(0.210)	(0.211)	(0.233)
N	4,882	4,882	4,578

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

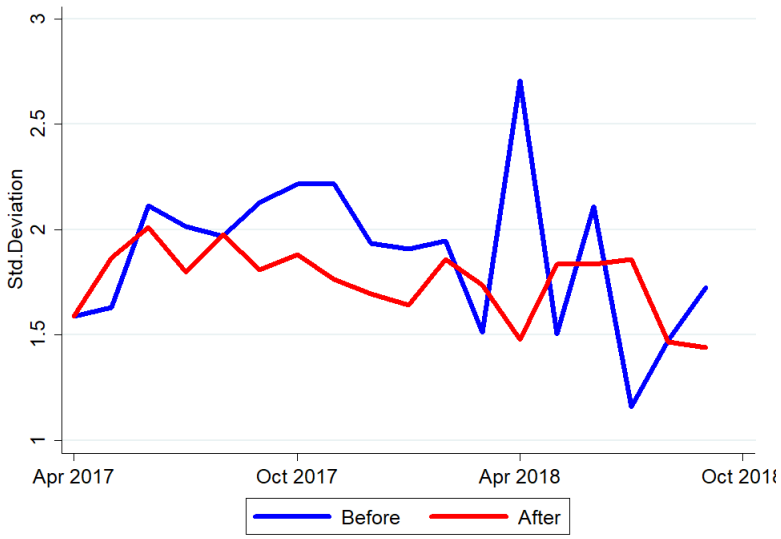
over the sample period, there is less disagreement about current year inflation among firms answering after than among firms answering before the release of the information. The hypothesis of equal variances is rejected at 99% confidence level and according to the variance ratio test the standard deviation of current year inflation expectations of the group of firms answering after the CPI release is lower than that of firms answering before the CPI information is publicly available.

Table 4.4: *Disagreement about current year inflation: before and after CPI release*

	Observations	Mean	Std. Deviation
After	3,555	8.35	1.78
Before	2,061	8.52	1.92

Similarly, if we look at the evolution over time, we observe that, in general, the standard deviation of current year inflation expectations is larger among firms answering before the release of the monthly CPI statistics (Figure 4.1). These results suggest that the CPI release gives firms information used to form their inflation expectations.

Figure 4.1: *Disagreement about current year inflation: before and after CPI release*



5 Robustness Checks

Firms self-select in the answering date. We perform two robustness checks in order to discard that the results are driven by self-selection. First, we estimate a probit model of the probability of answering before the publication of the CPI on a set of firms' observed characteristics. If firms' decision on when to answer the survey is not explained by any firm observed characteristic we can be assured that our results are not driven by firms' observables characteristics. We control for firm sector and size and find that these firms' characteristics do not predict whether a firm answer the survey before the publication of the CPI

A second robustness check exploits the within firm variation in when they answer the survey. As it was already noted, of the 403 firms that appear at least once in our sample, 87 answered always after the release of the CPI, while only 10 answered the survey always before the publication of the CPI. Thus, there is variation on the date of survey answering within firms. It could be argued that the results are driven by firms that answer always after or always before the publication of the CPI. To check this we discard from our sample firms answering always before or always after the publication of the CPI. Our main results are not affected by restricting the sample. Full details of the results are available from the authors upon request.

6 Conclusion

The empirical evidence on the effectiveness of central bank communications as a policy tool is scarce. In this paper, we provide evidence on how firms' inflation expectations react to the publication of the monthly CPI in a country with a history of high and volatile inflation.

We show that firms that answer the survey after the release of the monthly CPI information are more likely to revise their current year inflation expectations, have lower forecast errors, and lower disagreement about future inflation than firms that answer the survey before the National Statistical Office publish the official CPI monthly statistics. In that sense albeit the existing evidence for low-inflation countries suggests that agents do not react to monetary policy announcements, we show that might not be the case in medium or high-inflation countries.

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