Communication, Information and Inflation Expectations[*]

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Abstract

We identify differences in the formation of inflationary expectations, credibility, and prediction errors, depending on the communication and in the level of information of price setters. We estimate dynamic panel data models to identify the relevance of being informed about the inflation target and the current inflation rate. We also find that the tone of the monetary policy communication reinforces the bias imposed on the monetary instrument. Through the interaction of information about inflation target and range, and the tone of monetary policy statements of the central bank, we conclude that partially informed agents form their expectations differently from non-informed ones, have lower prediction errors, and are more skeptical respect to the inflation target.

Keywords: inflation, credibility, inflation target, communication, monetary policy.
JEL Classifications Codes: E31, E52, E58.

1 Introduction

A key aspect of the adoption and implementation of monetary policy decisions is communication. According to Blinder *et al.* (2008): "*communication has become an increasingly important aspect of monetary policy*. In recent years, there has been a shift towards greater transparency of central banks to the general public that increased the predictability of central banks' actions; this can enforce the effectiveness of the monetary policy. Traditionally, central banks used to be very conservative in the disclosure of the monetary policy, are even accused of a lack of clarity and transparency. In recent years, central banks' strategy has moved towards a progressive increase in the communication of monetary policy decisions, and they have also been disclosing more information about the main objectives they pursue, and even of their projections regarding future developments in the economy. It has been argued that central bank openness to the general public increased the predictability of their actions; this can lead to a more effective management of monetary policy and the economy as a whole. Woodford (2011) points out that the success of monetary policy was not guaranteed just by controlling short-term interest rates, but also by influencing market expectations in the desired direction.

Despite the large variation in communication strategies across central banks, there is not yet a consensus regarding optimal communication strategies. Our study aims to contribute understanding the effect of information disclosure and communication by central banks on the effectiveness of monetary policy to affect inflation expectations.

Understanding inflation expectations is essential for monetary policy, particularly in an inflation target regime. We will analyze the degree of information of the firms and the communication efficiency affecting inflation expectations, particularly through the monetary policy committee releases analysis.

Uruguay has inflation targeting regime since 2007, but it had two stages in terms of the monetary policy management instrument during the period analyzed in this paper. Between 2007 and 2013 the interest rate was used as a policy instrument, in July of 2013 the inflation target range was widened, from [4-6] to [3-7], and the growth of monetary aggregates became the policy instrument until September 2020, when the Banco Central del Uruguay (BCU) returned to the short term interest rate as the monetary policy instrument. Additionally, the monetary policy horizon was extended, from 18 months to 24 months[1]. These allows us to focus over the change of the inflation target range and in the change of policy instrument. Moreover, throughout this period

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[1]See Figure 1, it presents the inflation target range, the effective annual inflation rate, and the firms expectations.

inflation was rarely within the target range, however, there seems to be no substantive de-anchoring of expectations, as these are at high levels but stable over time.

We analyze the impact of central bank's communication together with the firms' knowledge about monetary policy and inflation, particularly with the firms' awareness about the inflation target and the inflation rate. We will interpret the tone of the central bank's communication, with the focus on the differences in inflation expectations between informed and non-informed agents. We are also interested in assessing whether changes in the inflation target range affected the formation of expectations and the accuracy of forecasts differently, depending on the degree of information of the firms.

Based on a novel, monthly business expectations survey between 2009 and 2020, we will apply a dynamic panel model to estimate the impact on expectation formation of knowing the inflation target beforehand. If there is a statistically significant impact, it could provide a rationale for improving the communication of the inflation target.

The research strategy focuses on two pillars, one communicational and the other informational. In the first pillar, we construct an *"index of monetary policy contractivity"* as an interpretation of the tone of the statements of the Monetary Policy Committee of the Central Bank of Uruguay. The informational pillar is an approximation to the degree of knowledge that firms have about monetary policy and inflation. In this sense, we exploit two main questions occasionally done in the Inflation Expectations Survey: one referring to the knowledge of the annual inflation rate, and the other one referring to the knowledge of the Central Banks' inflation target. Based on the answers to these questions, we categorize the firms into *informed about the inflation target (IAIT)* and *informed about inflation rate (IAIR)*. Finally, we estimate dynamic panel models for the inflation expectations for the monetary policy time horizon and the firms' annual inflation rate forecast error.

We find significant differences in inflation expectations formation and inflation forecast errors between informed and non-informed agents. We also find evidence that awareness about monetary policy is related to credibility and about the importance of institutional communication over expectations and forecast errors.

Since the annual inflation rate is usually above the target range, we find consistent results even though very different from those expected in a scenario where the fulfillment of the inflation target was the norm. Partially informed agents have a lower level of confidence in the inflation target and a lower inflation forecast error. Informational variables are positively correlated with higher inflation expectations and are therefore more accurate predictors. This fact reflects low credibility in the inflation objective of the central bank, although not in authorities since the communication has a significant

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effect that improves the predictions of the agents. Expectations do not seem to be de-anchored as fully informed agents are those who keep inflation expectations stable with the lowest predictions and with the highest errors. This can respond to the multiples objectives of the central bank, which implies a need for better communication regarding their targets and instruments. Meeting the inflation objective, communicating, and educating agents is essential to guide inflation expectations within the target, and thus achieving full credibility in monetary policy.

The rest of the paper is as follows: Section 2 explores the literature on central bank communications whereas Section 3 describes the expectations survey. Section 4 shows the empirical models for inflation expectations and forecast errors. Finally, Section 5 summarizes some of the main insights and discuss further work.

2   Literature Review

The relevant background for this work can be divided into two branches: the literature concerning information problems and how they relate to expectations formation and, on the other hand, the one that refers to communication as a fundamental aspect of monetary policy. Both are part of a growing and relatively recent literature.

Although most of the literature is empirical, some theoretical developments can be found regarding the informational frictions that the agents face. Sims (2003) developed a model where agents can update prices continuously but they only have access to imperfect information. The agents have a noisy measure of the variables of interest.

The question that arises is how the expectations of firms are affected according to access to economic information. In this sense, Coibion *et al.* (2018) found that firms in New Zealand update their beliefs in a Bayesian manner, this implies that when the firms receive new information, they update their prior expectations about macroeconomic conditions, particularly about inflation. In the same line, Frache and Lluberas (2019) stated that inflation expectations tend to converge as firms are more informed about past inflation. However, they argue that a sizable proportion of firms in Uruguay do not revise their expectations. This fact is pointed out by Andrade and Le Bihan (2013) who found that professional forecasters from the eurozone do not systematically update their forecasts following the new information. Substantial disagreement about future inflation among firms is a common finding in the literature and it has been documented that firms exhibit a high degree of attention to inflation conditions, but at the same time, firms fail to incorporate all of the available information (Borraz and Zacheo (2018)).

Banks' communication. Blinder *et al.* (2008), in a comprehensive survey of this

strand of the literature, suggested that communication is a relevant part of the Central Bank's toolkit, as it can improve the predictability of monetary policy decisions and potentially help achieve the macroeconomic goals. Geraats (2002) also provided a notable survey discussing the theoretical literature on the effects of transparency of monetary policy. This field takes the steady-state as a starting point with anchored expectations to analyze transparency. Our study is part of a new and unexplored branch of the literature that refers to the effects of communication with expectations no anchored in the inflation target.

Haldane and McMahon (2018) evaluate the significance of communication over relevance and knowledge about monetary policy. In line with this paper, we create an index that knowledge about monetary policy that we use to check the robustness of the results of informational variables concerning inflation expectations and forecast error of firms' predictions.

Coibion *et al.* (2019) found a significant impact of different forms of communication in their influence over the inflation expectations of individuals from the United States. The authors conclude that these have implications for how central banks should communicate to the broader public. This work is related to Coibion and Gorodnichenko (2015) who estimated the degree of information rigidity and provide evidence that central bank independence has an appreciable impact on the expectations formation process among industrialized countries.

Using a qualitative index for monetary policy communications and creating a variable that measures public diffusion of the central bank's news, Licandro and Mello (2015) found that news affects inflation expectations with the expected sign. Licandro and Mello (2014), using the same survey that we are using in this work, found a negative relationship between the monetary stance and inflation expectations, and concluded that there is no clear relation between firms' inflation expectations and the assessment of experts published by the Central Bank.

A recent stream of central bank communications literature is Haldane *et al.* (2020) that discusses the relevance of communication with the general public in both theoretical models and empirical analysis. They concluded that the central bank should provide as much detail as possible.

3 Data

3.1 Firms survey

Our dataset is the Inflation Expectations Survey (IES), carried out by the Instituto Nacional de Estadisticas (INE), commissioned by the Banco Central del Uruguay. The general sample corresponds to the Annual Economic Activity Survey (AEAS), which is representative of the universe of the Uruguayan private companies, except for the agricultural and the financial sectors with more than ten employees. This sample has two groups: the forced and the non-forced group. The force group comprises all companies with more than 49 employees, and the non-forced group is a representative sample of the smallest companies, between 10 and 49 employees. Meanwhile, the IES is a sample of the forced core group with 591 companies throughout the entire period between October 2009 and March 2020[2], thus is representative of all the private non-financial nor-agricultural firms with 50 employees or more.

The AEAS has an annual frequency and presents a large set of economic and financial information of the firms. The IES has a monthly frequency and contains information about firms' prices and costs expectations. Specifically, the question that reveals inflation expectations is: *"What do you think will be the variation in the CPI (Consumer Price Index)?"* The question is asked considering 3 different horizons: the current year, the next 12 months, and the next 24 months (the monetary policy horizon). As well, it has punctual and sporadic questions of particular items such as financial stability, monetary policy, competition, etc.

The IES is sent monthly to 500 firms with an average response ratio of 77% since October 2009, and a minimum response ratio of 44%. The resulting sample is an unbalanced panel with 46.580 observations, representative of all the sectors in the economy, except for the financial, agricultural, and public sectors. The database is a long panel with a total of 126 months. During the sample period, 591 firms completed the survey at least once, while 65% of the firms answered the questionnaire more than 50% of the time (63 months). Table 1 presents the distribution of firms by economic sector in the sample and the whole population.

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[2]The sample period does not include significant effects related to COVID-19 since the first case in Uruguay was reported on March 13th, and on March 10[th]teenth, the last wave of the survey ends.

Table 1: Firms' distribution by sectors: sample and population (%)

Sector	Sample	Population
Manufacturing	41.48	46.60
Trade & commerce	29.99	23.06
Services	18.40	14.96
Health	4.47	11.61
Primary activities	2.36	1.06
Education	1.99	1.73
Utilities	0.58	0.74

3.2 Informed about the inflation target

We use three waves of the survey with specials questions on three different occasions: September 2017, June 2018, and September 2018. In particular, the question asked is "*What rate of inflation (or range) do you think the Banco Central del Uruguay tries, on average, to achieve?*".

Some firms believe that the Central Bank seeks to reach an inflation rate, and they respond a number but others understand that it considers a range within which inflation should be on the monetary policy horizon. In the latter case, the firms must answer a floor and a ceiling of the target range.

We define the variable *informed about the inflation target* (IAIT), that takes a value of 1 if the answer to the previous question is a *range* with the minimum and maximum values of 3 and 7 respectively. We also classified the firm as informed if it answered a rate inside this inflation target range.

Then we impute values for the variable *informed about inflation target* in those months where the question was not asked. The observed variable takes value a 0 or 1 on three occasions. Such value remains fixed until the next time in which the question about the inflation target is raised again. To assign the values for this variable, from the first period until when the question is available (from October 2009 to September 2017) we assume that if the average of the answers exceeds 50% then the firm is informed and not informed in the other case. Table 2 presents the observed and the imputed values for the firms' information about the inflation target.

Table 2: Firms' distribution: Informed about the inflation target

	Observed *(IAIT)*		Imputed *(IAIT)*	
	Freq.	Percent	Freq.	Percent
No	587	66.03	30,297	65.26
Yes	302	33.97	16,127	34.74
Total	889	100	46,426	100

3.3 Informed about the inflation rate

We work with five waves of the survey, based on specific questions about the knowledge of the annual inflation rate, September 2015, March 2016 and 2017, June 2018, and September 2018. In particular, the question asked was "*Which is the last month's annual inflation rate?*". We define the variable "*informed about the inflation rate*" that takes a value of 1 if the answer to the previous question has an absolute error smaller than 0.25 percentage points.

Then we imputed values for the whole sample, completing the variable "*Informed about the inflation rate*" (IAIR) used in the econometric models. The observed variable takes value 0 or 1 on the five occasions when the firms were surveyed. We fixed those values until the next time in which the question about the inflation rate is raised again. To assign values to this variable from the first period until the question is asked for the first time, this is between October 2009 to September 2015, we imputed the value of 1 if the average of the observed answers for the firm exceeds 0.5, and 0 in the other case.

Table 3 shows the observed and the imputed distribution of firms, near 60% of the firms are informed about the inflation rate, in the observed variable, while 56.55% are informed in the imputed case.

Table 3: Firms' distribution: Informed about the inflation rate

	Observed *(IAIR)*		Imputed *(IAIR)*	
	Freq.	Percent	Freq.	Percent
No	675	40.04	19,874	43.45
Yes	1,011	59.96	25,870	56.55
Total	1,686	100	45,744	100

There is a high dispersion in the accuracy of these responses related to the current moment when the question is done, particularly related to the level of the inflation rate.

As it is shown in Table 4, during periods of steady inflation the share of firms that are informed about inflation is high; for example, 92.67% in June 2018. The precision of the predictions drops a lot when there are significant changes in the inflation rate. For example, 1.2% of all responses had an absolute error lower than 0.25 percentage points in March 2017, when the inflation rate was 6.7%, after an unexpected and abrupt reduction (see Figure 1)[3].

Table 4: Percentage of firms informed about inflation rate

Date	Mean	Std. Dev.	Freq.
September 2015	40.99	49.25	383
March 2016	85.75	35.00	379
March 2017	1.20	10.89	334
June 2018	92.67	26.11	300
September 2018	85.17	35.60	290
Total	59.96	49.01	1,686

This finding is highly consistent with high persistence in inflation expectations found for Uruguay in previous works (see Licandro and Mello (2014)). At the same time, there seems to be an asymmetry regarding the level of inflation: when it is high, the attention that firms give is greater than the periods in which it is lower. For example, in March 2016, the annual inflation rate was 10.6%, and the proportion of informed firms was 85.75%.

Additionally, we defined the category "*Informed about monetary policy*" as those firms that are informed about the inflation rate and the inflation target. These firms have a significant awareness of monetary policy, and we will consider them as fully informed.

3.4 Knowledge about monetary policy

We create a qualitative variable that reflects the degree of knowledge about monetary policy. This variable takes value 0 for those firms that do not know anything about monetary policy, they don't know the inflation rate nor the inflation target range in a period t. If the firm is informed about the inflation rate but not about the central bank's inflation target, the variable takes a value of 1. We consider that knowing the inflation target range implies more specific knowledge about monetary policy than

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[3]All figures are in the Appendix B.

being informed about the inflation rate, so the variable takes the value 2 if the firm is informed about the inflation target but not about the inflation rate. If the firm is informed about both, inflation rate and target, the variable takes the value 3. In table 5 we present the distribution of this variable. The probability of being informed about the inflation target is lower than being informed about the inflation rate and the target. The probability of being *fully informed* is 0.1971, while half of the firms are *partially informed*.

Table 5: Firms' distribution: Knowledge about monetary policy

Value	Freq.	Percent	Cum.
0	13,765	29.55	29.55
1	16,688	35.83	65.38
2	6,945	14.91	80.29
3	9,182	19.71	100.00
Total	59.96	49.01	

3.5   Monetary contractivity index

In an inflation targeting regime communication, by the central bank could affect inflation expectations, in particular those of firms. To account for this channel, we construct an index to assess the contractivity tone of the statements by the monetary policy authority.

To construct the monetary contractivity index, we collect all the monetary policy statements published after policy decisions in the period under analysis. By using web scraping and text analysis techniques, we identify two target words inside each statement: *inflation* and *monetary policy*. We first identify these words in a statement to extract the adjacent parts of the text from the sixth word before to the sixth word after each target word. Therefore, we select and analyze strings of 13 words that contain one of our target words. To characterize the tone of each string, we assign a value between -2 and 2 to each one, where -2 means very expansive, -1 is expansive, 0 is neutral, 1 is contractive, and 2 is very contractive. In Appendix A, we present details about this assessment. Finally, the contractivity index of each monetary policy statement is the simple average of the values assigned to the corresponding strings.

Figure 2 in Appendix B presents the normalized short term interest rate and the monetary contractivity index. While the short term interest rate takes expansive and contractive values the contractivity index shows positive values most of the time (with

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values between zero and one).Hence, the tone of monetary policy communication has fluctuated but with a moderate contractionary bias during the period under analysis.

4 Empirical Models

4.1 Description of variables

As stated earlier, the sample period is from October 2009 to March 2020, including 46,580 observations. Table 6 shows descriptive statistics for the main variables of interest of the expectations survey, differentiating between those who are informed about the inflation target and those who not.

For the informed firms, the mean annual inflation rate forecast for the whole period is 8.76%, and the median is 8.5%, while non-informed firms predict 8.96% on average and a median of 8.9%. The inflation forecast in the monetary policy horizon $(t = T)$, is also higher for non-informed firms. The mean difference tests state that the difference between the forecasts of the groups is statistically significant.

Figure 1 shows the annual inflation rate, the median of the inflation expectations for the monetary policy horizon for informed and non-informed agents, and the upper bound of the inflation target range. It shows that the informed firms predict lower inflation and that their expectations fall faster in periods in which the inflation rate decreases and rise slower when the inflation rate increases. The expectations for the costs variation, on average, median, and their standard deviation are higher than the projection for the inflation rate and higher for non-informed firms.

The absolute error for the annual inflation forecast is higher for the non-informed firms. Figure 3 shows that the forecast error of informed firms is lower throughout the whole period. In 2017, when the inflation rate had an unexpected fall, forecast errors for both types of agents increased drastically, but even more for non-informed firms.

Figure 4 shows the volatility of the inflation forecasts, measured as the monthly dispersion of responses, distinguishing the informed from the non-informed firms. In the non-informed group, there is a higher level of disagreement regarding the inflation forecast. This stylized fact is exposed in Frache and Lluberas (2019). It is interesting to note that since the change in monetary regime, in June 2013, there is a clear differentiation between the volatility of the forecasts of informed firms and those not informed about monetary policy. During 2017, when inflation was significantly lower, both types of agents increase their volatility, but non-informed firms increase much more.

Additionally, the volatility in the responses between informed and non-informed

firms varies significantly since the change in the instrument and the range of the monetary policy. Intuitively, the use of the interest rate offers a transparent and continuous communication of the commitment to the monetary policy instrument. The use of monetary aggregates provides much less information and less transparent communication, and therefore, the dispersion of responses increases more in the group of non-informed firms. This point deserves analysis in further research.

Nearly two-thirds of the firms that know the inflation target are also informed about the inflation rate, 63%, while 57.68% of the non-informed firms know what the inflation is. Additionally, there is also a higher share of informed firms that observed the inflation rate when they answered the survey, 67.54% vs 60.48% for the non-informed firms. Note that on average, the informed firms respond to the survey 9.44 days after the publication of inflation by the INE, and the non-informed firms respond on average 8.75 days after publication. Thus, there is no significant difference in this aspect between both groups.

Finally, Table 6 shows the share of firms that believe that the inflation rate will be in the target in the next 12 months and the monetary horizon, respectively. As can be appreciated, both the share of informed and non-informed firms that forecast an inflation rate inside the target is low, around 8% for the next 12 months and 10% for the monetary policy horizon. In Figure 5 we observe that the share of informed and non-informed firms that predict inside the target is similar until 2017 when the inflation rate fell drastically. Since then, the share of believers, for both types of firms, increases significantly, but the informed firms share increased more and keep higher until nowadays.

Table 6: Descriptive statistics by awareness about the inflation target

| | Informed about the inflation target | | | | Non-informed about the inflation target | | | | Mean diff test |
	Obs.	Median	Mean (1)	Std. Dev.	Obs.	Median	Mean (2)	Std. Dev.	(2)-(1)
Expected inflation rate $t = 12$	16,127	8.50	8.76	1.71	30,297	8.90	8.96	1.91	0.196***
Expected inflation rate in $t = H$	16,127	8.50	8.82	1.96	30,297	8.88	9.01	2.10	0.192***
Expected costs variation $t = 12$	15,818	9.80	9.97	4.02	29,706	10.00	10.25	3.65	0.275***
$\rho_t = \lvert \pi_t - E_{it-12}(\pi_t) \rvert$	16,127	1.18	1.59	1.48	30,297	1.29	1.75	1.68	0.156***
Share of informed about π_t	517	na	63.06	48.31	990	na	57.68	49.43	-5.379**
Share of firms that observed π_t	2,089	na	67.54	46.83	3,889	na	60.48	48.90	-7.071***
Response respect CPI publication	2,894	8.00	9.44	10.32	5,307	7.00	8.75	10.48	-0.686***
Share of believers in IT for $t + 12$	16,127	na	8.24	27.50	30,297	na	7.52	26.36	-0.725***
Share of believers in IT for T	16,127	na	10.49	30.65	30,297	na	9.28	29.01	-1.214***

* p<0.10, ** p<0.05, *** p<0.01

4.2 Modeling inflation expectations

The estimated inflation expectations equation is:

$$E_{it}(\pi_H) = \alpha_i + \beta_1 E_{it-1}(\pi_H) + \beta_2 \pi_{t-1} + \beta_3 i_t^{st} + \beta_4 CI_t + \beta_k IV_{it} + \varepsilon_{it} \qquad (1)$$

where $E_{it}(\pi_H)$ is the inflation expectation for the monetary policy horizon $(t = H)$ of firm i in period t, π_{t-1} is the observed annual inflation rate in $t-1$ (which is the most recent data about inflation that is available to firms when making inflation expectations at date t), i_t^{st} is the short term interest rate in period t, CI_t is the contractivity index presented in 3.5 and IV_{it} is a vector of the informational variables presented in subsections 3.2, 3.3 and 3.4.

In Table 7 we present our regressions. In model M1, the inflation expectations are explained only by the inflation rate, and the short-term interest rate. In M2, we complete the monetary policy instruments adding the communicational aspects through the contractivity index. In models M3, M4, and M5, we include informational variables, and in M6, we substitute informational dummies with the qualitative variable that approximates the knowledge about monetary policy.

We estimate with the Generalized Method of Moments (GMM). GMM is an appropriate estimation method because the inflation expectations are highly persistent, especially in monthly frequency. In all models, we include an autoregressive term. We also incorporate time effects with a year fixed effect to control for the learning of the firms in the inflation forecast and a monthly fixed effect because of the intra-annual seasonality of the variables included in the regression.

Other control accounts for the diminishing rate of response to the IES through time, which affects the composition of inflation forecasters. More precisely, we introduce the number of responses to the IES each month. Finally, we control for the change in the policy target and instrument that occurred in June 2013 by introducing a dummy variable taking the value of one since July 2013. Our regression models face endogeneity problems. In particular, monetary policy variables, i.e. the short-term interest rate and the monetary contractivity index are endogenous to inflation expectations. To solve these problems, we follow Arellano and Bond's methodology, which takes the lags of the endogenous variables as instruments. We also introduce as instruments the 12 monthly average change of expected costs and the inflation rate by firms.

In our estimations, both monetary policy variables have the expected sign. An increase in the short-term interest rate is negative correlated with inflation expectations. Additionally, the communicational variable, the contractivity index, is also negatively

correlated with inflation expectations. A contractionary tone of the statement from the monetary policy committee reduces the inflation expectations of firms.

In models M3 and M4 which incorporate informational variables, they are positively correlated with inflation expectations. Due that the inflation rate is majorly above the upper bound of the inflation target range, the fact of being informed about inflation or the inflation target makes the firm predict with more information and therefore increases its inflationary expectations.

In model M5, we include the interaction between awareness about the inflation rate and the target (we call this as *informed about monetary policy*), and this variable is negative correlated with inflation expectations. Firms that are fully informed about monetary policy predict lower inflation, and this is related to some degree of credibility in the central bank of most informed firms. Fully informed firms are more likely to that know the communications and policy measures of the central bank, so they are more influenced by him, forming their expectations more aligned with the central bank communications and movements in monetary instruments. In this sense, although inflation is above the target, the target is an anchor for the inflation expectations for informed firms. However, if we include the coefficients associated with all of the informational variables in this model, the information is positively correlated with inflation expectations. Therefore, fully informed firms do not offset the expectations of partially informed and non-informed firms.

In model M6, we substitute informational variables with knowledge about the monetary policy, which is also significant and positively correlated with expectations. Thus we can conclude that information makes the firms do better (and higher) predictions even if the inflation rate is above the target. To check this result, we next evaluate the forecast errors of firms.

Table 7: Information, communication, and inflation expectations

	M1	M2	M3	M4	M5	M6
Expected inflation rate $(t-1)$	0.118***	0.095***	0.088***	0.072**	0.065***	0.074*
	(0.031)	(0.030)	(0.034)	(0.035)	(0.024)	(0.042)
Inflation rate $(t-1)$	0.314***	0.323***	0.306***	0.283***	0.274***	0.287***
	(0.012)	(0.012)	(0.013)	(0.016)	(0.020)	(0.050)
Short term interest rate (t)	-0.263***	-0.229***	-0.222***	-0.203***	-0.192***	-0.202***
	(0.021)	(0.021)	(0.021)	(0.029)	(0.027)	(0.035)
Contractivity Index		-0.156***	-0.150***	-0.142***	-0.136***	-0.143***
		(0.010)	(0.010)	(0.013)	(0.013)	(0.020)
Informed inflation rate			1.019***	0.961***	1.608***	
			(0.324)	(0.288)	(0.340)	
Informed inflation target				2.084***	3.243***	
				(0.775)	(0.624)	
Informed monetary policy					-2.128**	
					(0.836)	
Knowledge monetary policy						0.912***
						(0.333)
Obs	41,078	41,078	40,377	40,290	40,.290	41,078
N-Groups	570	570	570	566	566	570
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.501	0.452	0.150	0.086	0.034	0.243
Hansen-p	0.753	0.752	0.791	0.805	0.817	0.768
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Endogenous variables: lagged expected inflation rate, short term rate, contractivity index and IT range.

Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation.

Other controls: number of responses per month and monetary policy target change.

Estimating Method: Two step GMM, robust to heteroskedasticity.

* p<0.10, ** p<0.05, *** p<0.01

4.3 Modeling forecast errors

To evaluate the relation between information and the precision of the inflation prediction of firms, we estimate an equation for the inflation forecast absolute error as follows:

$$\rho_{it} = c_i + \delta_1 \rho_{it-1} + \delta_k IV_{it-12} + v_{it}, \tag{2}$$

where, $\rho_{it} = |\pi_t - E_{it-12}(\pi_t)|$ is the difference between the annual inflation expectations that the firms had one year ago, respect to the current observed inflation rate.

Table 8 presents the estimated models for the absolute forecast errors of inflation predictions. Forecast errors have persistence, as inflation expectations have. Therefore, our estimations confirm the intuition presented previously. Being informed about the inflation rate or the central bank's target significantly reduces the inflation forecast errors.

Table 8: Absolute forecast error models

	FE1	FE2	FE3	FE4	FE5
Absolute forecast error $(t-1)$	0.132***	0.131***	0.107***	0.108***	0.106***
	(0.018)	(0.017)	(0.033)	(0.039)	(0.019)
Informed inflation rate $(t-12)$		-0.807***	-0.506**	-0.682	
		(0.231)	(0.209)	(0.432)	
Informed inflation target $(t-12)$			-2.429***	-2.843**	
			(0.722)	(1.339)	
Informed monetary policy $(t-12)$				0.622	
				(0.852)	
Knowledge monetary policy $(t-12)$					-1.015***
					(0.199)
Obs	32,761	32,224	32,188	32,188	32,761
N-Groups	543	543	539	539	543
AR1_p	0.000	0.000	0.000	0.000	0.000
AR2_p	0.018	0.135	0.057	0.097	0.024
Hansen_p	0.993	0.994	0.997	0.996	0.998
Time fixed effects	Yes	Yes	Yes	Yes	Yes

Endogenous variables: lagged expected absolute forecast error.

Instruments: lagged endogenous, time average 12 months expected variation of firms costs,

time average 12 months expected inflation.

* p<0.10, ** p<0.05, *** p<0.01

5 Conclusions

In the period analyzed where inflationary expectations seem anchored at a level above the inflation target range of the monetary policy, we find that there is a clear difference in how informed and non-informed firms form their inflation expectations and in the precision of their predictions. As expected, informed firms predict better than non-informed firms, principally when they receive additional information. They have higher inflation expectations, consistent with a scenario like the Uruguayan, where the inflation rate is mostly above the inflation target range.

Those agents that are informed about the inflation target or on the inflation rate have higher inflation expectations, but those firms that are aware of both aspects of monetary policy predict an inflation rate nearer to the inflation target, even when they have higher expectations than the target. Also, fully informed firms reduce fast their expectations when inflation is falling, and they delay in reacting to the inflation rate when it is growing. These results lead us to think that there is some credibility in the target even when inflation expectations are outside the inflation target as the range acts as an anchor for expectations. Additionally, we found evidence that the monetary policy regime is related to the volatility of inflation expectations according to the degree of information that the agents have.

The central bank's communication reinforces the monetary conditions determined by the policy instrument, and both elements contribute to the formation of the expectations of the firms. The share of informed firms that predict the inflation rate inside the inflation target is much higher than non-informed when the inflation rate goes into the inflation target.

As was foreseeable, non-informed firms have a higher forecast error and higher volatility in their expectations than informed firms. This fact is related to how costly to stay informed for firms is.

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Appendix

A. Monetary contractivity index: assessment of strings

In order to assess the contractivity tone of each string of text selected from the monetary policy statements, we assign scores according to the following criteria:

- When the monetary authority emphasizes to control inflation as its priority, we assign a very contractive score (+2).

- When the monetary authority shows worries about inflation, we assign a contractive score (+1).

- When the monetary authority expresses that inflation is not a main priority, we assign an expansive score (-1).

- When the monetary authority shows worries about economic activity, we assign a very expansive score (-2).

- When the monetary authority emphasizes that inflation or inflation expectations are low or had gone down, we assign an expansive score (-1).

- When the monetary authority maintains the same inflation target, we assign a neutral score (0).

- When the monetary authority changed the monetary policy rate, we assign a very contractive or a very expansive score depending on the direction of the change (-2 or 2).

- When the monetary authority makes explicit the contractionary character of the monetary policy stance, we assign a contractive score (+1).

- When the monetary authority claims that monetary policy is or has been slightly contractive but the real monetary stance is expansive we assign an expansive text (-1). However, if there is not a clear bias in the monetary policy stance we assign a neutral score (0).

B. Figures

Figure 1: Inflation expectations (monetary policy temporal horizon)

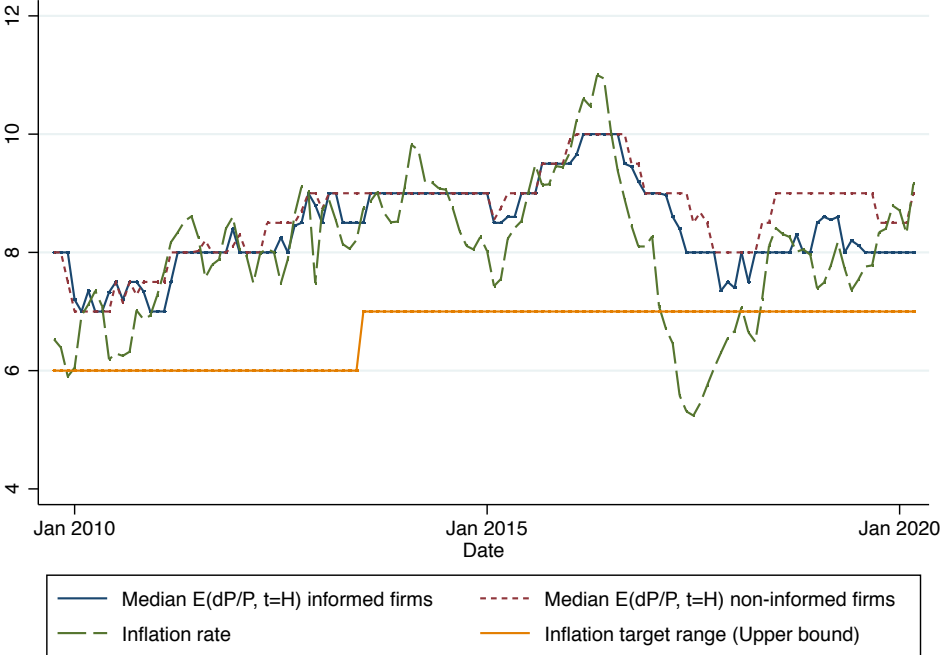|	
Median E(dP/P, t=H) informed firms	Median E(dP/P, t=H) non-informed firms
Inflation rate	Inflation target range (Upper bound)

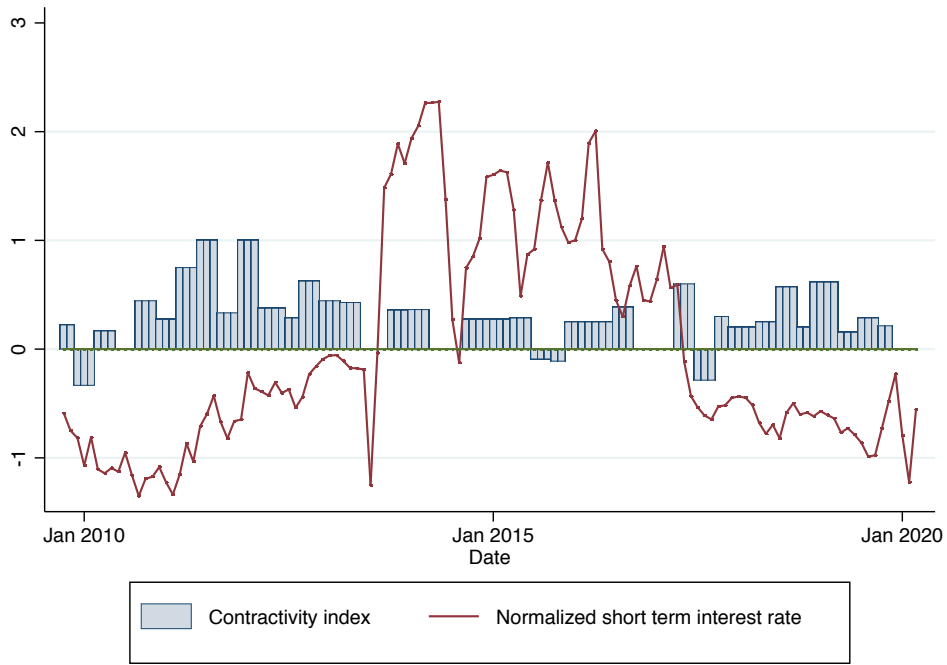Figure 2: Short term interest rate and contractivity index

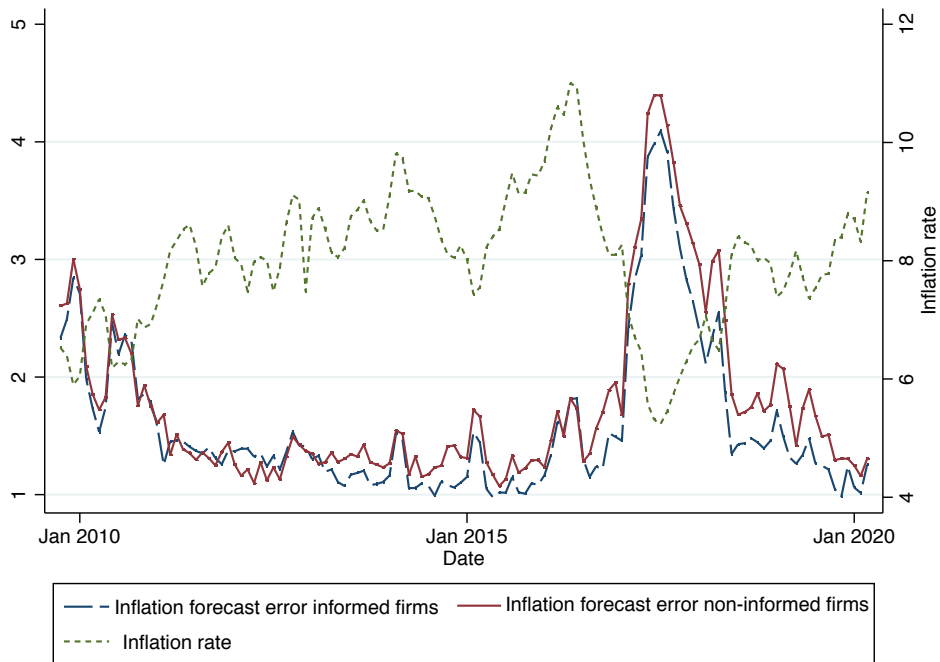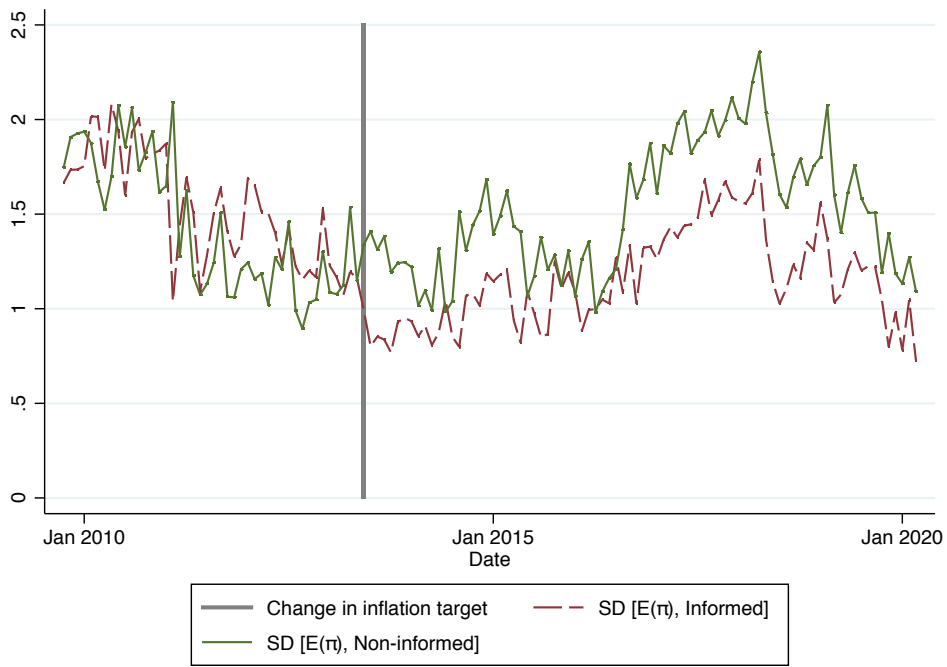Figure 3: Annual inflation rate forecast error

Figure 4: Forecast volatility

Figure 5: Firms credibility in the inflation target