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Resumen

La proporción de empresas que diferencian sus expectativas de inflación entre horizontes de uno y dos años es una estadística relevante para los cambios en las expectativas de inflación. Además, las empresas que obtienen información del banco central son más propensas a distinguir entre horizontes y pronosticar convergencia en las expectativas de inflación. Los responsables de la toma de decisiones tienden a no diferenciar entre horizontes, pero cuando lo hacen, es más probable que pronostiquen la convergencia en las expectativas de inflación. Los asesores externos tienden a diferenciar entre horizontes y son más propensos a predecir la divergencia en las expectativas de inflación. Los resultados ponen de relieve la importancia de analizar la formación de expectativas de inflación por parte de las empresas para comprender la dinámica de la inflación y llevar a cabo una política monetaria eficaz.

JEL: D83, D84, E31, E52, E58
Palabras clave: Expectativas de inflación, dinámica inflacionaria, política monetaria

Abstract

The share of firms that differentiate their inflation expectations between one-year and two-year horizons is a relevant statistic for changes in inflation expectations. Furthermore, firms that obtain information from the central bank are more likely to distinguish between horizons and forecast convergence of inflation expectations toward the inflation target. Decision-makers tend not to differentiate between horizons, but when they do, they are more likely to predict convergence. External advisors tend to differentiate between horizons and are more likely to predict divergence. The results highlight the importance of analyzing inflation expectations formation by firms for understanding inflation dynamics and conducting effective monetary policy.

JEL: D83, D84, E31, E52, E58
Keywords: Inflation expectations, Inflation dynamics, Monetary Policy

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1 Introduction

Monetary policy requires a forward-looking view of the evolution of the economy. For that reason, central bankers look at the private sector's expectations and regularly communicate its economic forecasts. One particular expectation dominates the discussion of monetary policy: inflation. A scrutiny of the job of the central bank is usually based on whether inflation expectations are low or high. Hence, over the last decades, there has been a growing interest in having different measures of private sector inflation expectations.

Nowadays, several countries have inflation expectations obtained from financial prices and surveys to professional forecasters, financial specialists, households, and firms. Several recent studies have documented interesting patterns of economic expectations obtained from different sources (see, for instance, the collections of studies in Bachmann *et al.*, 2023). In the case of inflation, expectations tend to be different among professional forecasters, households, and firms. These differences also vary across countries. For instance, using firms' surveys in a sample of several countries, Candia *et al.* (2022) find that awareness of inflation by firms is quite different between advanced and emerging economies. Indeed, the random control trials conducted by Weber *et al.* (2023) confirm the attention of Uruguayan firms to inflation.

In this context, the purpose of this work is to analyze the factors that determine the term structure of inflation expectation by firms in Uruguay, an emerging economy that has a well-established firms' survey on economic expectations. In doing so, we include additional questions in June 2022 to the regular survey to understand the differences across firms in the way that predict inflation. The case of Uruguay is interesting because it has a higher level of inflation compared to advanced economies, which provides more incentive to firms to acquire information about the evolution of inflation.

We pay particular interest in uncovering what determines that a firm expects a reduction or an increase in inflation toward the policy horizon (two years). We focus our analysis on three main questions. First, Does inflation expectation evolution by firms depends on who regularly answers the survey? Second, how does the information source affect inflation expectations by firms? Finally, Are there differences in the inflation expectations depending on how the firms use the results from the survey?

Why is relevant for the monetary policy in Uruguay understanding the term structure of inflation expectations by the private sector? The appendix A presents motivating evidence on the role of inflation expectations at the aggregate level in Uruguay. First, we show that inflation expectations derived from the surveys to firms and analysts

(professional forecasters) improve core inflation forecasts. These improvements in forecasting core inflation are present in quarterly or monthly frequency, but with the latter are less strong. Moreover, inflation expectations by firms provide clearer forecasting gains for core inflation compared to expectations obtained from bond yields and to expectations by analysts when using monthly data. Second, shares of firms expecting a rise and reduction in inflation from one year to two years is a useful statistic to characterize the path of inflation expectations by the private sector. We name this evolution of inflation expectations at different horizons as the term structure of inflation expectations. In fact, we show in the appendix A that difference between the share of firms that expect a rise in inflation expectations and the share of firms that expect a fall in inflation expectations is a valid balance statistic for the term structure of inflation expectations. Moreover, this balance statistic not only explains the term structure of firms' inflation expectations, but also the term structure of expectations obtained from analysts' survey and from bond yields.

We focus on firm forecasts of inflation at different horizons, i.e. the term structure of inflation expectations. If firms are aware of the difference between inflation in the short run (one year ahead) and in the monetary policy horizon (two years), they should be more aware of the mechanisms of monetary policy. A firm that does not differentiate its forecast between the different horizons might be expected to be a firm that is less sophisticated or attentive to monetary policy. If a firm does differentiate between the horizons, it is presumed to be more precise in its predictions. Likewise, if they predict higher inflation in the short-run than in the monetary policy horizon, it implies that they consider current inflation as transitory, and they expect inflation to converge to a certain point coherent with the central bank's objective of stabilizing inflation.[1] On the contrary, the expectation of an increase in inflation, in the long run, implies that firms are less aware of the monetary policy and the role of the central bank in having low and stable inflation.

Our estimations are based on an unbalanced panel of monthly frequency of 289 firms between October 2020 and September 2022. The main results are the following. First, the shares of firms expecting divergence and convergence of inflation from one to two years are relevant aggregate statistics to changes in inflation expectations. Second, firms getting informed through the Central Bank of Uruguay (BCU) are more likely to differentiate horizons when predicting inflation and to forecast a convergence of inflation two years ahead. Although less intense, getting informed through government

[1]The inflation target ranges between 3% and 6%, while the average inflation expectation by firms in the period under analysis is 8.46% in the monetary policy horizon of 24 months.

agencies and the statistical office has similar effects. Decision makers in the firms tend not to differentiate horizons. When predicting inflation, but when they do, they are more likely to forecast a convergence of inflation from one to two years. In contrast, when advisors respond to the survey, they do differentiate the horizons when predicting inflation and are more likely to forecast a divergence of the inflation rate.

Our results have policy implications. Although we have not identified what type of information by the central bank implies a reduction of inflation expectations by firms in the long run, we find that central bank communication offers a great opportunity to shape inflation expectations in Uruguay. This is particularly relevant for attentive decision markers in the firms (those that differentiate horizons when predicting inflation) because they will search for information to forecast inflation and the central bank communication is indeed a source of information that they use. This contrasts with the evidence showing that in advanced economies with low inflation, firms, and household expectations tend to be relatively inattentive to monetary policy changes (see Coibion *et al.*, 2020). Finally, this opportunity of using central bank communication comes with the responsibility of conducting monetary policy consistently to keep and expand the capacity of the central bank in influencing inflation expectations.

The rest of the manuscript is organized as follows. The next section presents related literature. Section 3 discussed the data coming from the firms' survey and the special questions added to the survey in June 2022, providing descriptive statistics. Section 4 shows our empirical approach to estimating the factors that determine whether a firm predicts an increase or reduction in inflation. Finally, Section 5 provides concluding remarks.

2 Related literature

Our work is related to three strands of the literature. First, with the use of private sector inflation expectations to predict and explain the aggregate inflation dynamics. Thus, several studies have shown that using inflation expectations by the private sector helps to predict actual inflation. Relevant contributions about this are Ang *et al.* (2007) and Faust and Wright (2013). The use of the Phillips curve to explain inflation dynamics has also recognized the value of inflation expectations by the private sector. This has become more relevant since the behavior of inflation after the global financial crisis has raised questions about the validity of the Philips curve relationship that connects inflation with unemployment. However, several works have shown that controlling for private inflation expectations, alternative measures of unemployment,

and changes in the slope of the relationship argue that the Phillips curve is still a valid equation to explain inflation dynamics. These conclusions are arrived in studies such as Blanchard (2016) Ball and Mazumder (2011), Ball and Mazumder (2019), Coibion and Gorodnichenko (2015b), among many others.

Second, our study is also related to recent works that analyze how individual inflation expectations inform us about how private agents use and process information about the state of the economy. For instance, Andrade and Le Bihan (2013), Coibion and Gorodnichenko (2015a), and Fuhrer (2018) provide empirical support for the fact that agents form expectations deviating from full-information and rational expectations. Moreover, Coibion and Gorodnichenko (2015b) argue that inflation expectations by households are better equipped than those by professional forecasters to explain inflation dynamics in the US after the great recessions, whereas Coibion *et al.* (2018) find that firms' expectations display widespread dispersion using a survey in New Zealand.[2] However, firms' attention to inflation, depends on the economic environment, in high inflation states firms are more attentive to inflation relative to low inflation scenarios, when inflation is not an issue, Weber *et al.* (2023).

Third, this work is a continuation of previous studies that have used the firms' survey in Uruguay to understand how the price and wage decisions are connected with monetary policy and inflation expectations. Examples are Borraz *et al.* (2013), Borraz and Zacheo (2018), Frache and Lluberas (2019), Borraz and Mello (2020), Caruso *et al.* (2022) and Carotta *et al.* (2023) who use the same survey as this study to understand the expectations by firms in different aspects such as knowledge about the current inflation, inflation target, the effect of wage adjustment, and other dimensions relevant for monetary policy conduct and communication in Uruguay.

We contribute to these strands in the literature by providing evidence on how the evolution of inflation expectations by firms in an emerging economy helps to understand the actual behavior of inflation and how monetary policy can shape these expectations. Like Ball and Mazumder (2011) and Blanchard (2016), we find that a Phillips curve augmented with private sector expectations, either by professional forecasters or firms, can fit better the aggregate inflation in Uruguay. Also, related to the studies that have documented the heterogeneity in inflation expectation across firms such as Coibion *et al.* (2018), Candia *et al.* (2022), Weber *et al.* (2022), and Frache and Lluberas (2019), we try to explain this dispersion in inflation expectations based on additional questions included to the survey in June 2022.

[2]The recent book by Bachmann *et al.* (2023) contains several chapters that analyze inflation expectations by different types of sources and agents.

3 The Business Expectations Survey

In the rest of the paper, we use data from the Business Expectations Survey (BES). The BES is carried out by the Instituto Nacional de Estadísticas (INE), commissioned by the Banco Central del Uruguay (BCU), to firms in Uruguay since October 2009. The survey is conducted monthly to a representative sample of the universe of Uruguayan firms with more than 50 employees until September 2020, and more than 100 employees since then, excluding the agricultural and financial sectors. The BES contains information about firms' inflation and cost expectations. The main question of interest in the survey is *What do you think will be the percentage change in the CPI (Consumer Price Index)?* This question is asked considering 3-time horizons: the current year, the next 12 months, and the next 24 months. The BES has been answered by 905 firms with an average response ratio of 74% since October 2009.

A set of special questions was introduced in the wave of June 2022. These special questions refer to who usually responds to the BES, the sources of information they use to form their expectations, and the use they give to the published information from the survey. In the next subsection, we will dive deeper into this questions.[3]

In this paper, we restrict the sample to a window around the month in which the special questions were asked. More precisely, our sample ranges from October 2020 and September 2022. As a result, we use an unbalanced panel with 289 firms over 24 months, with a total of 6,298 observations.

3.1 Special questions in the BES

The first special question asked to firms in June 2022 refers to who usually answers the survey. Specifically, the question is: *Who usually answers the survey?* The options for response were: *(i) Decision maker (owner or manager); (ii) an employee; (iii) an external advisor.*

[3] A detailed description of the special questions added in June 2022 and their answers can be found in Marrero and Mello (2023).

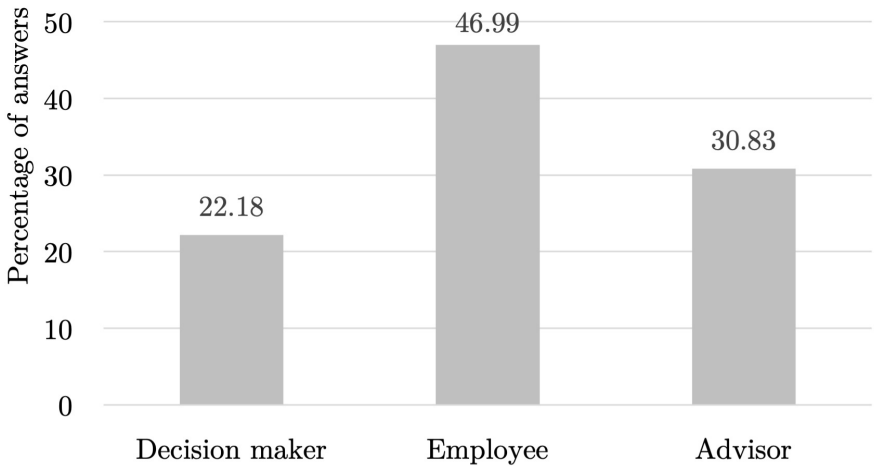

Figure 1: Who usually answers the survey

Figure 1 shows the distribution of answers to this question. The survey is usually answered by an employee in nearly half of the universe of firms. Decision makers usually answer the survey in around one-fifth of the sample, while external advisors do it in around one-third of it. The information about who answers the survey allows us to look for differences in expectations and in the accuracy of inflation forecasts according to different categories of respondents.

The second special question refers to the different sources of information that firms use to form their expectations. Specifically, the question is: *What kind of information do you usually use to form your economic expectations?* The response options were the following: *(i) BCU monetary policy communications; (ii) Communications from other government agencies; Statistical information (INE); (iv) Specialized press; (v) Business associations reports; (vi) Results of internal economic projection models; (vii) Advisors Reports.* Firms can select more than one option.

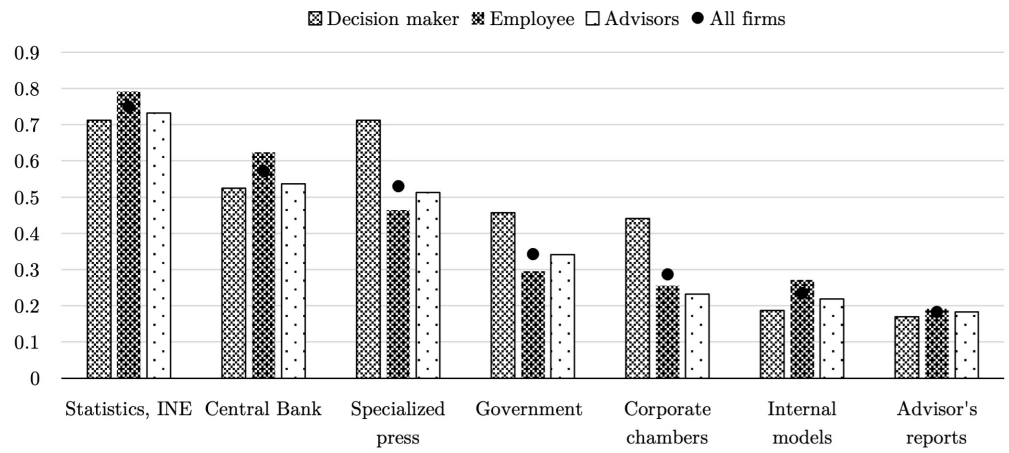

Figure 2: Information sources

Figure 2 presents the frequency of the different information sources that firms declare to use. The main source is the communication of the INE (75%). Presumably, this response refers to the monthly publication of the CPI Index by INE. Interestingly, decision-makers are informed more than the mean from the specialized press, government communications, and business associations.

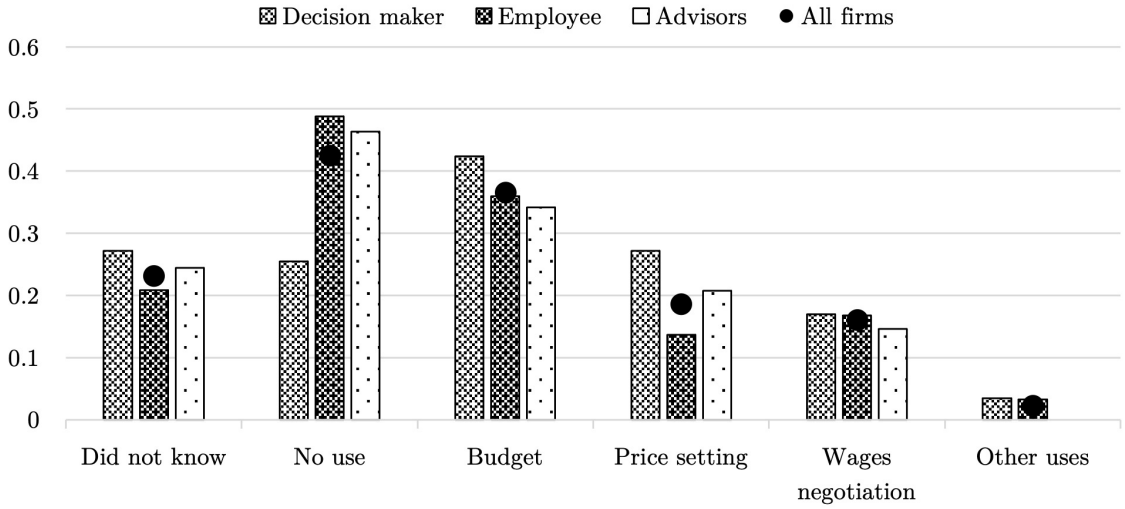

Figure 3: Survey's information uses

Another relevant aspect that is assessed by the special questions refers to the use that firms give to the information that is monthly published from the BES, i.e. the mean, median, and standard deviation of the answers. The specific question is: *What use do you give to the information published on this survey?* The response options

were: *(i) Budget planning; (ii) Define the company's pricing policy; (iii) Input for the company's wages negotiation; (iv) No use in particular; (v) I did not know that information about this survey was published; (vi) Other use*. Again, multiple responses by a firm are allowed.

Figure 3 presents the distribution of the answers. The main use for the survey's information is for budget planning (37%) and for pricing (19%). Interestingly, almost 45% of the firms declare not to use the BES information, and 23% that they do not know that the information was available.

3.2 Descriptive statistics

Table 1 presents the descriptive statistics of the variables used in our analysis. The firms' average inflation expectations for the 12 months horizon is 8.67%, while for the 24-month horizon, it is 8.46%. The average inflation rate during the period was 8.53%, with a maximum of 9.95%, these are above the upper bound of the inflation target range of 3% to 6%. The forecast error of firms, calculated as the difference between the observed inflation rate and the prediction done 12 months before, in absolute terms, was 1.63 percentage points. From this forecast error, we found that approximately half of the sample underestimates the inflation rate, while the other half overestimates it.

The main goal of this paper is to provide evidence on the factors that determine the firms' inflation expectations dynamics. In so doing, it is relevant to determine whether the firms differentiate their predictions between temporal horizons, and if the expectations diverge or converge towards the inflation target range. Analyzing whether firms differentiate horizons when making inflation expectations is coherent with our motivating evidence that shows that the share of firms expecting a rise or a fall in inflation is a relevant statistics to explain the term structure of firms' inflation expectations.

We construct a quantitative variable that takes value of 0 if the firm predicts the same inflation rate for both relevant horizons, 12 and 24 months, and takes a value -1 if the firm predicts a higher inflation in the 24 months horizon than in 12 months, and takes the value 1 if the firm predicts a lower inflation rate for the longer horizon. Additionally, we create a dummy variable that takes the value 1 if the firm does different predictions for each temporal horizon, and zero in the case that they do not differentiate, i.e. if it expects the same inflation rate in both horizons.

The average share of firms that do not differentiate between horizons is 39.2% during the period of analysis. Additionally, 45.5% of the firms expect that the inflation will be lower in 24 months than in the 12 months horizon. Meanwhile, 15.5% of the firms expect the inflation rate will diverge from the inflation target.

The rest of Table 1 shows descriptive statistics for the responses to the special questions introduces to the BES in June 2022 (i.e. those that were analyzed in the previous subsection).

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
12 months inflation expectation	6,298	8.666	1.614	3	20
24 months inflation expectation	6,298	8.456	1.865	3	20
Inflation rate	6,298	8.534	1.003	6.64	9.95
Forecast absolute error	3,395	1.634	1.288	0.010	12.04
Underestimates	3,395	0.507	0.500	0	1
Overestimates	3,395	0.493	0.500	0	1
Differentiates horizons	6,298	0.609	0.488	0	1
24 - 12 months infl. expectations	6,298	-0.210	1.034	-10	12
Expects convergence	6,298	0.454	0.498	0	1
Expects divergence	6,298	0.154	0.361	0	1
Expects no change	6,298	0.392	0.720	0	1
Info Source: BCU	4,966	0.572	0.495	0	1
Info Source: Government	4,966	0.330	0.470	0	1
Info Source: INE	4,966	0.760	0.427	0	1
Info Source: Press	4,966	0.528	0.499	0	1
Info Source: Business associations	4,966	0.279	0.448	0	1
Info Source: Professional reports	4,966	0.185	0.388	0	1
Info Source: Internal models	4,966	0.217	0.412	0	1
Respondent: Decision maker	4,919	0.230	0.421	0	1
Respondent: Employee	4,919	0.459	0.498	0	1
Respondent: External advisor	4,919	0.311	0.463	0	1

4 Empirical approach

When forming their expectations on short-term inflation (over the next 12 months) and on the monetary policy horizon (two years), firms make two underlying decisions: first, whether or not they differentiate their predictions in the relevant horizons that are asked in the BES. Secondly, conditionally in differentiating, whether or not they are going to give an ascending or descending trajectory to their expectations. A downward trajectory, in our case, implies a convergence toward the target of the monetary

authority. On the contrary, an ascending or divergent trajectory to the central bank's target implies a clear lack of credibility.

In a first approximation to characterize the term structure of inflation expectations we build the following variable:

$$P_{it} = \begin{cases} -1 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) > 0 \\ 0 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) = 0 \\ 1 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) < 0 \end{cases} \tag{1}$$

We first estimate a model of the term structure of inflation expectations using a multinomial logit specification represented as:

$$P_{it} = \alpha + \beta_1 E_{it-1}(\pi_{t+12}) + \beta_k W_{ik} + \beta_j I_{ij} + \beta_h U_{ih} + \beta_q X_{iq} + \delta_t + \varepsilon_{it} \tag{2}$$

We include the lagged inflation expectation, $E_{it-1}(\pi_{t+12})$, to control for the level of inflation expectations. The intuition to include this variable is that if expectations are anchored, high previous expectations probably are followed by a decreasing trend for the future inflation rate. On the contrary, for low levels of previous expectations, it is more likely that the firm will expect an increasing trend in the inflation rate. We also include three vectors of dummy variables: W_{ik} represents who usually answers the BES, I_{ij} reflects the sources of the information that the firm uses, and U_{ih} accounts for the use that firm i makes of the published information from the survey. A vector of other control variables (size and economic sector of the firm), X_{iq}, and a time-fixed effect, ρ_t, are included as controls for the omitted aspects that might affect all firms in a given month.

Table 2 presents the estimation for Equation 2. We estimate using multinomial logit, controlling by time fixed effects and using firms' clustered standard errors, the base case is $P_{it} = -1$. There is no significant difference in the probability of forecasting the same inflation expectation for 12 and 24 months, with respect to forecasting a diverging trend for inflation. On the other hand, the probability of forecasting a lower inflation rate for 24 months than for 12 months increases if the firms use the Central Bank's information to form their expectations. Additionally, when the BES is usually answered by external advisors, the probability that the firm has converging expectations reduces.

Table 2: Inflation expectations perspectives: multinomial logit estimation

$P_{it} = 0$	M1	M2	M3	M4	M5
$E_{it-1}(\pi_{h=t+12})$	-0.114**	-0.077	-0.103*	-0.086*	-0.103*
	(0.054)	(0.050)	(0.054)	(0.051)	(0.054)
Source CB	-0.188		-0.194		-0.193
	(0.240)		(0.243)		(0.244)
Source gov.	-0.101		-0.085		-0.093
	(0.271)		(0.276)		(0.263)
Source INE	-0.313		-0.318		-0.323
	(0.302)		(0.312)		(0.322)
Source press	0.109		0.143		0.135
	(0.237)		(0.235)		(0.245)
Source chambers	0.216		0.247		0.242
	(0.275)		(0.301)		(0.299)
Source models	0.427*		0.411*		0.400*
	(0.237)		(0.237)		(0.234)
Source advisors	0.313		0.318		0.316
	(0.278)		(0.283)		(0.283)
Decision makers		-0.155	-0.267		-0.277
		(0.327)	(0.365)		(0.380)
Advisors		-0.199	-0.245		-0.251
		(0.269)	(0.265)		(0.270)
Use budget				-0.015	-0.011
				(0.269)	(0.249)
Use pricing				0.003	0.074
				(0.356)	(0.371)
Use wages				0.143	0.049
				(0.350)	(0.368)
$P_{it} = 1$					
$E_{it-1}(\pi_{h=t+12})$	-0.366***	-0.351***	-0.335***	-0.371***	-0.332***
	(0.065)	(0.065)	(0.066)	(0.065)	(0.066)
Source CB	0.554**		0.582**		0.570**
	(0.227)		(0.232)		(0.231)
Source gov.	0.316		0.288		0.253
	(0.245)		(0.253)		(0.247)
Source INE	0.069		0.130		0.106
	(0.278)		(0.283)		(0.290)
Source press	0.144		0.165		0.122
	(0.227)		(0.223)		(0.225)
Source chambers	0.103		0.031		0.002
	(0.244)		(0.274)		(0.273)
Source models	0.367		0.392*		0.373
	(0.230)		(0.232)		(0.231)
Source advisors	0.209		0.237		0.212
	(0.275)		(0.279)		(0.283)
Decision makers		0.152	0.127		0.103
		(0.291)	(0.344)		(0.360)
Advisors		-0.500**	-0.464*		-0.483**
		(0.255)	(0.240)		(0.246)
Use budget				0.206	0.057
				(0.242)	(0.239)
Use pricing				0.230	0.181
				(0.327)	(0.331)
Use wages				0.276	0.211
				(0.323)	(0.334)
N Obs	4,738	4,693	4,693	4,738	4,693
N Censored	0.083	0.060	0.089	0.059	0.091
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firms Cluster SE	Yes	Yes	Yes	Yes	Yes

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

However, the fact of differentiating the inflation forecast or not is a sign of heterogeneity between firms. Not differentiating the expectations in both relevant horizons may be because the firm expects a high persistence in the inflation rate, or maybe because the firm did not make an effort to differentiate the response, it simply answered both horizons automatically.

To account for this heterogeneity, we model the dynamic forecasting process in two stages. In the first stage the firm decides if they differentiate their predictions or not. In the second stage, the firm predicts a convergent or divergent trend of inflation. For representing the first stage we define *Differentiate* horizons, D_{it}, as follows:

$$D_{it} = \begin{cases} 1 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) \neq 0 \\ 0 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) = 0 \end{cases}. \tag{3}$$

In the second stage, conditional in $D_{it} = 1$, the variable *Convergence*, C_{it}, is defined as follows:

$$C_{it} = \begin{cases} 1 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) < 0 \\ 0 & \text{if} \quad E_{it}(\pi_{t+24}) - E_{it}(\pi_{t+12}) > 0 \end{cases}. \tag{4}$$

This variable indicates whether or not inflation expectations in the monetary policy horizon are lower than in a shorter-term horizon. With inflation expectations well above the ceiling of the target, having one in this variable indicates a convergence of expectations towards the monetary policy inflation target (although not necessarily mean that inflation expectations will fall into the targeted range).

We will estimate a two-step model, with an endogenous selection first stage[4]. The Heckman-type selection model reflects well this sequence of decisions. In particular, we estimate the following equation system, where Equation 5 is Heckman's model selection equation, and Equation 6 is the equation that explains the convergence of inflation expectations:

$$D_{it} = \alpha + \gamma_1 E_{it-1}(\pi_{t+12}) + \gamma_k W_{ik} + \gamma_j I_{ij} + \gamma_h U_{ih} + \gamma_q X_{iq} + \delta_t + \mu_{it}, \text{ and} \tag{5}$$

$$C_{it} = \omega + \theta_1 E_{it-1}(\pi_{t+12}) + \theta_k W_{ik} + \theta_j I_{ij} + \theta_h U_{ih} + \theta_{q-1} X_{iq-1} + \rho_t + \psi_{it}. \tag{6}$$

[4]In Table7 in the Appendix we present these estimations in one step with clustered standard error, the main results of the two-stage estimation hold.

Table 3 presents the baseline estimations. In the lower panel of the table, we show the selection equation (Equation 5). The differentiation of horizons is related to a different type of firm, the Mills ratio is statistically different from zero, this implies that the differentiation of horizons by the firms significantly selects the sample in two kinds of different firms, those that differentiate temporal horizons in their expectations are different from those that do not.

Firms that use official information sources, e.g. the central bank, the government, and the statistical institute (INE), have a higher probability of differentiating horizons when forming their inflation expectations. This result may be evidence of a higher sophistication in the forecast of those firms that differentiate their predictions. Sophisticated agents are more likely to know and use the official data. On the other side, those firms that use business associations and advisors as information sources are less likely to differentiate horizons. However, those firms that answer the BES through external advisors present a higher probability of doing differentiated predictions in the different temporal horizons.

In the estimation of Equation 6, the official information sources are the most important factor to explain a convergence in inflation expectations. In particular, using the central bank information has a positive, statistically significant, and robust coefficient. Additionally, we can state that those firms that answer the BES through external advisors have a higher probability of expecting higher inflation in the 24 months horizon than in the 12 months horizon, i.e. to show divergence in inflation expectations. In contrast, firms that respond to the survey through decision-makers have a higher probability of converging in their expectations.

These results highlight the importance of official information to explain the dynamics of inflation expectations. In particular, the information provided by the central bank is the one with the greatest statistical and economic significance to explain the differentiation of inflation expectation over the different horizons of projection. Moreover, it also has a positive impact on the probability that firms show a downward trajectory of their inflation expectations.

Table 3: Convergency models: Heckman two steps estimations

Convergence	M1	M2	M3	M4	M5
$E_{it-1}(\pi_{h=t+12})$	-0.070***	-0.050***	-0.079***	-0.053***	-0.085***
	(0.006)	(0.005)	(0.009)	(0.005)	(0.011)
Source CB	0.163***		0.235***		0.259***
	(0.025)		(0.037)		(0.046)
Source gov.	0.086***		0.111***		0.113***
	(0.020)		(0.027)		(0.033)
Source INE	0.088***		0.125***		0.139***
	(0.024)		(0.034)		(0.041)
Source press	0.029*		0.015		0.002
	(0.016)		(0.023)		(0.029)
Source chambers	0.002		-0.046		-0.064*
	(0.019)		(0.028)		(0.035)
Source models	0.049**		0.039		0.032
	(0.020)		(0.027)		(0.034)
Source advisors	0.023		-0.000		-0.015
	(0.021)		(0.029)		(0.036)
Decision makers		0.006	0.090***		0.105**
		(0.019)	(0.033)		(0.041)
Advisors		-0.069***	-0.081***		-0.087***
		(0.018)	(0.026)		(0.033)
Use budget				0.020	0.025
				(0.017)	(0.031)
Use pricing				0.036*	0.039
				(0.021)	(0.039)
Use wages				0.043*	0.060
				(0.022)	(0.042)
Differentiate Horizons					
$E_{it-1}(\pi_{h=t+12})$	-0.070***	-0.070***	-0.070***	-0.070***	-0.070***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Source CB	0.483***	0.483***	0.483***	0.483***	0.483***
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
Source gov.	0.136***	0.136***	0.136***	0.136***	0.136***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Source INE	0.265***	0.265***	0.265***	0.265***	0.265***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Source press	-0.031	-0.031	-0.031	-0.031	-0.031
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Source chambers	-0.121***	-0.121***	-0.121***	-0.121***	-0.121***
	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)
Source models	-0.080*	-0.080*	-0.080*	-0.080*	-0.080*
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Source advisors	-0.131***	-0.131***	-0.131***	-0.131***	-0.131***
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
Decision makers	0.094	0.094	0.094	0.094	0.094
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
Advisors	0.211***	0.211***	0.211***	0.211***	0.211***
	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)
Decision × CB	0.297***	0.297***	0.297***	0.297***	0.297***
	(0.105)	(0.105)	(0.105)	(0.105)	(0.105)
Advisor × CB	-0.490***	-0.490***	-0.490***	-0.490***	-0.490***
	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)
Use budget	0.021	0.021	0.021	0.021	0.021
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Use pricing	0.038	0.038	0.038	0.038	0.038
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
Use wages	0.090	0.090	0.090	0.090	0.090
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
N Obs	4,693	4,693	4,693	4,693	4,693
N Censored	1,813	1,813	1,813	1,813	1,813
Mills ratio	0.312***	-0.104**	0.659***	-0.110**	0.802***
SE Mills	(0.080)	(0.046)	(0.134)	(0.044)	(0.170)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Size and economic sector controls are included but not reported.					

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

We carry out rolling estimations to assess the robustness of the previous results, as well as to determine if the probability of convergence based on the information provided by the central bank has changed in the period under analysis. More precisely, we use a 6 monthly window and rolling quarterly. Tables 7 and 8 in the Appendix show the detailed results.

Figure 4 presents the probability of convergence using central bank communication as an information source. These probabilities are calculated as marginal effects over the estimated coefficients for that variable in Equation 6. The probability of predicting a lower inflation rate in the 24 months horizon with respect to the 12 months horizon raised from 13% in 2020 to 25% in 2022. However, this economically significant increase is not statistically significant, since this variation is included in the estimation confidence interval.

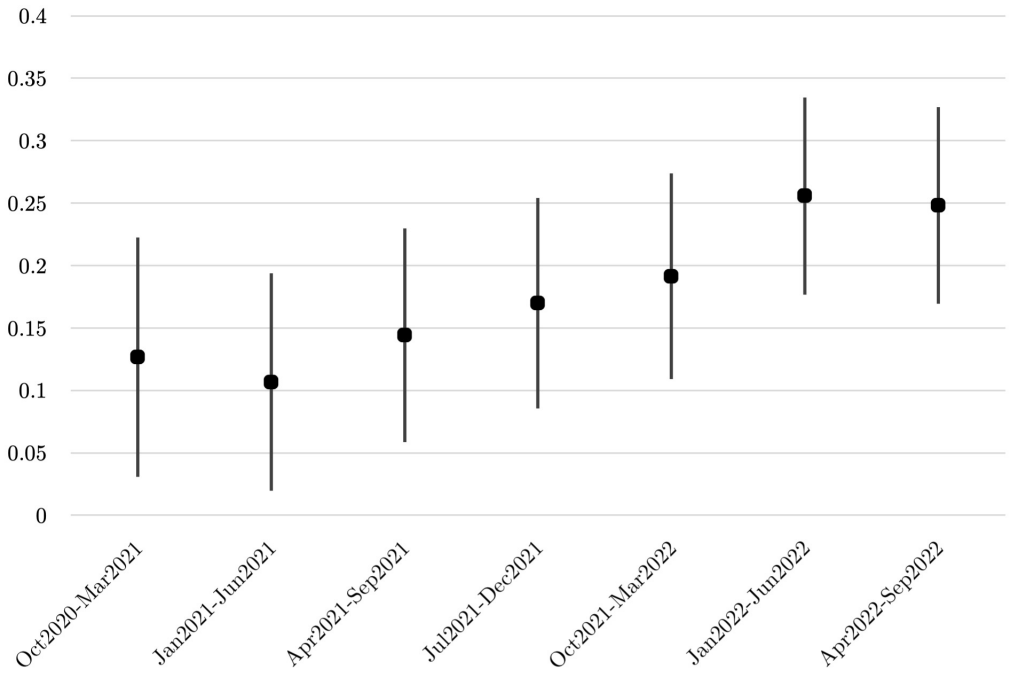

Figure 4: Probability of convergence in expectations if informed through the central bank

5 Conclusions

Sixty years ago, Milton Friedman provocatively concluded: *Inflation is always and everywhere a monetary phenomenon* (Friedman (1963)). Since then, a consensus has emerged that the main mandate for central banks should be to achieve a low and stable

level of inflation. Understanding the determinants of inflation and inflation expectations is central to this goal. As discussed above, different factors affect inflation expectations across countries and also across different types of agents within a country.

This work analyzes the evolution of inflation expectations by firms in Uruguay, an emerging economy that has faced relatively more difficulties to reign inflation in comparison to advanced economies. However, as suggested by Candia *et al.* (2022), these difficulties in controlling inflation in emerging economies imply that firms would be more attentive to the inflation dynamics in these economies. We explore this potential attention in inflation expectations by firms in Uruguay, finding evidence that inflation expectations by firms in Uruguay can influence the dynamics of actual inflation. We also find that firms that are aware of central bank information tend to expect a convergence of inflation. These results suggest the potential benefits of using intelligently and coherently the communication strategies by the Central Bank of Uruguay to shape inflation expectations and actual inflation.

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Appendix A: Estimations of the aggregate role of firms' expectations

This appendix presents an assessment of the role of inflation expectations by firms at the aggregate level in Uruguay. First, we analyze if these expectations contribute to forecast core inflation. Second, we evaluate how the share of firms expecting a reduction or a rise of inflation from one year to two years capture the dynamics of inflation expectations.

In order to assess whether inflation expectations by the private sector improves inflation forecasting, we consider the following specification to predict core inflation h periods ahead:

$$\pi_{x,t+h} = \beta_0 + \sum_{j=0}^{k} \gamma_j \pi_{x,t-j} + \sum_{j=0}^{k} \delta_j \pi_{t-j} + \sum_{j=0}^{k} \phi_j \Delta e_{t-j} + \beta_1 \pi_t^{e,12m} + \beta_2 \pi_t^{e,24m} + u_t \quad (7)$$

where $\pi_{x,t}$ is the core inflation rate between period t and $t-1$, π_t is the headline inflation rate between t and $t-1$, Δe_t is the nominal devaluation of the domestic currency relative to the US dollar between period t and $t-1$, $\pi_t^{e,12m}$ is the expected inflation 12 months ahead in period t and $\pi_t^{e,24m}$ is the expected inflation 24 months ahead in period t. We use separately the three sources of inflation expectations: (i) Analysts or Professional Forecasters; (ii) Financial assets; and (iii) Firms. The ones derived from financial assets are obtained using a break-even condition that estimates the implicit expected inflation based on nominal bond rates and indexed bond rates. Table 4 present several Wald tests of the hypothesis that jointly $\beta_1 = \beta_2 = 0$ using quarterly data from 2013 to 2021.[5] The different columns vary the horizon h for the forecasting equation above. The panel A present the p-values for $\beta_1 = \beta_2 = 0$ using the inflation expectations by Analysts, the panel B the same in the case of inflation expectation by financial assets and, finally, panel C with the inflation expectations by Firms. We note that inflation expectations obtained from financial assets has less statistical power to improve core inflation forecast. This could be attributed to the fact that these inflation expectations based on bond yields also contain risk and liquidity premiums. The main conclusion is that using inflation expectations by Analysts and Firms tends to improves the forecasting performance of core inflation not only one quarters ahead, but also a longer horizons.

[5] We use $k = 1$ for quarterly data and $k = 3$ for monthly data (see below).

Table 4: Wald test $\beta_1 = \beta_2 = 0$. Quarterly data 2013–2021

Horizon	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$
	Panel A. Analysts				
P-Value	0.00	0.00	0.00	0.01	0.00
	Panel B. Financial assets				
P-Value	0.10	0.40	0.37	0.19	0.08
	Panel C. Firms				
P-Value	0.00	0.00	0.00	0.00	0.04

Tests using robust standard errors.

Table 5: Wald test $\beta_1 = \beta_2 = 0$. Monthly data 2013–2021

Horizon	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$
	Panel A. Analysts				
P-Value	0.30	0.90	0.35	0.02	0.10
	Panel B. Financial assets				
P-Value	0.52	0.53	0.54	0.52	0.39
	Panel C. Firms				
P-Value	0.03	0.09	0.09	0.02	0.13

Tests using robust standard errors.

We also re-estimate the equation above using monthly data. The Wald tests for the estimations with monthly data is shown in table 5. The performance of inflation expectations by the private sector to improve forecasting is reduced in comparison to the use quarterly data. This worse forecasting performance with monthly observations is expected, since with higher frequency (monthly in comparison to quarterly observations) series are harder to predict. Nevertheless, even with monthly data we can conclude that inflation expectations by firms tend to help more the forecasting of core inflation than the other sources of inflation expectations.

Beyond the level of inflation, expectations by firms offer alternative statistics to understand inflation dynamics. In fact, Coeuré (2019) suggests that households' and firms'

expectations may not be able to identify the current level of inflation in the Eurozone, but they can provide valuable information to understand changes in the trend of inflation. Based on consumer expectations, Coeuré (2019) constructs qualitative consumer inflation expectations, computed as a balance statistic which is the difference between the share of respondents who expect prices to rise and the share of those who expect prices to fall, or stay about the same. This qualitative consumer inflation expectation has a high correlation with actual inflation in the Eurozone.

We also construct a balance statistic with the firms' survey computed as the difference between the share of respondents that expect a rise (divergence) in inflation expectations from one year to two years and the share of respondents that expect a fall (convergence) in inflation from one year to two years. We denote by d_t this variable and estimate the following equation:

$$\hat{E}_t\left[\pi^a_{t+8}\right] = \gamma_0 + \hat{E}_{a,t}\left[\pi^a_{t+4}\right] + \gamma_1 d_t + \tilde{e}_t, \tag{8}$$

where $\hat{E}_t\left[\pi^a_{t+8}\right]$ is the inflation expectation for two years ahead (8 quarters) and $\hat{E}_t\left[\pi^a_{t+4}\right]$ is the inflation expectations one year ahead (4 quarters). Table 6 presents the estimations for the period 2012Q1 to 2021Q4 of this equation using the three alternative sources to measure inflation expectations: (i) professional forecasters; (ii) firms; and (iii) financial market-based. The strong result that emerges is that this balance statistic, d_t, is a good proxy to understand changes in inflation expectations either by professional forecasters, firms, or the financial market-based.

Table 6: Dynamics of inflation expectations

Source of expectations	Professional forecasters	Firms	Financial markets
γ_0	-0.15 **	0.08 ***	0.07
	(0.07)	(0.03)	(0.12)
d_t	0.85 ***	0.95 ***	0.85 **
	(0.20)	(0.20)	(0.40)
R^2	0.86	0.97	0.94
Adj. R^2	0.85	0.97	0.93
N Obs	34	34	40

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parenthesis

Two main messages are derived from this appendix. First, inflation expectations by firms tends to improve the core inflation forecast beyond standard regressors such lags

of core inflation, headline inflation and nominal devaluation of the currency. Second, the share of firms expecting fall (convergence) or rise (divergence) of inflation from one year to two years is a relevant statistic to describe the dynamics of inflation expectations by both professional forecasters, firms, and financial market-based.

Appendix B: Additional table estimations

Table 7: Convergence models one-step estimation cluster standard errors

Convergence	M1	M3	M5
$E_{it-1}(\pi_{h=t+12})$	-0.059***	-0.057***	-0.057***
	(0.011)	(0.011)	(0.011)
Source CB	0.109***	0.108***	0.106***
	(0.042)	(0.040)	(0.041)
Source gov.	0.059	0.057	0.050
	(0.038)	(0.039)	(0.038)
Source INE	0.055	0.050	0.048
	(0.049)	(0.048)	(0.048)
Source press	0.026	0.021	0.013
	(0.036)	(0.036)	(0.036)
Source chambers	0.013	0.001	-0.003
	(0.037)	(0.040)	(0.041)
Source models	0.056	0.055	0.054
	(0.035)	(0.036)	(0.035)
Source advisors	0.033	0.028	0.023
	(0.041)	(0.042)	(0.042)
Decision makers		0.015	0.014
		(0.045)	(0.046)
Advisors		-0.058	-0.059
		(0.044)	(0.044)
Use budget			0.005
			(0.039)
Use pricing			0.025
			(0.047)
Use wages			0.040
			(0.047)
Differentiate Horizons			
$E_{it-1}(\pi_{h=t+12})$	-0.069***	-0.068**	-0.068**
	(0.027)	(0.027)	(0.027)
Source CB	0.490***	0.490***	0.489***
	(0.158)	(0.157)	(0.157)
Source gov.	0.133	0.131	0.128
	(0.118)	(0.118)	(0.119)
Source INE	0.270*	0.270*	0.268*
	(0.139)	(0.139)	(0.139)
Source press	-0.029	-0.029	-0.031
	(0.113)	(0.113)	(0.113)
Source chambers	-0.116	-0.117	-0.118
	(0.129)	(0.128)	(0.128)
Source models	-0.085	-0.085	-0.086
	(0.122)	(0.121)	(0.122)
Source advisors	-0.134	-0.135	-0.137
	(0.140)	(0.140)	(0.140)
Decision makers	0.068	0.066	0.062
	(0.218)	(0.217)	(0.217)
Advisors	0.251	0.244	0.244
	(0.220)	(0.210)	(0.210)
Decision × CB	0.335	0.346	0.349
	(0.271)	(0.266)	(0.266)
Advisor × CB	-0.535**	-0.546**	-0.547**
	(0.271)	(0.268)	(0.267)
Use budget	0.016	0.015	0.017
	(0.115)	(0.114)	(0.117)
Use pricing	0.032	0.031	0.039
	(0.158)	(0.157)	(0.159)
Use wages	0.082	0.080	0.094
	(0.169)	(0.168)	(0.171)
N Obs	4,693	4,693	4,693
N Censored	1,813	1,813	1,813
Time fixed effects	Yes	Yes	Yes
Firms Cluster SE	Yes	Yes	Yes

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

One-step estimates use maximum likelihood estimation (MLE), M2 and M4 did not achieve convergence.

Table 8: Convergency models rolling estimation

Convergence	R1	R2	R3	R4	R5	R6	R7
$E_{it-1}(\pi_{h=t+12})$	-0.072***	-0.039***	-0.059***	-0.129***	-0.119***	-0.076***	-0.078***
	(0.016)	(0.013)	(0.014)	(0.031)	(0.024)	(0.020)	(0.024)
Source CB	0.128***	0.136***	0.213**	0.346**	0.294***	0.295***	0.338***
	(0.040)	(0.048)	(0.084)	(0.151)	(0.097)	(0.087)	(0.109)
Source gov.	0.038	0.053	0.070	0.095	0.154**	0.157**	0.118*
	(0.049)	(0.048)	(0.051)	(0.079)	(0.069)	(0.064)	(0.067)
Source INE	0.111**	0.120**	0.114*	0.137	0.086	0.063	0.187**
	(0.048)	(0.052)	(0.067)	(0.102)	(0.082)	(0.072)	(0.094)
Source press	0.078**	0.032	-0.022	-0.015	-0.088	-0.068	0.015
	(0.038)	(0.039)	(0.044)	(0.069)	(0.063)	(0.061)	(0.063)
Source chambers	-0.076*	-0.047	-0.047	-0.043	-0.006	-0.055	-0.105
	(0.043)	(0.052)	(0.063)	(0.081)	(0.065)	(0.065)	(0.079)
Source models	0.139***	0.067	0.049	0.064	-0.011	-0.011	-0.056
	(0.047)	(0.047)	(0.052)	(0.079)	(0.070)	(0.068)	(0.082)
Source advisors	-0.046	-0.029	-0.014	-0.067	-0.019	0.027	0.078
	(0.058)	(0.051)	(0.059)	(0.110)	(0.075)	(0.066)	(0.076)
Decision makers	0.016	0.038	0.049	0.080	0.088	0.110	0.211**
	(0.046)	(0.055)	(0.067)	(0.107)	(0.081)	(0.074)	(0.099)
Advisors	-0.044	-0.037	-0.079	-0.129	-0.078	-0.151**	-0.110
	(0.045)	(0.044)	(0.052)	(0.085)	(0.067)	(0.065)	(0.070)
Use budget	0.019	0.026	-0.006	-0.014	-0.023	-0.014	0.071
	(0.042)	(0.044)	(0.048)	(0.074)	(0.062)	(0.059)	(0.067)
Use pricing	-0.008	-0.010	0.091	0.182	0.099	0.026	-0.047
	(0.050)	(0.053)	(0.066)	(0.112)	(0.082)	(0.075)	(0.088)
Use wages	0.001	0.028	0.015	-0.012	0.092	0.134	0.160
	(0.055)	(0.059)	(0.069)	(0.113)	(0.087)	(0.085)	(0.105)
Differentiate Horizons							
$E_{it-1}(\pi_{h=t+12})$	-0.126***	-0.052**	-0.035	-0.084***	-0.087***	-0.063***	-0.063***
	(0.029)	(0.025)	(0.025)	(0.024)	(0.025)	(0.024)	(0.024)
Source CB	0.316**	0.240*	0.346***	0.431***	0.514***	0.714***	0.672***
	(0.146)	(0.126)	(0.116)	(0.112)	(0.110)	(0.107)	(0.106)
Source gov.	0.328***	0.172*	0.072	0.092	0.165*	0.192**	0.080
	(0.114)	(0.097)	(0.090)	(0.087)	(0.086)	(0.083)	(0.081)
Source INE	0.232*	0.220**	0.222**	0.195**	0.227**	0.247***	0.342***
	(0.120)	(0.104)	(0.098)	(0.096)	(0.094)	(0.088)	(0.085)
Source press	0.158	0.002	0.005	0.010	-0.152*	-0.193**	-0.043
	(0.101)	(0.088)	(0.084)	(0.082)	(0.081)	(0.079)	(0.076)
Source chambers	-0.080	-0.196**	-0.171*	-0.045	-0.038	-0.157*	-0.188**
	(0.113)	(0.097)	(0.092)	(0.091)	(0.088)	(0.083)	(0.081)
Source models	0.169	0.074	-0.029	-0.048	-0.114	-0.173**	-0.215**
	(0.126)	(0.106)	(0.098)	(0.094)	(0.092)	(0.088)	(0.085)
Source advisors	-0.408***	-0.170	-0.115	-0.257**	-0.171*	-0.048	0.043
	(0.123)	(0.109)	(0.105)	(0.101)	(0.097)	(0.092)	(0.090)
Decision makers	-0.094	-0.106	-0.102	-0.026	0.022	0.309**	0.388***
	(0.195)	(0.167)	(0.157)	(0.153)	(0.147)	(0.139)	(0.135)
Advisors	0.155	0.131	0.019	0.015	0.243*	0.336***	0.343***
	(0.174)	(0.150)	(0.138)	(0.135)	(0.133)	(0.127)	(0.123)
Decision × CB	0.403	0.594***	0.572***	0.464**	0.372*	-0.094	-0.004
	(0.266)	(0.228)	(0.212)	(0.204)	(0.200)	(0.191)	(0.188)
Advisor × CB	-0.622***	-0.354*	-0.160	-0.226	-0.504***	-0.791***	-0.661***
	(0.223)	(0.193)	(0.181)	(0.178)	(0.176)	(0.169)	(0.163)
Use budget	0.146	0.110	-0.006	0.005	0.003	-0.068	0.004
	(0.113)	(0.096)	(0.091)	(0.089)	(0.086)	(0.082)	(0.080)
Use pricing	-0.005	0.054	0.167	0.230**	0.145	-0.008	-0.133
	(0.140)	(0.123)	(0.117)	(0.116)	(0.114)	(0.108)	(0.106)
Use wages	-0.069	-0.065	-0.092	-0.148	0.050	0.265**	0.353***
	(0.158)	(0.137)	(0.128)	(0.124)	(0.123)	(0.119)	(0.115)
N Obs	868	1,073	1,144	1,195	1,252	1,366	1,429
N Censored	270	361	439	496	516	542	588
Mills ratio	0.303***	0.429***	0.625***	0.963	0.839**	0.830**	0.942
SE Mills	0.182	0.218	0.311	0.511	0.312	0.270	0.342
	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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