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FISCAL POLICY AND INFLATION EXPECTATIONS

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Fiscal Policy and Inflation Expectations*

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Abstract

We find empirical evidence of a positive correlation between the budget deficit to GDP and inflation expectations of price setters. This implies an interdependence between fiscal and monetary policies: monetary policy faces more challenges to maintain inflation expectation anchored when the fiscal outcomes worsen. The limits imposed by fiscal policy to the achievement of monetary policy objectives are larger when the fiscal deficit is larger. The result is robust to considering other fiscal variables and to controlling for macroeconomic covariates.

JEL Codes: E52, E62, E63.

Keywords: Inflation expectations, budget deficit, fiscal policy, monetary policy, Uruguay.

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1 Introduction

Inflation expectations play a crucial role in modern monetary policy. Economic agents update their expectations based on new information. In turn, these expectations regarding the future affect present behavior and macroeconomic outcomes. Monetary authorities aim to anchor inflation expectations to the values that are targeted in order to ensure price stability. But inflation expectations may be affected by other variables in general, and by fiscal policy in particular, determining an interdependence between fiscal and monetary policies. While theory suggests that inflation expectations play an important role in transmitting fiscal considerations into inflation, little empirical evidence exists on the matter.[1] What limits does fiscal policy impose on the achievement of the monetary policy objective through the inflation expectations channel?

This paper uses micro data on inflation expectations by firms and their perception about the soundness of the fiscal position to answer this question. More precisely, it assesses the effect of fiscal variables that are known by price setters in Uruguay at the moment of answering to a monthly inflation expectation survey. The period under analysis ranges from October 2009 to March 2020.

Empirical evidence shows a positive and statistically significant relationship between the budget deficit to GDP and inflation expectations. This relationship is robust to a series of controls and robustness checks. Overall, this result suggests that fiscal policy outcomes impair monetary policy effectiveness by affecting inflation expectations. Monetary policy faces more challenges to maintain inflation expectations anchored when the fiscal outcomes worsen, implying an interdependence between fiscal and monetary policies. The results also show that the short-term interest rate acting through the credit channel of monetary policy was not enough to compensate the negative impact of fiscal policy on inflation expectations. Nevertheless, monetary policy also affects inflation expectations through other channels. In order to assess the relevance of monetary policy communication, we compile a monetary contractivity index. This index has the expected negative sign and is statistically significant. Hence, a contractive tone in the communication of the central bank reinforces the interest rate channel of monetary policy.

Overall, empirical results suggest that monetary policy working through both the credit (or interest rate) and the communication channels compensates the effect of the budget deficit on inflation expectations. The coefficient of the interaction of these three variables is negative and statistically significant, meaning that their combined effect is correlated with a reduction of inflation expectations towards the target range. This does not imply, however, that monetary policy was effective to put the inflation rate in the target range. As can be seen in Figure (2) in the Appendix, both the inflation rate and the median of inflation expectations were above the upper bound of the inflation target

[1] One important exception is Coibion et al. (2021).

range for most of the period under analysis. Nevertheless, inflation expectations remain relatively stable and out of a continuously increasing path that would be expected if its positive correlation with the budget deficit to GDP were not compensated by a negative correlation introduced by monetary policy.

In June 2013 there was a major change in the conduct of monetary policy, moving from using the interest rate as policy instrument to monetary aggregates. In addition, after this date the inflation target was expanded and the horizon of monetary policy was extended. Running the analysis in the two sub-periods before and after June 2013 shows that the limits imposed by fiscal policy to the achievement of monetary policy objectives, in particular to anchoring inflation expectations, are larger in the second sub-period, where the fiscal deficit is larger and monetary policy uses monetary aggregates as an instrument.

This paper provides empirical evidence on the effect of fiscal policy outcomes on the formation of inflation expectations by firms, and thus on the relationship between fiscal and monetary policies through the expectations channel. Fiscal dominance could be an explanation of the results. Recent work by Bucacos (2021) finds evidence of a mild fiscal dominance in Uruguay during the period 1999 to 2019. Nonetheless, the budget deficit is a macroeconomic variable that calls the attention of large part of the population and thus it could serve as a summary of the macroeconomic context, capturing a set of macroeconomic determinants of inflation expectations. Poor fiscal results could lead to increasing prices today as agents anticipate the rising inflation and pass it into current prices and wages.

The rest of the paper is organized as follows. The next section revises related literature. Section 3 presents and describes the data. Section 4 describes the empirical strategy, presents the results and robustness checks. Finally, Section 5 contains final remarks. The methodology to compute the monetary contractivity index, figures and tables with robustness check results are in the Appendix.

2 Related Literature

This paper contributes to a growing body of literature on the formation of inflation expectations. Considering survey-based agents' inflation expectations one could distinguish between experts (i.e. professional forecasters) and non experts (i.e. firms and households). Mankiw & Reis (2002) argue that professional forecasters update their information set infrequently. Coibion & Gorodnichenko (2015) estimate the degree of information rigidity among experts and show that monetary institutions affect the formation of expectations. Andrade & Le Bihan (2013) show that professional forecasters in the Eurozone do not systematically update their forecasts following new information. Carroll (2003) argues that not every household pays close attention to all macroeconomic news and that they

absorb the economic content probabilistically, which implies stickiness on the formation of expectations. Reis (2006*a*) and Reis (2006*b*) argue that consumers and producers update their information set sporadically. Easaw et al. (2013) show that households tend to absorb professionals forecasts when forming their expectations. A recent strand of literature focuses on how agents' form their inflation gap forecasts (see Chan et al. 2018, Dixon et al. 2020, Jain 2019). When agents form multi-period forecast (as is the case in our survey data), they are trying to capture the momentum of inflation (see Cogley et al. 2010).

In Sims (2003) agents update prices continuously but they only have access to imperfect information. Hence, agents access noisy measures of the variables of interest when making their inflation expectations. The question that arises is how inflation expectations of firms are affected according to economic information. In this paper, we assess whether or not a key fiscal variables affect the formation of inflation expectations by price setters. As in Coibion et al. (2018), firms in our sample update their beliefs after receiving new information about macroeconomic conditions, that could be summarized in the outcome of fiscal policy.

The interaction between fiscal and monetary policies has been explored at length since the seminal work by Sargent & Wallace (1981). Most of the literature focuses on the concept of fiscal dominance (see Leeper & Leith 2016, for a survey). Conceptually, poor fiscal outcomes (e.g. high debt levels without foreseeable improvements in the budget deficit) could lead to increasing prices today as agents anticipate the rising inflation and pass it into current prices and wages. While theory suggests that inflation expectations play an important role in transmitting fiscal considerations into inflation, little empirical evidence exists on the matter. One exception is Coibion et al. (2021). They conduct a randomized control trial survey to assess whether household inflation expectations are sensitive to fiscal considerations, and find that news about future debt leads households to anticipate higher inflation. In this paper, we provide empirical evidence showing that firms inflation expectations are sensitive to fiscal outcomes. Hence, fiscal policy might impair the transmission channels of monetary policy.

We contribute to the line of work by Gelós & Rossi (2008) by exploiting a novel, monthly survey on firms' inflation expectations. As we do, they find a strong influence of the tax situation upon the shaping of expectations in the case of Uruguay. Nevertheless, both papers complement in several respects: they use an IMF's dataset on inflation expectations for a non-inflation targeting period, while we use a novel survey of firms' inflation expectation in Uruguay, which is representative of the universe of firms with more than 10 employees, in a period where the central bank follows an inflation targeting regime. Moreover, we assess the interaction effects between fiscal and monetary policies.

Our paper also contributes to a growing literature on inflation expectations in Uruguay by assessing the limits that fiscal policy may impose to monetary policy and the relative

importance of the tone of monetary policy communication (following Blinder et al. 2008). We construct a monetary contractivity index by using web scrapping and text analysis techniques of monetary policy statements. Similarly to Borraz & Mello (2020), we find that a contractive tone of monetary policy communication has a negative correlation with firms' inflation expectations. Licandro & Mello (2014) also find a negative relationship between the monetary stance and inflation expectations made by firms.

3 The Data

3.1 Inflation Expectations Survey

Our main source of data is the Inflation Expectations Survey (IES) carried out by the Instituto Nacional de Estadísticas (INE), commissioned by the Banco Central del Uruguay (BCU), to firms in Uruguay. The survey is conducted monthly to a sample of firms that is representative of the universe of the Uruguayan private companies with more than 10 employees. The survey, however, does not cover the agricultural and the financial sectors. The sample period is from October 2009 to March 2020.

The IES has a monthly frequency and contains information about firms' price and cost expectations. Specifically, our dependent variable corresponds to the answers to the question that reveals inflation expectations in the survey: *What do you think will be the variation in the CPI (Consumer Price Index)?* This question is asked considering 4 different time horizons: the current year, the next 12, 18 and 24 months. In this work we consider the firms' inflation expectation in the horizon of monetary policy ($t = H$).[2] In June 2013 the horizon of monetary policy was extended from 18 to 24 months. At the same time, the inflation target was expanded from 4-6% to 3-7%. We control for these changes in the regressions that are presented in the next section.

The IES is sent monthly to around 500 firms with an average response ratio of 77% since October 2009 (with a minimum response ratio of 54%). The resulting dataset is an unbalanced long panel with a total of 126 months and 46,580 observations. 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 times (64 months).

3.2 Fiscal and Macroeconomic Variables

Fiscal and macroeconomic variables come from different sources. Since our objective is to assess how fiscal policy affects inflation expectations, we focus on a fiscal variable that is widely accessible to the general public, and to firms in particular: the budget deficit as a percentage of GDP. This variable is published by the Ministry of Economy

[2] Qualitative results remain robust to considering different horizons.

and Finance the last day of each month with a delay of one month.[3] While the primary budget result or the debt-to-GDP ratio could also be relevant, an extended practice in Uruguay is that fiscal statements and fiscal news generally focus on the budget deficit expressed as a percentage of GDP. Hence, we consider this as a relevant fiscal variable to assess the impact of fiscal policy when firms make their expectations.

Indeed, we run robustness analysis replacing the budget deficit to GDP by other fiscal variables: primary budget deficit to GDP and gross public debt to GDP. These variables come from the same source than the budget deficit to GDP. The empirical results in the next section show that while other fiscal variables also affect inflation expectations, the budget deficit to GDP have coefficients four times larger, which can be interpreted as evidence of their relative importance.

Inflation expectations may be affected by the current inflation rate, then we use this variable as a control in the empirical analysis of the next section. The monthly inflation rate, computed as the variation of the Consumer Price Index, is published by the Instituto Nacional de Estadísticas the third business day of the following month.[4]

In an inflation targeting regime, monetary policy aims to affect inflation expectations with the objective of maintaining inflation in the target range. One channel to do so goes through the interest rate and is commonly known as the credit channel of monetary policy. The basic mechanism implies that a market interest rate above that considered as neutral indicates a contractive stance, affecting market conditions and, in turn, inflation expectations. Monetary policy aims to affect the market interest rate by using its instruments. In the case under study, the selected instrument was a short-term interest rate until June 2013 and monetary aggregates since then. In order to account for the above mentioned mechanism throughout the entire period under analysis, we introduce a short-term interest rate in the empirical regressions.[5] More precisely, we compute the short-term interest rate as the 30-day node of the ITLUP curve developed by the Electronic Stock Exchange (BEVSA).[6]

Other widely accessible macroeconomic variables are introduced in order to check the robustness of the results: GDP growth, foreign exchange rate (FX) depreciation and volatility, and unemployment rate. GDP is quarterly published by the Banco Central del Uruguay with a delay of approximately a quarter. The FX depreciation is the inter-annual variation of the inter-bank price of the USD in BEVSA. Likewise, the FX volatility was calculated as the square of the monthly standard deviation of daily operations in the inter-bank market.[7] The unemployment rate is monthly published by the Instituto Nacional

[3] See https://www.gub.uy/ministerio-economia-finanzas/tematica/resultados-del-sector-publico?page=0.

[4] See http://www.ine.gub.uy/indicadores?indicadorCategoryId=11421.

[5] Other monetary policy channels are also considered. See Sections 3.3 and 3.4.

[6] ITLUP is the curve of returns of assets denominated in local currency, e.g. Pesos Uruguayos, in the local market. See https://web.bevsa.com.uy/CurvasVectorPrecios/CurvasIndices/ITLUP.aspx.

[7] See https://web.bevsa.com.uy/Mercado/MercadoCambios/Dolar.aspx.

de Estadísticas the last day of each month with a delay of two months.

3.3 Monetary Contractivity Index

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 that were 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". After identifying these words in a given statement, we extract the adjacent parts of the text counting from the sixth word before to the sixth word after each target word. So 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 computed as the simple average of the values assigned to the corresponding strings.

Figure (1) in Appendix B presents the normalized short-term interest rate and the monetary contractivity index. As it can be appreciated, while the short-term interest rate fluctuates from values that can be considered expansive to contractive ones, the contractivity index is positive most of the time with values ranging between zero and one. Hence, the tone of monetary policy statements has fluctuated in a range of contractiviness during the period under analysis.

3.4 Awareness about Monetary Policy

Economic agents may have different information about monetary policy. In turn, the degree of awareness about these variables may have deep implications on the formation of inflation expectations. For instance, Borraz & Zacheo (2018) show that firms responding to the IES exhibit a very high degree of attention to current inflation conditions and that firms' forecasts are more accurate than those of professional forecasters in Uruguay. Additionally, being more aware about monetary policy variables could strengthened the expectation channel of monetary policy as shown by Borraz & Mello (2020).

To control for these effects, we use a variable that accounts for the awareness about monetary policy of firms responding the IES, which is constructed by Borraz & Mello (2020). In short, the variable assigns the value 1 to a firm, i.e. aware about monetary policy, when it responds correctly to two questions: *What rate of inflation (or range) do you think the Banco Central del Uruguay tries, on average, to achieve?* (being informed

about the inflation target), and *Which is the last month's annual inflation rate?* (being informed about the inflation rate).[8]

3.5 Descriptive Statistics

As stated earlier, the sample period ranges from October 2009 to March 2020, including 46,580 observations. Table (1) shows descriptive statistics for the variables of interest. Figures are in the Appendix.

The expected inflation rate by firms in the horizon of monetary policy ($t = H$, with $H = 18$ months until June 2013 and $H = 24$ since then) averages 8.95%, while its median is 8.65% in the period under analysis. As a reference, the expected inflation rate for the next 12 months horizon is 8.89% in average and 8.7% in median. The inflation rate during the period was systematically above the central bank's target. In average the inflation rate has been 8% during the period, with a maximum of 11% and a minimum rate of 5.24%. Figure (2) in Appendix B shows the annual inflation rate, the median of the inflation expectations for the monetary policy horizon and the upper bound of the inflation target of the central bank. The median inflation expectation is highly correlated with the observed inflation rate, but it seems to be stickier than the observed rate, particularly when inflation falls.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Expected inflation rate in $t = H$	46,580	8.95	2.06	5.00	25.00
Inflation rate	46,580	8.00	1.16	5.24	11.00
Short-term interest rate	46,580	9.76	2.60	6.25	15.66
Budget deficit to GDP	46,580	2.98	1.30	0.44	5.11
Primary budget deficit to GDP	46,580	-0.53	1.03	-3.11	0.70
Gross public debt to GDP	46,580	62.84	4.04	55.99	71.44
Monetary contractivity index	46,580	0.28	0.29	-0.33	1.00
Awareness about monetary policy	46,580	0.20	0.40	0.00	1.00
FX depreciation	46,580	0.48	2.43	-5.11	13.93
FX volatility	46,580	0.10	0.19	0.00	1.78
GDP growth	36,062	2.79	2.09	-1.49	7.96
Unemployment rate	46,580	7.25	1.00	5.60	10.80

Notes: Authors' elaboration.

The short-term interest rate is 9.76% in average for the whole period. During the first part, i.e. before July 2013 when the interest rate was the policy instrument, the average short-term interest rate was 7.87%. Since July 2013, i.e. during the period in

[8]Please see Borraz & Mello (2020) for further details about the construction of these variables.

which monetary aggregates are used as policy instrument, the short-term interest rate averages 11%. Figure (3) in Appendix B illustrates the sharp increase in the short-term interest rate at the time of changing the monetary policy instrument in June 2013.

As discussed in Section 3.2, in order to analyze the relation of fiscal policy and firms' inflation expectations we consider the budget deficit in terms of GDP as the most relevant variable and also check the robustness of the results by using other fiscal variables. Figure (4) in Appendix B presents the primary budget deficit and the budget deficit to GDP. Until 2013 Uruguayan Government had primary budget surpluses. Since then the primary result is nearby to zero, while the budget deficit increased substantially, representing around 5% of GDP at the end of the sample period. In average, budget deficit to GDP is 2.98% during the period under analysis. Gross public debt to GDP averages 62.84% during the period under analysis. Figure (5) in Appendix B shows the path of this variable through time.

The monetary contractivity index averages 0.28, confirming the message in Figure (1) in Appendix B that the tone of monetary policy communication was mainly contractive during the period under analysis.

On average, the awareness of firms about monetary policy is 0.2. This means that only 20% of the firms knew the inflation target of the central bank and the annual inflation rate. By components, the awareness of firms about the inflation rate is higher than their knowledge about the inflation target. Only 35% of firms in average, knew the inflation target during the period under analysis. However, 57% of them knew the annual inflation rate.

Finally, Table (1) shows descriptive statistics of other macroeconomic variables that are used to check the robustness of the results: foreign exchange rate depreciation and volatility, GDP growth and unemployment rate. Figure (6) in Appendix B shows the evolution of unemployment and the GDP growth during the period. Given that the unemployment rate is relatively sticky through the period under analysis (see Figure (6) in Appendix B), we use the rate of growth of the unemployment rate.

4 Empirical Analysis

4.1 Main Regression Model

The main regression model for inflation expectations that we estimate in this paper is the following:

$$E_{it}\left(\pi_H\right) = \alpha_i + \beta_1 E_{it-1}\left(\pi_H\right) + \beta_2 \pi_{t-1} + \beta_3 i_t^{st} + \beta_4 E_{it}(F_t) + \varepsilon_{it}, \tag{1}$$

where $E_{it}\left(\pi_H\right)$ 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, and $E_{it}(F_t)$ is the expectation of the budget deficit made by firm i in period t. The latter variable is non-observable. For this reason we use the last observed budget deficit, F_{t-2}, as a proxy.

As a benchmark, we estimate the same model but excluding the expected fiscal budget deficit. In addition to the benchmark model (M1 in Table 2) and the main regression model (M2), we also estimate four more models in order to account for: the interaction between the short-term interest rate and the budget deficit (M3), the contractivity stance of monetary policy (M4), the interaction between contractivity stance and budget deficit (M5), and the interaction between both monetary policy variables and the budget deficit (M6).

Estimation is done with the Generalized Method of Moments (GMM). This is an appropriate estimation method because the high persistence of inflation expectations. In all models we include the auto-regressive term. We also include time fixed effects: a year fixed effect in order to account for an eventual learning of the firms in the prediction of inflation, and a monthly fixed effect to control 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 in each month. Finally, we control for the change in the policy target and instrument 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. Additionally, firms observe the budget deficit with a two month delay. In order 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 last 12 months time average variation of the expected costs and inflation rate by firms. The expectation of the budget deficit made by firm i in period t, which is proxy by the last observed budget deficit to GDP, is instrumented by the lags of this variable.

4.2 Results

Table (2) shows the main results of our empirical analysis. The estimated coefficients of the benchmark model (M1) are statistically significant at the 1% level and have the expected sign: an increase in the inflation rate observed by firms is positively correlated with their inflation expectations, and monetary policy seems to be effective in influencing inflation expectation through the credit channel because an increase in the short-term interest rate is negatively correlated with firms' inflation expectations (a result already

Table 2: Expected inflation estimations

	M1	M2	M3	M4	M5	M6
(1) Expected inflation rate $(t-1)$	0.118***	0.143***	0.143***	0.122***	0.122***	0.121***
	(0.031)	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)
(2) Inflation rate $(t-1)$	0.314***	0.232***	0.225***	0.242***	0.244***	0.238***
	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)
(3) Short-term interest rate (t)	-0.263***	-0.233***	-0.226***	-0.198***	-0.200***	-0.202***
	(0.021)	(0.022)	(0.023)	(0.022)	(0.023)	(0.023)
(4) Budget deficit to GDP (TC) (t)		0.387***	0.390***	0.354***	0.350***	0.349***
		(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
(3)x(4)			0.053**			
			(0.024)			
(5) Monetary contractivity index				-0.147***	-0.152***	-0.135***
				(0.010)	(0.011)	(0.011)
(4)x(5)					0.013	
					(0.011)	
(3)x(4)x(5)						-0.027**
						(0.013)
Obs	41,078	37,930	37,930	37,930	37,930	37,930
N-Groups	570	560	560	560	560	560
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.501	0.966	0.955	0.900	0.921	0.887
Hansen-p	0.741	0.871	0.888	0.876	0.882	0.881
Annual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Monthly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Endogenous variables: short-term interest rate, trend cycle budget deficit in t, contractivity index. Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation, lagged observed budget deficit to GDP in $t-2$. 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.

fund by Licandro & Mello (2014)).

Results for the main regression model are in column M2 of Table (2). The qualitative results of the benchmark model also hold in model M2. Interestingly, the coefficient of the fiscal variable, i.e. budget deficit to GDP, is positive and statistically significant at the 1% level. This positive correlation between the budget deficit and the inflation expectations made by price setters, i.e. firms, in Uruguay is the main finding of this paper. It implies a positive relationship between the deterioration in a key outcome of the fiscal policy and a key variable in an inflation targeting regime. Overall, this result provides empirical evidence that monetary policy faces more challenges to maintain inflation expectation anchored when the fiscal outcomes worsen, implying a clear link between fiscal and monetary policies.

We introduce the interaction of the short-term interest rate and the budget deficit to GDP (see model M3) in an attempt to find evidence on whether or not one of the variables prevails over the other. Finding a positive and statistically significant coefficient could be interpreted as evidence that, on average during the period under analysis, the short-term interest rate acting through the credit channel of monetary policy was not sufficient to compensate the negative impact of fiscal policy on inflation expectations.

Nevertheless, monetary policy also affects inflation expectations through other channels. In order to assess the relevance of monetary policy communication, we introduce the monetary contractivity index as explanatory variable in model M4. The monetary contractivity index has the expected negative sign and is statistically significant at the 1% level. Hence, a contractive tone in the communication of the central bank reinforces the interest rate channel of monetary policy. The coefficient of the budget deficit to GDP remains robust to introducing the monetary contractivity index, confirming the importance of this fiscal variable for the formation of inflation expectations. The interaction of the budget deficit to GDP with the monetary contractivity index is, however, statistically non-significant (see model M5).

Finally, model M6 in the last column in Table (2) assesses the relative power of monetary policy through both the credit (or interest rate) and the communication channels to compensate the impact of the budget deficit on inflation expectations. We find a coefficient for the interaction of these three variables that is negative and statistically significant at the 5% level. Overall, these results imply that the combined effect of these variables is correlated with a reduction of inflation expectations towards the target range. This does not imply that monetary policy was effective to put the inflation rate in the target range. As it can be seen in Figure (2) in Appendix B, both the inflation rate and the median of inflation expectations were above the upper bound of the inflation target range for most of the period under analysis. Nevertheless, inflation expectations remain relatively stable and out of a continuously increasing path that would be expected if its positive correlation with the budget deficit to GDP were not compensated by a negative correlation introduced by monetary policy.

Table 3: Expected inflation estimations: October 2009 to June 2013

	M1S1	M2S1	M3S1	M4S1	M5S1	M6S1
(1) Expected inflation rate $(t-1)$	0.211***	0.209***	0.208***	0.193***	0.193***	0.200***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
(2) Inflation rate $(t-1)$	0.306***	0.238***	0.242***	0.358***	0.394***	0.265***
	(0.009)	(0.010)	(0.010)	(0.011)	(0.014)	(0.018)
(3) Short-term interest rate (t)	-0.544***	-0.487***	-0.583***	-0.447***	-0.405***	-0.408***
	(0.030)	(0.030)	(0.033)	(0.031)	(0.035)	(0.062)
(4) Budget deficit to GDP (TC) (t)		0.144***	0.125***	0.054***	0.055***	0.395***
		(0.018)	(0.018)	(0.019)	(0.019)	(0.031)
(3)x(4)			-0.058***			
			(0.012)			
(5) Monetary contractivity index				-0.129***	-0.122***	-0.358***
				(0.006)	(0.006)	(0.018)
(4)x(5)					-0.081***	
					(0.016)	
(3)x(4)x(5)						-0.078***
						(0.006)
Obs	14,549	14,549	14,549	14,549	14,549	14,549
N-Groups	542	542	542	542	542	542
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.312	0.302	0.306	0.294	0.312	0.330
Hansen-p	0.000	0.000	0.000	0.000	0.000	0.000
Annual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Monthly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Endogenous variables: short-term interest rate, trend cycle budget deficit in t, contractivity index. Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation, lagged observed budget deficit to GDP in $t-2$. Other controls: number of responses per month. Estimating Method: Two step GMM, robust to heteroskedasticity.
* p<0.10, ** p<0.05, *** p<0.01.

The previous results where obtained using the entire sample, i.e. from October 2009 to March 2020. In June 2013 there was a major change in the conduct of monetary policy moving from using the interest rate as policy instrument to monetary aggregates. In addition, after this date the inflation target was expanded and the horizon of monetary policy was extended. In the previous regressions we control for these changes by introducing a dummy variable. In the remaining of this subsection we estimate the same six models than before (M1 to M6) for two sub-periods: S1 ranging from October 2009 to June 2013, and S2 from July 2013 to March 2020. The results are in Tables (3) and (4) respectively.

The qualitative results previously described hold in both sub-periods. In particular, the sign and the degree of statistical significance of the coefficients for the short-term interest rate, the budget deficit to GDP, the monetary contractivity index, as well as the

interaction among these three variables are the same than for the entire period.

Other results of interest emerge from the comparison between the two sub-periods. First, the absolute value of the coefficients of the short-term interest rate are larger for the first sub-period than for the second one. This is an intuitive result because the short-term interest rate was used as the monetary policy instrument during the first sub-period.

Second, the magnitude of the coefficients of the budget deficit to GDP are smaller for the first sub-period than for the second one. Interestingly, as it can be seen in Figure (4) in Appendix B, we observe a change in the fiscal results around 2013, with the primary budget surpluses decreasing significantly and the budget deficit constantly increasing in the second sub-period.

Third, except for M6, the absolute value of the coefficients of the monetary contractivity index are smaller during the first sub-period. Being the short-term interest rate a more transparent and informative monetary policy instrument than monetary aggregates, the relative importance of the tone of monetary policy communication is larger during the second sub-period.

Fourth, the interaction between the budget deficit to GDP and the short-term interest rate ((3)x(4) in Tables 3 and 4), as well the interaction between the budget deficit to GDP and the monetary contractivity index ((4)x(5) in the Tables) are statistically significant at 1%, negative in the first sub-period and positive in the second one. These changes in the sign of the coefficients suggest that the limits imposed by fiscal policy to the achievement of monetary policy objectives are larger in the second sub-period, where the fiscal deficit is larger and monetary policy uses monetary aggregates as an instrument.

Table 4: Expected inflation estimations: July 2013 to March 2020

	M1S2	M2S2	M3S2	M4S2	M5S2	M6S2
(1) Expected inflation rate $(t-1)$	0.090***	0.088***	0.140***	0.139***	0.181***	0.181***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
(2) Inflation rate $(t-1)$	0.760***	0.615***	0.542***	0.403***	0.409***	0.383***
	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
(3) Short-term interest rate (t)	-0.130***	-0.018***	-0.029***	-0.274***	-0.093***	-0.255***
	(0.009)	(0.005)	(0.003)	(0.005)	(0.005)	(0.006)
(4) Budget deficit to GDP (TC) (t)		0.422***	0.467***	0.999***	0.478***	1.022***
		(0.009)	(0.007)	(0.007)	(0.007)	(0.008)
(3)x(4)			0.169***			
			(0.005)			
(5) Monetary contractivity index				-0.451***	-0.416***	-0.073***
				(0.005)	(0.005)	(0.009)
(4)x(5)					0.504***	
					(0.006)	
(3)x(4)x(5)						-0.155***
						(0.003)
Obs	24,957	24,957	23,381	23,381	23,381	23,381
N-Groups	516	516	502	502	502	502
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.700	0.679	0.666	0.671	0.294	0.294
Hansen-p	1.000	1.000	0.899	0.918	0.999	0.999
Annual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Monthly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Endogenous variables: short-term interest rate, trend cycle budget deficit in t, contractivity index. Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation, lagged observed budget deficit to GDP in $t-2$. Other controls: number of responses per month. Estimating Method: Two step GMM, robust to heteroskedasticity.
* p<0.10, ** p<0.05, *** p<0.01.

4.3 Robustness Checks

In order to assess the robustness of the main results we perform a series of checks. In the previous subsection we have shown that the qualitative results remain robust to split the sample in two sub-periods that were selected to account for the major change in the conduct of monetary policy occurred in June 2013. Moreover, Tables (5) and (6) in Appendix C show the regression results of substituting the budget deficit to GDP for the primary budget deficit to GDP and the gross public debt to GDP respectively. For comparison, we reproduce the outcome of the main regression model (M2) in the first column of each table.

Overall, the signs, signification levels and value of the coefficients for the expected inflation rate in $t-1$, the inflation rate in $t-1$, and the short-term interest rate in t are

robust to considering the primary instead of the total budget deficit to GDP (see columns R1 to R5 in Table 5). The qualitative results that were highlighted in the previous section also hold when considering alternative fiscal variables (see columns R1 to R10 in Tables 5 and 6), providing robustness check evidence of the importance of fiscal policy outcomes on monetary policy through the inflation expectation channel.

The results show that the primary budget deficit to GDP and the gross public debt to GDP affect inflation expectations. Interestingly, the coefficients for these two fiscal variables (0.070 and 0.100 respectively) are approximately a quarter of the estimated coefficient for the budget deficit to GDP (0.387). This could be interpreted as evidence that the latter fiscal variable has greater power to affect inflation expectations. As commented in Section 3.2, this result could be explained by the fact that public discussion about the fiscal situation generally focuses on the level of the budget deficit expressed as a percentage of GDP, while other fiscal variables receive relatively less attention. Overall, this result confirms our prior of considering the budget deficit to GDP as a relevant fiscal variable to assess the impact of fiscal policy when firms make their expectations.

In column R11 of Table (7) we add as explanatory variable to the main regression model (M2 in Table 2) the awareness of price setters about monetary policy. Introducing this variable does not change the qualitative results from the main regression model. Moreover, being informed about the inflation target and the current inflation rate, i.e. being aware about monetary policy, does not have a statistically significant effect on the formation of inflation expectations. This is different form the results in Borraz & Mello (2020).

In the rest of the models (R12 to R16) presented in Table (7) we introduce different macroeconomic variables that could have an impact on firms' inflation expectations: FX depreciation, FX volatility, GDP growth and unemployment growth. The coefficient associated to the budget deficit to GDP, i.e. our fiscal policy variable, remains statistically significant at the 1% level and with a similar order of magnitude than in the main regression model through all the robustness checks.

Interestingly, while the budget deficit to GDP preserves its significance, other macroeconomic variables lack of statistical significance to explain the inflation expectations made by firms. It is the case of the FX depreciation, the unemployment and the GDP growth (the latter is only statistically significant at the 10% level). The only macroeconomic variable that is significant at the 1% level is the FX volatility. In a highly dollarized economy like Uruguay, a higher volatility of the exchange rate is positively correlated with higher firms' inflation expectations.

On top of confirming the robustness of the positive correlation between the budget deficit and the inflation expectations made by firms, the previous results suggest that this fiscal variable captures more of the macroeconomic determinants behind the determination of inflation expectations.

5 Final Remarks

Inflation expectations play a crucial role in an inflation targeting regime. Monetary policy aims to anchor inflation expectations in order to achieve its target, but this task may be affected by other public policies. In this paper, we find robust empirical evidence of a positive correlation between the budget deficit (both the total and the primary ones) and the gross debt to GDP with the inflation expectations of price setters. This result implies an interdependence between fiscal and monetary policies. More precisely, monetary policy faces more challenges to maintain inflation expectation anchored when the fiscal outcomes worsen. The limits imposed by fiscal policy to the achievement of monetary policy objectives are larger after June 2013, where the fiscal deficit is larger and major changes in the conduct of monetary policy occurs. Nevertheless, the empirical evidence indicates that monetary policy has been effective to compensate the distortions introduced by fiscal policy on inflation expectations during the period under analysis. Inflation expectations remain relatively stable and out of a continuously increasing path that would be expected if its positive correlation with the budget deficit to GDP were not compensated by a negative correlation introduced by monetary policy.

Among fiscal variables, the budget deficit to GDP appears as the most relevant in affecting inflation expectations. This fiscal variable, together with macroeconomic variables like the volatility of the exchange rate in the dollarized Uruguayan economy, receives great attention in the news, public discussion and among professional analysts. The budget deficit may be capturing a set of macroeconomic determinants of inflation expectations. In this regard, the budget deficit is a macroeconomic variable that calls the attention of large part of the population, including price setters, and thus it could serve as a summary of the macroeconomic context, together with the volatility of the exchange rate.

More work is needed in order to explain the determinants behind these results. Some progress has been done regarding fiscal dominance, which is defined as the financing of budget deficits by money creation. Bucacos (2021) finds evidence of a mild degree of fiscal dominance in Uruguay during the period 1999 to 2019. This is consistent with the existence of clear rules where the central bank can not finance more than 10% of the previous year's budget deficit.

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Appendix

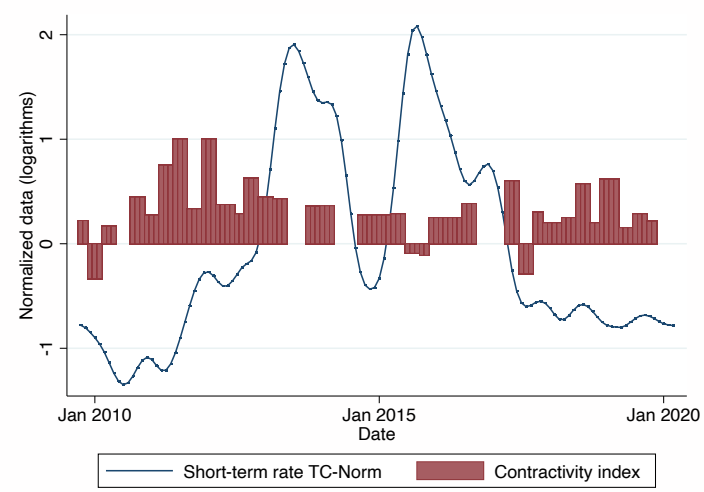
A Monetary Contractivity Index: Assessment of Strings

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).

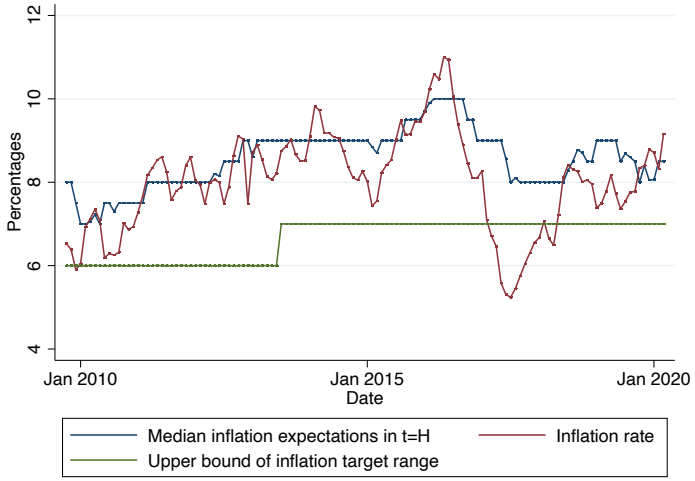
B Figures

Figure 1: Short-term interest rate and the Monetary Contractivity Index



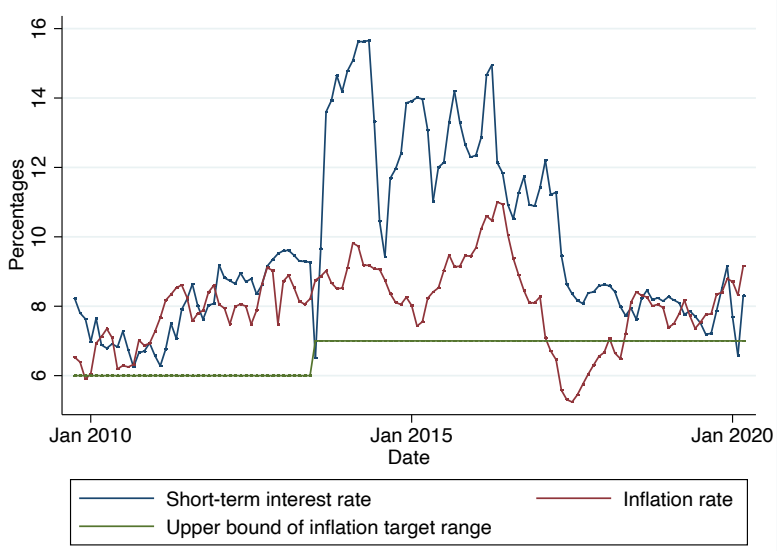
Notes: The evolution of the normalized short-term interest rate and the Monetary Contractivity Index are depicted in this figure. The sample period ranges from October 2009 to March 2020 and includes 46,580 observations. The Monetary Contractivity Index was constructed by the authors based on monetary policy statements using web scraping and text analysis techniques. The short-term interest rate is computed as the 30-day node of the ITLUP curve developed by the Electronic Stock Exchange (BEVSA).

Figure 2: Inflation expectations and inflation rate



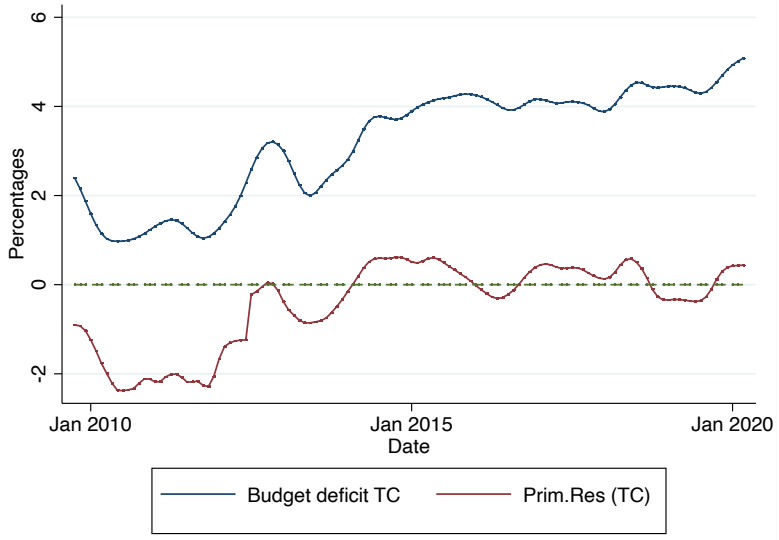
Notes: The Inflation Expectations Survey (IES) carried out by the Instituto Nacional de Estadísticas (INE), commissioned by the Banco Central del Uruguay, is used for the construction of this figure. The survey is conducted monthly to a representative sample of Uruguayan private firms with more than 10 employees. The monthly inflation rate is computed as the varation of the Consumer Price Index, published by the Instituto Nacional de Estadísticas the third business day of the following month. The sample period ranges from October 2009 to March 2020 and includes 46,580 observations. The horizon of the monetary policy (t = H, with H = 18 months until June 2013 and H = 24 since then averages 8.95% and its median is 8.65%.

Figure 3: Inflation rate and short-term interest rate



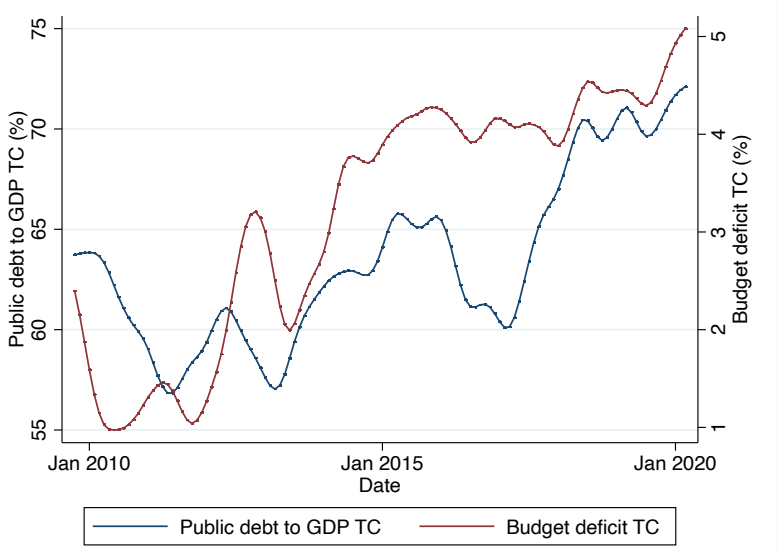
Notes: The sample period ranges from October 2009 to March 2020 and includes 46,580 observations. Before July 2013 the interest rate was Uruguay's policy instrument. Since July 2013, monetary aggregates are used as policy instrument. The monthly inflation rate is computed as the varation of the Consumer Price Index, published by the Instituto Nacional de Estadísticas the third business day of the following month. This figure illustrates the sharp increase in the short-term interest rate at the time of changing the monetary policy instrument.

Figure 4: Budget deficit to GDP (trend-cycle component)



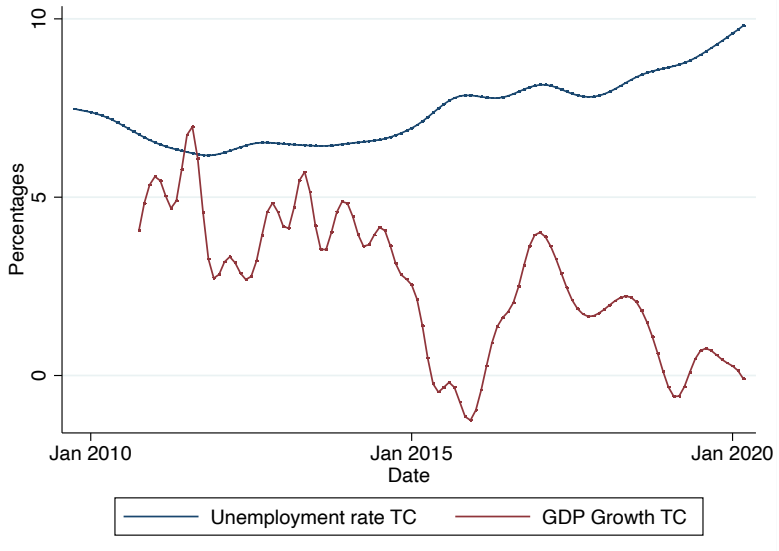
Notes: The budget deficit as a percentage of GDP is the most relevant variable, but primary budget deficit is analyzed as robustness check. In average, budget deficit to GDP is 2.98%. As can be seen, around 2013, the primary surpluses decreased significantly and the budget deficit increased constantly. Both variables are published by the Ministry of Economy and Finance the last day of each month with a delay of one month. The sample period ranges from October 2009 to March 2020 and includes 46,580 observations.

Figure 5: Gross public debt to GDP



Notes: As robustness check the authors analyze both the budget deficit to GDP and gross public debt to GDP. This figure shows the path of the variables through time. In average, the budget deficit to GDP is 2.98%, while the gross public debt to GDP averages 62.84% during the period under analysis. Both the gross public debt to GDP and the public debt to GDP are published by the Ministry of Economy and Finance the last day of each month with a delay of one month. The sample period ranges from October 2009 to March 2020 and includes 46,580 observations.

Figure 6: GDP growth and unemployment rate (trend-cycle component)



Notes: The evolution of unemployment and GDP growth from October 2009 to March 2020 is depicted in this figure. The unemployment rate is relatively sticky. GDP is quarterly published by the Banco Central del Uruguay with a delay of approximately a quarter. The unemployment rate is monthly published bu the Instituto Nacional de Estadísticas the last day of each month with a delay of two months.

C Robustness Check Results

Table 5: Expected inflation estimations using primary budget deficit to GDP

	M2	R1	R2	R3	R4	R5
(1) Expected inflation rate $(t-1)$	0.143***	0.160***	0.159***	0.136***	0.135***	0.135***
	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)
(2) Inflation rate $(t-1)$	0.232***	0.284***	0.287***	0.291***	0.292***	0.290***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
(3) Short-term interest rate (t)	-0.233***	-0.245***	-0.227***	-0.209***	-0.212***	-0.215***
	(0.022)	(0.022)	(0.023)	(0.022)	(0.023)	(0.023)
Budget deficit to GDP (TC) (t)	0.387***					
	(0.036)					
(4) Primary budget deficit to GDP (TC) (t)		0.070**	0.083**	0.071**	0.062*	0.070**
		(0.034)	(0.034)	(0.035)	(0.036)	(0.035)
(3)x(4)			0.001***			
			(0.000)			
(5) Monetary contractivity index				-0.158***	-0.173***	-0.137***
				(0.010)	(0.011)	(0.012)
(4)x(5)					0.038***	
					(0.012)	
(3)x(4)x(5)						-0.000***
						(0.000)
Obs	41,078	37,930	37,930	37,930	37,930	37,930
N-Groups	570	560	560	560	560	560
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.501	0.929	0.974	0.998	0.945	0.987
Hansen-p	0.741	0.865	0.854	0.869	0.864	0.814
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Monthly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Endogenous variables: short-term rate, trend cycle budget deficit in t, contractivity index. Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation, lagged observed budget primary deficit to GDP in $t-2$. 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.

Table 6: Expected inflation estimations using gross public debt to GDP

	M2	R6	R7	R8	R9	R10
(1) Expected inflation rate $(t-1)$	0.143***	0.048	0.049	0.048	0.047	0.045
	(0.029)	(0.036)	(0.037)	(0.037)	(0.037)	(0.037)
(2) Inflation rate $(t-1)$	0.232***	0.123***	0.124***	0.131***	0.132***	0.112***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
(3) Short-term interest rate (t)	-0.233***	-0.078***	-0.459	-0.078***	-0.080***	-0.086***
	(0.022)	(0.022)	(0.513)	(0.022)	(0.022)	(0.022)
Budget deficit to GDP (TC) (t)	0.387***					
	(0.036)					
(4) Gross public debt to GDP (TC) (t)		0.100***	0.100***	0.096***	0.095***	0.098***
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
(3)x(4)			0.006			
			(0.008)			
(5) Monetary contractivity index				-0.033***	-0.042***	-0.048***
				(0.011)	(0.011)	(0.011)
(4)x(5)					0.022*	
					(0.012)	
(3)x(4)x(5)						-0.001***
						(0.000)
Obs	41,078	37,930	37,930	37,930	37,930	37,930
N-Groups	570	560	560	560	560	560
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.501	0.210	0.213	0.212	0.210	0.179
Hansen-p	0.741	0.831	0.862	0.853	0.862	0.850
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Monthly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Endogenous variables: short-term rate, trend cycle budget deficit in t, contractivity index. Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation, lagged observed gross public debt to GDP in $t-2$. 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.

Table 7: Expected inflation estimations using macroeconomic controls

	R11	R12	R13	R14	R15	R16
(1) Expected inflation rate $(t-1)$	0.146***	0.143***	0.141***	0.143***	0.143***	0.144***
	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)	(0.029)
(2) Inflation rate $(t-1)$	0.227***	0.234***	0.241***	0.230***	0.235***	0.240***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
(3) Short-term interest rate (t)	-0.233***	-0.234***	-0.240***	-0.235***	-0.234***	-0.243***
	(0.023)	(0.022)	(0.023)	(0.023)	(0.023)	(0.023)
(4) Budget deficit to GDP (TC) (t)	0.382***	0.395***	0.398***	0.389***	0.397***	0.401***
	(0.036)	(0.035)	(0.036)	(0.036)	(0.036)	(0.036)
(5) Awareness about monetary policy (t)	0.624					0.573
	(0.451)					(0.454)
(6) FX depreciation (t)		0.004				0.003
		(0.003)				(0.004)
(7) FX volatility (t)			0.176***			0.155***
			(0.035)			(0.041)
(8) GDP growth (t)				0.054*		0.053
				(0.031)		(0.033)
(9) Unemployment growth (t)					0.031	0.036
					(0.027)	(0.028)
Obs	37,229	37,930	37,930	37,930	37,930	37,229
N-Groups	556	560	560	560	560	556
AR(1)-p	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)-p	0.636	0.972	0.992	0.964	0.959	0.638
Hansen-p	0.894	0.891	0.869	0.868	0.854	0.880
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Monthly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Endogenous variables: short-term rate, trend cycle budget deficit in t, GDP growth in t, growth of unemployment rate in t. Instruments: lagged endogenous, time average 12 months expected variation of firms costs, time average 12 months expected inflation, lagged observed budget deficit to GDP in $t-2$, lagged GDP growth $t-2$, lagged unemployment $t-1$. 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.