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 in Uruguay. It implies an interdependence between fiscal and monetary policies: monetary policy faces more challenges to maintain inflation expectation anchored when the fiscal outcome worsen. The result is robust to considering other fiscal variables and to controlling for macroeconomic covariates. During the period under analysis, however, monetary policy has been effective to compensate the distortions introduced by fiscal policy on inflation expectations.

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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 continuously 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 that is different from the classical fiscal dominance argument.

This paper 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 outcome worsen, implying an interdependence between fiscal and monetary policies. Nonetheless, monetary policy seems to be effective to compensate the distortions introduced by fiscal policy on inflation expectations made by price setters during the period under analysis.

Empirical results 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 affect inflation expectations through other channels. In order to assess the relevance of monetary policy communication, we compile a monetary contractivity index and include it in the regressions. The monetary contractivity 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, monetary policy working through both the credit (or interest rate) and the communication channels compensates the effect of the budget deficit on inflation expectations.

This paper contributes to a growing literature on inflation expectations by highlighting the effect of fiscal policy outcomes and thus the relationship between fiscal and monetary policies. However, more work is needed in order to explain the determinants behind these results. While fiscal dominance could be an explanation, recent work by Bucacos (2020) finds no evidence of fiscal dominance in Uruguay during the period

1999 to 2019. Nonetheless, other explanations suggest that the budget deficit is 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 and thus it could serve as a summary of the macroeconomic context.

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

The interaction between fiscal and monetary policies has been explored at length since the seminal work by Sargent and Wallace (1981). For the case of Uruguay, Licandro and Vicente (2006) analyze the link between fiscal policy and inflation objectives and find that relatively high inflation rate helps to reduce the fiscal deficit between 1970 and 2005. More recently, Bucacos (2020) applies the method proposed by De Resende (2007) and finds no evidence of fiscal dominance, i.e. the financing of budget deficits by money creation, between 1999 and 2019 in Uruguay. While most of the literature focus on the concept of fiscal dominance, in this paper we follow a complementary approach. More precisely, we aim to assess whether or not fiscal policy might impair some of the transmission channels of monetary policy in an inflation targeting regime.

Inflation expectations play a crucial role in an inflation targeting regime. Sims (2003) develop a model where agents can 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 made by firms are affected according to economic information. In this paper, we assess whether a key fiscal variable, i.e. the budget deficit to GDP, affects firms' inflation expectations. 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 higher the budget deficit, the higher the inflation expectations of firms, implying an extra effort that monetary policy needs to make in order to anchor expectations.

Our paper is close to Gelós and Rossi (2008). 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. In particular, following Blinder *et al.* (2008) we assess the importance of the communication channel of monetary policy. Similarly to Borraz *et al.* (2020), we find that a contractive tone of monetary policy communication has a negative correlation with firms' inflation expectations. Licandro and Mello (2014) also find a negative relationship between the monetary stance and inflation expectations made by firms.

3 The data

This section contains a description of the data we use in this paper.

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 ($t = H$).[1] 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

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

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, firms in particular: the budget deficit as a percentage of GDP. This variable is published by the Ministry of Economy and Finance the last day of each month with a delay of one month.[2] 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.[3]

In an inflation targeting regime, monetary policy aims to affect inflation expectations as a mechanism to maintain inflation in the target. In order to account for this mechanism, we introduce a short term interest rate in the empirical regressions.[4] More precisely, we compute the short term interset rate as the 30-day node of the ITLUP curve developed by the Electronic Stock Exchange (BEVSA).[5]

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

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

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

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

[5]See https://web.bevsa.com.uy/CurvasVectorPrecios/CurvasIndices/ITLUP.aspx.

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.[6] The unemployment rate is monthly published by the Instituto Nacional de Estadísticas the last day of each month with a delay of two months.

3.3 Monetary contractivity index

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

To construct the monetary contractivity index we collect all the monetary policy statements 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 appreciate, 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 and Zacheo (2018) show that firms

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

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 *et al.* (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 *et al.* (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).[7]

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 the Appendix 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. Inflation expectation median is highly correlated with the observed inflation rate, but it seems to be stickier than the observed rate, particularly when inflation falls.

[7]Please see Borraz *et al.* (2020) for further details about the construction of these variables.

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

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 which monetary aggregates are used as policy instrument, the short term interest rate averages 11%. Figure 3 in the Appendix 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 the Appendix 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 the Appendix shows the path of this variable through time.

The monetary contractivity index averages 0.28, confirming the message in Figure 1 of 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 the Appendix 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 the Appendix B), we use the rate of growth of the unemployment rate.

4 Empirical analysis

In this section we present the empirical analysis and show the main results of the paper. We also assess their robustness.

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 it is instrumented with F_{t-2}.

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. As explained before, the expectation of the budget deficit made by firm i in period t is instrumented by the last observed budget deficit, i.e. with a lag of two months.

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 fund by Licandro and 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

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

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, observed budget deficit 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

inflation expectation anchored when the fiscal outcome 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 affect 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. Interestingly, the interaction of the budget deficit to GDP with the monetary contractivity index is statistically non-significant (see model M5). This result could be interpreted as evidence that the communication of a contractive tone by the central bank compensates the impact of the budget deficit on inflation expectations.

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 that is negative and statistically significant at the 5% level. Overall, monetary policy seems to be effective to compensate the distortions introduced by fiscal policy on inflation expectations made by price setters.

4.3 Robustness checks

In order to assess the robustness of the main results we perform a series of checks. Tables 3 and 4 in the Appendix 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 3). The qualitative results that were highlighted in the previous section also hold when considering alternative fiscal variables (see columns R1 to R10 in Tables 3 and 4), 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 focus 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 5 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 *et al.* (2020).

In the rest of the models (R12 to R16) presented in Table 5 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 bud-

get 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 in Uruguay. 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 outcome worsen. Nevertheless, the results indicate that monetary policy has been effective to compensate the distortions introduced by fiscal policy on inflation expectations during the period under analysis.

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 (2020) finds no evidence 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 contractivity index

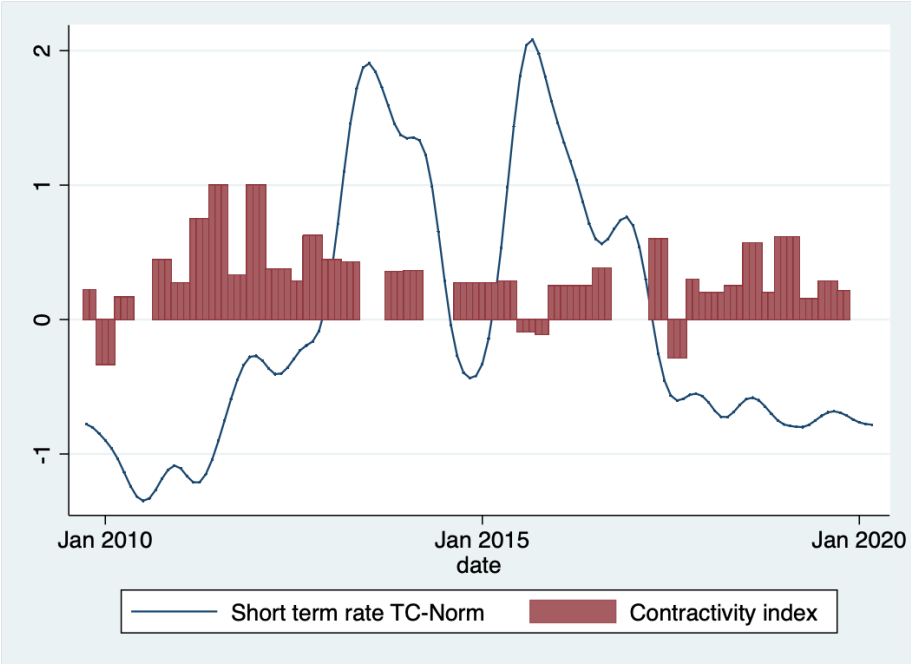


Figure 2: Inflation expectations and inflation rate

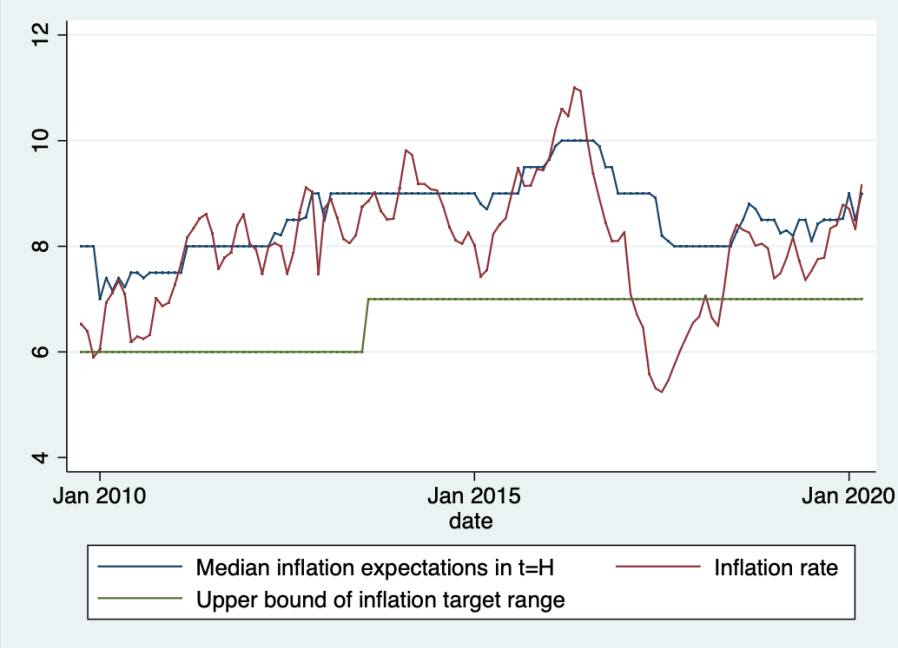


Figure 3: Inflation rate and short term interest rate

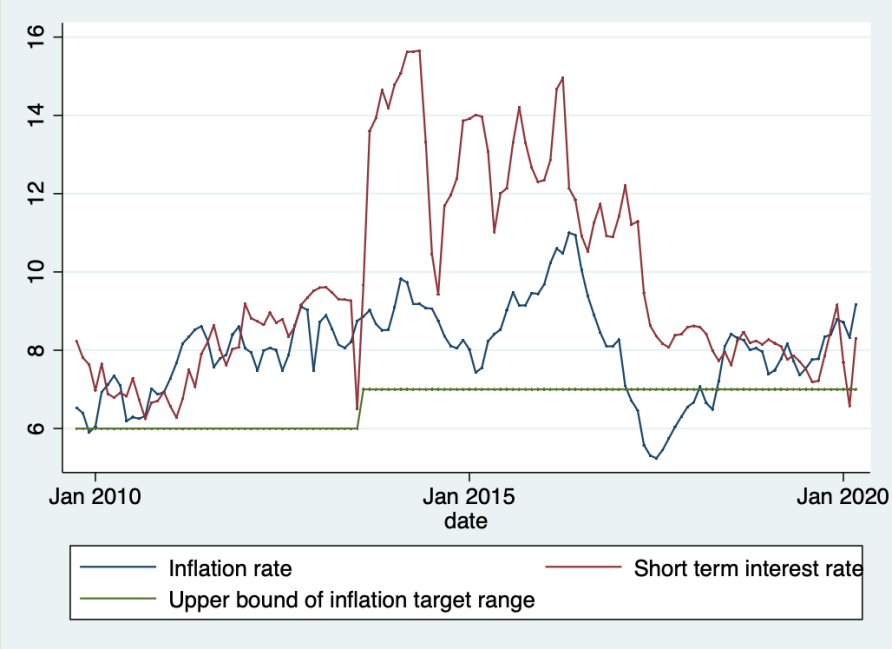


Figure 4: Budget deficit to GDP (trend-cycle component)

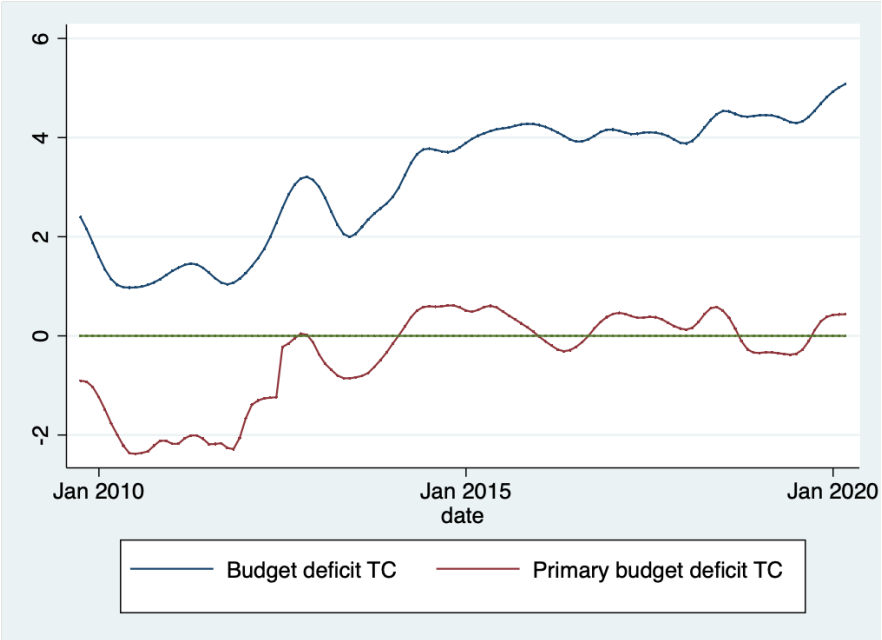


Figure 5: Gross public debt to GDP

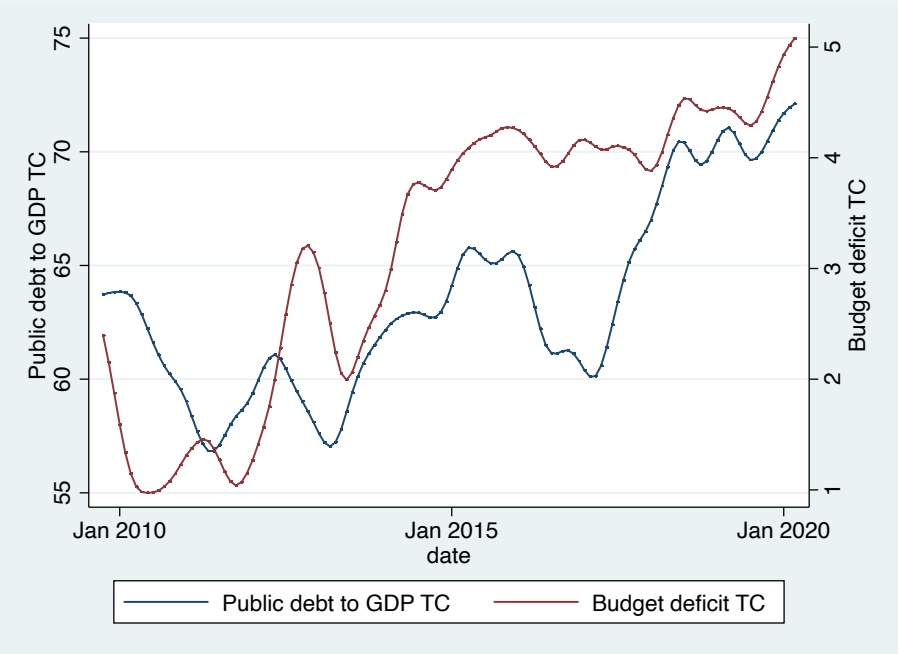
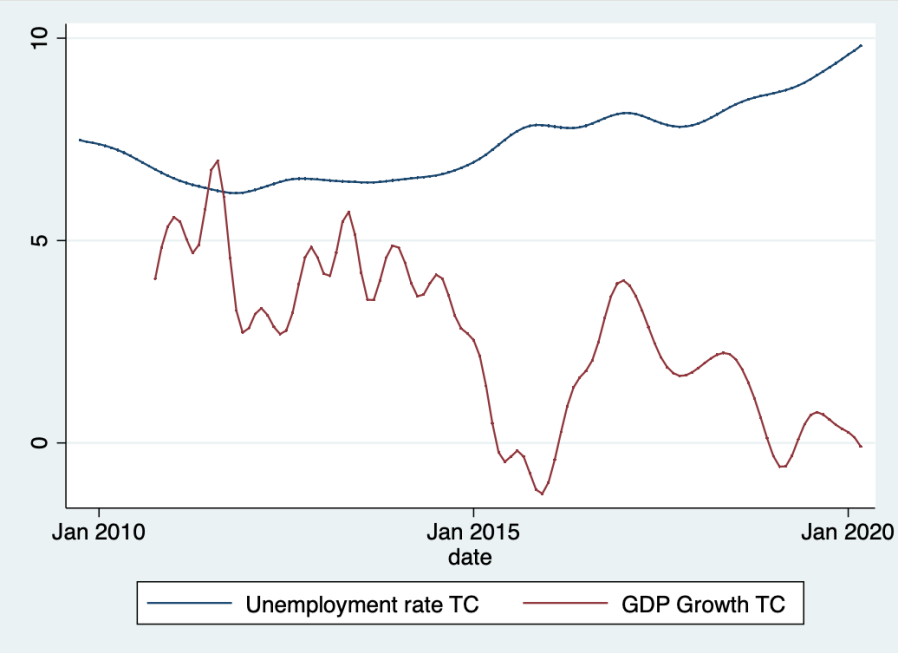


Figure 6: GDP growth and unemployment rate (trend-cycle component)



C Robustness check results

Table 3: 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

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, 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 4: 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

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, 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 5: 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

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, GDP growth $t-2$, 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