REVISTA DE ECONOMÍA, Vol. 21, Nº 2, Noviembre 2014. ISSN: 0797-5546

FIRM INFLATION EXPECTATIONS AND MONETARY POLICY IN URUGUAY[1]

GERARDO LICANDRO[2]
glicandr@bcu.gub.uy

MIGUEL MELLO[3]
mmello@bcu.gub.uy

Date of reception: May 2014 Date of acceptance: October 2014

ABSTRACT

Using a novel monthly survey of firm inflation expectations for Uruguay from January 2009 to June 2013, this paper studies the impact of monetary policy on inflation expectations at the micro level. Using several panel data techniques we consistently find a negative and statistically significant relationship between monetary policy and inflation expectations. We also find a high level of inertia in expectations. Past inflation changes have a positive impact on inflation expectations, while exchange rate changes have a significant but low importance on expectations. We observe a negative link between inflation expectations and expected economic activity, potentially due to past experiences of a monetary financing of crisis. Contrary to intuition, there is no clear link between firm inflation expectations and the median assessment of experts published by the Central Bank.

JEL Classification: E43, E52, E58

Keywords: Monetary transmission, inflation expectations, expectations channel.

---

1 We thank participants at the seminars of the Economics Department of the FCS- UDELAR, and the ORT University seminars, and Banco Central del Uruguay for valuable comments. We want to thank José Licandro, Diego Gianelli, an anonymous referee of the Research Network of CEMLA for their comments and an anonymous referee of Revista de Economia for his helpful suggestions to improve this work. All the opinions expressed in this paper and remaining mistakes are our sole responsibility and do not compromise Banco Central del Uruguay.

2 Banco Central del Uruguay, Gerencia de Investigaciones Económicas.
3 Banco Central del Uruguay, Área de Investigaciones Económicas.

RESUMEN

En este trabajo usamos una base de datos nueva de expectativas de inflación empresariales en Uruguay entre 2009 y 2013 para estudiar la influencia de la política monetaria en la formación de expectativas de inflación. Usando varias técnicas econométricas encontramos que los cambios esperados en la instancia de política monetaria afectan a la inflación esperada a doce meses con el signo esperado y en manera estadísticamente significativa. Las expectativas muestran un comportamiento inercial marcado y una influencia notoria a los shocks de inflación pasada. Adicionalmente, encontramos que el arrastre esperado de la inflación ha aumentado durante el período analizado. Los modelos estimados sugieren que los empresarios asocian épocas de inflación alta con malas noticias para el nivel de actividad. Asimismo, el efecto de la devaluación en la inflación esperada, si bien estadísticamente significativo, es prácticamente irrelevante desde una perspectiva económica. Estos resultados se mantienen para cuatro variantes metodológicas de estimación: MCO, Efectos Fijos, Arellano Bond en una etapa y Arellano Bond en 2 etapas, y es robusto a tres medidas alternativas de la instancia monetaria.

Clasificación JEL: E43, E52, E58

Palabras clave: transmisión monetaria, expectativas de inflación, canal de expectativas.

I. INTRODUCTION

Since 2005, Uruguay's monetary policy has implemented an inflation targeting regime; however there are few papers that analyze the impact of monetary policy on inflation expectations, an essential variable in handling this monetary policy regime.

Given the unavailability of data on inflation expectations, until 2007 there were no estimates for Uruguay. Since then, whether using data from the consensus forecast of the International Monetary Fund or the expectation survey of the Central Bank of Uruguay, papers began to emerge using inflation expectation data to estimate mixed Phillips curves. Notwithstanding, to date there are no impact estimates of monetary policy on firm's inflation expectations. Furthermore, existing studies question the rationality of public information on inflation expectations (see Borraz and Gianelli, 2010).

This paper attempts to fill the gap previously mentioned. By using data from a survey of medium and large Uruguayan firms on about inflation we model the whether firms inflation expectations respond to changes in monetary policy stance.

In order to do this we've used several econometric models, including Ordinary Least Squares, Moulton and panel data method such as Fixed Effects and Arellano/Bond.

We have found that an increase in interest rates of 1% reduces inflation expectations in the long run by 0.3 %, a result that is robust to changes various econometric specifications. We also find that expectations show a distinct inertial behavior and an evident influence of the shocks of past inflation. According to estimated models, business owners associate high inflation periods with bad news for the productivity level. Furthermore, the effect of devaluation on the expected inflation, although statistically considerable is practically negligible.

We also find that the survey of inflation expectations to opinion leaders carried out by the Central Bank of Uruguay does not have a clear and robust influence on private sector firms inflation expectations. Even though the median of twelve month ahead inflation expectations appears to

affect private sector firms inflation expectations with the correct sign in our preferred estimation model (Two stages Arellano Bond), the pass-through of inflation expectations is low, it loses significance in alternative econometric specifications and the coefficient changes sign between models.

Additionally, we find the expected inflation carry-forward has increased, making inflation stabilization more difficult in the short run.

The rest of the paper is organized in the following way: section II makes a brief review of the role of inflation expectations in Uruguay's monetary policy; section three reviews the background for this paper; section four describes the data; section five describes the methodology and the results and section six provides the conclusion.

II. THE ROLE OF INFLATION EXPECTATIONS IN URUGUAY

II.1. Inflation targeting and the role of the shaping of expectations.

Inflation expectations, mostly ignored until the '60s, are currently essential to the analysis of the transmission of monetary policy. Once the Phillips curve (Phillips (1958)) was born and the first experiments on monetary policy based on it were conducted, it quickly became evident that inflation expectations have a paramount role in monetary policy. The Phillips curve emphasizes the effect of surprise inflation on real wages, the demand for labor and total production. The first formulations on this relationship, born in periods of low and stable inflation, assumed inflation expectations were static. In the first applications of this relationship, partially due to a legacy of many years of monetary stability in the post-war period, the surprise increase in the amount of money lead to short-term increases in output as suggested by the Phillips curve. Notwithstanding, approaching the second half of the '60s, the reiterative application of the expansive recipe lead to increasing inflation with almost no response on output, generating the perception that expectations are not static. During the '70s the academy started a long discussion on the degree of rigidity of expectations, the central result remained the same: as long as some sort of rigidity exists in expectations formation monetary policy could lead to

a short run reaction of the activity level. Towards the end of the '70s, the steady increase of global inflation resulted in the consensus that the private sector could not be systematically surprised, leading to the rational expectations revolution and the formulation of the time inconsistency hypothesis (Kydland y Prescott (1977)).

Given the problem of monetary policy inconsistency, inflation expectations became as or more important than the current evolution of demand and costs in forming prices. Temporary inconsistency is a problem between the private sector and the Central Bank, whereby, once the private sector has taken nominal contracts in pesos (which include a given inflation expectation) such as the nominal debt in national currency and nominal wages, the Central Bank has an incentive to create surprise inflation in the short term to erode the real value of the nominal contracts. The private sector, that's aware of this issue, will foresee the public sector incentives and will therefore include in nominal contracts an inflation expectation sufficiently high so that the public sector won't have an incentive to create surprise inflation. In the short term, the Central Bank which no longer has an incentive to create surprise inflation, decides a lower inflation would suit it best, but has no incentive to go against the private sector expectations in the one shot game since this would cause a recession, hence monetary policy would end up validating private sector expectations in the one shot game.

Advances in the study of price rigidity have also brought forward the discussion on the role of inflation expectations. In fact, the models emphasizing asymmetric information issues as well as those emphasizing menu costs or competence problems in asset and factor markets cause the shaping of expectations to play a central role. According to Lucas (1972), expectations are important since there is asymmetric information in the perception of demand shocks in individual asset markets. According to Calvo (1983), Taylor(1980) and Fuhrer and Moore (1995) the rigidity of the salary negotiation and the price adjustment opportunities force the agents involved in the pricing process to take into account what will happen in the following periods in order to guide their current pricing strategies. Thus, the behavior of future economic foundations in the pricing process, particularly regarding monetary policy, is essential to the fixing of inflation expectations and prices.

II.2 The implementation of inflation targeting in Uruguay.

Uruguay starts implementing an inflation targeting regime based in monetary aggregates management in 2004, after the 2002 crisis put an end to a long history of exchange rate management. Prior to 2002, Uruguay had floated the currency only for very short periods of time, mainly after the abandonment of a previously failed inflation stabilization attempt with an exchange rate anchor. In Uruguay, the implementation of a monetary policy focused on targeting inflation, which meant putting aside decades of committing to the exchange rate, acknowledges the increasing role of expectations in the pricing process. After abandoning the fixed exchange rate regime in 2002, Uruguay moved towards inflation targeting, as described in Licandro (2001), De Brun and Licandro (2006) and Licandro and Mello (2012). After the fall of the fixed exchange regime that operated through July 2002, Uruguay, in the midst of the worst financial crisis of its history, tried to build a reputation on monetary policy by strictly fulfilling fixed monetary base targets. During 2003 monetary policy in Uruguay shifted its intermediate target towards M1 and introduced a reference for one year ahead inflation. From the beginning of 2004 through the first quarter of 2005 Uruguay started to loosen the commitment to the Monetary target while it narrowed the commitment to the inflation reference, until the official target of monetary policy became inflation and the monetary aggregate became the tool to achieve it.

As inflation expectations became central to the management of monetary policy, in 2004 the Central Bank of Uruguay started gathering inflation expectations from a group of opinion leaders and research centers. This survey was first published in January 2004 and remains public as of today.

After the crisis of 2002 two changes took place that helped justify the change in the course of monetary policy in order to focus on inflation expectations.

a) The development of markets in pesos. Uruguay, one of the most dollarized economies in the world previous to the 2002 crisis, centered its post-crisis policy agenda on the reduction of financial fragilities derived from dollarization. One of the pillars of that agenda was the reconstruction of markets in pesos as an alternative to setting savings contracts and credit

contracts in dollars. .As part of that agenda, as described in Licandro and Licandro (2010), Uruguay made deep changes in financial regulation to internalize the risks implied by currency mismatches and worked in the creation and lengthening of yield curves in pesos. As monetary stabilization and regulatory change generated positive spillovers on peso markets, the development of peso markets increased the power of monetary policy in what can be described as a virtuous cycle.

b) Changes in salary negotiation. Even though Uruguay has had a centralized bargaining system by law since 1943, the practice of the negotiation process was largely very similar to a decentralized bargaining prior to 2005 (see Fernández et al. ,2008). Starting in 2005 there is a return to centralized wage negotiations. Wage contracts are negotiated for periods that last between 12 and 36 months, and set wage adjustments that can occur either once or twice a year. All contracts have wage adjustments that are focused on expected inflation. Past inflation remains central in wage setting since most contracts include provisions to correct wage losses due to the discrepancy between expected and effective inflation.

The results of those two changes is that inflation expectations have a much more important role in the real expected cost of domestic financing, real expected production costs and real expected incomes.

III. BACKGROUND

As we mentioned in the introduction, there is only a small group of papers studying the role of monetary policy on inflation expectations, mainly due to the absence of public data on inflation expectations prior to 2004. Existing papers can be classified in four categories. Firstly there's a group of papers analyzing the way in which inflation expectations affect pricing, among which are Gelós and Rossi (2007), Gianelli (2009), Basal and others (2010), Acosta (2011); Secondly there are papers that look into the rationality of the shaping in expectations, among which are Borraz and Gianelli (2010), Zunino et al (2010) and Lanzilotta et al (2007), then there are two points of view portrayed in the literature analyzing the relationship between concern about inflation and economic policy (García and Rocha (2010)) as well as microeconomics fundamentals of price setting (Borraz and Licandro (2013)). Although this set of studies incorporates significant

progress in the subject matter, there are no prior studies applied to the effect of monetary policy on the expectations of price makers.

Gelós and Rossi (2007), Gianelli (2009) and Acosta (2011) consider the existence of mixed Phillips curves. Gelós and Rossi (2007), using a IMF's dataset on inflation expectations in Uruguay, deem the weight of inflation expectations in price setting be important, with a strong influence of the tax situation upon the shaping of expectations. Gianelli (2009) finds an inflation elasticity of future inflation expectation from 0.9 against Gelós and Rossi's 1.17. .Both estimates point to a larger role of inflation expectations than inflation inertia in price formation.[4]

Studies on the expectation survey of the Central Bank of Uruguay were focused on the rationality of the shaping of expectations. Borraz and Gianelli (2010) find that agents that respond to the survey carried out by the Central Bank of Uruguay have a low predictive power, showing herd-type behavior. They overweight the importance of the ceiling of the target range and they seem to pay little attention to the use of the instruments of monetary policy. On the other hand, Zunino et al (2010) finds support in the hypothesis of weak rationality which implies it's not possible to demonstrate agents do not use all the available information in order to create long term forecasts. Results of short term forecasts show a more convincing use of the information. Taken as a whole, the existing results support the idea that there's rigidity in the creation of inflation forecasts among the participants of the Central Bank of Uruguay's survey within the analyzed period of time. No convincing evidence was found supporting that monetary policy affects agents' expectations, for either case.

Another type of study has highlighted the relationship between the concern about inflation and the policy process. García and Rocha (2010) developed an inflation concern index based on the press publications of articles related to inflation and then regressed monetary policy stance- as measured by a monetary conditions index- on both inflation and activity concerns of the private sector (they use the expectations of private firms on

4 The IMF has collected data on inflation expectations of some private sector consultants over the years Uruguay has had programs the IMF. The dataset is unbalanced, has only a few opinions (at times only one), and has important data gaps. At the beggining information was collected yearly. To work with this data, Gelós and Rossi (2007) use interpolation methods to fill the gaps.

future activity as their proxy for private sector worries about real activity). They found evidence suggesting that concern for the activity level and inflation influence as expected the shaping of monetary policy.

Recently, Borraz and Licandro (2013) have shown that both past and expected inflation have an important role in the price setting process. Using data from a specific survey on price setting by firms, they found firms pay equal attention to past and expected factors in order to set prices. Additionally, they found that firms overweight wages on price formation since they deem wages amongst the most important factors in price setting, while the weight of wages in their cost structure is relatively low. Taking the role of inflation expectations in the setting of salaries into account, they find evidence to support an important role of the expectation's channel in the monetary policy transmission process.

Hence, although there has been progress in the knowledge of expectation channels, there are no studies about Uruguay that directly refer to the impact of monetary policy on expectations of price makers. In the following sections we will introduce the first results on this subject.

IV. DATA DESCRIPTION

Why is it important to consider the expectations of firms besides the expectations of opinion makers? From a theoretical point of view it's important to be acquainted with the impact of monetary policy in economic decisions of agents: Investment, consumption, labor supply, etc. From that point of view, the expectations that really matter, those monetary policy wished to affect, are those of the agents that make these decisions directly. Traditionally central banks carry out inflation expectation surveys focused on a group of experts opinion makers, for three fundamental reasons:

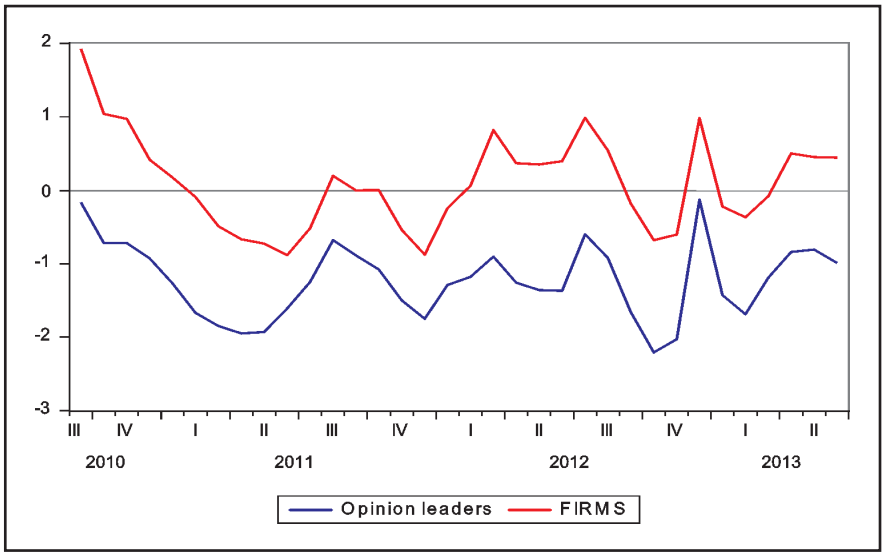
1) it is simpler and more cost-effective,

2) facing a more specialized audience it's possible to formulate a wider and more complex set of questions,

3) it is expected that the expectations of this group of agents will definitely influence the expectations of agents making economic decisions.

Even though the first two reasons are quite obvious, the third one is a hypothesis that needs empirical testing. Particularly, the expectation survey of the Central Bank of Uruguay has some drawbacks which make the interpretation of the results difficult (Borraz and Gianelli, 2010). Firstly, the sample has been -and still- is small. Secondly, the sample has changed several times its data gathering criteria; it's been affected greatly by the change of government, the conditions by which its results were disclosed and the changes in criteria with regard to the agents consulted. In fact, the transition of analysts from the private sector to ones in the public sector occupying important positions meant no longer gathering information from some agents and having other agents join. Additionally, while initially the data would only be presented as a whole, since 2010 the data is disclosed at consultant level, which has caused a reduction in the number of responses to the survey. Finally, as discussed in the previous section, it's unclear whether the responses of the agents participating use in their entirety available information when making forecasts. In practice, most of the time the median of inflation expectations of the consulted agents remains below the effective inflation, in a prediction bias difficult to explain.

Graph 1: Uruguay:
Inflation Forecast Errors of Firms and Opinion Leaders



Sources: INE and BCU

In Graph 1 it is possible to see that while firm inflation expectations have remained centered around actual inflation, the survey conducted by the Central Bank of Uruguay maintains a downward bias as reported by Borraz and Gianelli (2010). Overall, the expectations of opinion leaders seem to show the same direction as of firm's expectations, while there is a systematic downward bias in the level of inflation expectations of the survey of the Central Bank of Uruguay.

Consequently, analyzing the inflation expectation of firms directly provides us the opportunity of directly checking the effect of monetary policy in the agents taking relevant economic decisions.

IV.1. The Data

Our analysis focuses on the period comprehended between October 2009 and June 2013. During that period Uruguay operated under an inflation targeting regime with interest rates as the instrument of monetary policy. Notwithstanding, the management of aggregates or interest rates only differs in dimensions that aren't relevant to the methodology we'll be using hereunder since the transmission channels of monetary policy are the same. The traditional management of monetary policy presumes a shock in the amount of money affects the interest rate in the money market, this is passed on to all the yield curve and affects consumption and savings decisions. Monetary transmission under the traditional interest-rate channel, under interest-rate management, remains the same as in the case of a monetary instrument, but instead of beginning with the shock to monetary aggregates it begins with changes in the interest rate.[5]

A data panel of businesses was created for inflation expectations, and time series for expectations regarding economic and business activity were included as control variables. The data sources used are diverse and described below:

5 There are evident differences in the way volatility in the money market is carried to aggregates and interest rate, the interest rate stabilizes the demand shocks and the aggregates provide volatility to the interest rate, consumption and investment. However, impacts on relative volatility of interest rates and monetary aggregates aside, the sign of the effects of monetary policy shocks remain the same.

- Business expectations of the National Statistics Institute (INE) - Micro data: 10/2009-06/2013.
- Business expectations of the Chamber of Industries of Uruguay.
- Inflation expectations of the Central Bank of Uruguay.
- Consumer Confidence data from Equipos Consultores.

The business expectation survey is prepared monthly by the National Statistics Institute. Such survey drew up opinions from a sample of 644 firms between October 2009 and June 2013 (45 temporary observations of monthly frequency).Once the base was purged we had 549 firms in the month when more answers were given, with an average of 425 monthly answers, which resulted in a total of 18,579 observations.

During the period analyzed for expected inflation as well as expected costs business owners have higher expectations within 18 months than within 12 months. We also noticed an increasing trend in the sample for both inflation expectations and costs, consequently the series present a persistent autoregressive element, which suggests the need to use dynamic models for estimation purposes.

In order to assess the monetary policy stance we created two variables defined in the following way:

First option: a simple natural interest rate rule.

$$IM_t = TPM_t - TNI_t \quad (1)$$

$$TNI_t = r + \pi^e_t\_18 \quad (2)$$

The monetary stance is represented by IM_t at time t, TNI_t is a proxy for the natural interest rate of Uruguayan economy, defined as the sum of the real interest rate r, and the median of expected inflation within 18 months (monetary policy horizon) at time t, $\pi^e_t\_18$.[6] We choose a very simple representation of monetary stance, following a wicksellian approach according to which the structural position of monetary policy is verified

6 Since we used the median of the National Statistics Institute survey, it isn't feasible to find herd effect as Borraz and Gianelli (2010) did since this survey isn't public.

in comparison to a reference or "neutral" rate, which is the interest rate that would prevail in a balanced growth path of an economy. In order to determine the value of the natural interest rate, we choose a value inside of the interval estimated by Brum, Carballo and España (2011). We choose a value of 2.5%, close to the floor of the interval of 2-8% estimated by Brum et al. (2011), which is comparable with usual estimates of neutral rates in comparable countries. We concentrate on a constant value of the neutral rate throughout the sample for two reasons. On the one hand, since we are modeling expectations at the firm level, we need to focus on ways of following monetary stance that are simple enough so as to be a reasonable representation of private sector behavior (most firms would not have neither the incentive nor the resources to build complex rules of monetary policy control). On the other hand, we are constrained to cases in which monetary policy has effects and that rules out variable neutral interest rates, since that would be the case of a business cycle driven by productivity shocks in the absence of price rigidities. In so doing we concentrate on a Keynesian interpretation of the cycle, in the sense that the technological conditions of supply remain stable and fluctuations are mainly driven by demand shocks in the presence of price rigidities.[7]

In order to get the nominal neutral rate, we add to the assumed 2.5% of the real rate the median of inflation expectations for the survey in the monetary policy horizon, namely 18 months ahead inflation expectations.

Second option: a simple Taylor rule

Even though we think that simple rules like the one we explained above represent more closely the way individual firms analyze the stance of monetary policy, we also consider a monetary stance variable derived from a simple Taylor rule, as built for the case of Uruguay by Gianelli and Licandro (2014). The formula for this variable is:

7 In a classical conception, where prices are flexible, the shocks that cause the cycle are real shocks, that affect capital accumulation during the steady state and the real interest rate. Within this environment and given price flexibility, monetary policy has no effects. In new keynesian models, which presents price rigidities, it is implied that offer conditions are relatively stable and that fluctuations arise from the demand side.

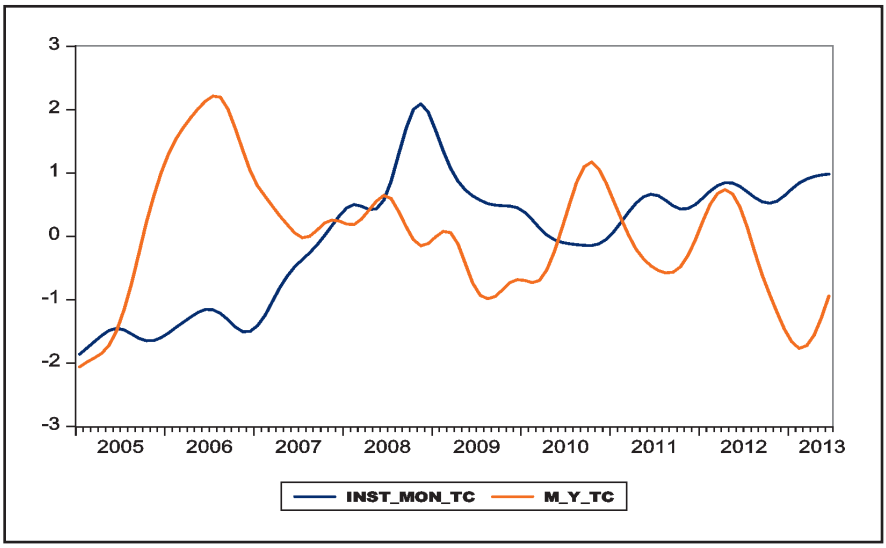
$$IM_t^2 = TPM_t - \left[TNI_t + 0.5\left(y_t - y_t^{potential}\right) + 1.5\left(\pi_t - \pi^{target}\right)\right] \quad (3)$$

Where our previous measure of the natural interest rate is corrected by the position of gdp around potential, and inflation around the target. We use this variable to control the robustness of the results.

Having defined the monetary stance, negative values of the variable suggest an *expansive monetary policy*, whereas positive values suggest a *contractionary monetary policy*.

In order to get a sense of the messages our simple measure of monetary stance is giving us, we compare it with a proxy for core money growth computed as the difference between the real growth of monetary aggregates (expanded M1) and the real growth of GDP. Graph 2 shows both variables in trend-cycle terms. We see that, when monetary policy becomes contractive according to our measure of monetary stance the growth rate of our proxy for core money falls, which is consistent with the theory. It's important to note the correlation is relatively weak within the period as expected. This is due to the fact that money demand grew not only due to the increase in the level of transactions, but also grew as a result of the strong increase in peso markets experienced in the sample. As Licandro and Licandro (2010) and Licandro and Mello (2012) argue, this increase in peso denominated assets is due to changes in domestic regulation, the increasing international appetite for emerging country assets and the changes in the minimum variance portfolio of domestic agents resulting from the higher relative variance of the exchange rate in the (see Brum et al.(2011), and Rovascio et al.(2011)).

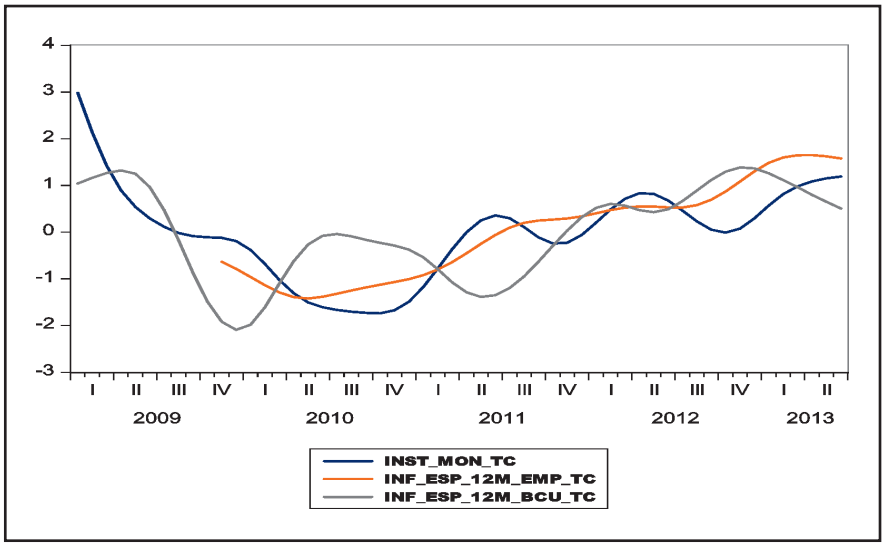
Graph 2: Monetary stance and real growth of M1 of the real growth of the GDP, in cycle trend (normalized data)



Graph 3 presents the link between the simple indicator of monetary stance and two series of median inflation expectation measurements used in the paper in a 12-month horizon; all of this expressed in trend-cycle terms. For the time series models we've used the expectation survey from the Central Bank of Uruguay, which is based on the monthly opinion of a team of experts from January 2005 to June 2013. For panel data models we've used the inflation expectation within 12 months taken from the National Statistics Institute's Monthly Business Expectation Survey.

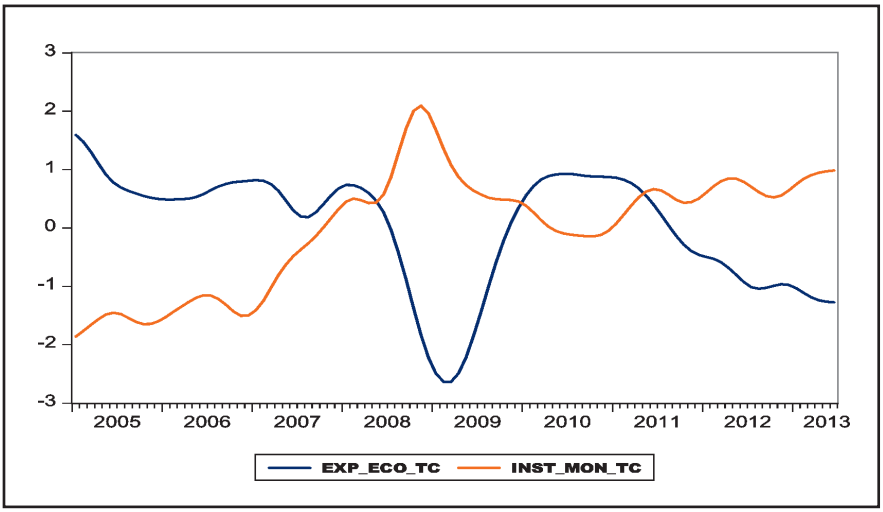
An increasing trend can be appreciated in both expectations, although the median of the Bank's survey seems to be more influenced by the monetary policy stance.

Graph 3: Monetary stance and expected inflation trend cycle (normalized data)



Graph 4 represents the trend cycle of the median of economic expectations of business owners drawn up by the Chamber of Industries of Uruguay and the trend cycle of the simple indicator of monetary stance. A negative correlation can be appreciated between the trends, when faced with a more contractionary monetary policy the economic expectations drop. A possible interpretation, which will need to be later confirmed through econometric estimates, is that business owners associate an increase in inflation or a more flexible monetary policy with economic crises due to the history of the country.

Graph 4: Monetary stance (simple indicator) and economic expectation based on the Chamber of Industries of Uruguay's business survey, all in trend cycle (normalized data)



As a conclusion, the trends on expectations seem to be influenced by the monetary stance; below we'll introduce the models, methodology and results used.

Table 1 shows the correlation between inflation expectations within 12 and 18 months, and the median used in equation (2). There's an important correlation between the expected inflation within 12 months and the expected inflation within 18 months but no significant correlation with the median can be found.

Table 1: Correlation among inflation expectation in different horizons

	inf_esp_12m	mediana_inf_esp_18m	inf_esp_18m
inf_esp_12m	1		
mediana_inf_esp_18m	0.1236	1	
inf_esp_18m	0.8926	0.1029	1

Table 2: Descriptive statistics of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
infesp_12m	18576	8.261705	1.686714	5	20
inst_mon	18576	–3.157739	.6772864	–4.13	–2.22
inf	18576	7.595076	.8803518	5.9	9.11
exp_inf_bcu	18576	6.773519	.4013598	6.05	7.6
deva	18576	–4.278735	8.365029	–19.49	18.09

IV.2 Does the monetary stance have an effect on business owners' inflation expectations?

The following panel data model was estimated:

$$\pi^{e}_{i,t} = \phi_i + \sum_0^k \alpha \,.\, \pi^{e}_{i,t-s} + \sum_0^k \rho \,.\, (IM_{t-s}) + \sum_0^k \lambda \,.\, \pi_{t-s} + \sum_0^k \delta \,.\, d_{t-s} + \beta . M_t + \varepsilon_{i,t} \quad (3)$$

where $\pi^{e}_{i,t}$ the twelve months ahead expected inflation rate by firm *i* at the moment *t*, IM_{t-s} represents the monetary policy stance at the moment *t-s*, *s* being the lag indicators and *k* being the number of significant lags, π_{t-s} the annual inflation rate, d_{t-s} the annual depreciation rate of the exchange range, M_t vector of business, macroeconomic and international control variables and ϕ_i represents the heterogeneity of each firm surveyed which cannot be appraised, which should be constant throughout time and is associated to the estimates of panel data models.[8]

In this paper a panel data model is employed in order to capture the heterogeneity among the surveyed firms which cannot be apprised. This model allows us to carry out a more dynamic analysis by incorporating the temporary dimension of the data, which makes the analysis more enriching. This is why equation (3) is estimated through the generalized method of moments (GMM). More specifically a model of Arellano/Bond type was used with the change suggested by Roodman (2009). This methodology is useful since it provides a simple alternative when the distribution function of random variables is unknown, i.e., it substitutes the most authentic method; and provides a theoretical framework for its comparison and assessment. Specifically in the case of the standard indicator of instrumental variables,

8 The business, macroeconomic and international variables used can be found in the appendix.

this can be appraised as a special case for the GMM indicator. If the number of instrumental variables (moment restrictions) is equal to the number of parameters to be estimated the instrumental variables indicator should be the same as GMM. Otherwise, if the number of instruments is greater than the numbers of parameters to be estimated, the equation will be over-identified.

Although the Arellano/Bond methodology does not always provide efficient estimates, especially in small samples, there are important arguments for choosing that methodology for this paper. Mainly, the goal is to assess monetary policy effects which, due to the nature of the transmission channels, impact economic agents with a delay. Therefore, it is important to consider dynamic panel models in the estimation process.

Likewise, the dependent variable shows an important autocorrelation for monthly data. Hence using a static model causes an important autocorrelation bias in the residuals.

The foregoing notwithstanding, OLS estimates were also produced, as well as Moulton's correction, as a way of controlling possible aggregation bias of explicative variables. Moulton (1986, 1990) revealed that when the explicative variable is at a greater degree of aggregation than the dependent variable, the standard errors of the OLS estimates have a negative bias due to the presence of intra group correlation. Simultaneously, a Fixed Effects model, which is always consistent, was also estimated. Very similar results were yielded from all the methods, consequently, the estimates are robust.

Table 3 shows the results of the estimates through the five methods used: OLS, Moulton, Fixed Effects, Arellano/Bond in one stage and Arellano/Bond in two stages.

As it should be expected in monthly data, firm inflation expectations are -In all models-highly persistent. All models show three significant lags of the dependent variable, with coefficients that add up to 0.81-0.89. This persistence reflects the fact that inflation fundamentals according to firms do not change much in a monthly frequency.

Table 3: Estimated models for simple monetary stance

	OLS	moulton	FE	AB 1S	AB 2S
Inflation Exp (-1)	0.561***	0.561***	0.540***	0.475***	0.475***
	(0.018)	(0.009)	(0.018)	(0.038)	(0.038)
Inflation Exp (-2)	0.205***	0.205***	0.194***	0.140***	0.140***
	(0.021)	(0.010)	(0.022)	(0.041)	(0.041)
Inflation Exp (-3)	0.129***	0.129***	0.117***	0.187***	0.188***
	(0.019)	(0.009)	(0.014)	(0.027)	(0.028)
Mon Stance (-2)	-0.174***	-0.174***	-0.167***	-0.147***	-0.142***
	(0.028)	(0.025)	(0.023)	(0.035)	(0.034)
Inflation Rate (-1)	0.153***	0.153***	0.154***	0.199***	0.198***
	(0.013)	(0.013)	(0.015)	(0.021)	(0.021)
Economic Exp	-0.402**	-0.402**	-0.469***	-0.864***	-0.851***
	(0.189)	(0.196)	(0.157)	(0.248)	(0.250)
Inflation Exp BCU	-0.013	-0.013	0.006	0.166***	0.164***
	(0.041)	(0.040)	(0.038)	(0.057)	(0.057)
Currency Depreciat~e	0.005***	0.005***	0.005***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Constant	-0.721***	-0.721***	-0.496**	-1.446***	-1.411***
	(0.261)	(0.277)	(0.239)	(0.405)	(0.410)
N-Groups			529.000	529.000	529.000
r2	0.76				
r2_a	0.76				
r2_w			0.45		
r2_o			0.76		
r2_b			0.96		
ar1p				0.00	0.00
ar2p				0.04	0.17
sarganp				0.00	0.00
hansenp				0.46	0.46

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

Table 4: Estimated model for Taylor rule stance

	OLS_TR	moulton_TR	FE_TR	AB_1S_TR	AB_2S_TR
Inflation Exp (-1)	0.565***	0.565***	0.544***	0.486***	0.486***
	(0.018)	(0.009)	(0.018)	(0.038)	(0.038)
Inflation Exp (-2)	0.204***	0.204***	0.193***	0.138***	0.138***
	(0.021)	(0.010)	(0.022)	(0.041)	(0.041)
Inflation Exp (-3)	0.125***	0.125***	0.113***	0.176***	0.176***
	(0.019)	(0.009)	(0.014)	(0.027)	(0.027)
Mon Stance Taylor~1)	-0.077***	-0.077***	-0.076***	-0.113**	-0.112**
	(0.017)	(0.017)	(0.016)	(0.045)	(0.044)
Mon Stance Taylor~2)	0.043***	0.043***	0.039***	0.028*	0.028*
	(0.011)	(0.010)	(0.011)	(0.015)	(0.015)
Inflation Rate (-1)	0.099***	0.099***	0.097***	0.066	0.065
	(0.026)	(0.027)	(0.026)	(0.071)	(0.069)
Economic Exp	0.584***	0.584***	0.456***	-0.391	-0.395*
	(0.135)	(0.139)	(0.123)	(0.241)	(0.236)
Inflation Exp BCU	0.116***	0.116***	0.130***	0.280***	0.275***
	(0.044)	(0.044)	(0.042)	(0.060)	(0.060)
Currency Depreciat~e	0.005***	0.005***	0.005***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Constant	-0.881***	-0.881***	-0.619**	-1.365***	-1.326***
	(0.265)	(0.296)	(0.248)	(0.411)	(0.409)
N-Groups			529.000	529.000	529.000
r2	0.76				
r2_a	0.76				
r2_w			0.45		
r2_o			0.76		
r2_b			0.96		
ar1p				0.00	0.00
ar2p				0.05	0.18
sarganp				0.00	0.00
hansenp				0.39	0.39

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

Furthermore, the Table shows us the number of observations (N), the number of individuals or groups (N_g), the number of instruments used (j), the adjustment of the different models (r2_a, r2_w, r2_o y r2_b), the p values of the autocorrelation test of the residual according to the Arellano/Bond model (ar1p y ar2p) and the p value of Hansen's over-identification test.The most important result on the table is that monetary stance affects inflation expectations according to theory, and in a statistically significant manner. The results are quite similar regardless of which of the 5 estimation method was used and the coefficient associated to the second lag of monetary policy stance is highly significant, it varies from -0,14 to -0,17. This result supports previous findings using aggregate data which suggested the existence of a transmission channel of monetary policy through the agents' expectations (Gianelli (2009), Gianelli and Licandro (2013), Gelós and Rossi (2007)).

A striking result is the low coefficient found of expected devaluation on all models, even though it's not the first time this has been observed. Given the long history of dollar indexation, throughout which Uruguayan firms had automatic dollar indexation formulas to adjust their prices it's surprising that the value of the devaluation coefficient would be so low. Borraz and Licandro (2013) reach a similar result on their paper on price-setting by Uruguayan firms, which render raw materials (mostly tradable) extremely relevant for the price setting process and the exchange rate much less important. As a whole, these results suggest Uruguayan firms have learnt that in floating exchange rate systems the movements of the exchange rate can be mainly temporary, as has occurred throughout the sample analyzed in this paper in Uruguay.

Additionally, the estimates confirm there is a negative relationship between expected and observed inflation and the economic expectations of business owners, as suggested by graph 3. One possible interpretation of this result might be linked to the long history of Uruguay of crisis and failed stabilization attempts. The Uruguayan business cycle is characterized by a positive a negative correlation between activity and inflation. This correlation comes mainly from the fact that Uruguayan crisis are mainly fiscal crisis, and inflation has always been part of the tools used to stabilize fiscal accounts. Therefore, Uruguayan firms are used to see that

strong inflation comes in times of crisis. In that sense, this result might be evidence of lack of credibility on the commitment of monetary policy with low inflation.[9] It seems business owners identify inflation with a clearly monetary phenomenon, or one related to the loss of value of the currency, and not with a phenomenon linked to aggregate demand.

It is not clear the relationship between the expectations of opinion leaders and firm inflation expectations. Even though the expectations of opinion leaders show up with the expected sign and in a statistically significant manner, the result is not robust to the econometric specification. This result is particularly relevant because all previous literature worked with opinion leaders data in the estimation of mixed Phillips curves in the case of Uruguay.

In Table 4 we have the results of the same regression techniques applied on inflation expectations, but taken as indicator of monetary stance the Taylor-like expression that appears in equation (3). We find that in our preferred specification, i.e. two stages Arellano Bond model, most of the results found with a simpler monetary stance indicator hold true. Indeed, all the coefficients in the model have the same sign and are statistically significant. Using the more complex monetary stance indicator, inflation expectations show less inertia, a higher role for monetary shocks in the steady state, and a higher role for past inflation in the formation of inflation expectations. Also, monetary policy shocks seem to affect expectations earlier in this specification than in the model with the simpler monetary stance indicator. Overall, the change in the monetary stance indicator does not seem to alter the results in any meaningful way.

In Table 5 we quantify the mean inertia in inflation expectations suggested by the models, the inertia the models show in the last observation of the sample and the steady state impact of monetary stance in inflation expectations.

9 Licandro and Vicente (2006) explore the relationship between monetary and fiscal policy in the Uruguayan case.

Table 5: Persistence quantification of inflation expectations and impact of monetary policy.

	OLS	Moulton	Fix Effects	Arellano-Bond One Stage	Arellano-Bond Two Stages
Inflation Expectations Inertia whole period	6.58	6.58	6.48	5.19	5.23
Inflation Expectations Inertia June 2013	7.15	7.15	7.02	5.73	5.77
Simple Stance impact on inflation expectations	-0.28	-0.28	-0.32	-0.34	-0.33
Taylor rule impact on inflation expectations	-0.32	-0.32	-0.25	-0.43	-0.42

Comparing the mean inertia implied by the models with the one observed by the end of the sample, we see that inflation expectations inertia has increased in the margin, for all specifications of the inflation expectation equation. Also, for all models inflation carry-forward is bigger than the center of the center of the target range of monetary policy.

The long -run impact of the monetary stance can be approximated by the steady state multiplier, i.e., the reason between the coefficient associated to the monetary policy variable and one less the sum of the coefficients of the lags of the dependent variable.[10] The interpretation is that an increase of a percentage point in the monetary stance reduces the expected inflation in approximately 0,3 percentage points.[11]

10 This means that in order to align firm inflation expectations with the center of the target range of the Banco Central del Uruguay it would be necessary to make the monetary stance more contractive in about 7%.

11 This long run multiplier implies a parameter of 3 for the response of monetary stance to the increase in inflation expectations in a Taylor Rule.

VI. CONCLUSIONS

In this paper we have analyzed for the first time an unprecedented data set on Uruguayan firms inflation expectations in.

The data analyzed shows that firm inflation expectations are systematically higher that the inflation expectations gathered from surveys of opinion leaders by the Central Bank of Uruguay and that they relate directly to firms' expected cost behavior. Inflation expectations show an increasing trend throughout the sample both for 12 and 18 month horizons. Also, in the sample 18 month ahead inflation expectations are systematically higher than 12 month ahead inflation expectations. Towards the end of the sample a stabilization of inflation expectations of a median of approximately 9% can be appreciated.

Using two alternative ways of measuring monetary stance and five different econometric specifications we have found that changes in the monetary policy stance affect twelve month ahead expected inflation with the expected sign and in a statistically significant way. Expectations show a distinct inertial behavior and an evident influence of past inflation shocks. The relationship between opinion leaders' inflation expectations and firms' inflation expectations is not robust to changes in model specification. Additionally, we've found the expected carry-forward of inflation has increased toward the last part of the sample. According to estimated models, business owners associate high inflation periods with bad news for the productivity level. Furthermore, the effect of devaluation on the expected inflation, although statistically significant is practically negligible.

The results highlight the existence and importance of an expectation channel of monetary policy in Uruguay and help to build the case to conduct monetary policy through an inflation targeting regime.

BIBLIOGRAPHY

Acosta Santiago, Manuel Rosales and Torsten Wezel (2011). Uruguay: Selected Issues Paper, *IMF Country Report* No. 11/63.

Barcellos Paulo and Marcelo Portugal (2009). The Natural Rate of Interest in Brazil Between 1999 and 2005. *Revista Brasileira de Economía,* v. 63, p. 113-118.

Basal Jorge, Diego Gianelli, José Mourelle and Leonardo Vicente (2011). "A quarterly macroeconomic model for the Uruguayan economy", DTBCU 11/2010, *Banco Central del Uruguay.*

http://www.bcu.gub.uy/Estadisticas-e-indicadores/Documentos%20de%20Trabajo/11.2010.pdf

Borraz Fernando and Gerardo Licandro (2013). Wage and Price Setting: New Evidence From Uruguayan Firms, *XXIX Jornadas Anuales de Economía,* Banco Central del Uruguay.

http://www.bcu.gub.uy/Comunicaciones/Jornadas%20de%20Economa/t_borraz_fernando_2013_1683.pdf

Borraz Fernando and Diego Gianelli (2010). An analysis of behavior in terms at a Central Bank of Uruguay agent of inflation expectation survey level, DTBCU 01/2010, *Banco Central del Uruguay.*

http://www.bcu.gub.uy/Estadisticas-e-Indicadores/Documentos%20de%20Trabajo/1.2010.pdf

Brum Conrado, Elizabeth Bucacos and Patricia Carballo (2010)."Money demand in a dollarized economy: An estimation for Uruguay", DTBCU 13/2010, *Banco Central del Uruguay.*

http://www.bcu.gub.uy/Estadisticas-e-Indicadores/Documentos%20de%20Trabajo/13.2010.pdf|Working

Calvo Guillermo (1983). "Staggered Prices in a Utility-Maximizing Framework". *Journal of Monetary Economics* 12 (3): 383–398.

De Brun Julio and Gerardo Licandro (2006). To hell and back - crisis management in a dollarized economy: the case of Uruguay. Financial dollarization: the policy agenda.- Houndmills [u.a.]: *Palgrave Macmillan,* ISBN 1403987599. - 2006, p. 147-176

Fernández Adrián, Bibiana Lanzilotta, Graciela Mazucchi y Juan Marcelo Perera (2008) "La Negociación Colectiva en Uruguay: Análisis y Alternativas." Centro de Investigaciones Económicas y Programa de Modernización de las Relaciones Laborales *Universidad Católica del Uruguay.*

http://www.cinve.org.uy/wp-content/uploads/2013/01/Negociacion-Colectiva.pdf

Fernández Adrian, Bibiana Lanzilotta and Gonzalo Zunino (2007). "Assessment of analysts' forecasts: the Central Bank's inflation expectation survey", Monetaria, XXXI, 1, pp.1-25, *Latin American Monetary Studies Center,* CEMLA.

Ferández Adrian, Bibiana Lanzilotta and Gonzalo Zunino (2010). Are inflation forecasts rational? A discussion on the basis of the Central Bank's expectation Survey, Working paper 02/2010, *cinve.*

Fuhrer Jeffrey and Moore George. 1995. "Inflation Persistence." *Quarterly Journal of Economics,* 110 (February): 127–159.

García Santiago and Carolina Rocha (2011). "A measurement of social concern about Uruguay's inflation", *Monetaria,* Vol. 34.2011, 3, p. 351-411.

Gelós Gastón and Fernanda Rossi (2008), "Inflation Process in Uruguay" on Macroeconomic Implications of Financial Dollarization: The Case of Uruguay edited by Gaston Gelos, Alejandro López Mejía, Marco A. Piñón-Farah.

Gianelli Diego (2009), A small structural model for Uruguayan economy. DTBCU 1/2009. *Banco Central del Uruguay.*

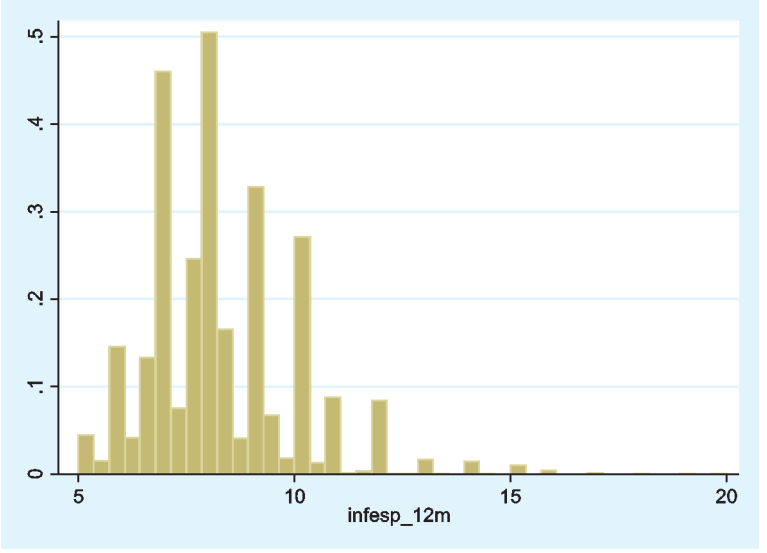
http://www.bcu.gub.uy/Estadisticas-e-Indicadores/Documentos%20de%20Trabajo/1.2009.pdf

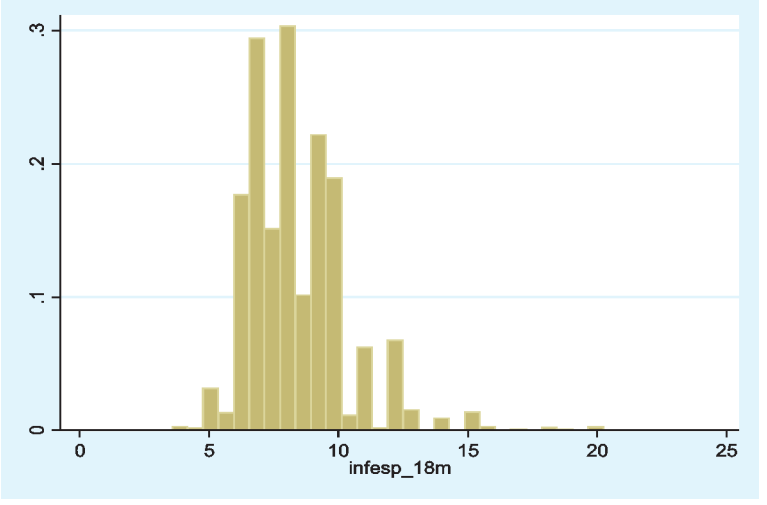
Gianelli Diego y José Antonio Licandro (2013). "Una década de metas de inflación en la región." Cuadernos de Economía, Nº 6, segunda época, *Universidad Católica del Uruguay.*

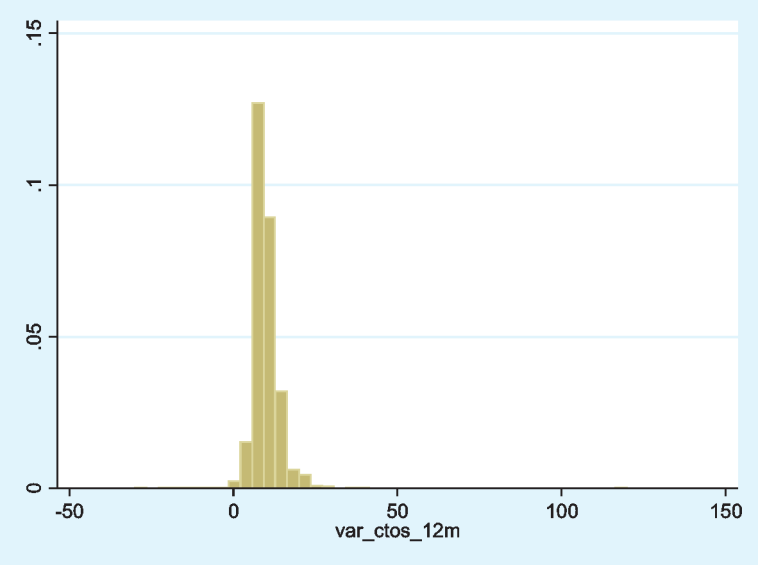
Kydland Finn and Edward Prescott (1977) "Rules Rather than Discretion: The Inconsistency of Optimal Plans". *Journal of Political Economy,* Vol 85, Issue 3, 473–492.

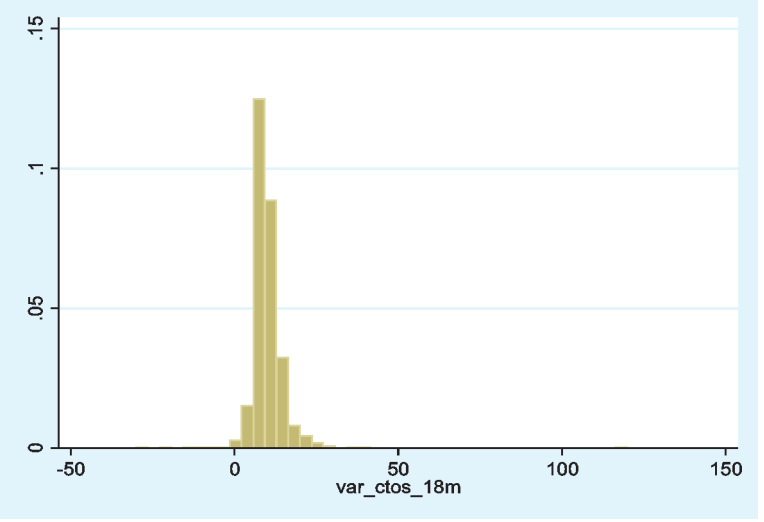
APPENDIX

Histogram of expected inflation within 12 or 18 months






.15
.1
.05
0
-50
0
50
100
150
var_ctos_12m


.15
.1
.05
0
-50
0
50
100
150
var_ctos_18m

Variables used in the panel data estimates

infesp_12m	expected inflation for a 12-monthhorizon
infesp_1	first delay of the expected inflation within 12 months
infesp_2	second delay of the expected inflation within 12 months
infesp_3	third delay of the expected inflation within 12 months
infesp_18m	expected inflation for an 18-monthhorizon
var_ctos_12m	expected cost variation expected inflation for a 12-monthhorizon
var_ctos_18m	expected inflation for an 18-monthhorizon
inst_mon	Monetary policy instance created through equations (1) and (2)
inst__1	first delay of the monetary policy stance
inst_2	second delay of the monetary policy stance
inst_3	third delay of the monetary policy stance
call	interbank call rate
pib	gross domestic product
tc	exchange rate
deva	Uruguayan pesosannual depreciation rate relative to the dollar
tcr	real exchange rate
icc	confidence index of consumers
exp_cons_pais	consumer expectations relative to economic evolution of the country
exp_inf_bcu	median of the Central Bank of Uruguay expected inflation survey
exp_pib_bcu	median of the expectations of the GDP evolution drawn up by the Central Bank of Uruguay on its monthly economic expectation survey
exp_eco	economic expectation of business owners as from the survey of the Chamber of Industries of Uruguay
exp_emp	firm expectation of business owners as from the survey of the Chamber of Industries of Uruguay
exp_fiscal	median of tax expectations drawn up by the Central Bank of Uruguay on its monthly economic expectation survey
ubi	Uruguay country risk
inf	anual inflation rate
w_real	real wage
ims	median wage index
desempleo	annual unemployment rate
rti	relationship of terms of trade
embi	embi+ Uruguay
gap_y	Gap of the product as a diversion from a Hodrick and Prescott tendency
ctopib	GDP growth rate
tar_pub	Variation rate of public rates

Model by Ordinary Least Squares

Linear regression

Number of obs = 12923
F(8, 12914) = 2444.17
Prob > F = 0.0000
R-squared = 0.7590
Root MSE = .80526

infesp_12m	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
infesp_1	.5605554	.0179994	31.14	0.000	.5252739	.5958369
infesp_2	.2046169	.0212715	9.62	0.000	.1629217	.2463121
infesp_3	.1293337	.0190502	6.79	0.000	.0919926	.1666748
inst_2	-.1736072	.0277431	-6.26	0.000	-.2279878	-.1192267
inf_1	.1528616	.0134337	11.38	0.000	.1265296	.1791937
exp_eco	-.4020178	.1885009	-2.13	0.033	-.7715075	-.0325281
exp_inf_bcu	-.0129869	.0408234	-0.32	0.750	-.0930069	.067033
deva	.0047522	.0011232	4.23	0.000	.0025506	.0069538
_cons	-.7211809	.2606691	-2.77	0.006	-1.232131	-.2102309

Model by Ordinary Least Squares corrected by Moulton

OLS Regression: standard errors
adjusted for cluster effects using Moulton

Number of clusters (ine) = 529

Number of obs = 12923
R-squared = 0.7590
Adj R-squared = 0.7589
Root MSE = .805265

infesp_12m	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
infesp_1	.5605554	.009334	60.06	0.000	.5422593	.5788514
infesp_2	.2046169	.0103336	19.80	0.000	.1843615	.2248723
infesp_3	.1293337	.0092293	14.01	0.000	.1112429	.1474244
inst_2	-.1736072	.0254528	-6.82	0.000	-.2234984	-.1237161
inf_1	.1528616	.0132917	11.50	0.000	.1268079	.1789154
exp_eco	-.4020178	.1963736	-2.05	0.041	-.786939	-.0170967
exp_inf_bcu	-.0129869	.0396053	-0.33	0.743	-.0906191	.0646452
deva	.0047522	.0011325	4.20	0.000	.0025323	.0069721
_cons	-.7211809	.2768205	-2.61	0.009	-1.26379	-.1785719

Intraclass correlation in infesp_1 = 0.5857
Intraclass correlation in infesp_2 = 0.5816
Intraclass correlation in infesp_3 = 0.5833
Intraclass correlation in inst_2 = 0.0641
Intraclass correlation in inf_1 = 0.0552
Intraclass correlation in exp_eco = 0.0803
Intraclass correlation in exp_in~u = 0.0736
Intraclass correlation in deva = 0.0524
Intraclass correlation in residual = 0.0094

Fixed Effects Model

```
Fixed-effects (within) regression          Number of obs      =     12923
Group variable: ine                        Number of groups   =       529

R-sq:  within  = 0.4639                    Obs per group: min =         1
       between = 0.9515                                   avg =      24.4
       overall = 0.7458                                   max =        42

                                           F(8,528)           =    335.66
corr(u_i, Xb)  = 0.7120                    Prob > F           =    0.0000

                                (Std. Err. adjusted for 529 clusters in ine)
```

infesp_12m	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
infesp_1	.4501237	.0199227	22.59	0.000	.4109862	.4892612
infesp_2	.1378325	.0210155	6.56	0.000	.0965482	.1791169
infesp_3	.0471683	.0143448	3.29	0.001	.0189885	.0753481
inst_2	-.1278855	.0235185	-5.44	0.000	-.1740868	-.0816842
inf_1	.1562438	.015707	9.95	0.000	.125388	.1870997
exp_eco	-.7844812	.1577779	-4.97	0.000	-1.094431	-.4745318
exp_inf_bcu	.1082978	.0390259	2.78	0.006	.0316327	.1849629
deva	.0042073	.0011054	3.81	0.000	.0020358	.0063788
_cons	.691257	.2525182	2.74	0.006	.1951933	1.187321
sigma_u	.54012893					
sigma_e	.77456954					
rho	.32717301	(fraction of variance due to u_i)				

Random Effects Model

```
Random-effects GLS regression              Number of obs      =     12923
Group variable: ine                        Number of groups   =       529

R-sq:  within  = 0.4542                    Obs per group: min =         1
       between = 0.9587                                   avg =      24.4
       overall = 0.7588                                   max =        42

                                           Wald chi2(8)       =   9983.75
corr(u_i, X)   = 0 (assumed)               Prob > chi2        =    0.0000

                                (Std. Err. adjusted for 529 clusters in ine)
```

infesp_12m	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
infesp_1	.540374	.0179575	30.09	0.000	.505178	.5755701
infesp_2	.1944679	.0217314	8.95	0.000	.1518751	.2370607
infesp_3	.1174183	.0143441	8.19	0.000	.0893044	.1455322
inst_2	-.1674245	.0230142	-7.27	0.000	-.2125314	-.1223176
inf_1	.1542208	.0151758	10.16	0.000	.1244768	.1839648
exp_eco	-.4686147	.157488	-2.98	0.003	-.7772855	-.1599439
exp_inf_bcu	.0063285	.0384546	0.16	0.869	-.0690411	.0816981
deva	.0047546	.0010233	4.65	0.000	.0027489	.0067603
_cons	-.4959281	.2392888	-2.07	0.038	-.9649255	-.0269307
sigma_u	.12233232					
sigma_e	.77456954					
rho	.02433669	(fraction of variance due to u_i)				

Arellano/ Bond model in one stage

```
Dynamic panel-data estimation, one-step system GMM
```

Group variable: ine				Number of obs	=	12923
Time variable : fecha				Number of groups	=	529
Number of instruments = 500				Obs per group: min	=	1
Wald chi2(8) = 1153.03				avg	=	24.43
Prob > chi2 = 0.000				max	=	42

infesp_12m	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
infesp_1	.4754623	.0375451	12.66	0.000	.4018753	.5490493
infesp_2	.1395857	.0410212	3.40	0.001	.0591857	.2199857
infesp_3	.1874863	.0274096	6.84	0.000	.1337644	.2412082
inst_2	-.146728	.0349289	-4.20	0.000	-.2151875	-.0782685
inf_1	.1991429	.0209245	9.52	0.000	.1581316	.2401542
exp_eco	-.863634	.2481966	-3.48	0.001	-1.35009	-.3771776
exp_inf_bcu	.166095	.0572149	2.90	0.004	.0539558	.2782342
deva	.0061208	.0018863	3.24	0.001	.0024238	.0098178
_cons	-1.446348	.4046236	-3.57	0.000	-2.239396	-.6533004

```
Instruments for first differences equation
  Standard
    D.var_ctos_18m
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/12).var_ctos_12m
Instruments for levels equation
  Standard
    var_ctos_18m
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.var_ctos_12m
```

```
Arellano-Bond test for AR(1) in first differences: z =  -7.38  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   2.10  Pr > z =  0.036
```

```
Sargan test of overid. restrictions: chi2(491)  =2678.30  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(491)  = 493.11  Prob > chi2 =  0.465
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(449)  = 468.25  Prob > chi2 =  0.256
    Difference (null H = exogenous): chi2(42)   =  24.86  Prob > chi2 =  0.984
  iv(var_ctos_18m)
    Hansen test excluding group:     chi2(490)  = 493.05  Prob > chi2 =  0.453
    Difference (null H = exogenous): chi2(1)    =   0.06  Prob > chi2 =  0.807
```

Arellano/ Bond model in two stages

```
Dynamic panel-data estimation, two-step system GMM
```

Group variable: ine				Number of obs	=	12923
Time variable : fecha				Number of groups	=	529
Number of instruments = 500				Obs per group: min	=	1
Wald chi2(8) = 1141.63				avg	=	24.43
Prob > chi2 = 0.000				max	=	42

infesp_12m	Coef.	Corrected Std. Err.	z	P>|z|	[95% Conf.	Interval]
infesp_1	.4754706	.0375434	12.66	0.000	.4018869	.5490542
infesp_2	.1400988	.040946	3.42	0.001	.0598462	.2203514
infesp_3	.1876232	.0275919	6.80	0.000	.133544	.2417023
inst_2	-.1420387	.034493	-4.12	0.000	-.2096438	-.0744337
inf_1	.1977725	.020552	9.62	0.000	.1574914	.2380537
exp_eco	-.8506022	.2500994	-3.40	0.001	-1.340788	-.3604165
exp_inf_bcu	.1638629	.056999	2.87	0.004	.0521468	.2755789
deva	.0059895	.0018765	3.19	0.001	.0023116	.0096674
_cons	-1.410897	.4095289	-3.45	0.001	-2.213559	-.6082356

```
Instruments for first differences equation
  Standard
    D.var_ctos_18m
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/12).var_ctos_12m
Instruments for levels equation
  Standard
    var_ctos_18m
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.var_ctos_12m
```

```
Arellano-Bond test for AR(1) in first differences: z =  -6.74  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   1.38  Pr > z =  0.167
```

```
Sargan test of overid. restrictions: chi2(491)  =2678.30  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(491)  = 493.11  Prob > chi2 =  0.465
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(449)  = 468.25  Prob > chi2 =  0.256
    Difference (null H = exogenous): chi2(42)   =  24.86  Prob > chi2 =  0.984
  iv(var_ctos_18m)
    Hansen test excluding group:     chi2(490)  = 493.05  Prob > chi2 =  0.453
    Difference (null H = exogenous): chi2(1)    =   0.06  Prob > chi2 =  0.807
```