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The interdependence of Fiscal and Monetary Policies in an Emerging economy: The case of Uruguay

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Abstract

This article's main goal is to evaluate the degree of fiscal dominance in Uruguay in 1999-2019 to improve the understanding of economic policy for theoretical reasons and applied needs related to good practices and accountability. Two strategies are followed: one, to quantify the fraction of fiscal expenditures that are financed by monetary liabilities and, the other one, to analyze the effects of fiscal deficit on the price level and inflation because inflationary financing may prevent the central bank from reaching its inflation target. Both situations may subordinate the monetary policy to the fiscal policy, signaling fiscal dominance. In addition, through the analysis performed to assess the degree of fiscal dominance, it is possible to detect the main determining factors of the Uruguayan price level (inflation) formation during the last two decades. So far, preliminary results suggest that inflation is not exclusively a monetary phenomenon and point to some inflationary financing with a mild degree of fiscal dominance.

Keywords: Monetary policy; Joint analysis of fiscal and monetary policy; Uruguay

JEL Classifications: E52; E63

Introduction

The interrelationship between monetary and fiscal policies is crucial in macroeconomic design. Policy coordination is not enough because even when monetary and fiscal policies are clearly stated, price stability requires an appropriate monetary policy and an appropriate fiscal policy. For instance, while the central bank firmly commits to price stability and independence, the fiscal policy must avoid deficit monetization or excess indebtedness that eventually could be financed by future money creation. Nevertheless, when unavoidable shocks to the government's budget constraint occur, and the treasury refuses to increase distortionary taxes, some price instability may be optimally accepted (Sims, 1999), (Woodford, 1998). In practice, those so-called non-Ricardian policies are wrong. Suppose fiscal authorities do not internalize that tax cuts or increases in government spending today have to be paid with higher taxes in the future. In that case, the outcome will be excessive spending, excessive debt, and inflation. Appropriate fiscal policies add specific measures to rule them out – i.e., debt limitations (Christiano & Fitzgerald, 2000).

The traditional quantitative theory of price formation states that systematic increases in the money supply generate inflation. As a result, balancing fiscal deficits with seigniorage leads to inflation. But it does not follow that sustained deficits necessarily cause inflation since increases in government debt can finance them. Outstanding Government debt implies a promise of future government surpluses for honoring that debt. To the extent that high indebtedness levels may reduce the government's credibility and, therefore, its ability to borrow, the only possible choice for the government is to rely on increases in the money supply to balance its accounts. Consequently, there is a direct connection between fiscal deficits and inflation.

This linkage alerts to likely interferences between fiscal and monetary policies' objectives and advises optimal joint design. The conventional view suggests that central bankers should commit to fulfilling their inflation goals and act independently from fiscal authorities to eschew pressures to finance budgetary deficits. Other scholars indicate that central bankers should actively influence fiscal rules towards an appropriate behavior. Which is the optimal mix?

Central bank independence may be the solution against dynamic consistency problems when short-sighted policymakers pursue overly expansionary monetary policies relying on delayed associated inflationary costs. Fiscal dominance is significant in many developing countries owing to weak institutions and historical subordination of the central bank to the budgetary authority. Many countries have placed legal barriers to isolate the central bank from fiscal policy considerations. (Dincer & Eichengreen, 2014) provide a list of those when they measure the degree of independence of central banks in many countries - i.e., long-term appointments to central bank boards, bans on Government debt, etc. The euro area rests on two cornerstones: the principle of central bank independence and a single monetary policy that pursues price stability. The Maastricht Treaty established a clear division of responsibilities between the European Central Bank (ECB) and country-fiscal actors, with implicitly coordinated ex-post policy outcomes. Nevertheless, central bank distance from the fiscal policy can be achieved without formal institutional limits – i.e., the U.S. Federal Reserve and the Bank of England (Orphanides, 2010).

Greater central bank independence does not necessarily lead to better macroeconomic performance. (Friedman, 1968) saw central bank independence with ample discretionary power as insufficient to deliver good outcomes because, when needed the most, close coordination of monetary, fiscal, and other policies is precluded. The Great Depression is an example of mismanagement of monetary matters where the errors, according to Friedman, can be attributed in part to the FED's independence.

In the aftermath of the 2008 GFC and confronted with the zero lower bound, the gravity of the crisis made the policymakers turn to unconventional policy tools. Quantitative easing (Q.E.) policy was implemented by expanding the central bank's balance sheet through large-scale asset purchases. As a result, the government's fiscal space was created, blurring the boundaries between “fiscal” and “monetary” policies. Furthermore, Q.E. improved debt dynamics by lowering the cost of refinancing government debt (r) relative to the economic growth (g) – i.e., $\Delta b_t = (r - g)b_{t-1} + d_t$, where b is the debt-to-GDP ratio, d is the primary-deficit-to-GDP ratio, r is the real interest rate to government debt, and g is the real growth rate of GDP. In particular, the central banks of the three largest advanced economies – i.e., the FED, the ECB, and the BOJ - applied Q.E. policy, and payoffs differ according to the rhythm of expansion in each central bank. Only the FED could keep inflation expectations anchored at 2 percent (Orphanides, 2010).

The global COVID-19 pandemic is another example where central bank independence is not the correct answer to overcome the negative consequences on people's lives and riches. An already nonexistent fiscal space in many countries challenged the role of fiscal policy as a stabilization tool, and coordination between fiscal, monetary, and sanitary policies has been the response to the crisis in an overwhelming number of economies, both advanced and emerging. (Tobias et al., 2021) point out that many central banks in emerging market economies have used asset purchases to reduce financial stresses and stimulate the macroeconomy during the pandemia.

Latin America in general and Uruguay in particular share a long history of high inflation rates and significant fiscal deficits that were financed by money issuing. As a result, monetary policy had low credibility. The good news is that there is an uncoupling between fiscal deficits and inflation because better institutions break fiscal dominance, help central banks to gain credibility, and let them pursue countercyclical macroeconomic policies (Végh, 2020). Uruguay is a small, open, and dollarized emerging economy with a historical record of persistent fiscal deficits and untamed inflation. As of December 2019, 77% of deposits and 54% of loans by private non-financial sectors in the banking system are denominated in U.S. dollars. That structure has been relatively stable through the years. The risks of monetary financing and inflation appear exceptionally high for countries with a significant level of dollarization (and consequently, relatively small domestic-currency monetary base) such as Uruguay. Public debt denominated in foreign currency (especially in U.S. dollars) has been historically high, but since 2001-2002 crisis efforts have been made to reduce its weight in total government indebtedness (i.e., 40% by December 2019), to improve maturity profiles and to prefer fixed interest rates. With investment grade and debt-to-GDP ratios that show debt sustainability, despite high uncertainty and volatility since the COVID-19 pandemic, Uruguay issued a significant amount of long-term debt in domestic currency by 2020.

(Oddone & Marandino, 2019) point out that from 1960 to 2017, the inflation tax was the primary source of fiscal finances, but since the 1970s and especially after 1991, the use of seigniorage to finance budgetary deficit decreased. Figure 1 depicts the consolidated fiscal result over GDP together with the annual inflation rate — measured as 12-month Consumer Price Index (CPI) changes — for 1999-2019*.

Figure 1: Uruguay fiscal result and annual inflation rate, 1999-2019

Source: Author's calculations based on BCU and INE data.

To evaluate the degree of fiscal dominance in Uruguay during 1999-2019 is the main objective of this investigation. That knowledge could help understand the inflation persistence in the last twenty years by identifying the existence of institutional flaws in the macroeconomic policy design. If monetary policy is subordinated to fiscal policy, then the central bank's inflation goal is a second-order target that may or may not be eventually achieved.

The estimation strategy involves two approaches: (1) the first approach, following (de Resende, 2007), assesses the relevance that seigniorage has to back the outstanding nominal debt. Specifically, it quantifies the fraction $(1 - \delta)$ of fiscal expenditures that are financed by monetary liabilities (seigniorage):

* Data availability restricts the econometric analyses over the period between 1999 and 2019.

$$s_t = (1 - \delta) i_{t-1} \frac{B_{t-1}}{p_t} \quad (1)$$

Where s_t is the present discounted value of present and future seigniorage, $i_{t-1} \frac{B_{t-1}}{p_t}$: is the outstanding Government debt plus interests. If the δ -DOLS estimate equals 1, then the outstanding Government debt plus interests are backed only by primary surpluses (in discounted value), and there is zero fiscal dominance; if the δ -DOLS estimate equals 0, then seigniorage (in discounted value) is the only source to finance the outstanding Government debt plus interests, and there is complete fiscal dominance; values between 0 and 1 reflect different degrees of central bank independence. This investigation estimates a point value of 0.8080 within the interval [0.7864 0.8296] for 95% confidence.

(2) the other approach analyses the fiscal deficit effects on inflation. It modifies (Catao & Terrones, 2005) 's ARDL model to a time series approach in a multi-cointegration framework that considers more than one long-run relation and diverse sources of consumer price changes. This procedure points to the main determining factors of the Uruguayan price level (inflation) formation during the last two decades. It helps to decide whether the price level can be better explained by the traditional theory (based on the stock of money and the monetary policy), by the fiscal theory of price determination (FTPL, based on the intertemporal government budget constraint and the fiscal policy), by a combination of both or many other sources. Five long-run equilibrium relationships among the variables point to a multi-causal price formation process: money, pass-through from exchange rate to domestic prices, and goods market movements intervene in the Uruguayan price formation. In particular, fiscal deficits influence inflation through money market conditions and real exchange rate equilibrium, while government dollarization exacerbates that pressure.

The outcome of this investigation suggests that inflation is not exclusively a monetary phenomenon in Uruguay and point to some inflationary financing with a mild degree of subordination of monetary policy to fiscal policy.

The rest of this document has the following structure. First, the literature review is presented in Section 2. Next, in Section 3, the methodological approaches are explained. Then, Section 4 analyses the results. Finally, some conclusions are drawn.

Literature Review

This article builds upon significant work done by distinguished scholars early in the last century and revived lately. After being ignored in economic textbooks for a long time, the fiscal-monetary policy relationship has made a remarkable comeback since the 2008 GFC and especially the COVID-19 pandemic. Basically, in the economic literature, the effects of fiscal policy on monetary policy are studied through government intertemporal budget constraint and the impact of fiscal policy on monetary variables (i.e., interest rates, interest spreads, exchange rates).

(Keynes, 1939) believed that in times of heavy unemployment, when monetary measures cannot lower interest rates, government spending could compensate for insufficient private investment. On the other hand, (Friedman, 1968) advocated that money matters but warned against assigning monetary policy a more prominent role than it could perform and advised to follow a steady growth rate in a monetary aggregate publicly. Other researchers discuss non-corner solutions. The celebrated paper of (Sargent & Wallace, 1981) describes a coordination game between fiscal and monetary authorities. If the central bank makes the first move, it can discipline the fiscal officer (Monetary Dominance). If the fiscal authority moves first (i.e., it decides its budget independently and determines the corresponding amount of revenues through debt and seigniorage), the central bank follows the treasury's decision. It loses its ability to control inflation (Fiscal Dominance). (Aiyagari & Gertler, 1985) develop a two-period overlapping generations model to explain how fiscal and monetary policy relation affect the ability of monetary policy to control inflation. In a Ricardian regime, the government sets taxes to back debt fully; the non-Ricardian portion of that debt must be supported by the monetary authorities' inflationary-prompting money issue. (Leeper, 1991) describes this non-Ricardian situation as one where an active fiscal policy exists together with a passive monetary policy. (Christiano & Fitzgerald, 2000) discuss the reason for different views on price formation between monetarists and followers of the fiscal theory of price level (FTPL). The former see the government budget equation as a constraint that imposes a modification on taxes or/and government expenses whenever it is disturbed. FTPL advocates believe that the government has no obligation to modify its budget since the price moves to restore equality. Under those circumstances, an independent central bank combined with loose a fiscal policy could

result in inflation without increases in seigniorage. (Cochrane, 1988, 1999), (Auernheimer & Contreras, 1990), (Leeper, 1991), (Woodford, 1994, 1995, 1996, 1998, 2000), (Sims, 1994, 1995, 1997, 1998), (Canzoneri & Diba, 1998), (Canzoneri et al, 1997, 2001, 2002), (Bergin, 2000), (Schmitt-Grohe & Uribe, 2000) and (Benhabib et al, 2001) contribute to FTPL's debate. More recently, (Orphanides, 2010) explains the motives for coordinated action in stress situations like the 2008 GFC, and (Tobias et al., 2021) develop the measures to tackle the COVID-19 pandemic.

Several empirical works focus on finding quantitative evidence of fiscal dominance. Most papers analyzing developed countries find that monetary policy has not accommodated to fiscal policy indicating thus no fiscal dominance: (Melitz, 1997, 2002), (Wyplosz, 1999), (Favero, 2002), (Von Hagen et al., 2002), (Favero & Monacelli, 2003), (Afonso et al., 2019). The latter finds monetary authority assumes a more significant role in economic stabilization in periods of higher debt accumulation for the European Union. For developing countries applying different econometric models (Catao & Terrones, 2005), (Zoli, 2005), (de Resende, 2007), (Arora, 2017), (Jevđović & Milenković, 2018) provide evidence suggesting that the scope for monetary policy has been contingent on fiscal policy. (Catao & Terrones, 2005) applied an ARDL pooled mean group estimator on inflation, money supply, overall budget balance, openness, and oil prices to analyze how persistent and large fiscal deficits eventually lead to monetary financing and inflation. (Zoli, 2005), presents an extensive survey on this topic. She performs a VAR model proposed by (Canzoneri et al., 2001) and (Tanner & Ramos, 2002) to assess whether primary balances are set exogenously and independently from public sector liabilities. Besides, she inquires whether fiscal variables enter significantly in the reaction function of the monetary authority. Finally, she concentrates on an event study where analyzes the impact of news related to fiscal variables and fiscal policies on sovereign spreads and exchange rates in Brazil during the macroeconomic instability around 2002. The results are mixed. (de Resende, 2007) estimates a dynamic panel by Ordinary Least Squares (OLS) on money supply, household consumption, and debt, finding that fiscal dominance is more common in developing countries than in the OECD nations. That debt plays a minor role in price determination. (Arora, 2017) applies a Structural Vector Autoregressive (SVAR) model for India during 1990Q1-2011Q4, using sign restrictions and magnitude restrictions to identify policy actions, and interprets the results using impulse responses and variance decomposition. Evidence from (Jevđović & Milenković, 2018) suggests that fiscally-led regimes prevailed in all five emerging European economies studied.

Regarding the Uruguayan case, (Borchardt et al., 1997) estimate fiscal balance adjusted by short-run fluctuations in relevant macroeconomic variables. (Licandro, 2000) analyzes four fiscal rules and proposes the one that imposes a limit on the cyclically-adjusted budgetary deficit. (Licandro & Vicente, 2006) show that inflation acceleration has been one of the main reasons for fiscal balance improvement in the 1970-2005 period through reductions in real government expenses. On the other hand, (Oddone & Marandino, 2019) present a neat description of fiscal and monetary policies interaction in 1960-2017 using the budget constraint approach developed by (Sargent, 1986). They find that, on average, the inflation tax is two-thirds of total sources but with declining importance since the 1970s and especially since 1997 when significant structural changes were implemented – i.e., financial liberalization, a more restricted institutional framework for the central bank. Their results align with those of (Bucacos, 2003) 's who find a downward trend of seigniorage's weigh-in public deficit financing.

Considering the review's findings, the distinction between Ricardian and non-Ricardian regimes is a helpful tool for understanding the difficulty of the monetary policy in achieving low and stable inflation. Under a "monetary dominant" (M.D.) regime, prices are determined exogenously in the money market (following the quantitative theory of money). At the same time, the primary balance adjusts endogenously according to the government budget constraint. Under a "fiscal dominant" (F.D.) regime, the path of the primary balance is exogenous while prices adjust endogenously to keep sustainability. The central bank loses power to control inflation and can only control its timing (Sargent & Wallace, 1981). This differentiation is a theoretical exercise to enhance the understanding of economic policy and a widely applied device related to good practices and accountability.

It follows that the Uruguayan economy, characterized by high dollarization, chronic government deficits, and untamed inflation, appears to be an interesting case to study the link between fiscal and monetary policies. Further empirical research on Uruguay will provide, to my knowledge, the first estimation of central bank independence related to the level of fiscal dominance preferred by the government, δ . This estimate will help determine the prevailing policy regime along the period of analysis to clarify the understanding of the difficulty

of the monetary policy in achieving low and stable inflation. In addition, it will give guidelines to improve monetary policy design.

To capture the complexity of inflation dynamics, a different approach to unveil the link between fiscal deficits and inflation is proposed: a multi equation multi-cointegration model, where the price data generating process can be explained by several economic theories and the effect of the budgetary deficit on inflation could be better isolated.

Methodology

Our search for a measure of actual fiscal dominance in Uruguay in the last 21 years is conducted by analyzing two situations that may subordinate the monetary policy to the fiscal policy, signaling fiscal dominance.

M1: To quantify the fraction of fiscal expenditures financed by monetary liabilities, regardless of the formal structure regulating monetary and fiscal relations. The key equation in (de Resende, 2007) 's model is the government's long-run fiscal policy rule:

$$(\mathcal{T}_t - \mathcal{G}_t) + \mathcal{S}_t = i_{t-1} \frac{B_{t-1}}{p_t} \quad (2)$$

where a given fraction (δ) of the outstanding debt is backed by the present discounted value of current and future primary surpluses:

$$(\mathcal{T}_t - \mathcal{G}_t) = \delta i_{t-1} \frac{B_{t-1}}{p_t} \quad (3)$$

and since the government's intertemporal budget constraint is always satisfied, the remaining debt is backed by seigniorage revenue:

$$\mathcal{S}_t = (1 - \delta) i_{t-1} \frac{B_{t-1}}{p_t} \quad (4)$$

The parameter δ characterizes the degree of independence between fiscal and monetary authorities: when δ equals 1, treasury backs fully all outstanding debt and there is zero fiscal dominance; when δ equals 0, all outstanding debt is paid with seigniorage, and there is complete fiscal dominance. δ is a deep parameter that shows the revealed preference of the government regarding its financing strategy. "It does not reflect a publicly announced commitment, nor a commitment formally written in a country's budget, Constitution or central bank organic law" affirms (de Resende, 2007).

Using the price equation derived in (de Resende, 2007) for the money market equilibrium $p_t = \frac{(1-\beta)[M_t + (1-\delta)B_t]}{\gamma C_t}$ and rearranging terms:

$$M_t = \frac{\gamma}{(1-\beta)} C_t - (1-\delta)B_t \quad (5)$$

M_t is money supply, B_t is outstanding government debt, β is the discount rate, δ is the parameter that indexes the set of fiscal regimes, γ is the marginal utility of real money balances, C_t is nominal consumption. It can be estimated as:

$$M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + \varepsilon_t \quad (6)$$

where $\alpha_1 = \frac{\gamma}{(1-\beta)}$, $\alpha_2 = -(1-\delta)$

and the parameter δ can be estimated as:

$$\hat{\delta} = 1 + \hat{\alpha}_2 \quad (7)$$

The data set used in this estimation is composed of monetary aggregate (M) where monetary base (M.B.) and M1 are used for sensitive analysis, private consumption (C), total public sector net debt (B), and gross domestic product (Y). All variables are expressed in billions of U.Y. pesos from 1999Q4 to 2019Q4. Those time series are non-stationary, but they can be cointegrated. As M_t , C_t , B_t are endogenous to the model, DOLS (Stock and Watson, 1993) are applied.

Dynamic OLS (DOLS) estimation method is used to eliminate the feedback in the cointegrating system (Saikkonen (1992) and Stock and Watson (1993)). DOLS involves augmenting the cointegrating regression with lags and leads of ΔC_t and ΔB_t so that the resulting cointegrating equation error term is orthogonal to the entire history of the stochastic regressor innovations:

$$M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + \sum_{i=1}^p \alpha_{3i} \Delta C_{t-i} + \sum_{i=1}^p \alpha_{4i} \Delta B_{t-i} + \sum_{j=1}^q \alpha_{5j} \Delta C_{t+j} + \sum_{j=1}^q \alpha_{6j} \Delta B_{t+j} + \varepsilon_t \quad (8)$$

M2: Another approximation to the issue of monetary policy subordination to fiscal policy is to isolate the effect of fiscal deficits on inflation. A byproduct of this study evidence is provided on the determining factors of the price level (inflation) throughout the review.

(Catao & Terrones, 2005) arrive at a relationship between inflation and fiscal deficits based on a standard macroeconomic model, with a shopping time technology rationalizing the demand for monetary holdings. Empirically, they present an autoregressive distributed lag (ARDL) econometric model to study the long-run relationship between fiscal deficits and inflation dynamics. This paper proposes another approach.

ARDL is a single-equation approach, which suggests that the researcher has a good idea (from theory) regarding which variable is endogenous and which are exogenous. If the variables constitute a system, such that all the variables are potentially endogenous, then a complete system approach to estimation is preferable. If there is one cointegrating relationship and specific weak exogeneity results hold, Engle-Granger or ARDL can estimate the cointegrating relationship. When there are two or more cointegrating relationships, Johansen estimates the space spanned by the cointegrating relationships. If there are two, then any two independent combinations are also cointegrating vectors. It may be possible to impose conditions arising from economic theory to identify such linear combinations. If there are two or more cointegrating vectors, estimating one in isolation omits influences that might lead to inconsistent and inefficient estimation. In this case, the one estimate provided by Engle-Granger or ARDL should lie in (or be "statistically" close to) the Johansen cointegration space and is, therefore, some linear combination of the Johansen cointegration vectors. Thus, the coefficients have no structural meaning.

Given that inflation is a complex phenomenon and more than one explanation for the price formation may be true, a straightforward conclusion is that the data generating process of prices validates more than one stable (long-run equilibrium) relationship linking the price level with different economic variables. Over time, inflation dynamics studies the forces that change the aggregate price - mainly the aggregate consumer price index (CPI). Many reasons can cause price changes, and economic literature proposes the leading causes of inflation as: (1) *demand-pull inflation factors* (e.g., excess aggregate demand, money and credit boom, increase in public spending, positive output gap, etc.); (2) *cost-push inflation factors* (e.g., rising wage costs in labor markets, increasing raw material and components costs, rising import costs, etc.); (3) *inflation expectations* (once inflation becomes established and it is difficult to remove most agents will raise their expectations about the evolution of prices in the future and build it into their calculations and decisions); (4) *administered prices*, among others. The roots of inflation have been explained by different theories, depending on its deep causes or drivers. Each of those theories hinges on the specification of a few stable relations that involve the price level. For instance, the quantity theory of money states a long-lasting relationship $M v = P Y$, which implies that the price level of goods and services is proportional to the money supply in that economy: $P = \left(\frac{v}{Y}\right) M$, with v as money velocity. In an open economy, exchange rate movements impact domestic prices through the prices of traded goods and services (i.e., consumer goods, production inputs, oil, etc.). This channel is called pass-through: $P = EP^*$. Consequently, it seems inappropriate to use a single-equation approach to analyze price formation. So, (Catao & Terrones, 2005) model is modified and adapted to a time series approach in a multi-equation multi-cointegration framework that considers more than one long-run relation, diverse sources of consumer price changes, and several endogenous variables.

Let p be the price index (in logs) and x a vector of economic variables that includes fiscal deficits. The VECM (Vector Error Correction Model) that will be estimated — with n correcting vectors CV and k lags for the variables in first differences — has the following structure:

$$\begin{bmatrix} \Delta p_t \\ \Delta x_t \end{bmatrix} = \begin{bmatrix} a_{p0} \\ a_{x0} \end{bmatrix} + \begin{bmatrix} a_{p1} & \dots & a_{pn} \\ a_{x1} & \dots & a_{xn} \end{bmatrix} \begin{bmatrix} CV_1 \\ \dots \\ CV_n \end{bmatrix}_{t-1} + \begin{bmatrix} c_{p1} \dots & c_{pk} \\ c_{x1} \dots & c_{xk} \end{bmatrix} \begin{bmatrix} \Delta p_{t-1} \\ \dots \\ \Delta p_{t-k} \end{bmatrix} + \begin{bmatrix} h_{p1} & \dots & h_{pk} \\ h_{x1} & \dots & h_{xk} \end{bmatrix} \begin{bmatrix} \Delta x_{t-1} \\ \dots \\ \Delta x_{t-k} \end{bmatrix} + \begin{bmatrix} \varepsilon_{pt} \\ \varepsilon_{xt} \end{bmatrix} \quad (9)$$

This specification is rich enough to include different theories of inflation by imposing long-run restrictions that are expressed in some of the n cointegrating vectors (i.e., some C.V.s may not include prices). As long as the $(a_{p1} \dots a_{pn})$ parameters are statistically significant and have the correct sign (i.e., they correct the errors), the inflation process can be explained in the long run by the theory encapsulated in such C.V.s. In addition, provided the $(a_{x1} \dots a_{xn})$ parameters are statistically significant and have the correct sign (i.e., they move to restore equilibrium), the x variables react to discrepancies in the long-run relationships, indicating endogeneity. In such circumstances, a Vector Error Correction (VECM) model approach has to be used instead of a single-equation one.

The way fiscal deficits and inflation are related is not trivial because they are part of a broader macroeconomic system. Impulse-response analysis and variance decomposition are done to capture intertemporal government expenditure management's effects on inflation.

The data is chosen to detect different causes of price changes besides fiscal deficits. By controlling for other sources of inflation, the effect of fiscal deficits on inflation could be better measured. The data set is composed of money (M , approximated by M1 plus savings accounts), consumer price index (P), gross domestic product (Y), nominal interest rate (i), nominal exchange rate (U.Y. Pesos/U.S. dollars, E), foreign price index (P^*), nominal wage index (W), potential output (s_{pot}), unemployment rate (μ), openness ratio (total exports plus total imports over GDP, op), fiscal deficit ratio (d , calculated as total Government revenue minus total Government expenses over M), international prices of food (P_f), meat (P_m), soybeans (P_s) and oil (P_{oil}). All variables (in lower case letters) are expressed in logs of indices with based on the year 2004 except interest rate, openness ratio, and deficit ratio. The sample expands from 2004Q1 to 2019Q4 because the unemployment rate began in 2004, reducing the original sample size from 80 to 60 observations. Those time series are non-stationary (some with structural breaks), but they can be cointegrated. Several unit root tests are performed.

Results

In the tables below, regression analysis results using DOLS to estimate the δ parameter (R1) and a VECM to assess the effect of fiscal deficits on inflation (R2) are presented. Both models' goodness of fit statistics implies a certain degree of fiscal dominance and a multi-causal inflationary process.

R1: Estimating parameter δ

Table 1: Fiscal dominance in Uruguay, 1999Q4-2019Q4

Method: Dynamic Least Squares (DOLS)				
HAC standard errors and covariances				
Dep. Variable →	Monetary Base/GDP		M1 plus saving deposits/GDP	
Indep. Variable ↓	Coefficient	p-value	Coefficient	p-value
Consumption/GDP	7.1373	0.0003	3.4660	0.0097
Debt/GDP	-0.0492	0.0034	-0.1920	0.0000
Constant	-4.1574	0.0005	-1.6769	0.0331
Trend	-0.0091	0.0003	-0.0021	0.2660
Adj. R-squared	0.9850		0.9839	
SIC criterion: leads	11		9	
lags	11		7	
Sample (adjusted)	2002Q4 2017Q1		2001Q4 2017Q3	
Cointegration tests	Rejection of null hypothesis of no cointegration		Rejection of null hypothesis of no cointegration	
$\hat{\delta}$	0.9508		0.8080	
Range of $\hat{\delta}$ at 95%	[0.9268 0.9748]		[0.7864 0.8296]	

Source: Author's calculations.

Both point estimates and their probability range suggest a mild degree of fiscal dominance, regardless of the monetary aggregate considered. However, monetary policy independence seems stronger the narrower the definition of money used. The different compositions of those monetary aggregates may explain this result. The monetary base comprises the amount of currency in circulation plus commercial bank deposits held in the central bank's reserves. In contrast, the monetary supply defined as M1 includes cash in the public's hands and non-cash assets such as demand deposits. All of the money supply's components can back the government's outstanding debt (plus interests) while commercial banks' reserves can't, which justifies a smaller value for the δ estimate when using M1, showing less monetary policy independence.

Estimation results for Uruguay for 1999-2019 point that the value of the δ coefficient is in the upper range for emerging economies but still below the values for developed economies, suggesting a low degree of fiscal dominance. Its magnitude is comparable to the point estimate for Mexico (0.80) found by (de Resende, 2007) for the 1966-2004 period. A recent assessment for Belize (0.65) found by (Soutar & Arana, 2020) for the 2007-2019 period corroborates that idea.

R2: VECM estimation

Johansen test points to five cointegrating vectors (CV_n) among the variables[†]. After a parsimonious process of parameterization, condition imposition, and testing, it is possible to identify five stable equilibrium relationships (i.e., all five cointegrating vectors are stationary) with sensible economic meaning. Coefficient estimates are statistically significant at 5 percent, and most are statistically significant at 1 percent.

They are:

$$\frac{m_t}{p_t} = -13.7875 + 3.2957 y_t - 0.03206 i_t + 0.0091 d_t - 0.0109 T_t + \varepsilon_{mt} \quad (10.1)$$

$$\frac{e_t p_t^*}{p_t} = 6.1340 - 0.0193 d_t - 0.0132 T_t + \varepsilon_{et} \quad (10.2)$$

$$\frac{w_t}{p_t} = -1.9066 + 0.2196 y_t - 0.0020 op_t + 0.0076 T_t - 0.0056 DT_{2013} + \varepsilon_{wt} \quad (10.3)$$

$$y_t = 2.7596 + 0.4305 p_t - 0.0310 \mu_t + 2.7597 T_t + \varepsilon_{y1,t} \quad (10.4)$$

$$y_t = 1.8511 + 0.7264 y_{pot,t} - 0.1502 e_t - 0.0012 op_t + \varepsilon_{y2,t} \quad (10.5)$$

Let us explain each cointegrating vector in more detail.

$$\frac{m_t}{p_t} = -13.7875 + 3.2957 y_t - 0.03206 i_t + 0.0091 d_t - 0.0109 T_t + \varepsilon_{mt} \quad (10.1)$$

Equation (10.1) summarizes the monetary market: real money balances are demanded by both the public — for the transaction and speculative motives — and the government to back up a proportion of the fiscal deficit. The long-run income elasticity of real money demand, although positive, seems somehow higher than typical values. In contrast, the long-run semi-elasticity of the nominal interest rate to real balances has the expected sign and value. This long-run equilibrium relation suggests that a one-point increase in the fiscal deficit ratio would impact 0.9 percent on the annual growth rate of money in real terms. Finally, evidence of a demonetization process reduces the demand for real money at an average rate of 1.1 percent per quarter, mainly owed to the inflation-devaluation close relationship. Portfolio analysis can help in better understanding this phenomenon by considering three interconnected variables: (i) the inflation rate, (ii) the inflation rate volatility, and (iii) the covariance between inflation and devaluation rates. As money is a fixed-rent asset, higher inflation hurts currency and both demand and savings deposits[‡], reducing real money demand. In addition, greater inflation volatility is associated with lower real balances demand. Finally, in an open and highly-dollarized economy like the Uruguayan one, inflation movements are closely linked to the evolution of the U.S. dollar currency. (Brum et al., 2011) find that transactional money demand is positively associated with the variance of the devaluation rate and negatively related to the covariance between inflation and devaluation rates. That is, three out of four factors are expected to exert down pressure on real balances demand, and only one could increase it, i.e., the variance of the devaluation rate.

$$\frac{e_t p_t^*}{p_t} = 6.1340 - 0.0193 d_t - 0.0132 T_t + \varepsilon_{et} \quad (10.2)$$

[†] Some variables are finally excluded from the cointegrating vectors, such as openness, the international price of oil, soybeans, meat, and food. Trend variables are included for the whole period (T_t) and from the year 2013 (DT_{2013}).

[‡] Uruguay uses M1 plus saving deposits as the operational definition of money.

Equation (10.2) points to the long-run real exchange rate. It shows a steady fall in the last sixteen years at an average rate of 1.3 percent, which can be explained by a decline of the American currency with respect to the rest of the currencies and a domestic inflationary process above foreign inflation. In addition, fiscal deficits seem to be associated with real exchange appreciation.[§] In Uruguay, government revenues are mainly based on tradable goods and services, while government expenses are mostly non-tradable. Consequently, a government deficit pushes up non-tradable goods demand, increasing their price relative to tradable goods, resulting in real exchange appreciation. In addition, real depreciation can have a positive fiscal impact, and government deficits may be negatively associated with the real exchange rate (Romaniello, 2010). In effect, in the 2002-2003 crisis, government debt denominated in U.S. dollars jumped, and sustainability indicators drastically deteriorated. Surprisingly, the government ran a primary surplus owing to favorable relative prices; furthermore, this effect was so significant that it allowed backing the bulk of interest government debt during those years.

$$\frac{w_t}{p_t} = -1.9066 + 0.2196 y_t - 0.0020 op_t + 0.0076 T_t - 0.0056 DT_{2013} + \varepsilon_{wt} \quad (10.3)$$

Equation (10.3) shows long-run equilibrium in the labor market. Increasing real output goes along with higher real wages. This positive correlation shows the relative easiness of the employers to pay higher wages when the economy is working on a positive phase of the business cycle. On the other hand, greater openness pushes real wages down, indicating more competition in the labor market once the economy opens up. Finally, the steady increase of real wages since the beginning of the sample slowed down by 2013 (i.e., DT_{2013} stands for a dummy variable that behaves as a trend variable since 2013Q1 and takes the zero value otherwise). The growth rate of real wages declined from 0.8 percent per quarter to 0.2 percent quarterly. The economy has decelerated since 2011, causing a slight deterioration in employment and a striking slowdown in the wages growth rate that seems to be captured in equation (10.3).

$$y_t = 2.7596 + 0.4305 p_t - 0.0310 \mu_t + 2.7597 T_t + \varepsilon_{y1,t} \quad (10.4)$$

Equation (10.4) stands for long-run real output. Lower unemployment means more workers in the production process and, together with higher prices, reflects increases in real output. The positive sign associated with consumer prices is indicative of a supply curve.

$$y_t = 1.8511 + 0.7264 y_{pot,t} - 0.1502 e_t - 0.0012 op_t + \varepsilon_{y2,t} \quad (10.5)$$

Equation (10.5) depicts another long-run relationship that involves real output. The higher potential output enables real growth while openness and nominal devaluation dump real output. As imported inputs are more expensive after a devaluation and fewer are bought and included in the production process, they can harm the final real output.

In sum, the existence of more than one cointegrating vector discards the ARDL model approach. Had the latter been used, a linear combination of the five long-run relationships (10.1)-(10.5) would have been found but without any sensible structural meaning. Those five long-run relationships are backed by statistically significant error correction terms for certain variables, while the rest of them are weakly exogenous. In particular: (a) consumer prices are endogenous in the money market, the goods market, and the real exchange rate relationship, (b) government deficits are endogenous in the long-run real exchange rate determination.

Determining factors of the price level in the long term

According to the results, inflation has not been exclusively a monetary phenomenon in the last two decades. Several plausible theories of price formation can also be applied to explain the Uruguayan case. The quantity theory of money relies on two fundamental propositions: proportionality between money growth and inflation and long-run neutrality between money growth on the one hand and output growth and velocity changes on the other. Both are found in this investigation (equation 10.1) which validates the traditional quantity explanation of price formation in the long run. The exchange rate pass-through to domestic prices via prices of traded goods and services (e.g., consumer goods, production inputs, oil, etc.) is also supported by the results (equation 10.2). Finally, the market-clearing mechanism moves the price level to restore equilibrium in the goods market (equation 10.4).

[§] There is a bidirectional relation between government deficits and real exchange movements that may become clear soon.

Furthermore, the estimates show the influence of fiscal policy on monetary policy because consumer prices increase when fiscal deficit pressures money market equilibrium (equation 10.1). This outcome supports the fiscal theory of price level (FTPL), that is, budgetary deficits do induce inflation, pointing to a certain degree of fiscal dominance. In addition, monetary policy may affect fiscal policy through real exchange rate movements caused by price changes (equation 10.2).

Determining factors of the price level in the medium and short term

The **price equation** estimate is:

$$\Delta p_t = 0.032 + \begin{pmatrix} 0.064 \\ 0.098 \\ 0.239 \end{pmatrix}' \begin{pmatrix} -1.00 & 1.00 & 0.03 & 0.00 & 0.00 & 0.00 & -3.30 & 0.00 & -0.01 & 0.00 & 0.00 & 0.00 & 0.11 & 13.79 \\ -1.00 & 0.00 & 0.00 & 1.00 & 1.00 & 0.00 & 0.00 & 0.00 & 0.02 & 0.00 & 0.00 & 0.00 & 0.01 & -6.13 \\ -0.43 & 0.00 & 0.00 & 0.00 & 0.00 & 0.00 & 1.00 & 0.00 & 0.00 & 0.00 & 0.03 & 0.00 & 0.00 & -2.76 \end{pmatrix} \begin{pmatrix} p \\ m \\ i \\ e \\ p^* \\ w \\ y \\ y_{pot} \\ d \\ op \\ \mu \\ DT_{2013} \\ Trend \\ Const \end{pmatrix}_{t-1} + \sum_{j=1}^2 A_j \begin{pmatrix} \Delta p \\ \Delta m \\ \Delta i \\ \Delta e \\ \Delta p^* \\ \Delta w \\ \Delta y \\ \Delta y_{pot} \\ \Delta d \\ \Delta op \\ \Delta \mu \\ \Delta DT_{2013} \\ \Delta Trend \end{pmatrix}_{t-j} + \varepsilon_{pt} \quad (11)$$

where A_j is the matrix of autoregressive coefficients.

In the short and medium terms, price dynamics include all the variables considered in the present investigation because prices are part of an autoregressive system. For example, the *impulse response analysis* shows that when government finances worsen – i.e., fiscal deficit increases by one standard deviation - consumer prices (inflation) rise 0.25 percent the following quarter (Figure 2) and accumulates an increase in inflation of 0.90 percent in a year, adding up to 6.40 percent in five years – a Presidential term (Figure 3). These results point to inflationary financing.

Figure 2: Response of consumer prices to the fiscal deficit increase-Generalized one s.d. innovations
Source: Author's calculation.

Figure 3: Accumulated response of consumer prices to the fiscal deficit increase-Generalized one s.d. innovations

Source: Author's calculation.

Price inertia becomes apparent in the variance decomposition of prices. The relative importance of fiscal deficit seems to be relatively stable at around 6 percent of prices' forecast error variance, regardless of the ordering of the variables. The other variables have varying relative importance: while money and wages decline, nominal exchange rate and output gain more relevance.

Discussion and Conclusions

The results suggest that inflation in Uruguay is not exclusively a monetary phenomenon and that a multi-causal approach has to be taken when analyzing the inflationary process. In particular, fiscal deficits do induce inflation, suggesting a certain degree of fiscal dominance.

This investigation points to a relatively low degree of fiscal dominance, at least in the last twenty-one years. The δ point estimate of 0.8080 is in the range of [0.7864 0.8296] with 95 percent certainty. Fiscal deficits positively affected consumer prices, although (on average) they explain only 6 percent of price forecast error variance. This result is aligned with those of (Bucacos, 2003) 's and (Oddone & Marandino, 2019) 's who found a declining influence of inflationary finances in Uruguay since the 1970s and especially after 1991 — owing to significant macroeconomic measures such as the opening of the economy, financial liberalization, greater access to external financing, stabilization plans, and the more restrictive institutional framework of the central bank. In particular, the limit imposed on the assistance the Central Bank of Uruguay (BCU) could offer to the rest of the public sector.** translates into an average value of 0.975 for the δ coefficient. This implies that theoretically, seigniorage could only back on average 2.5 percent of the government's outstanding debt plus interests while (according to our results) the government's willingness to do so is around 19.2 percent. This 16.7 percent gap implies room for improvement on both fiscal and monetary authorities' behavior through a cultural change that enhances the social value of policy coordination instead of the dominance of one policy over the other.

Movements towards more transparency help gain more credibility in the central bank's performance and stabilize prices. The actions recently implemented by the Central Bank of Uruguay (i.e., change of monetary policy instrument from controlling money aggregates to fixing short-time interest rate, increase in the frequency of Monetary Policy Committee (COPOM in Spanish) meetings, ongoing de-dollarization strategy, etc.) seem to be in the right direction. Additional efforts have to be taken to get actual transparency (i.e., the value measured by standard indices) closer to perceived transparency (i.e., the individuals' feeling regarding the scope of the central bank's openness). Suppose the majority of the agents believe that the central bank is not transparent. In that case, that belief reduces their confidence in the central bank's commitment to

**According to legal provisions enshrined in the BCU Act (1995), the central bank can hold up to 10 percent of the primary budget of the previous year in public sector debt stock. Simplifying: $(1 - \delta) \frac{iB}{p} = 0.10(T - G)$. For (percentages over GDP) $T - G = -0.3$, $B = 60$ and $i = 2\%$, the point value of δ is 0.975.

fulfilling its promises, affecting inflation expectations negatively and the original central bank's compromise (Bucacos et al. (2021)). The gap between actual and perceived transparency can be reduced by better communicating the central bank's targets, functioning, and achievements and deepening the de-dollarization agenda.

On the fiscal side, a flexible budgetary rule gives the fiscal authority a wedge to respond to unexpected shocks while keeping its political compromise of budgetary responsibility. Fiscal discipline allows the budgetary officer to gain credibility. Consequently, an independent central bank coordinating with a responsible fiscal authority gains social value to keep price stability and improve welfare.

Future research should focus on different channels through which fiscal policy can affect monetary policy (i.e., exchange rates). In addition, the research agenda should inquire if regime shifts exist in the interactions between monetary and fiscal policies. For example, relevant changes have occurred in Uruguay (i.e., subsequent monetary policy instruments, recent implementation of inflation targeting) that could have modified the connections between the central bank and the treasury.

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