MONETARY POLICY REACTION DYNAMICS IN A DEVELOPING ECONOMY: EVIDENCE FOR THE DOMINICAN REPUBLIC

José R. Sánchez-Fung

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This paper investigates the central bank's behaviour in a developing economy through a nominal monetary policy feedback rule (NFR) that embodies an inflation targeting mechanism. Particularly, the Dominican Republic is modelled by allowing the hypothetical NFR to receive feedback from inflation and exchange rate (market and official rates differential) gaps. The findings show that, on average, an 'accommodative' monetary policy was pursued during the period investigated. However, some evidence of monetary tightening in response to adverse developments in the exchange rate indicator is also unveiled.

JEL classification numbers: E52; E58; F41.

Keywords: Nominal monetary policy feedback rule (NFR); 'implicit' inflation targeting; multiple exchange rate markets; Dominican Republic.

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This paper investigates the central bank's behaviour in a developing economy through a nominal monetary policy feedback rule (NFR) that embodies an inflation targeting mechanism. Particularly, the Dominican Republic is modelled by allowing the hypothetical NFR to receive feedback from inflation and exchange rate (market and official rates differential) gaps. The findings show that, on average, an 'accommodative' monetary policy was pursued during the period investigated. However, some evidence of monetary tightening in response to adverse developments in the exchange rate indicator is also unveiled.

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1. Introduction

In spite of the fact that for developing economies the idea of an 'explicit' inflation targeting (IT) framework generates several caveats (See Masson, Savastano, and Sharma, 1997) [1], in practice the central banks of such countries generally aim at preserving price stability, chiefly because they are mandated to do so legally. Therefore, it would be interesting to determine empirically whether or not central banks in such economies behave *as if* they were following an 'implicit' IT monetary policy strategy. For instance, can a nominal monetary policy feedback rule (NFR) that embodies an inflation targeting mechanism approximate historical monetary policy behaviour in a

[1] These provisos are mainly related to the institutional conditions that should 'ideally' be met before a central bank explicitly adopts an inflation targeting monetary policy framework.

developing economy context? This paper will attempt to provide evidence on this idea by investigating the Dominican Republic (DR).

Several questions, which are not only relevant for the DR but for similar economies as well, can be addressed through this methodology. For instance, (a) what is the link between the indicators and targets of the monetary authorities? (b) Is there evidence that the central bank has ‘implicitly’ targeted inflation? (c) What role (if any) have other key variables, such as the exchange rate, played in the monetary authorities' historical behaviour?

In addition to the above arguments, in this context its is worth quoting Mishkin and Savastano (2000, p.3) "Issues central to the understanding of monetary policy such as the nature and duration of the lags from instruments to targets, the main transmission mechanism of monetary impulses, and the identification of monetary policy shocks are largely absent from the Latin America debate, and for a number of countries studies of those issues do not even exist."

It is worth emphasising that the paper's objective *is not* to substantiate the existence of a formal IT strategy in the DR, with all its implications, as described by, for example, Mishkin (2000). *A priori* we know it is not the case. The basic intuition behind the proposed framework is that shifts in an indicator of monetary policy should be associated with the developments over time in the (implicit) targets of a central bank's authorities, i.e. a *positive*, rather than a *normative*, exercise.

The analysis developed in this investigation is based on a mechanism that considers the behaviour of the monetary authorities only incorporating nominal variables. Therefore, this 'indicator model' approach is expected to shed light on the approximate intentions of the CBDR, rather than on their *exact* policymaking procedures, as reflected through variations of an intended inflation indicator with respect to key macroeconomic variables. In other words, the paper deals with an *operational* issue.

Finally, it is worthy of note at the outset that the level of inflation in the DR has been historically mild, averaging 13.50% per annum during the period to be considered below. This last fact is important given that the proposed analysis would be more difficult to motivate in the context of a high and variable rate of inflation.

What remains of the investigation is organised as follows. Section 2 elucidates the economic intuition behind the nominal feedback rule (NFR) to be employed. Section 3 describes the data set at hand, and rationalises the econometric specification opted for. The outcomes of the empirical modelling are evaluated in section 4. Section 5 conveys final remarks on the paper's findings.

2. A nominal monetary policy indicator model for the Dominican Republic

In formulating a suitable a nominal monetary policy feedback rule (NFR) for the DR the research considers a 'generic' mechanism of the form

$$\Delta z_t = \delta_0 + \Delta(z - y)_{\langle t|t-1\rangle} + \delta_1 (y - y^*)_t \,. \qquad (1)$$

In equation (1), which expresses all the variables in logs, z is a policy instrument or intermediate target assumed to be controllable by the monetary authorities; y and y^* are the hypothesised nominal target and its reference value, respectively; δ_0 is the baseline rate of growth of the nominal target; δ_1 is a feedback parameter which indicates how swiftly the monetary authorities respond to gaps between the actual and desired levels of the nominal target variable; and $\Delta(z-y)_{\langle t|t-1\rangle}$ is a forecast of the relationship amongst the nominal target and the instrument. Throughout the paper Δ denotes the difference operator.

In a particular application of a NFR like (1), Duecker and Fisher (1996) incorporate open economy features to analyse Switzerland's monetary policy. Specifically, the authors allow for the possibility of central bank reactions to the nominal exchange target rate. An analogous specification would also seem to be appropriate for the analysis of the DR's monetary policy[2]. Although the CBDR has, by law, several mandates, one of its objectives is to preserve internal price stability. Specifically, the cardinal goals of the CBDR are to promote and maintain monetary, exchange rate, and credit conditions that help sustain the purchasing power of the Dominican Peso (DR$), internal price stability, and economic growth [3].

Additionally, in the light of the fact that the DR has for a long time had a multiple exchange rate regime[4], some sort of exchange rate indicator should be one of the (implicit) targets considered in a hypothetical NFR. In the light of the above arguments, the feedback equation to be analysed for the DR is

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[2] A major advantage of a NFR is that it does not depend on real aggregate economic activity variables. Such variables, notably for the case of developing economies, are sometimes not available at relatively high (quarterly or monthly) frequencies, and/or are wrongly measured.

[3] See the CBDR's website (http://www.bancentral.gov.do/) for further particulars.

[4] The system is composed of the official, banking system, and extra-banking system (parallel-black) exchange rate markets. Additionally, at the moment around 15% of the total volume of foreign exchange transactions are subject to CBDR surrender requirements, the rest are handled through the private (banking plus parallel) market. Throughout, the paper refers to the exchange rate of Dominican Republic Pesos (DR$) per United States Dollars (US$), since the US is by far the DR's main trading partner.

$$\Delta m_t = \delta_0 + \Delta(m-p)_{\langle t|t-1\rangle} + \delta_1(\pi-\pi^*)_{t-1} + \delta_2(e^m - e^o)_{t-1}. \qquad (2)$$

In (2) Δm_t is the rate of change of a nominal monetary aggregate assumed to be an *intermediate target* manipulated by the central bank (See B. Friedman, 1990); $\Delta(m-p)_{\langle t|t-1\rangle}$ is a forecast of the real demand for the monetary aggregate in question, included to infer the 'intended' inflation rate of the monetary authorities; $(\pi-\pi^*)_{t-1}$ and $(e^m - e^o)_{t-1}$ are the inflation gap (e.g. Svensson, 1997) and the black market and the official exchange rates differential, respectively, where π, π^*, e^m and e^O are the actual and target inflation rates, and the market and official exchange rates, respectively[5].

Additionally, in (2) δ_0, δ_1, and δ_2 are coefficients to be estimated empirically. The behaviour of the feedback coefficients δ_1 and δ_2 is crucial, given that they indicate how quickly inflation and exchange rate gaps are dealt with by the monetary authorities. Remarkably, the reader should perceive that when both such gaps are closed the model amounts to a period by period targeting of the long run inflation rate δ_0.

The use of a monetary aggregate as a monetary policy indicator in (2) deserves to be highlighted. Such a decision arises mainly due to the fact that monetary policy instruments frequently employed in developed countries, e.g. interest rates (Bernanke and Blinder, 1992), are less likely to be implemented in developing economies, given their unique transmission mechanism of monetary policy (Montiel, 1991). For instance,

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[5] Note that $(\pi-\pi^*)$ is a *growth-rate* target, which for an economy like the DR seems to be more appealing than a *growing-levels* target, e.g. $(p-p^*)$; π^* and p^* are reference values of the inflation rate and the price level, respectively. See McCallum (1999) for a discussion on *growth-rate* versus *growing-levels* targets.

in the DR ceilings were imposed on market interest rates until the beginning of the 1990s[6].

It is worth emphasising that the *crucial target* in (2) is ($e^m - e^o$), a differential the authorities would want to keep as small as possible. The larger is ($e^m - e^o$) the higher is the probability of a collapse of the official exchange rate regime; $\delta_2 < 0$ would be observed *if* the authorities are willing to defend the official rate from bubbles, speculative attacks, or other non-real factors[7]. Such an outcome could be generated mainly by depletion of foreign reserves (e.g. Lizondo, 1987; Sarno and Taylor, 2001), but could also be paired with a reduction in domestic credit (i.e. a contraction of the monetary base), in order to reduce liquidity[8]. However, under adverse, real, circumstances, it is difficult (if not impossible) to keep indefinitely an overvalued currency (See Garber and Svensson, 1995).

[6] Young et al (2001) provide a concise description of financial repression in the DR, which was considerable until the wide-ranging economic reforms undertaken at the beginning of the 1990s. Note, however, that even after the above mentioned liberalisation process the financial underdevelopment of the DR, the oligopolistic structure of its commercial banking system, and the (probably) limited credibility of the monetary authorities with the general public thwart the effectiveness of any interest rate based instruments.

[7] Therefore, ($e^m - e^o$) could be seen as a criterion economic agents employ in determining how ‘credible’ the exchange rate system is at each point in time.

[8] Note that a contraction in the monetary base is intuitively equivalent to an increase in the interest rate.

## 3. `	Data and specification

3.1. Data

The empirical analyses to be carried out below employ a monthly data set ranging from 1969.6 to 2000.12. The source of all the statistical information is the Central Bank of the Dominican Republic. Hereafter, m is the log of nominal $M2$, originally expressed in millions of Dominican Republic Pesos (DR$)[9]. Being the broadest measure of money calculated for the DR, nominal $M2$ appears to be a suitable candidate for the analysis[10]. The other variables employed in the study are the log of the consumer price index (p), the log of the 'parallel' exchange market nominal (sell) rate (e^m), and the log of the 'official' exchange market nominal (sell) rate (e^o). Both exchange rates are expressed as DR$ per US$, so that an increase in e is a depreciation and a decrease an appreciation. Additionally, $\Delta m_t = m_t - m_{t-12}$, and $\pi_t = p_t - p_{t-12}$, i.e. annual money growth and inflation rates, respectively.

The paper estimates the variables $\Delta(m-p)_{\langle t|t-1\rangle}$, and π^*. The first one is a technical approximation to the internal predictions a central bank is supposed to generate and use when designing its policy, while the second stands as a proxy for the expected inflation rate[11]. In generating both variables the methodology elucidated by Koopman et al (2000) is put to use. Chiefly, the approach involves the estimation of a

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[9] The measure of $M2$ comprises money and coins in circulation, sight deposits in commercial banks and the central bank, and savings plus long-term deposits in commercial banks.

[10] At this point it is useful to note that previous studies have provided evidence of money demand stability for the case of the DR, which is an important issue for the exercise at hand. To obtain a broad picture on the matter see Nadal De-Simone (2001), which models both $M1$ and $M2$ using monthly data.

'structural time series model', from which a data sequence is generated for all the points in the given sample through the application of a *Kalman filter*. It is crucial to pay attention to the fact that in producing the afore-mentioned series only information available up to the period $t-1$ is utilised.

3.2. A dynamic specification

The evaluation of the data introduced in the previous section is based on the estimation of a general dynamic time series econometric model of the form

$$[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_t = \delta_0 + \sum_{i=1}^{12}\{\phi_i[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-i} + \delta_{1i}(\pi-\pi^*)_{t-i}$$

$$+\delta_{2i}(e^m - e^0)_{t-i}\} + \varepsilon_t. \tag{3}$$

Equation (3) is an autoregressive distributed lag (ADL) specification of order twelve[12], which assumes that the central bank does not react to contemporaneous economic developments, i.e. a *dead-start* (or structural) time series model (Hendry, Pagan, and Sargan, 1984).

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[11] It has to be pointed out that the CBDR has not historically made this type of forecasts publicly available in a timely and consistent fashion.

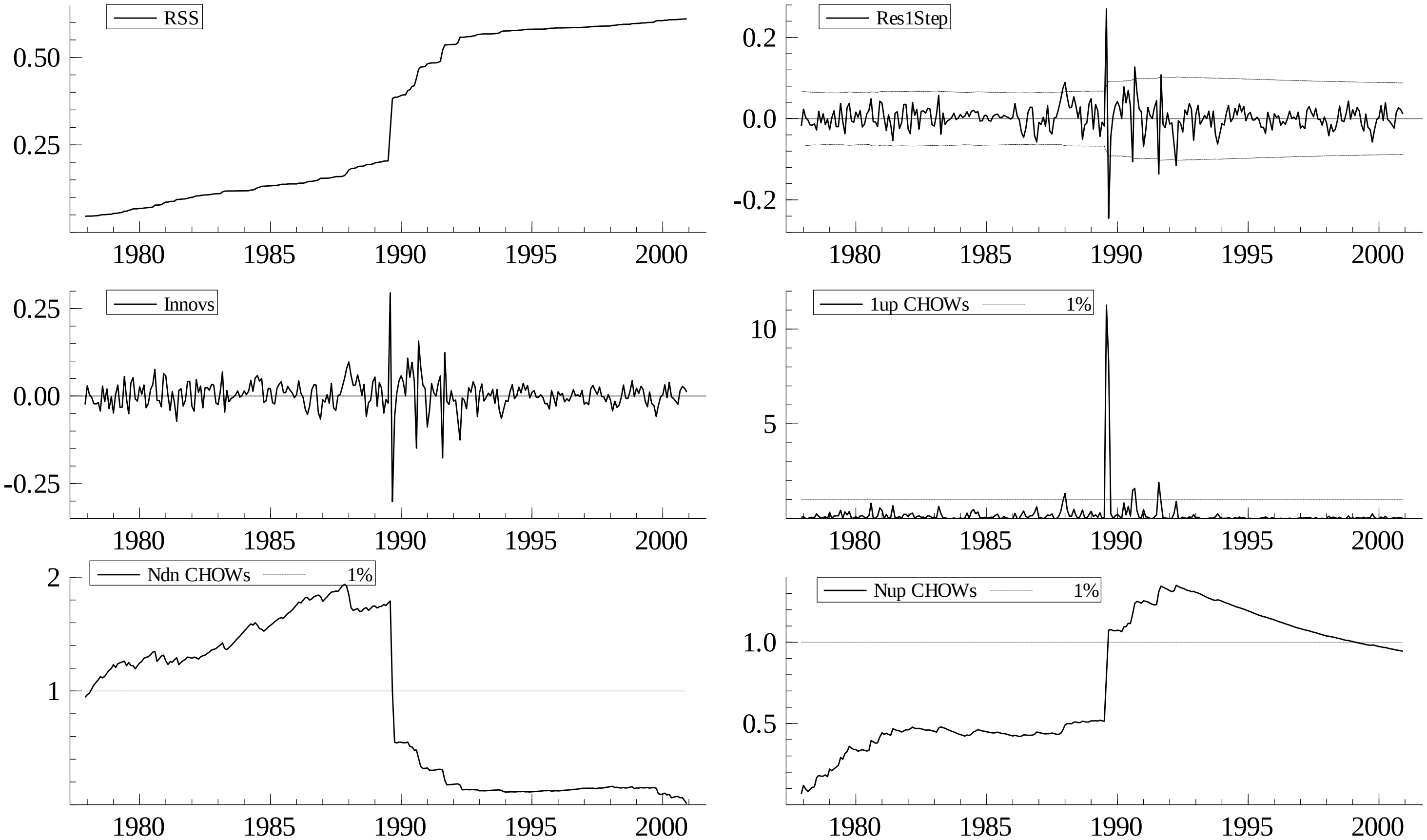
[12] This account for the (probably) long lags involved (inertia) in the transmission of impulses from key economic variables to the monetary authorities' policy instrument or indicator.

4. Empirical analyses

4.1. 1971.8-2000.12

All the OLS regressions to be presented below start from a dynamic specification like (3), and are sequentially reduced using the criteria of a general to specific modelling approach (See Hendry, 1995). The results displayed are those corresponding to the final preferred equations. The corresponding initial general models are contained in Table 1. The inquiry begins with the estimation of (3) for the period 1971.8-2000.12. The results, reported in Table 1, fail a series of diagnostic statistics. The corresponding recursive graphical analyses, displayed in Figure 1, also hint at regime shifts in the sample period (See Doornik and Hendry, 2001, for details on these tests). A possible cause of the imprecision of the above mentioned estimates is that the period 1971.8-2000.12 encompasses different monetary policy regimes. So, trying to fit a regression for the whole sample is not feasible.

Figure 1 NFR general dynamic model recursive evaluation statistics, 1971.8-2000.12



One way to proceed is to identify the different monetary policy regimes encapsulated within the sample under study (e.g. Judd and Rudebusch, 1998). The most plausible way of doing so is by delimiting the economic and institutional events driving the data set under evaluation, to which end the behaviour of the variables involved in the study should provide useful insights.

Figures 2 and 3 portray the joint graphs of Δm and $\Delta(m-p)_{\langle t|t-1\rangle}$, and of $(e^m - e^o)$ and π, respectively, for the full time span under consideration. At least four different regimes can be discerned by evaluating the Figures.

1) 1971.7-1984.12: lapse of a fixed official exchange rate regime, which led to a series of agreements with the IMF in January 1983, September 1984, and January 1985.

2) 1985.1-1988.6: period between the first devaluation of the official exchange rate in January 1985, its flotation, imposition of restrictions on the foreign exchange market by the CBDR, and subsequent re-fixing of the official rate in July 1988.

3) 1988.7-1991.8: span comprising the re-fixing of the official exchange rate and the stabilisation agreement signed with the IMF in August 1991.

4) 1991.9-2000.12: ranges from the 1991 agreement with the IMF to the year 2000 (See Young, 2001, for details on various institutional changes that have taken place in the DR during this last period.).

On the above sub-periods, it is also interesting to note that the transition pattern discerned from periods 1) to 2) to 3) is nicely described in Garber and Svensson (1995). Particularly, they outline the events that are usually observed before and after an exchange rate crisis. Quoting Garber and Svensson (1995, pages 1891-1892) in full "A salient feature of fixed exchange rate regimes is their inevitable collapse into some other policy regime. The collapse is frequently spectacular - extraordinary large interventions into foreign exchange markets and losses by central banks… and a period of turbulent floating in a transition to the new regime."

In what follows the strategy of the paper is to analyse individually these economically *and* institutionally determined regimes.

Figure 2 Δm **and** $\Delta(m-p)_{\langle t|t-1\rangle}$**, 1970.6-2000.12**

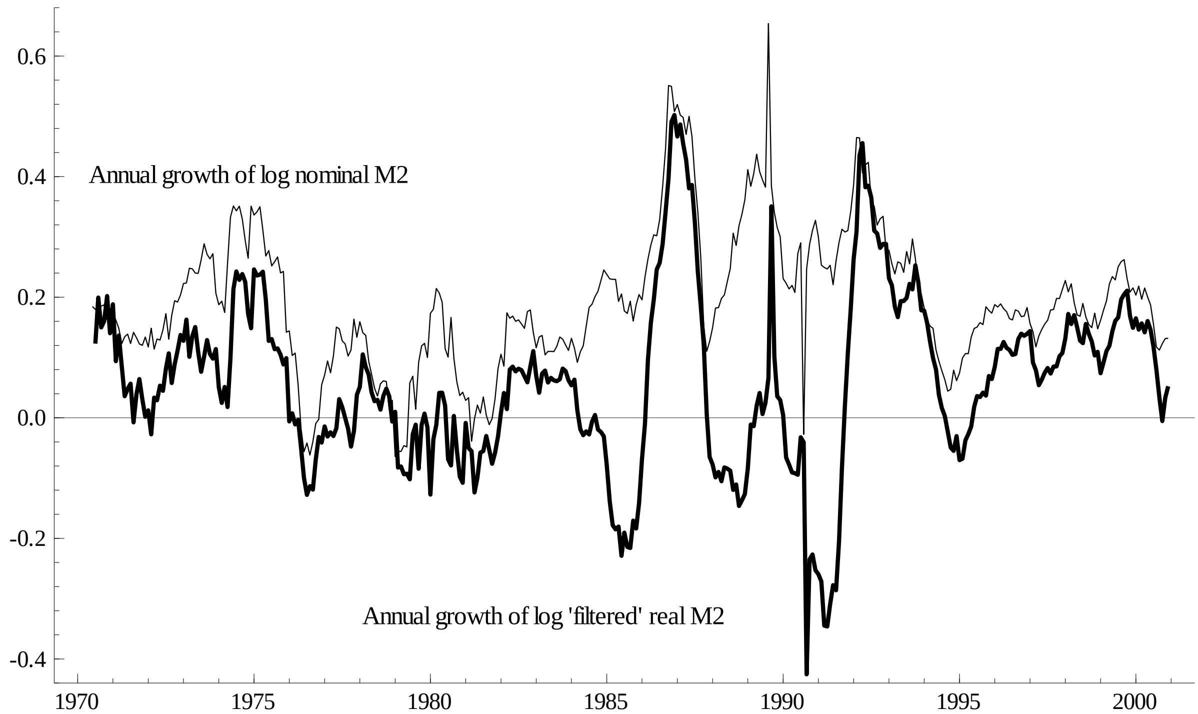


Figure 3 π **and** $(e^m - e^o)$**, 1970.7-2000.12**

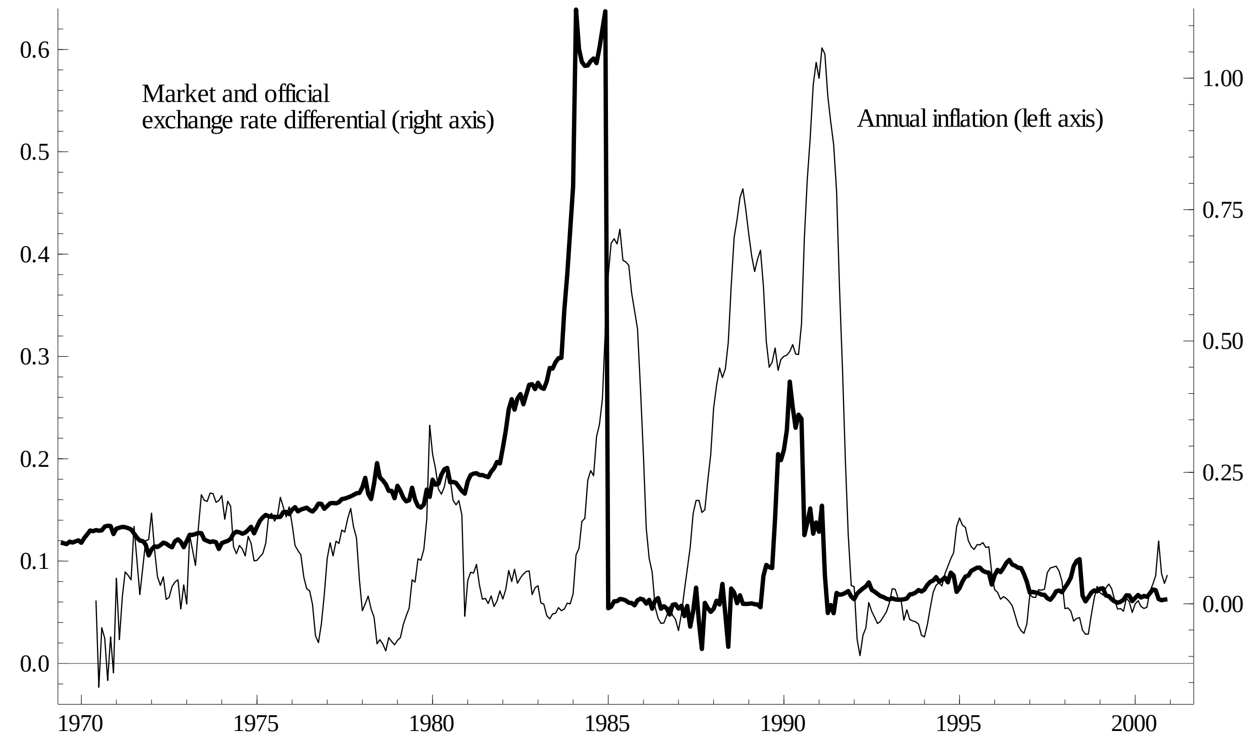


Table 1 OLS estimations of general dynamic models for the NFRs for the Dominican Republic

Coefficients	Lags											
	1	2	3	4	5	6	7	8	9	10	11	12
Model 1: 1971.7-2000.12												
ϕ	0.13**	0.26**	0.28**	0.21**	0.12*	0.13*	0.14*	0.03	-0.004	0.07	0.03	-0.47**
δ_1	0.75**	0.97**	1.19**	0.91**	0.64**	0.61**	0.62**	0.34*	0.31*	0.10	0.12	-0.11
δ_2	-0.005	0.01	-0.02	0.04	-0.04	0.02	0.003	-0.02	0.03	-0.03	-0.001	0.020
Model 2: 1971.8-1984.12												
ϕ	0.22**	0.18*	0.25**	0.13	-0.02	0.13	0.11	0.03	0.14	0.04	0.12	-0.54**
δ_1	0.81**	0.87**	1.00**	0.61**	0.53**	0.51*	0.42*	0.33	0.32	0.13	0.20	-0.29*
δ_2	-0.07	-0.002	0.07	0.09	-0.04	-0.06	0.01	0.04	0.06	-0.01	-0.17	0.07
Model 3: 1985.1-1988.6												
ϕ	1.04**	-0.06	0.38	-0.45*	-	-	-	-	-	-	-	-
δ_1	1.26**	-1.04*	0.39	-0.58	-	-	-	-	-	-	-	-
δ_2	-0.05	0.01	-0.006	0.05	-	-	-	-	-	-	-	-
Model 4: 1988.7-1991.8												
ϕ	-0.19	0.12	0.47*	0.41	-	-	-	-	-	-	-	-
δ_1	-0.31	0.86	2.49*	1.25	-	-	-	-	-	-	-	-
δ_2	-0.98*	0.38	0.0004	0.40	-	-	-	-	-	-	-	-
Model 5: 1991.9-2000.12												
ϕ	0.37**	0.23	0.20	0.15	0.17	-0.05	-0.08	0.15	0.007	-0.05	0.04	-0.26**
δ_1	0.66**	0.74**	0.38	0.94**	0.75**	0.04	0.42	0.43	0.18	-0.18	0.10	0.02
δ_2	-0.11	0.13	0.12	-0.18	0.03	-0.31	0.73**	-0.46	-0.08	0.08	0.16	0.13

Model evaluation statistics

Statistics	Model 1	Model 2	Model 3	Model 4	Model 5
$AR-F(\cdot,\cdot)$	1.0313	2.1855*	0.4601	0.42254	0.6576
$Arch-F(\cdot,\cdot)$	24.316**	0.5500	0.3794	0.2078	0.3340
$Norm-\chi^2(\cdot)$	540.01**	4.9097	5.1064	6.3766	0.0306
$RESET-F(\cdot,\cdot)$	0.2844	4.3567*	2.7236	0.1243	3.582

Notes on Table 1: (1) All the variables involved in the analysis are stationary. The corresponding ADF unit root test statistics are: $\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}$ = -3.971** (1971.8-2001.12); $(e^m - e^o)$ = -3.685** (1970.7-2000.12); $(\pi - \pi^*)$ = -8.861** (1971.9-2001.12), where ** denotes rejection of the unit root hypothesis at the 1% level. (2) Due to data limitations, for Models 3 and 4 the general modelling starts with four lags of each variable. (3) The model evaluation statistics are described in Table 2. The values of the test statistics are displayed. (4) ** and * denote significance of a coefficient/failure of a test at the 1% and 5% levels, respectively. See Doornik and Hendry (2001) for further details on the test statistics.

4.2. 1971.7-1984.12

The parsimonious equation for the first period is

$$[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_t = 0.027^{**} + 0.26^{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-1} + 0.27^{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-2}$$

$$+ 0.28^{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-3} + 0.17^{*}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-4} + 0.11^{*}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-7}$$

$$- 0.38^{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-12} + 0.88^{**}(\pi - \pi^*)_{t-1} + 0.74^{**}(\pi - \pi^*)_{t-2} + 0.85^{**}(\pi - \pi^*)_{t-3}$$

$$+ 0.38^{*}(\pi - \pi^*)_{t-4}. \qquad (4)$$

$$T = 162[1971.7 - 1984.12];\ AR1-7F(7,144) = 1.89[0.074];$$
$$Arch7F(7,137) = 1.1795[0.31];\ Norm\chi^2(2) = 2.04[0.36];\ HetF(20,130) = 0.85[0.65];$$
$$FuncHetF(65,85) = 0.57[0.99];\ RESETF(1,150) = 5.89^{*}[0.02];$$
$$Lags1-12F(10,151) = 37.89^{**}[0.00].$$

Equation (4) displays adequate results. Statistically, all the diagnostic tests are passed (with the exception of the failure of the *RESET* test). [Table 2 provides an explanation of the diagnostic statistics reported in (4) and the equations to follow.] Also, all the coefficients in (4) are significant. Hereafter * and ** indicate that a coefficient is significant at the 1% and 5% levels, respectively.

Table 2 Description of the model evaluation statistics

Statistic	Test description
$AR-F(\cdot,\cdot)$	Residual serial correlation.
$Arch-F(\cdot,\cdot)$	Autoregressive conditional heteroscedasticity.
$Norm-\chi^2(\cdot)$	Normality.
$Het-F(\cdot,\cdot)$	Heteroscedasticity.
$HetFunc-F(\cdot,\cdot)$	Heteroscedasticity/functional form test.
$RESET-F(\cdot,\cdot)$	Ramsey's functional form mis-specification test.
$Lags-F(\cdot,\cdot)$	Tests the significance of all lags included in a given equation..
$Wald-\chi^2(\cdot)$	Tests the null that the solved long-run coefficients of an equation are zero.

Notes on Table 2: the null distribution of the tests is given by $\chi^2(\cdot)$ or $F(\cdot,\cdot)$, where the degrees of freedom are inside parentheses. Throughout the main text ** and * denote failure of a diagnostic statistic at the 1% and 5% levels, respectively. See Doornik and Hendry (2001) for further details on these tests.

Equation (4) is a nominal feedback rule (NFR) in which only the inflation gap matters to the monetary authorities, embodying a long-run inflation target δ_0 of 10% (the corresponding test on the validity of the solved long-run coefficients is $Wald\chi^2(1)=7.36^{**}[0.006]$). Interestingly, such a NFR implies a *lean with the wind* policy was followed during the 1971 to 1984 period, i.e. a positive impact of an inflation gap on the intended inflation rate of the monetary authorities. While somewhat surprising, it is not an unreasonable reflection of developments in the DR.

This period was characterised by several episodes. From 1970-1973 GDP grew at an average annual rate of 11.16%, mainly led by the government's construction of physical infrastructure; and the economy was relatively stable, in part because of the favourable export commodity prices. Consequently, there was not much pressure on the exchange rate market. In contrast, the second part of the 1970s witnessed the world-wide increases in oil prices, and not so favourable export prices. The satisfactory rate of

GDP growth witnessed in the early 1970s could not be sustained in this new, adverse, environment. The government reacted by increasing public spending, financed by both external and domestic (mainly monetary) sources.

By the early 1980s the adverse world financial conditions for indebted developing countries were imminent. Additionally, since the DR's production is highly dependent on foreign inputs, the exchange rate regime that prevailed at the time could not survive very long. This situation was exacerbated by the huge gap that was allowed to develop between the market and official exchange rates in the period leading up to 1985, as can be perceived by inspecting Figure 3, and which is also reflected in the absence (as dictated by the model reduction process) of $(e^m - e^o)$ from equation (4). This saga ended with the country having to sign three agreements with the IMF (in January 1983, September 1984, and January 1985), and with the first devaluation of the official exchange rate in January 1985 (See Coutts et al, 1986, for a detailed analysis of this period).

4.3. 1985.1-1988.6

In contrast to the rest of the monetary policy regimes investigated, the one corresponding to the 1985.1-1988.6 could *a priori* be expected to result in a NFR that does not allows for feedback from the exchange rate gap. The reason for this restriction is that the official exchange rate was flexible, virtually floating, during this period (see Figure 2). This policy change was mainly a by-product of a series of stabilisation agreements the DR signed with the IMF in January 1983, September 1984, and January 1985, as noted above.

The final estimated NFR for this regime is

$$[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_t = 1.01^{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-1} + 1.05^{**}(\pi - \pi^*)_{t-1}. \qquad (5)$$

$$T = 42[1985.1-1988.6];\ AR1-7F(7,33) = 0.92[0.49];\ Arch7F(7,26) = 1.00[0.45];$$
$$Norm\chi^2(2) = 0.78[0.68];\ HetF(4,35) = 0.44[0.78];\ FuncHetF(5,34) = 0.44[0.82];$$
$$RESETF(1,39) = 2.35[0.13].$$

Equation (5) passes a battery of diagnostic statistics. Additionally, the estimated coefficients are significant at the 1% level. The NFR for the post-1985 period is a compact one that allows for feedback from the inflation gap, and smoothing of the intended inflation rate. (5) implies that the reaction of the central bank's authorities to a rise in the inflation gap is positive, albeit milder than for the regime analysed previously. During this period the government's substantial construction programme was largely financed by the Central Bank.

A further interesting point to note is that throughout 1985.1-1988.6 the CBDR had three different Governors (an average of 14 months in office for each Governor), a direct consequence of the government's control of the institution. Cukierman (1992, Chapter 20) has investigated the importance of this institutional setting on central bank performance. Particularly, this author analyses the relationship between the *governors' turnover rate* and inflation. In Cukierman's inquiry the governors' turnover rate is one of the proxies used to capture the extent of central bank independence (CBI) in developing countries, since legal independence proved to be a bad measure of CBI. Cukierman finds that higher independence (i.e. a *lower* governor turnover rate) leads to lower inflation (See also Cukierman et al, 2002). *Prima facie*, the implicit turnover rates for the DR (which is not included in Cukierman's sample) seem to be much higher than the average found in Cukierman's (1992) work. Notably, in a sample of over fifty developed and developing countries, Cukierman finds that the highest average turnover rate was that of Argentina, with an average tenure of fifteen months.

Finally, the lack of an explicit reaction of the monetary authorities to $(e^m - e^o)$ in equation (5) is rationalised by the fact that during the span in question the CBDR tried to influence the behaviour of the foreign exchange rate market chiefly through foreign exchange rationing policies, rather than by actively attempting to manipulate (reduce) the amount of money in circulation.

4.4. 1988.7-1991.8

From June 1988 onward the official exchange rate was fixed again. The corresponding estimated NFR can be written as

$$[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_t = 0.25{**} + 0.51{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-3} + 2.47{**}(\pi - \pi^*)_{t-3}$$

$$-0.34{*}(e^m - e^o)_{t-1}. \tag{6}$$

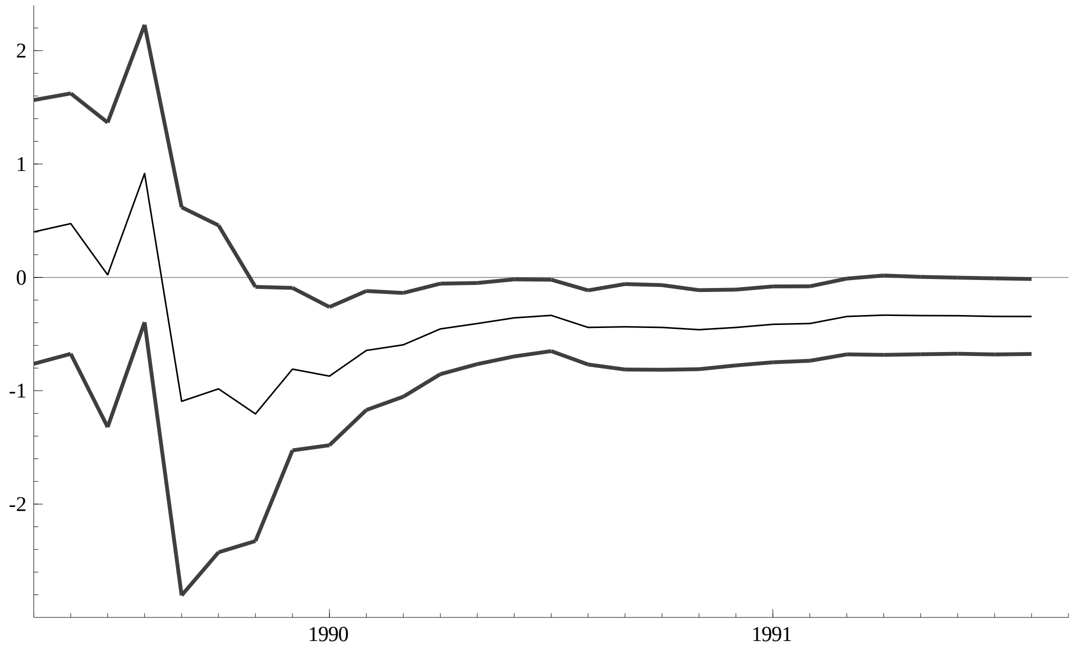
$T = 38[1988.7-1991.8]; AR1-3F(3,31) = 1.60[0.21]; Arch3F(3,28) = 0.89[0.46];$
$Norm\chi^2(2) = 4.04[0.13]; HetF(6,27) = 1.66[0.17]; FuncHetF(9,24) = 1.14[0.37];$
$RESETF(1,33) = 2.60[0.12]; Lags1-3F(3,34) = 6.95{**}(0.00).$

All the diagnostics tests and coefficient values related to (6) are appropriate. Equation (6) suggests that the monetary authorities reacted positively to both the lagged dependent variable and the inflation gap on a quarterly basis. Also, and in contrast to the regimes analysed up to now, the coefficient affecting the exchange rate differential is negative and significant, as could be expected.

Figure 4 provides further evidence on the matter by displaying the recursively-estimated coefficient of $(e^m - e^o)$. Note that both the coefficient and error bands consistently lie in the negative region during most of the regime under scrutiny. This outcome could be interpreted as evidence that the authorities manipulated its conjectured indicator variable in response to deviations of the parallel exchange rate from the official one. Given the instability in the exchange rate market during 1985.1-1988.6, the evidence that the authorities allowed for feedback from $(e^m - e^o)$ in the subsequent period is economically compelling, notably as a signal of the CBDR's willingness to consolidate its eroded reputation (e.g. Bertocchi and Spagat, 1993).

Furthermore, note that the evidence on the reactions to the exchange rate variable in this regime is in harmony (in the sense that developments in the exchange rate market appear to have become more important) with the exchange rate regime classification for this period presented by Reinhart and Rogoff (2002). Specifically, for the exact period from February 1988 to August 1991 Reinhart and Rogoff classify, using a statistical procedure, the DR's exchange rate regime as *free falling*. Free falling is defined by the authors as a classification for countries that display a twelve-month rate of inflation of more than 40%. Remarkably, the DR experienced the highest inflation in its modern history during this period, as can be seen in Figure 3.

Figure 4 Recursive estimate of $\delta_{2,t-1} \pm 2S.E.$ for 1988.7-1991.8



In spite of the above findings the 1988.7-1991.8 regime was problematical. The highest inflation rate in the history of the DR was registered in 1990 (See Figure 3), and a stand-by agreement with the IMF was approved in August 1991. A major private banking sector crisis at the end of the 1980s, the high oil prices of 1990 (mainly a result of the Gulf War), and recurrent government deficits are amongst the main causes of these events. The upshot of all these incidents is reflected in an estimated monthly (-annualised) long-run inflation target δ_0 of roughly 25% for this period, the highest significantly estimated for any of the regime sub-samples.

4.5. 1991.9-2000.12

The last period to be evaluated ranges from the 1991 macroeconomic stabilisation agreement with the IMF to the year 2000. The empirical assessment of a NFR like (3) for this interval leads to the following equation

$$[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_t = 0.48{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-1} + 0.30{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-2}$$

$$+0.26{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-4} - 0.18{**}[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]_{t-12} + 0.68{**}(\pi-\pi^*)_{t-1}$$

$$+0.76{**}(\pi-\pi^*)_{t-2} + 0.79{**}(\pi-\pi^*)_{t-4} + 0.63{**}(\pi-\pi^*)_{t-5} + 0.59{**}(\pi-\pi^*)_{t-7}$$

$$+0.26{**}(e^m - e^o)_{t-12}. \tag{7}$$

$$T = 112[1991.9-2000.12];\ AR1-7F(7,95) = 1.77[0.10];\ Arch7F(7,88) = 0.41[0.89];$$
$$Norm\chi^2(2) = 1.32[0.52];\ HetF(20,81) = 1.30[0.20];\ FuncHetF(65,36) = 0.85[0.72];$$
$$RESETF(1,101) = 0.97[0.32];\ Lags1-12F(10,102) = 168.22{**}[0.00].$$

All the tests applied to (7) are passed with ease. The regression equation displays a rich lag structure with declining coefficient weights affecting both $[\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle}]$ and $(\pi-\pi^*)$, and a positive coefficient corresponding to the previous year's exchange rate gap.

There could be at least two, non-competing, economic interpretations for this exchange rate coefficient. It is well documented that the DR undertook major economic reforms and stabilisation policies starting in the 1990s, basically as a response to the misfortunes of the 1980s (See Young, 2001; Prazmowski, 2002). Amongst these reforms there was a move to an implementation of monetary policy through more indirect instruments, namely via *Certificates of Participation* of the Central Bank of the Dominican Republic.

Henceforth, the first explanation for the positive coefficient affecting the exchange rate gap could be that even though the monetary authorities might have reacted to adverse exchange rate developments, say by issuing *Certificates of Participation*, they were not successful in preventing a *pass-through* to internal prices. Also note that the coefficient in question is relatively low (0.26), supporting this rationalisation. In digesting this argument the reader should recall that the central bank can stir its indicator, but cannot perfectly control it.

A second, non-competing, plausible explanation of the phenomena at hand could be the impact of the rate of the *Certificates of Participation* on the term structure of interest rates, and finally on inflationary expectations (See, for instance, the analysis of Tzavalis and Wickens, 1996, on forecasting inflation via the term structure). Note that a higher $(e^m - e^o)$, or higher depreciation expectations ($\dot{e}^m$), triggers a response from the monetary authorities, which, during the 1990s, was in many cases translated into open market operations in the form of *Certificates of Participation* issued at attractive rates in relation to the prevailing market rates. The resulting higher interest rates are expected to curtail depreciation expectations ($\dot{e}^m$), although probably only in the short run. It could be argued that these higher rates altered the term structure of the market rates and increased the inflationary expectations embodied in such a structure. The outcome of this process is reflected in the intended inflation measure contained in the NFR which, as noted above, can be stirred *but not* perfectly controlled by the monetary authorities.

The reader should bear in mind that the above arguments are not intended to furnish (by themselves) a rationalisation of the phenomena at hand, which could probably be illuminated by the consideration of alternative approaches in future studies.

5. Concluding remarks

This paper inquires into the historical behaviour of the Dominican Republic's monetary authorities by employing a hypothetical nominal monetary policy feedback rule that incorporates an implicit inflation targeting mechanism, using a monthly data set ranging from 1969.6 to 2000.12. The results of the investigation suggest that the Central Bank of the Dominican Republic (CBDR) has, on average, pursued accommodative policies. This *lean with the wind bias* throughout the sample period investigated is particularly evident from the coefficients of the general models reported in Table 1.

The outcome of the empirical exercises is sensible, notably given the degree of dependence the CBDR has historically had on the government's requirements. Consequently, the fact that responses akin to those of an implicit inflation targeting regime cannot be consistently found should be considered in the light of the rules versus discretion debate (Kydland and Prescott, 1977), and of the copious literature on central bank (non) independence (e.g. Alesina and Summers, 1993). A signal of the relevance of such topics for the case at hand is the fact that the DR succeeded in dealing with the two most serious episodes of high inflation and unrest in the exchange rate market (both observed around 1985 and 1990) only by agreements with the IMF, i.e. through an externally imposed commitment.

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