

WP/04/29

IMF Working Paper

Inflation Dynamics in the Dominican Republic

Oral Williams and Olumuyiwa S. Adedeji

IMF Working Paper

Western Hemisphere Department

Inflation Dynamics in the Dominican Republic

Prepared by Oral Williams and Olumuyiwa S. Adedeji¹

Authorized for distribution by Guy Meredith

February 2004

Abstract

This Working Paper should not be reported as representing the views of the IMF.

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper investigates the determinants of inflation in the Dominican Republic during 1991–2002, a period characterized by remarkable macroeconomic stability and growth. By developing a parsimonious and empirically stable error-correction model using quarterly observations, the paper finds that inflation is explained by changes in monetary aggregates, real output, foreign inflation, and the exchange rate. Long-run relationships in the money and traded-goods markets are found to exist, but only the disequilibrium from the money market exerts a significant impact on inflation.

JEL Classification Numbers: E5, F41

Keywords: Inflation, Cointegration, Error-Correction

Author's E-Mail Address: owilliams2@imf.org and oadedeji@imf.org

¹ We acknowledge and thank P. Cashin, H. Leon, E. Kalter, G. Meredith, and José Roberto Sánchez-Fung for providing useful comments and suggestions. All remaining errors are attributed to the authors.

Contents	Page
I. Introduction.....	3
II. Institutional Framework and Macroeconomic Developments.....	4
A. Structure and Operation of Foreign Exchange Markets	4
B. Institutional Framework for Conduct of Monetary Policy	5
C. Evolution of Inflation.....	6
D. Evolution of Broad Money and Exchange Rate	7
III. Analytical Framework	7
A. Long-Run Relationships	7
B. Modeling Inflation	9
IV. Empirical Analysis.....	9
A. Data	9
B. Estimation	10
C. Unit Root Tests	10
D. Money Market.....	11
E. Traded-Goods Market.....	14
F. Error-Correction Model for Inflation.....	16
V. Conclusion	18
References.....	19
Figures	
1. Dominican Republic: Broad Money, Inflation, and Exchange Rate, 1991–2002	6
2. Dominican Republic: Data in Levels and First Differences, 1991–2002	12
3. Actual and Predicted Inflation, 1991–2002	18
Tables	
1. Unit Root Tests	11
2. Cointegration Analysis of Money Market	11
3. Money Market Tests for Weak Exogeneity	14
4. Cointegration Analysis of the Traded-Goods Market.....	15
5. Traded-Goods Market Tests for Weak Exogeneity	15
6. Inflation Equation Estimates.....	17

I. INTRODUCTION

For most of the 1990s, the Dominican Republic experienced robust economic growth, declining unemployment rates, low inflation, and a generally manageable external position. In the second half of the decade, the Dominican Republic ranked among the world's fastest-growing economies, with standout performances in construction, telecommunications, tourism, and free-trade exports. The ratio of public external debt to GDP fell markedly, from over 70 percent at the beginning of the decade to about 20 percent by the end of the decade.

This picture contrasts dramatically with the country's poor economic performance during the 1980s owing to a combination of severe monetary and fiscal imbalances, pervasive price controls, financial sector rigidities, multiple currency practices, and an extremely restrictive trade regime (see Young and other, 2001). As a result of a series of wide-ranging stabilization and structural reforms, macroeconomic stability was restored and sustained throughout most of the 1990s. This period was characterized by single digit inflation despite a prolonged period of sustained rapid growth and the buffeting of the economy by a series of external shocks—an oil price shock in 2000, the September 11 terrorist attacks, and the global economic slowdown in 2001. Toward the end of 2002, a banking crisis emerged and became full blown in 2003, resulting in macroeconomic instability, which was characterized by a large rundown in government deposits, a significant fall in net international reserves, and a substantial depreciation in the value of the peso. An analysis of the factors leading to this banking crisis and its effects on inflation, although appealing, is beyond the scope of the current study.

This paper models and explains inflation in the Dominican Republic during the period 1991–2002. The period of investigation was characterized by a number of policy changes and external shocks that could have affected inflation. Hence, finding an empirically stable and parsimonious model that describes the evolution of the Dominican Republic's inflation represents a major challenge.

The study builds on empirical work on the Dominican Republic done by Sánchez-Fung (1999) and Tanner (2001), who investigated the validity of purchasing power parity (PPP) in explaining price developments, while Nadal-De Simone (2001) and Carruth and Sánchez-Fung (2000) examined the role of the money market. The current paper adds to the body of work on price dynamics in the Dominican Republic by jointly exploring the effects of disequilibria in the money and traded-goods markets on inflation, aside from other macroeconomic variables that could potentially influence inflation. In addition, the analytical framework and empirical estimation reflect the institutional characteristics for the conduct of monetary policy in the Dominican Republic, which emphasizes the importance of real demand for money. In addition, this is the first attempt at explaining inflation during the stabilization period, using quarterly observations.

The results indicate that there are two long-run relationships in the money and traded-goods markets, respectively. In the money market, a long-run relationship is uncovered between the real demand for money, real income, and the interest rate differential between peso-and dollar-denominated assets. With respect to the traded-goods market, a long-run relationship is found

among the nominal exchange rate, domestic prices, and foreign prices. Disequilibrium in the money market, but not in the traded goods market, exerts a significant impact on inflation. The results further suggest that inflation is driven by changes in real output, monetary aggregates, the exchange rate, and foreign prices. The endogeneity of the interest rate differential and the sensitivity of real money demand to the interest rate differential indicate scope for monetary policy in achieving macroeconomic stabilization.

The remainder of the paper is organized as follows: Section II describes the structure and operations of the foreign exchange market, the institutional framework for the conduct of monetary policy, and the evolution of inflation and relevant macroeconomic variables. Section III discusses an analytical framework for investigating the determinants of inflation in a small, open economy like the Dominican Republic. Section IV presents the empirical analysis, encompassing description of the data and a presentation of results based on the analytical framework in Section III. Section V presents the main conclusions.

II. INSTITUTIONAL FRAMEWORK AND MACROECONOMIC DEVELOPMENTS

A. Structure and Operation of Foreign Exchange Markets

A description of the exchange rate structure and the operation of the foreign exchange market are crucial to understanding the evolution of the exchange rate and the institutional framework for the conduct of monetary policy over the period of analysis.

During the period of analysis the Dominican Republic had a dual exchange rate regime which was subsequently unified in 2003. Apart from the official exchange rate that was set by Central Bank of the Dominican Republic (BCRD), there exists as well a market-determined exchange rate that reflects commercial banks' foreign exchange transactions with the public. In addition, there is also an extra bank market rate determined by foreign exchange transactions with exchange houses. The BCRD occasionally intervenes in the market via the commercial banks and foreign exchange dealers.

The foreign exchange market is segmented among commercial banks (14), the central bank and exchange houses (102). In 2002, the volume of transactions amounted to US\$7.8 billion, of which commercial banks accounted for 30.2 percent, the central bank 10.2 percent and exchange houses 59.6 percent. Both commercial banks and exchange houses derive their foreign exchange flows from exports of goods and services (tourism and free trade zone (FTZ)), remittances, private sector loans and foreign direct investment (FDI). In contrast, the central bank inflows are related to telecommunications charges, credit card transactions, disbursements of public sector loans, fuel supplies to ships, and from consulates.

The introduction of the Monetary and Financial Law in November 2002 gave rise to important changes in the structure and operations of the foreign exchange market in the Dominican

Republic. The most important of these being the free convertibility of the peso, elimination of dual markets, and the introduction of rules governing the participation of the central bank². The law also permitted wider market participation to include other nonbank financial institutions such as savings and loans, cooperatives and agricultural development banks.

B. Institutional Framework for Conduct of Monetary Policy

During the period of analysis, monetary policy in the Dominican Republic was formulated within a framework of limited central bank autonomy and a managed floating exchange rate regime. A key objective of the central bank was price stability, in conjunction with real output growth and reserve accumulation. The main ingredient for the monetary framework was the projection of real demand for money, which is used to determine appropriate level of base money. For a given demand for money and an net international reserves (NIR) target, the stock of central bank net domestic assets (NDA) becomes the intermediate target. The quarterly operational targets serve as guidelines to the Open Market Operations Committee, which is responsible for ensuring that policy objectives are met. Although the monetary program is not presented to the public in detail, the monetary authorities disclose their major objectives. This framework for the conduct of monetary policy is based on the assumption of a predictable real money demand function, warranting an analysis of the existence of a long-run real demand for money.

More recently, the monetary authorities have moved toward using the interest rate as intermediate instrument. In the past, direct instruments such as credit controls and freezing of excess reserves were employed in managing liquidity. However, the main instrument of monetary policy today is indirect in the form of issue of central bank paper or *certificados de participación* (CPs). Prior to November 2001, the interest rate was set unilaterally by the central bank, but with the expansion of the functions of the money desk (*mesa de dinero*), there has been a gradual move towards a more market-oriented determination of the interest rate. CPs are auctioned, but are also issued through direct placement with commercial banks.³ It would be important to examine the sensitivity of the real demand for money to the interest rate differential between domestic and foreign denominated assets, as the effectiveness of monetary policy in controlling inflation and smoothing exchange rate volatility requires some degree of responsiveness in real demand for money to the interest rate differential.

² The official exchange rate was set daily by the BCRD as a weighted average of the previous week's rate at commercial banks and exchange houses. A foreign exchange desk has been created to manage purchases and sales of foreign exchange for the BCRD through auctions, although this system is used only occasionally.

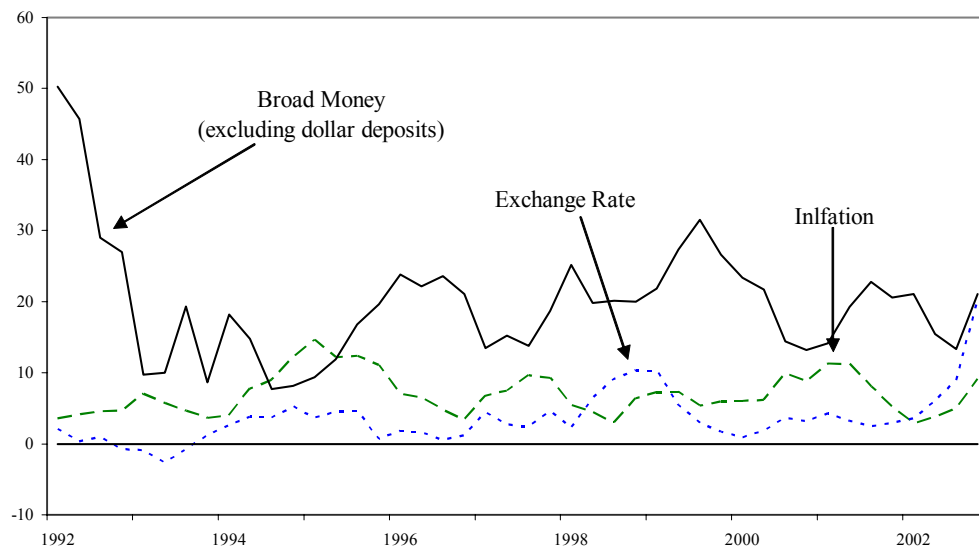
³ Although CPs are now issued through auctions, no fixed schedule has been established.

The BCRD also affects liquidity conditions through intervention in the private foreign exchange market, smoothing the volatility of the exchange rate. As mentioned earlier, the central bank operates within the framework of heavily managed exchange rate; this possibly reflects the presumption that exchange rate depreciation affects inflation. The paper investigates the extent of exchange rate pass through and examines alternative instruments that the central bank could explore to smooth exchange rate volatility instead of direct intervention.

C. Evolution of Inflation

This section presents a descriptive analysis of the evolution of inflation, exchange rate and broad money during the 1991–2002 period. The Dominican Republic's inflation, changes in broad money and exchange rate are shown in Figure 1. The main features of the evolution of inflation are enunciated below:

Figure 1. Dominican Republic: Broad Money, Inflation and Exchange Rate: 1991–2002



Source: Central Bank of the Dominican Republic and IMF staff estimates.

- There is evidence to remarkable variation in inflation, as annual average inflation increased from 18 percent during the 1981–85 period to about 40 percent over the period 1986–90, before declining to about 7 percent during 1992–2002 period;
- High inflation during the 1980–90 period, reflected among other factors, increasing monetization of public sector deficits; and
- The economic program introduced in late 1990 culminated in enhanced fiscal discipline and produced a remarkable fall in inflation. Domestic bank financing of the public sector deficit was reduced, monetary expansion slowed, and annual inflation rates were maintained at single digits for nearly all of the 1990s.

D. Evolution of Broad Money and Exchange Rate

The analytical framework for this paper is based on the assumption that in a small open economy like the Dominican Republic, inflation is primarily driven by conditions in the money and traded goods market. As a result, this section describes the evolution of broad money and exchange rate during the period covered by this paper. The following stylized facts emerge:

- A principal determinant of inflation is changes in monetary aggregates. Increase in money supply that reflects extension of credit to the public sector tends to exert upward pressure on price. This appears to be the case during the 1980s, when the consolidated public sector deficit was about 5.4 percent of GDP, the broad money increased by 30 percent on average, and annual average inflation was about 29 percent. However, an increase in monetary aggregates that reflects the private sector demand for credit does not appear to induce inflation. In the period 1991–2002, despite an increase in broad money of about 20 percent, the average annual inflation was estimated at 7 percent, as consolidated public sector deficit showed an annual average of 2.1 percent of GDP; and
- Changes in the exchange rate seem to matter for inflation. There appears to be consistency in the evolution of the exchange rate and inflation. Periods of exchange rate depreciations were associated with higher inflation.

III. ANALYTICAL FRAMEWORK

A. Long-Run Relationships

This section provides the theoretical framework for analyzing long-run equilibria in the money and traded goods markets, with a view to establish how these relationships are crucial in determining inflation in the Dominican Republic. This reflects the standard assumption that inflation in a small open economy could possibly originate from disequilibria in the money and traded goods markets.

The price level, p_t , is defined to be a weighted average of nontradable prices, p_t^N , and tradable prices, p_t^T .⁴

$$p_t = \sigma p_t^N + (1 - \sigma) p_t^T \quad (1)$$

The parameter, σ , is the share of nontradable prices in the price index. The price of tradable goods in foreign currency is determined in the world market, reflecting the small open

⁴ All variables are expressed in logs.

economy assumption. Their price in local currency depends on the foreign currency price, p_t^f , and the exchange rate, e_t (the unit of peso required to buy one U.S. dollar). So that,

$$p_t^T = e_t + p_t^f \quad (2)$$

the price of nontradables is assumed to be determined in the domestic money market, as the difference between the actual nominal money stock and the real demand for money:

$$p_t^n = m_t - m_t^d \quad (3)$$

where m_t is the outstanding stock of money, m_t^d is the demand for real money balances. If actual money supply exceeds demand, there would tend to be upward pressures on price. In the Dominican Republic, investment options are limited to three main categories: money, real assets, and foreign exchange⁵. Consequently, the demand for money is specified to depend upon the level of income, interest rate differential (capturing expected exchange rate movements and possibly risk premia) between domestic—and foreign—denominated assets.

Demand for money is specified as:

$$m_t^d = b_1 y_t + b_2 (r_t - r_t^f) \quad (4)$$

where y is the real income, r is the nominal interest on pesos, and r^f is the nominal interest rate on dollar assets. An increase in real income is expected to expand the demand for money for transactions and, in turn, lead to a decline in prices. An increase in domestic interest rate relative to foreign interest rate would trigger an increase in the demand for domestic assets, *ceteris paribus*

Substituting (4) into (3) yields:

$$p_t^n = m_t - (b_1 y_t + b_2 (r_t - r_t^f)) \quad (5)$$

Substituting (5) and (2) into (1), produces:

$$p_t = \sigma (m_t - (b_1 y_t + b_2 (r_t - r_t^f))) + (1 - \sigma)(e_t + p_t^f) \quad (6)$$

⁵ In the absence of indicators such as the real price of land, the real money demand function is specified as if economic agents have two options: to invest in pesos or foreign-denominated assets.

B. Modeling Inflation

Long-run relationships in the money and traded goods market are estimated using cointegration technique. Upon the establishment of long-run relationships in the aforementioned markets, a single-equation error correction model (ECM) for inflation is estimated as:

$$\Delta p_t = \alpha_0 + \sum_{i=1}^{k-1} \alpha_{1i} \Delta p_{t-i} + \sum_{i=1}^{k-1} \alpha_{2i} \Delta m_{t-i} + \sum_{i=1}^{k-1} \alpha_{3i} \Delta y_{t-i} + \sum_{i=1}^{k-1} \alpha_{4i} \Delta e_{t-i} + \sum_{i=1}^{k-1} \alpha_{5i} \Delta p_{t-i}^f + \eta_1 \left(m_t^d - (b_1 y + b_2 (r_t - r_t^f)) \right) + \eta_2 (p_t - p_t^f - e) + v_t \quad (7)$$

where Δ is the first difference operator, p is the domestic consumer price index (CPI), m is the nominal stock of money, y is real output, e is the nominal exchange rate, p^f is the foreign WPI index, r is the nominal rate of interest on peso deposits, r^f is the rate of return on dollar-denominated assets and v is a white noise process.

Equation (7) combines both long-run and short-run determinants of inflation. The long-run part of the model is given by the two error-correction terms η_1 (capturing disequilibrium in the money market and) η_2 capturing disequilibrium in the traded goods market. Their coefficients show the amount of disequilibrium (or degree of adjustment) transmitted in each period into the rate of inflation. The short-run part of the model is taken into consideration by including variables in their first differences.

Equation (7) can be interpreted as a general model that embeds various models of inflation. Monetary explanations of inflation would predict that excess money drives inflation, and as a result the coefficient η_1 should be the only significant parameter (Friedman and Schwartz, 1963; Harberger, 1963). This framework has been used to analyze inflation in small open economies (Vogel, 1974; and London, 1989). Another model of inflation would predict that disequilibrium in the traded-goods market matters for inflation, and as a result η_2 should be statistically significant (Hanson, 1995). Another important issue is the sensitivity of the current rate of inflation to past inflation. In the absence of inflation inertia, the parameters on lagged inflation should sum to zero. On the other extreme, where inflation is solely determined by past inflation, the parameters on lagged inflation should sum to unity. Other variables included in Equation (7) as possible determinants of inflation are changes in: the monetary aggregates; real output; the exchange rate; and foreign prices.

IV. EMPIRICAL ANALYSIS

A. Data

The sample period for the estimation is 1991–2002, using quarterly data. The real demand for money, including dollar deposits (m^d) is derived by deflating the logarithm of nominal broad money by the log of the CPI. Real GDP (y) is used as a measure of real income. The three-month peso deposit rate is used as a measure of own rate of interest on money (r). The three-

month deposit rate on U.S. certificates of deposit (CD) is used as a proxy for the foreign interest rate (r^f). The nominal exchange rate (e) used is the average of the peso/U.S. dollar rate from the private market that handles over 90 percent of all foreign exchange transactions, while the foreign price index is captured by the U.S. wholesale price index (p^f). Inflation is defined as the quarterly change of the logarithm of the CPI. All data are obtained from BCRD, except the U.S. wholesale price index and the U.S. three-month deposit, which are obtained from the IFS database.

Three dummy variables are used to capture one-time increases in inflation due to changes in policy or the effects of shocks in Equation (7). In the first quarter of 1997, inflation was above trend, resulting from the first attempt at unifying the official and private exchange markets. A dummy variable is constructed to account for this policy measure. In the fourth quarter of 1998, an additional dummy is defined to capture the effects of Hurricane George, which created widespread damage, disrupting production and the provision of services. During the third quarter 2000, another dummy measures the impact of the adjustment to prices of petroleum products, reflecting increases in the international price of oil.

B. Estimation

Equation (7) was estimated using OLS once the degree of integration of the variables was ascertained. Following Sacerdoti and Xiao (2001), equilibria conditions pertaining to the money and traded goods markets were separately estimated, due to sample-size constraints. As a result, the ECM terms associated with η_1 and η_2 could not be estimated simultaneously within the framework of Equation (7). Rather, once the long-run relationships were identified in two sub-systems using the Johansen (1991) procedure, weak exogeneity tests were performed. The long-run relationships from the two markets were then integrated within the context of a short-run dynamic equation. Once the general model was estimated, a more parsimonious representation was arrived at by excluding insignificant explanatory variables using the general to specific methodology.

C. Unit Root Tests

The augmented Dickey-Fuller test was applied to determine the order of integration of the variables used in the paper (Table 1 and Figure 2). All variables were I(1), requiring first differencing to achieve stationarity.

Table 1. Unit Root Tests¹

Variable	ADF in Levels t-statistics	ADF First Difference t-statistics
P	0.49	-5.57
m	-0.32	-6.9
y	0.51	-34.4
e	2.61	-4.42
p ^f	-1.52	-3.89
(r-r ^f)	-2.45	-5.03

^{1/} The ADF is the augmented Dickey-Fuller test. Critical values at the 5 percent significance level are -2.92.–

D. Money Market

Results from cointegration tests of the monetary block are summarized in Table 2. The VAR model consists of 3 lags on m , p , y , and $(r - r^f)$. From Table 2, based on trace statistics, the hypothesis that there is at most one cointegrating vector is not rejected, indicating the existence of a money demand function in the long run. The long-run relationship can be written as:

$$m = 1.12p + 1.52y + 1.7(r - r^f) \quad (8)^6$$

Table 2. Cointegration Analysis of Money Market¹

p-r	r	T*	C* (5%)
4	0	53.47	47.21
3	1	17.01	29.68
2	2	4.51	15.41
1	3	0.36	3.76

^{1/} p is the number of variables and r the number of cointegrating vectors.
T* is the trace test calculated under the hypothesis of no linear trend.
C* is critical value at the 5 percent level.

⁶ This specification assumes that the semi-elasticities on the two interest rates are of equal magnitude but opposite signs, as economic theory would suggest.

Figure 2. Dominican Republic: Data in Levels and First Differences, 1991–2002

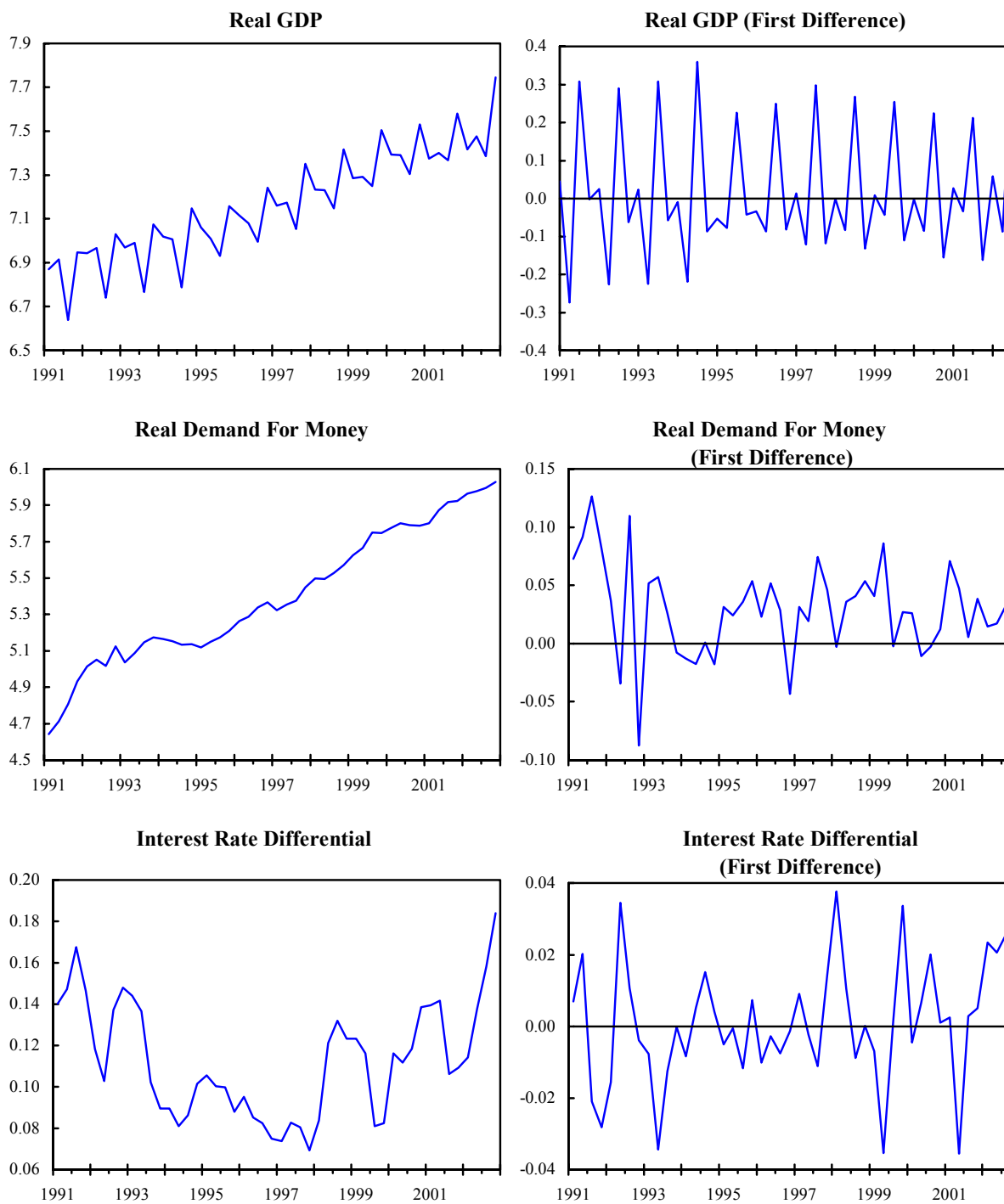
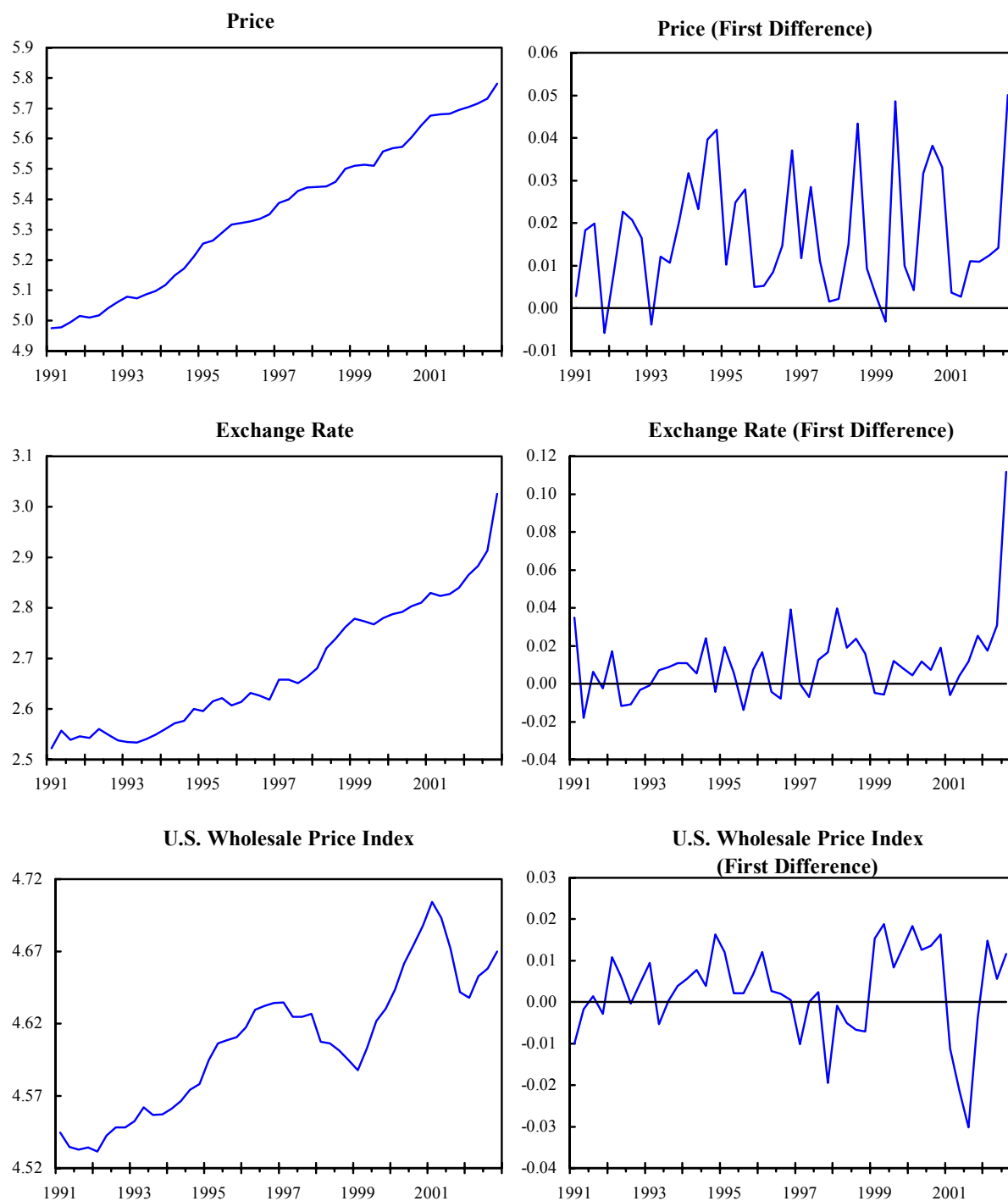


Figure 2. Dominican Republic: Data in Levels and First Differences, 1991–2002
(concluded)



Source: Central Bank of Dominican Republic and IMF staff estimates.

The price elasticity is close to one (a restriction that price elasticity equals 1 is not rejected based on a $\chi^2(1)$ test statistic of 0.22). The coefficient on interest rate differential indicates that an increase in the differential would be accompanied by an increase in the demand for money.

The restricted long-run money demand function can be written as:

$$m - p = 1.65y + 1.72(r - r^f) \quad (9)$$

Weak exogeneity tests⁷ of the variables in Equation (9) and shown in Table (3), suggest that output is weakly exogenous implying that if shocks were to cause the system to deviate from its long-run path, the interest rate differential, money and prices would adjust over time to restore the long-run equilibrium. The significance of the interest rate differential in the money demand equation implies some degree of effectiveness of the monetary policy. In controlling inflation, an increase in central bank interest rate with associated impact on interest rate on peso deposits would increase the demand for money and with a constant money supply leads to a reduction in price. In addition, an increase in demand for pesos could strengthen the exchange rate, as agents reshuffle portfolio from foreign-denominated assets, thereby reducing inflation.

Table 3. Money Market Tests for Weak Exogeneity

Variable	χ^2	p-Value for the Test Statistic
m	15.0	0.00
($r-r^f$)	6.7	0.00
p	6.2	0.01
y	0.59	0.43

E. Traded-Goods Market

Results from the cointegration analysis of the traded goods market are presented in Table 4. Based on the trace test, the hypothesis that there exists at most one cointegrating vector cannot be rejected. These results concur with those of Sánchez-Fung (1999), who explored this

⁷ In a system of error-correction equations, if the error-correction term is statistically insignificant in the equation for a particular variable, that variable is considered to be weakly exogenous. See Ericsson and Irons (1994), for detailed discussions on weak exogeneity tests.

relationship using quarterly data over a longer-time period. The long-run relationship among the exchange rate, domestic and foreign prices⁸ can be written as:

$$e = 1.09 * p - 0.98 * p^f \quad (10)$$

The unconstrained coefficients on the prices are very close to unity, consistent with economic theory and the restrictions that the coefficients on p and p^f are equal to one cannot be rejected⁹.

Table 4. Cointegration Analysis of the Traded-Goods Market 1/

p-r	r	T*	C*(5%)
3	0	28.1	24.31
2	1	8.51	12.53
1	2	2.61	3.84

1/ p is the number of variables and r the number of cointegrating vectors,
T* is the trace test calculated under the hypothesis of no linear trend.
C* is critical value at the 5 percent level.

Weak exogeneity tests suggest that foreign prices are weakly exogenous and that adjustment to the long-run equilibrium is achieved through either prices or the exchange rate (Table 5).

Table 5. Traded-Goods Market Tests for Weak Exogeneity

Variable	χ^2	p-Value for the Test Statistic
e	3.2	0.07
p	13.4	0.00
p ^f	0.41	0.51

⁸ In Equation (10), the foreign price is proxied by wholesale price index, which is a better proxy for the price of tradables relative to CPI (see Kakkar and Ogaki, (1999)). In the absence of data on wholesale price index for the DR, the CPI index is used.

⁹ The results have to be interpreted with a caution, as we recognize that the results could be sensitive to the sample size used in the analysis. For further discussions on finite-sample estimation biases see Meredith (2003).

F. Error-Correction Model for Inflation

Equation (7) is estimated to ascertain the determinants of inflation in the Dominican Republic during 1990–2002 period. The coefficient on the long-run disequilibrium in the money market is highly significant in the inflation equation, suggesting that disequilibrium in the money market matters for inflation (Table 6). The speed of adjustment is slow in that a 10 percent excess demand for money is likely to raise the rate of inflation by about 1 percent. In contrast, the coefficient on the error-correction term from the traded goods market is insignificant and therefore excluded.

Short-run dynamics in inflation appear to depend on changes in: monetary aggregates, the exchange rate, and foreign prices. Specific shocks or policy induced changes (first attempt at unifying the official and private exchange markets, the effects of Hurricane George and the adjustment to prices of petroleum products) exerted significant impact on inflation

Growth in money aggregates during the estimation period tended to lower inflation, as it appears that the observed changes in monetary aggregates were below desired changes in money balances. The changes in desired money balances reflected fast growth, as agents were willing to hold greater quantities of money consistent with its three basic functions. The coefficient on real GDP growth has a positive impact on inflation. However, there is a dampening effect, as output growth tends to encourage additional increase in the real demand for money. The coefficient on the foreign inflation is positive and significant, implying that a 1 percent change increase in foreign inflation would result in 0.35 percent rise in domestic inflation, but only after two quarters. The size of the pass-through coefficient is approximately 0.4, implying that the impact of exchange rate depreciation does not fully feed through to domestic inflation. This is consistent with the proposition and finding that exchange rate pass-through tends to be limited and subdued in a low-inflation environment (Taylor, 2000; and Choudry and Hakura, 2001). In addition, adjustment to menu costs could possibly have influenced suppliers to absorb the initial impact of exchange rate depreciation (Ghosh and Wolf, 2001).

The first attempt at unifying the exchange markets in 1997 is positive and disruptions in production and provision of services associated with hurricane George in 1998 exerted positive and significant impact on the inflation. The adjustment to fuel prices in 2000 had a positive but insignificant effect on inflation.

Diagnostic tests of the estimated model indicate that the residuals were normal (Jarque-Bera), free of serial correlation (LM), and heteroscedasticity (ARCH). The Ramsey reset test also indicates that the estimated parameters were stable over the estimation period. Figure 3 shows the estimated and actual inflation.

Table 6. Inflation Equation Estimates

Variable	Coefficient
C	0.43 (4.11)***
Δm_{t-1}	-0.11 (2.31)***
Δm_{t-2}	-0.10 (2.33)**
Δe_{t-1}	0.37 (2.95)***
$\Delta p^f_{(t-2)}$	0.40 (2.78)***
Δy_{t-1}	0.43 (3.6)***
ECM (Money) $_{t-1}$	0.06 (3.92)***
d97	0.022 (3.7)***
d98	0.021 (2.1)**
d00	0.012 (1.3)

Notes: *, **, *** denotes significance at the 10, 5, and 1 percent levels respectively.

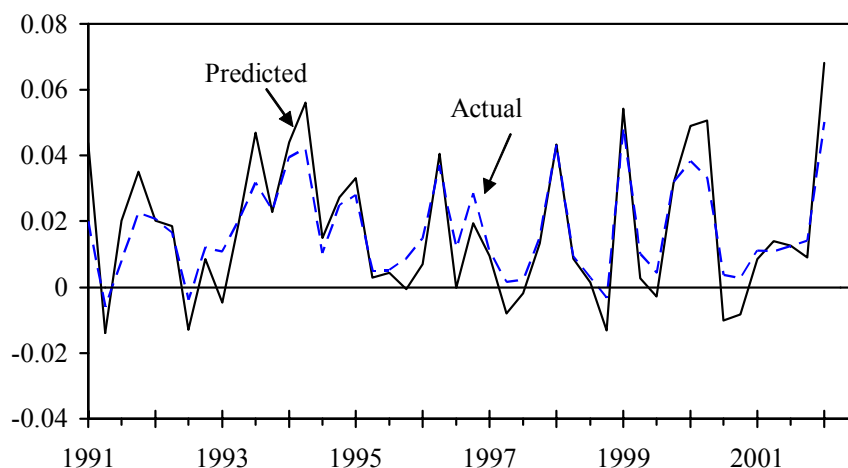
No. of obs.=44; Adj. R² 0.58; S.E.=0.009;

Jarque-Bera $\chi^2(2)$ =1.67; LM(4)=0.45; ARCH(2)=0.04

Chow:1996=0.85; Chow:1999=1.12;

Ramsey Reset=0.84

Figure 3. Dominican Republic: Actual and Predicted Inflation, 1991–2002



Source: Central Bank of Dominican Republic and IMF staff estimates.

V. CONCLUSION

This paper models the inflationary process in the Dominican Republic during 1991–2002, a period characterized by remarkable macroeconomic stability and growth. The results indicate that there is a long-run relationship among the real demand for money, real income, and the interest rate differential between peso- and dollar-denominated assets. An additional long-run relationship is found among the nominal exchange rate, domestic prices, and foreign prices. The results further suggest that in the short run, inflation is driven by changes in real output, monetary aggregates, the exchange rate, and foreign prices. Disequilibrium in the money market and not in the traded-goods market (captured by an error-correction term) is also a significant determinant of inflation. The first attempt at unifying the exchange markets and disruptions in production and provision of services associated with Hurricane George resulted in significant increases in inflation.

The pass-through of depreciation from the exchange rate to inflation was incomplete. This finding suggests that there is latitude to depart from the heavily managed exchange rate regime and introduce greater flexibility. This change in policy stance may be even more critical in light of the banking crisis that emerged in 2003 and the perennial low level of reserves. In addition, the exchange rate is no longer a credible nominal anchor, since the low level of reserves mitigates against sustained intervention in defending the peso.

Despite the fact that inflation has exogenous determinants such as foreign inflation, there is scope for the central bank to limit the impact of such shocks on inflation through an increase in its CPs' rate and a concomitant increase in the interest rate on peso deposits. This is facilitated by the finding that the interest rate differential is endogenous in a real-money-demand equation. The significance of the interest rate differential in the money-demand equation implies some degree of effectiveness of the monetary policy.

References

- Carruth, A., and J. R Sánchez-Fung, 2000, "Money Demand in the Dominican Republic," *Applied Economics*, Vol. 32, pp. 1439–1449.
- Choudry, E.U., and D.S. Hakura, 2001, "Exchange Rate Pass-Through to Domestic Prices: Does the Inflationary Environment Matter?" IMF Working Paper No. 01/194 (Washington: International Monetary Fund).
- Ericsson, N.R., and J.S. Irons (eds), 1994, "Testing Exogeneity: Advanced Tests in Econometrics," Oxford University Press
- Friedman, M. and A.J. Schwartz, 1963, "A Monetary History of the United States," pp. 1867–1990, Princeton University Press, Princeton.
- Ghosh, A.R., and H. Wolf, 2001, "Imperfect Exchange Rate Pass-Through: Strategic Pricing and Menu Costs," CESinfo Working Paper No. 436 (Munich).
- Hanson, J. 1995, "Inflation and Imported Input Prices in some Inflationary Latin American Economies," *Journal of Development Economics*, Vol. 18, pp. 395–410.
- Harberger, A.C., 1963, "The Dynamics of Inflation in Chile," in Christ, C.F. (ed) *Measurement of Economics: Studies in Economics and Econometrics in Memory of Yehunda, Grunfield*. Stanford University Press.
- Johansen, S., 1991, "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Annals of Statistics*, Vol. 17, pp. 419–428.
- Juselius, K., 1995, "Do Purchasing Power and Uncovered Interest Rate Parity Hold in the Long Run," *Journal of Econometrics*, No.69, pp. 211–240.
- Kakkar, V., and M. Ogaki, 1999, "Real Exchange Rates and Nontradables: A relative Price Approach," *Journal of Empirical Economics*, No. 6, pp. 193–215.
- London, A., 1989, "Money, Inflation and Adjustment Policy in Africa: Some Further Evidence," *African Development Review*, Vol.1 No.1.
- Meredith, G., 2003, "Medium-term Exchange Rate Forecasting: What Can We Expect?" IMF Working Paper, 03/21 (Washington: International Monetary Fund)
- Nadal-De Simone, F., 2001, "Money Demand in a Small Open Economy: The Case of the Dominican Republic," in *The Dominican Republic Stabilization, Reform, and Growth*. P. Young (Ed) pp. 47–61. International Monetary Fund Occasional Paper No. 206.

- Sacerdoti, E, and Y. Xiao, 2001, “Inflation Dynamics in Madagascar,” IMF Working Paper No.01/168 (Washington: International Monetary Fund)
- Sánchez-Fung, J. R., 1999, “Efficiency of the Black Market for the Foreign Exchange and PPP: The Case of the Dominican Republic,” *Applied Economics Letters*, Vol. 6, pp.173–176.
- Tanner, E. 2001, “Exchange Market Pressure, Monetary Policy, and Interest Rates: Recent Evidence from the Dominican Republic in *the Dominican Republic Stabilization, Reform, and Growth*. P. Young (Ed) pp. 62–68. International Monetary Fund Occasional Paper 206.
- Taylor, J.B., 2000, “Low Inflation Pass-through and the Pricing Power of firms,” *European Economic Review*, 44 (7), pp.1389–1408.
- Vogel, R.C. 1974, “The Dynamics of Inflation in Latin America, 1950-1969”, *American Economic Review*, vol.64, No. 1, 102-114.
- Wallis, and J.D.Whitley, 1990, Econometric Evaluation of the Exchange Rate in Models of the U.K. Economy, *The Economic Journal*, 403, 1230-1244.
- Young et al 2001, *The Dominican Republic Stabilization, Reform, and Growth*. International Monetary Fund Occasional Paper 206.