ECONOMIC GROWTH CENTER

YALE UNIVERSITY

P.O. Box 208269
New Haven, CT 06520-8269
http://www.econ.yale.edu/~egcenter/

CENTER DISCUSSION PAPER NO. 876

FOREIGN EXCHANGE CONTROLS, FISCAL AND MONETARY POLICY, AND THE BLACK MARKET PREMIUM

Mohsen Fardmanesh
Temple University

and

Seymour Douglas
Cox Communication

December 2003

Notes: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments.

We are grateful to T. N. Srinivasan, Koichi Hamada, Galina Hale and Paul Rappoport for their comments and to Temple University for partial financial support. Views expressed herein are those of the authors and do not represent Cox Communication or its affiliates. Fardmanesh: Department of Economics, Temple University, Philadelphia, PA 19122, m.f@temple.edu; Douglas: Cox Communication, Atlanta, GA 30319.

Abstract

This paper examines the relationship between the official and parallel exchange rates, in three Caribbean countries, Guyana, Jamaica and Trinidad, during the 1985-1993 period using cointegration, Granger causality, and reduced form methods. The official and parallel rates are cointegrated in all three countries, but with significant average disparity between them in Guyana and Trinidad, which unlike Jamaica applied infrequent and large adjustments to their official rates. The causation is bi-directional in the case of Jamaica and uni-directional, with changes in the official rate Granger causing changes in the parallel rate, in the cases of Guyana and Trinidad, reflecting the difference in their official exchange rate policies. Our reduced form estimates indicate that exchange controls, expansionary fiscal and monetary policy, and changes of government mostly have the expected positive effect on the black market premium. After past values of the premium, exchange controls exert the strongest impact on the premium.

Keywords: **Foreign Exchange Controls, Black Market Exchange Rate, Black Market Premium, Cointegration, Granger Causality**

JEL Classification: F31

1. Introduction

Parallel or black markets for foreign currencies have become common phenomena in developing countries, with parallel exchange rates deviating, in some cases, considerably from the official rates. One common thread in the emergence of these parallel markets has been the imposition of foreign exchange controls.[1] Malaysia's imposition of capital controls in the wake of the currency crisis it faced in 1997-8 has further pushed the use of foreign exchange controls back into the spotlight[2]. Where the degree of foreign currency rationing associated with foreign exchange controls is strong and the central bank does not have sufficient reserves to satisfy the demand for foreign currency parallel markets develop. Whatever gives rise to a parallel exchange rate, understanding its relationship with the official exchange rate is important,[3] for example, for the success of any foreign exchange rate unification attempt.[4]

In this paper we study the relationship between the parallel and official exchange rates for a sample of three Caribbean countries,[5] Guyana, Jamaica, and Trinidad for the period 1985-1993 using Granger causality, cointegration, and reduced form methods. These countries had well-developed parallel markets and attempted unification of their parallel and official exchange rates during the sample period, but existing studies have

[1] See for example, The Annual Report on Exchange Rate Arrangements and Restrictions published by the IMF.

[2] See Fortune Magazine, Sept. 1998, pp. 35-36.

[3] This relationship has been studied by, among others, Lizondo (1987), Culbertson (1989), Pinto (1989, 1991), Kharas and Pinto (1989), Agenor and Flood (1992), Montiel *et al.* (1993), Noorbakhsh and Shahrokhi (1993), Bessler and Yu (1994), Ghei, Kiguel and O'Connell (1995), Goldberg (1995), Chotigeat and Theerathorn (1996), Odedukun (1996), Ashworth *et al.* (1999), Gelbard and Nagayasu (1999), Apergis (2000), Baliamoune (2001), and Phylaktis and Girardin (2001) for various samples of (developing) countries.

[4] The effects of an official devaluation and stabilizations policies and the outcome of any policy targeting the official rate all hinge upon this understanding as well.

not considered any of them. While they were fundamentally similar at the onset of their political independence in the 1960s, their differences in economic policies and fortunes/misfortunes set them apart soon thereafter rendering them further interesting for our analysis.[6]

The rest of the paper is organized as follows. In the next section we present our choice of methodology and the hypotheses that are tested by them, and our choice of sample and data sources. In section 3 we test for a long run relationship between the parallel and official exchange rates in each country using stationarity and cointegration analysis; and for the direction of causation between their two rates using Granger causality analysis. In section 4 we study the determinants of their parallel market premia using reduced form regression models. Our concluding remarks are presented in section 5.

2. Tested Hypotheses, Methodology, Choice of Sample, and Data Sources

The theoretical framework underlying our empirical analysis is one of monetary approach to exchange rate determination. A framework in which expansionary fiscal and monetary policy mixes, as in monetized budget deficits, in the presence of foreign exchange controls render the fixed official exchange rate overvalued and, hence, raise the black market premium.[7] The hypotheses to be tested are twofold. First, there is a long-run relationship between the parallel and official exchange rates. Second, the parallel market premium is determined by foreign exchange policy/controls and by fiscal and monetary

[5] With the U.S. being their major trading partners, we use the respective nominal prices of the U.S. dollar in each country.
[6] Their per capita incomes were already diverging by mid 1970s.
[7] The premium in effect reflects the shadow price of the control.

policy mixes, as measured by changes in base money supply and the central bank credit to the government and other fiscal policy proxies.[8]

Our empirical strategy for testing the first hypothesis is as follows. First, we test for stationarity and integration of the two exchange rate series because this is a pre-condition for cointegration analysis. Second, having established stationarity and integration, we examine the long-run relationship between the two rates by testing for cointegration of the two series. Third, we study the direction of causality between the two rates by Granger causality test. Theoretically the direction of causation between the two rates is indeterminate. If central banks possess proprietary information regarding the state of the economy and incorporate this information in setting the official rate, then the official rate Granger causes the parallel rate. On the other hand, when exchange rate policy is endogenous such as when central banks follow a "premium rule" for setting the official rate, then the line of causation is reversed.[9]

Our empirical strategy for testing the second hypothesis is as follows. First, we transform our data by first differencing because our dependent variable, the parallel market premium, and our explanatory variables such as base money supply are (highly correlated) time series subject to a common trend/drift.[10] Second, we use an array of proxies to overcome the relative infrequency with which fiscal data are available;[11] the

[8] Due to a lack of government bond markets and central bank independence, in developing countries the central bank may have no choice but to finance any budget deficits. To the extent that this is the case its lending to the government reflects a fiscal policy stance, and to the extent that it chooses to finance a deficit its lending reflects a monetary policy stance. Since we do not have the information as to which one is the case here, we view the central bank lending to the government and its closely related changes in base money supply as a mixture of both fiscal and monetary policy.
[9] Maintaining a target premium by the central bank requires that the official rate be changed when the parallel rate changes in which case the parallel rate Granger causes the official rate.
[10] This eliminates any spurious relationship caused by a common trend; see Greene (2000), section 17.4.1.
[11] We consider use of fiscal proxies preferred to pooling the sample as a remedy for the fiscal data infrequency.

exchange rates and monetary data are available on a monthly basis. Our reduced form model specifications for the determinants of the parallel market premium are based on existing studies (e.g., Kharas and Pinto (1989), Pinto (1991), Ghei *et al*. (1995), Odedokun (1996), and Gelbard and Nagayasu (1999)). For example, our hypothesis that an expansionary fiscal-monetary policy mix (budget deficits), as measured by the central bank credit to the government, have a positive impact on the premium is supported by Ghei *et al*.'s study of thirty-three developing countries for the period 1976-89.

As for choice of sample, we focus on three Caribbean countries, Guyana, Jamaica and Trinidad for the 1985-1993 period. Our motivation for selecting these countries can be explained as follows. These countries had well-developed parallel markets and even attempted unification of their parallel and official exchange rates during the sample period,[12] but existing foreign exchange studies have not considered any of them. As for similarities, in 1970 these countries had three things in common.[13] First, each had attained political independence from Britain in the previous decade. Second, all were classified as low-income countries based on pre capita income. Third, in terms of exchange rate, all were tied to the pound sterling. But, despite their initial similarities, by 1975 their per capita incomes were diverging reflecting the difference in their economic policies and fortunes and misfortunes.[14]

[12] At the time of the unification in each of these countries the official rate was not viewed as credible and was coming under pressure from currency speculators.

[13] In addition, they share English as official language, and Guyana and Trinidad share a strong Indian cultural influence due to their initial sizeable immigrants from India.

[14] The discussion of these differences is beyond the scope of this study. It should suffice to note here that all three countries had the economic fortunes and misfortunes of mineral exports. Guyana, which had close economic ties with the former Soviet Union, bartered her minerals/aluminum for Soviet made consumption and capital goods, and as such had an economic decline along with the Soviet Union. Jamaica also exported aluminum but mostly to the U.S. whose demand declined in the 1970s with the end of the Vietnam War and rose in the 1980s with the Reagan's military buildup. Trinidad as an oil producer experienced a meteoric

As for the sources of our data, we use *International Financial Statistics*, *World Currency Yearbook, The Annual Report on Exchange Arrangements and Restrictions,* and the Ministries of Finance of Guyana, Jamaica, and Trinidad. We use monthly observations for the period 1985-1993. The annual averages of the parallel and official exchange rates, the annual average of the parallel market premium and the largest premium during each year for the three countries are presented in Tables 1-3.

3. Cointegration and Causality Analysis

In this section we study the interrelationship between the parallel and official exchange rates in our sample by testing for a long-run relationship between the two rates using stationarity and cointegration analysis and for the direction of causation between the two rates using Granger causality analysis. Our uses of the concepts of stationarity, cointegration, and Granger causality in this study are presented below along with the respective results.

The drawback to using non-stationary parallel and official exchange rates series in our case would be that the presence of deterministic time trends in the two rates could lead us to misinterpret what is essentially a co-movement of the two rates over time for a deeper relationship between them.[15] There are a number of methods used to test for stationarity and the presence of unit roots. The method used here is the Augmented

rise through early 1980s and a fast drop thereafter, a drop that she could not avoid because of a failure to diversify its resource-exporting economy before the collapse of world oil prices in mid 1980s.

[15] For a detailed discussion, see Banerjee et al. (1993).

Dickey-Fuller (ADF) test.[16] Using the parallel market rate as an example, we apply this technique by positing the equation

$$\Delta s_t = \mu + \gamma_c t - (1-\rho)s_{t-1} + u_t$$

where $\Delta s_t = s_t - s_{t-1}$, μ is the drift term and γ_c is the coefficient of the deterministic time trend t.[17] The standard critical values for t-statistics are invalid in testing whether the estimated coefficients in this model are statistically different from zero.[18] The test is thus conducted by comparing the obtained t-values with the relevant ADF statistic.

The results of our tests for stationarity by applying the ADF procedure to the parallel and official exchange rates for the three countries in our study are presented in Tables 4- 6.[19] s and e are the logarithm of the parallel and official exchange rates respectively and Δ is the difference operator. Both the parallel and official rates for Guyana are stationary in the first difference (Table 4). Both rates for Jamaica are stationary in the second difference (Table 5). The two rates for Trinidad are stationary in the first difference (Table 6). While testing for and establishing stationarity for the two exchange rates in each country does not provide us with any information about the interrelationship between them, it does satisfy the pre-conditions for studying this relationship. So we can proceed to test for the direction of causality between the two rates and for their cointegration.

We apply the concept of Granger causality by positing the following. Let $\tilde{e}$ and $\tilde{s}$ represent the transformed stationary values of our official and parallel exchange rates

[16] We choose this method over information criteria because it is more efficient in testing nested models like the ones reported in our Tables 4-6.

[17] We also estimate the nested model with no γ_c as well as the one with no μ or γ_c.

[18] The Least squares estimator is biased downward and converges to its probability limit more rapidly. For a detailed explanation, see Greene (2002), section 18.3.3.

respectively. If lagged values of $\tilde{s}$ helps to predict $\tilde{e}$ in the presence of lagged values of $\tilde{e}$, then the parallel rate $\tilde{s}$ is said to Granger cause the official rate $\tilde{e}$. Thus, in the autoregressive system

$$\tilde{s}_t = \sum_{k=1}^{m_1} \mu_{1k} \tilde{s}_{t-k} + \sum_{k=1}^{m_2} \mu_{2k} \tilde{e}_{t-k} + u_{1t}$$

$$\tilde{e}_t = \sum_{k=1}^{n_1} \theta_{1k} \tilde{s}_{t-k} + \sum_{k=1}^{n_2} \theta_{2k} \tilde{e}_{t-k} + u_{2t}$$

when $\tilde{s}_t$ Granger causes $\tilde{e}_t$ and there is no reverse Granger causation, then all the μ_{2k} coefficients would be statistically equivalent to zero and at least one of the θ_{1k} coefficients would be statistically different from zero. The results of our causality analysis are presented in Table 7.

Our causality analysis suggests that causation seems bi-directional in the case of Jamaica[20] and is uni-directional, with the changes in official rate Granger causing changes in the parallel rate, in the cases of Guyana and Trinidad. The difference in their lines of causation reflects the difference in their official exchange rate policies. Guyana and Trinidad pursued a policy of maintaining the official exchange rate over long periods with infrequent and large adjustments. Their parallel rates drifted away and far from their official rates for long periods. Jamaica followed the opposite policy of frequent and small adjustments in her official rate, and her parallel and official rates moved/changed in close

[19] The number of observations in these tables is 107, 106 and 107 respectively.

[20] Our econometric result from Granger test, which is built to detect only uni-directional causality, is inconclusive for Jamaica. This result along with information about her official exchange rate policy suggests a bi-directional causality between her official and parallel rates. Except for the 1991 unification, her central bank was mindful of the black market premium at every step of the way but not to the point of following a strict premium rule. If it had followed a premium rule, a uni-directional causality, with changes in the parallel rate Granger causing changes in the official rate, would have emerged. The opposite uni-directional causality between the two rates would have emerged if, as in Guyana and Trinidad, her central bank had opted for infrequent and large changes in the official rate independent of the size of the premium along the way. The exclusion of this tenuous result would not affect the main points of this paper.

lock steps. We can see their difference in Figures 1-3 that graph the logarithmic transformation of the parallel and official exchange rates for the three countries. For Guyana and Trinidad the graphs of their official exchange rates in Figures 1 and 3 resemble step functions. For Jamaica the graph of her official exchange rate in Figure 2 resembles the opposite. Since our causality analysis is done with transformed/differenced values of the two rates, it captures more of the short-term dynamics between the two rates.

We now turn to the long-run relationship between the parallel and official exchange rates. We use cointegration techniques developed in Johansen (1988, 1991) and Johansen and Juselius (1990)[21] that are based on Engle and Granger (1987). The Johansen method, which is based on the VAR approach,[22] is a full information maximum likelihood estimation of a system of cointegrating relationships.[23] We apply these techniques by positing the following. Let $X_t = (s, e)'$ be a vector of k variables which are integrated of order 1.[24] Then X_t can be written as the p^{th} order VAR[25] that with a certain reparameterisation can be written as[26]

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \Psi D_t + e_t$$

[21] This technique was chosen for its ease of use and wide availability in econometric software applications.
[22] The alternative Engle and Granger (1987) method is based on testing whether single-equation estimates of the equilibrium errors are stationary. This requires a fully specified long-run equilibrium relationship between the dependent variables and respective regressors including a constant, (stationary) exogenous variables, and/or a time trend. For details, see Greene (2000), section 18.4.
[23] Johansen and Juselius (1990) developed likelihood ratio tests for structural hypotheses concerning cointegrating relationships and their disequilibrium adjustment.
[24] Here k=2.
[25] The order of the VAR, p, is determined in advance. For our variables p=2.
[26] This is a multivariate ECM (Error Correction Model) with explicit distinction between (long-run) equilibrium and dynamic adjustments to it. Its transparent display of the cointegrating relationship among the variables is of interest here. For details, see Patterson (2000), section 14.4.

where $\Pi = (\sum_1^p \Pi_i - I), \Gamma_i = -\sum_{j=i+1}^p \Pi_j$, and D_t is a vector of deterministic components, possibly linear trends, constants or seasonal dummies, and e_t is k dimensional zero-mean random variables with variance matrix Ω.[27] If there are r (r<k) independent linear combinations of X_t that are difference stationary, then X_t is cointegrated of order r. The Granger representation theorem in Engle and Granger (1987) shows that if X_t is cointegrated of order r then the $k \times k$ matrix Π has rank r (r<k)[28] and one can write $\Pi = AB'$ where both A and B are $k \times r$ matrices of full column rank.[29] The algorithm developed in Johansen (1988) is essentially a procedure for estimating the above relationship subject to the constraint $\Pi = AB'$.

Our results of applying the Johansen method[30] to the parallel and official exchange rates data for Guyana, Jamaica and Trinidad are presented in Tables 8-10.[31] The first column of the upper panel for each country shows the eigenvalues[32] that are used to calculate the likelihood ratios presented in the second column,[33] which are then compared with the critical values in the third column. The fourth column indicates the number of cointegrating relationships hypothesized. The first hypothesis ($H_0 : r = 0$)

---

[27] $\Pi_i (i = 1,..., p)$ is the coefficient of X_{t-i} in the original p^{th} order VAR.

[28] That is, Π has reduced or deficient rank and one of its eigenvalues is zero.

[29] That is, r is also the column dimension of A and B. B' is the cointegrating vector. A contains the adjustment coefficients and B contains the equilibrium/cointegrating coefficients allowing for separate representation of the two coefficient sets.

[30] Johansen develops two test statistics for determining the cointegration rank. The first test is known as the trace statistics and is the relevant test statistics for the null hypothesis $r \leq r_0$ against the alternative $r \geq r_0 + 1$. The second test is the maximum eigenvalue test and improves the power of the test by changing the alternative hypothesis to $r = r_0 + 1$. For details, see Patterson (2000), section 14.4.3.

[31] The number of observations in these tables is 105.

[32] The eigenvalues, v, are obtained by solving the characteristic equation $|\Pi - vI| = 0$; for details, see Patterson (2000), section 14.3.2. They are the largest squared canonical correlations between the level and differenced transformation of time series in the VAR; for details, see Greene (2000), section 18.4.3.

tests whether the cointegration rank is zero--there is no equilibrium condition that keeps the parallel and official exchange rates in proportion to each other in the long run. This hypothesis is rejected for the three countries in our sample. The second hypothesis ($H_0 : r \leq 1$) tests whether the cointegration rank is less than or equal to one.[34] The data failed to reject this hypothesis for any of the three countries. The unnormalized and normalized estimated cointegrating coefficients for the two exchange rates are presented in the middle and lower panels of Tables 8-10, with the respective standard errors listed in parentheses.

Our cointegration analysis also suggests that over the sample period there are large disparities between the parallel and official exchange rates in Guyana and Trinidad; the normalized coefficients for their parallel rates are -2.35 and -2.74 respectively. On the average their official rates were maintained at 42% and 36% of their respective parallel rates.[35] The data for Jamaica on the other hand reveal a small disparity between her two exchange rates in the order of 6%. These results reflect once again the fact that the official exchange rate in Guyana and Trinidad was adjusted infrequently and by large amounts as opposed to the frequent and small changes in the official exchange rate in Jamaica.

4. Determinants of the Parallel Market Premium

In this section we study the determinants of the parallel market premium for our sample. We estimate the impact of foreign exchange controls and fiscal and monetary policy on

[33] Large values provide evidence against the hypothesis of r or fewer cointegrating vectors.
[34] Given the null hypothesis of the cointegtration rank being zero is rejected, the cointegration rank equals one.
[35] The respective figure for Jamaica is about 95%.

the parallel market premium using reduced form regression models and monthly data for the period 1985-1993.[36] To control for inflation we use inflation-adjusted values for the respective variables. To account for any inertia in the premium (denoted by "s-p"), we use its own past values as explanatory variables. We also account for country specific government (export) revenues for Guyana (from Bauxite) and for Trinidad (from oil).

As for foreign exchange policy/control, the policy tools used vary from country to country. To control for the difference in these policies and their likely impact on the parallel market premium, we consider the following three foreign exchange policy tools. We consider capital controls (denoted by "CapCon"), which are restrictions on payments for capital transactions. These restrictions apply exclusively to resident-owned funds. We consider current account restrictions (denoted by "Currac"), which are restrictions on payments for current account transactions. Governments in developing countries have typically enforced current account restrictions because current account transactions can be used to evade restrictions on capital transactions.[37] Finally, we consider the existence of multiple official exchange rates (denoted by "Multiple"), which are different fixed exchange rates for capital and current account transactions.[38] Jamaica did not use any of these restrictions in the sample period. Guyana utilized all three forms of restrictions, and Trinidad utilized only current account restrictions. These foreign exchange policy variables are dummy variables taking a value of one during the period in which they are

[36] By using lagged values of these policies we circumvent the issue of their endogeneity.
[37] By, among others, under invoicing exports and over invoicing imports.
[38] In such a case, the premium should be calculated as the difference between the black market rate and a weighted average of the various official rates. However, the respective data for various official transactions are generally unavailable, and for developing countries the readily available and prominent official rate for current account transactions is usually used to calculate the foreign exchange premium. For Guyana we include a dummy variable for her use of multiple official rates to compensate for the imperfection of her calculated premium.

enforced and zero otherwise. They are constructed from *The Annual Report on Exchange Rate Arrangements and Restrictions* published by the IMF.

Regarding fiscal and monetary policy, we use the following variables and proxies.[39] We use the central bank lending to the government (denoted by "Credit") as a measure of the part of the budget deficit covered in this manner.[40] This variable provides some indication about the ability of the central government to finance its current expenditures from its current revenues, but does not fully reflect its fiscal policy stance. To the extent that the central bank independently chooses, as opposed to being forced, to lend to the government, this variable reflects the monetary policy stance as well. Since the two types of lending by the central bank cannot be distinguished, this variable is viewed to reflect the fiscal and monetary policy mix.[41] Where data for the central bank lending to the government are unavailable, as in the case of Guyana, we use the closely related changes in the (real) base money supply—the notes and coins component of money supply (denoted by "m-p"). To the extent that inflation reflects (excessive) lending to the government and (excessive) expansion in the money supply,[42] we use past inflation rates, as in the case of Jamaica, to capture any additional impact on the premium of the fiscal and monetary policy that is not already accounted for.[43]

Governments can differ in their fiscal/economic policy orientation. Hence, changes of government create uncertainty that can affect the parallel market premium. In the absence of monthly fiscal data and to control for the possible inability of the central

[39] Use of these variables circumvents the limitation that data on government expenditures and revenues are not available at monthly intervals and that fiscal policy is not made on a monthly base.
[40] In developing countries usually entire fiscal deficits are monetized because markets for government securities are very thin or non-existent altogether.
[41] This was noted also in a footnote in section 2.
[42] "Excessive" is defined relative to the real growth of the economy.

bank lending to the government to capture changes in fiscal policy orientation, we use a variable "Elections", a dummy variable taking a value of one six months prior to and after a general election and zero otherwise, in our estimated specification. Our decision to use six months prior to a general election as the measurement period is based on the observation that during the sample period there was on average a difference of six months between the announcement and holding of general elections. Our choice of six months after a general election as the measurement period is based on the average time difference between the holding of general elections and the passing of annual budgets. Radical changes in government as in the case of Jamaica can be expected to cause extreme uncertainty and, hence, affect the parallel market premium in a pronounced way. To capture this impact we include a variable "Change of Government" (denoted by "Changov") in our specification for Jamaica. Like our variable "Elections", this variable is a dummy variable taking a value of one six months prior to and after the inauguration of a new government.

Given the importance of bauxite exports and oil exports for the government revenues in Guyana and Trinidad respectively, we include them (denoted by "Export" and "Oil Revenues") in our respective reduced form regression models. The Guyana's bauxite industry, which was nationalized in the sample period, accounted for more than 75% of her export earnings and government revenues. The Trinidad's oil industry accounted for more than 80% of her export earnings and government revenues. *International Financial Statistics* publishes the data for our first, second, sixth and

[43] The inclusion of this variable for Jamaica captures significant additional information about her black market premium even in the presence of the variable "credit".

seventh variables and the Ministry of Finance in each country publishes the data for our third, fourth and fifth variables.

The results of estimating our reduced form models of determinants of the parallel market premium in Guyana, Jamaica and Trinidad are presented in Tables 11-13.[44] The t-statistics values for the estimated coefficients are presented in parenthesis. The related elasticities, which are evaluated at the mean of the respective independent variable, are reported as well. The marginal effects that are reported in Tables 11-13 represent the net effect of the binary variables used in the analysis. Table 14 reports the battery of diagnostic tests used to evaluate each estimated model. The R2 is the standard coefficient of determination; the F(m,n) is the standard F test; and the DW is the standard Durbin-Watson statistic for serial correlation. AR1-5 is a test of residual autocorrelation. The null hypothesis for this test is that the lagged values of the residuals have coefficients equal to zero. The RESET is Ramsey's RESET Test of specification errors. Specification errors as used in this format cover the correlation between the independent regressors and the residual term, omitted variables and errors in the functional forms used in generating the estimates. The Normality test reported is the Jarque-Bera test of normality of the residuals; the null hypothesis is normality. The final diagnostic test listed is the ARCH [m]; the null hypothesis of this test is that the residual term is conditionally homoscedastic. The results in Table 14 indicate that the overall fits of the estimated regressions are satisfactory.

There are broad similarities as well as striking differences in the specifics in the behavior of the parallel market premium in the three countries. As for any inertia in the

[44] The number of observations in these tables is 102.

premium, its past values have a dampening effect on its current values in all three countries.[45]

As for the role of foreign exchange controls,[46] in Guyana current account restrictions have a large negative impact on the premium. The presence of such restrictions two periods earlier dampens the premium in current period by over 17%. In Trinidad current account restrictions create small but opposite effects over time. One period after their introduction these controls lead to an increase of 1.4% in the premium, while four periods after their introduction they lead to a reduction of 1.55% in the premium. This result shows that initially current account restrictions are ineffective in dampening the parallel market premium but over time they become binding and lead to a reduction in the premium.[47] In Guyana capital controls have the opposite effect. The presence of such controls in previous period results in a startling 24% increase in the premium in current period. Her use of multiple exchange rates also has a significant positive impact on the premium. To the extent that an increase in the premium is indicative of excess demand for foreign exchange in the parallel market, these results suggest that in Guyana capital controls and multiple exchange rates are effective tools in reducing the flow of foreign exchange into the parallel market.

As for the role of fiscal and monetary policy, the central bank credit to the government has a positive effect on the parallel market premium in Jamaica and Trinidad for which such data are available. Its impact is somewhat greater in Trinidad where the

[45] For Guyana the estimated elasticity, which is significant at the 1% level, implies that a 1% increase in the premium two months earlier would result in a startling/implausible 36.8% reduction in the premium in current period.
[46] To the extent that market participants may have expectations about controls being imposed or relaxed, our model specification reflects a reduced form. It is in the tradition of the existing studies noted in sections 1 and 2 that we interpret its estimated coefficients structurally.
[47] Interestingly, this is similar to the J-curve effect but with reversed causation.

five-period (five-month) lag of the central bank credit to the government, which is statistically significant at the 1% level, has an estimated elasticity of 0.858. The respective elasticity for Jamaica is 0.655. In Guyana, where data for the central bank lending to the government are unavailable, changes in (real) base money have a significant positive impact on the parallel market premium.[48] A 1% increase in her (real) base money supply in previous period implies a 6.89% increase in her premium in current period. Finally, in Jamaica a 1% increase in the inflation rate three periods earlier results in a startling increase of over 37% in the premium in current period. These results confirm the notion that budget deficits and expansionary fiscal and monetary policy put upward pressure on the exchange rate.

Elections have a positive impact on the premium in Guyana and Jamaica. Its impact is stronger in Guyana where an election in the previous period leads to a 4.37% increase in the premium in current period. The respective elasticity for Jamaica is 1.3%. Elections have no explanatory power in the case of Trinidad. Radical changes of government in Jamaica have positive and statistically significant impact on her premium; such a change of government two periods earlier leads to a 2.4% increase in her premium in current period. These results confirm the notion that changes of government, be it orderly or violently, result in uncertainty, albeit to different degrees, and lead to a rise in the parallel market premium.

As for government (export) revenues *a la'* bauxite exports in Guyana and oil exports in Trinidad we expect them to have a negative impact on the premium. The signs of the respective estimated coefficients are in line with our a-priori expectations, but the

[48] This variable has no explanatory power in the other two countries where data for the central bank lending to the government are available and are already present in the estimations.

one for Guyana is statistically insignificant and the one for Trinidad while statistically significant has a very small elasticity.

Putting aside the past values of the premium, in Guyana capital controls, in Jamaica, which did not use any exchange controls, inflation, and in Trinidad current account restrictions exert the strongest influence on the parallel market premium. That is, exchange controls, when used, are the strongest determinants of the premium.

5. Conclusions

In this paper we have studied the relationship between the parallel and official exchange rates for a sample of three Caribbean countries, Guyana, Jamaica, and Trinidad for the period 1985-1993 using Granger causality, cointegration, and reduced form methods on monthly data. These countries had well-developed parallel markets and attempted unification of their parallel and official exchange rates during the sample period. The fact that they were fundamentally similar at the onset of their political independence in the 1960s but faced different economic policies and fortunes/misfortunes soon thereafter has rendered this sample further interesting.

Our cointegration and causality analyses have revealed once again the importance of the official exchange rate policy pursued by the central bank for the relationship between the official and parallel rates. Where the official rate was adjusted infrequently and by large amounts as in Guyana and Trinidad the official rate Granger caused the parallel rate and there were significant disequilibria in the relationship between the two rates over the sample period. Where the official rate was adjusted frequently and by small amounts as in Jamaica the official and parallel rates exhibited bi-directional causation and

there was an equilibrium/long-run relationship between the two rates over the sample period.[49]

The results of our reduced form regression models have mostly confirmed the notions that expansionary fiscal and monetary policy, changes of government, and exchange controls in the forms of capital controls and multiple exchange rates put upward pressure on the exchange rate and, where the official rate is protected, increase the parallel market premium. The negative impact on the premium of current account restrictions in Guyana and Trinidad suggests that in certain cases such restrictions could be effective in curbing demand for foreign products/currency, albeit with a delay and in a J-curve fashion. The insignificant and small negative impact on the premium of country specific government (export) revenues *a la'* bauxite exports in Guyana and oil exports in Trinidad reveal that such foreign exchange earnings may be ineffective in removing the pressure on the official rate caused by, for example, monetaized budget deficits.

The fact that in our sample, after past values of the premium, exchange controls exert the strongest impact on the premium once again reveals the pivotal role of such controls for the emergence and behavior of parallel markets for foreign exchange. Given their strong impact on the premium, to minimize the distortions caused by them they can be accompanied by an active policy of frequent and small adjustments to the official rate as in Jamaica and *a la'* a "premium rule" rather than by a passive policy of infrequent and large adjustments to the official rate as in Guyana and Trinidad. Our analysis further supports the lesson that policy makers cannot play foot loose with fiscal and monetary

[49] These results make one wonder if an exchange rate unification attempt may have a higher chance for success where the latter official exchange rate policy is followed.

policy without its consequence showing up somewhere else in the economy. In our case, it shows up in the behavior of the parallel market premium.

References

Agenor, P.R. and Flood, R. (1992). "Unification of Foreign Exchange Market", *IMF Staff Papers*, Vol. 39, 923-47.

Apergis, N. (2000). "Black Market Rates and Official Rates in Armenia: Evidence from Causality Tests in Alternative Regimes,*Eastern Economic Journal*,Vol. 26,No. 3, 335-44.

Ashworth, J., Evans, L. and Triba, A. (1999). Structural Breaks in Parallel Markets?: The Case of Nigeria, 1980-1993", *Journal of Development Economics, Vol. 58, 255-64.*

Baliamoune, M.N. (2001). "Official and Black Market Exchange Rates in Morocco: A Cointegration Model", University of North Florida, Mimeo.

Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D.F. (1993). Co-integration, Reduced form, and the Econometric Analysis of Non-Stationary Data, Advanced Texts in Econometrics, Oxford University Press.

Bessler, D. and Yu, Hui-Kuang, (1994). "Official and Black Market Exchange Rates in Brazil: A Case of Iterated Logarithm", *Applied Financial Economics*, Vol. 4.

Chotigeat, T. and Theerathorn, P. (1996). "Cointegration: Black Market and Official Exchange Rates in Nine Pacific Basin Countries", *Journal of Economic Development*, Vol. 21 (June).

Culberston, P.W. (1989). "Empirical Regularities in Black Markets for Currency", *World Development*, (December) 1907-19.

Engle, R.F. and Granger, C.W.J. (1987). "Co-integration and Reduced form: Representation, Estimation and Testing", *Econometrica*, Vol. 55 (March).

Gelbard, E. and Nagayasu, J. (1999). "Determinants of Angola's Parallel Maraket Exchange Rate", *IMF Working Papers*, 99/90.

Goldberg, L.S. (1995). "Exchange Rate Regime Reforms with Balck Market Leakages", *Journal of Development Economics*, Vol. 48, 167-87.

Ghei, N., Kiguel, M.A. and O'Connell, S.A. (1995). "Parallel Exchange Rates in Developing Countries: Lessons from Eight Case Studies", in Kiguel, M.A., Lizondo, J.S. and O'Connell, S.A. (ed.), Parallel Exchange Rates in Developing Countries, St. Martin's Press, New York.

Greene, W.H. (2000). Econometric Analysis, 4th edition, Prentice Hall, New Jersey.

Kiguel, M.A. and O'Connell, S.A. (1995). "Parallel Exchange Rates in Developing Countries", *The World Bank Research Observer*, Vol. 10, 21-52.

International Financial Statistics, IMF, Washington, D.C., various issues.

Johansen, S. (1988). "Statistical Analysis of Cointegration Vectors", *Journal of Economic Control and Dynamic*, Vol. 12 (June).

Johansen, S. (1991). "Estimation and Hypothesis testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica*, Vol. 59 (November).

Johansen, S. and Juselius, K. (1990). "Maximum Likelihood Estimation and Inference on Cointegration-with Application to Demand for Money", *Oxford Bulletin of Economics and Statistics*, Vol. 52 (May).

Kharas, H. and Pinto, B. (1989). "Exchange Rates Rules, Black Market Premia and Fiscal Discipline: The Bolivian Hyperinflation", *Review of Economic Studies*, Vol. 56, 435-48.

Lizondo, J.S. (1987). Unificaiton of Dual Exchagne Markets", Journal of International Economics, Vol. 22, Feb., 57-77.

Montiel, Peter J., Agenor, Pierre-Richard and Ul Haque, Nadeem. (1993). Informal Financial Markets in Developing Countries, Blackwell Publishers, Oxford UK.

Noorbaksh, A. and Shahrokhi, M. (1993). "The Official and Black (Parallel) Foreign Exchange Markets, Causal Relationship: Empirical Evidence", Global Finance Journal, Vol. 4, 65-76.

Odedokun, M.O. (1996). " Monetary Model of Balck Market Exchange Rate: Evidence from African Countries", *Journal of Economic Studies*, Vol. 23, No. 4, 31-49.

Patterson, K. (2000). An Introduction to Applied Econometrics: A Time Series Approach. Palgrave, U.K.

Phylaktis, K. and Kassimatis, Y. (1997). "Black and Official Exchange Rate Volatility and Foreign Exchange Controls", *Applied Financial Economics*, Vol. 7, No. 1 (February), 15-24.

---------- and Girardin, E. (2001). " Foreign Exchange Markets in Transition Economies: China", *Journal of Development Economics*, Vol. 64, 215-35.

Pinto, B. (1989). "Black Market Premia, Exchange Rate Unification, and Inflation in Sub-Saharan Africa", *World Bank Economic Review*, Vol. 3, No. 3, 321-38.

---------- (1991). "Black Markets for Foreign Exchange, Real Exchange Rates and Inflation", *Journal of International Economics*, Vol. 30, No. 1, 121-136.

World Currency Yearbook, various issues.

Figure 1: Guyana-Exchange Rates

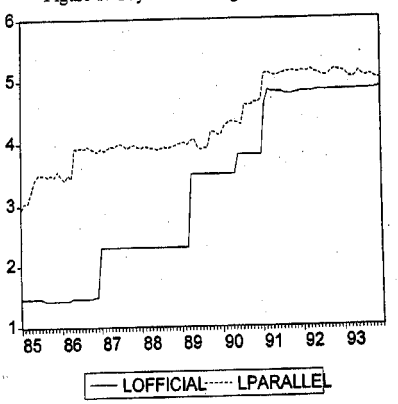

Figure 2: Jamaica-Exchange Rates

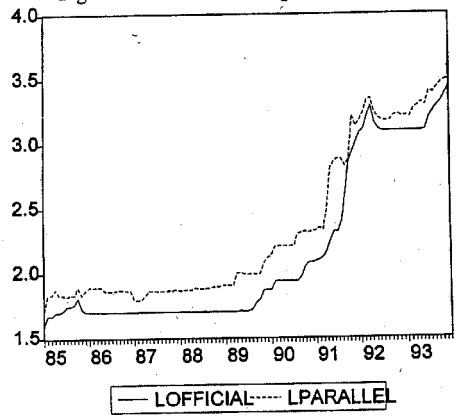

Figure 3: Trinidad-Exchange Rates

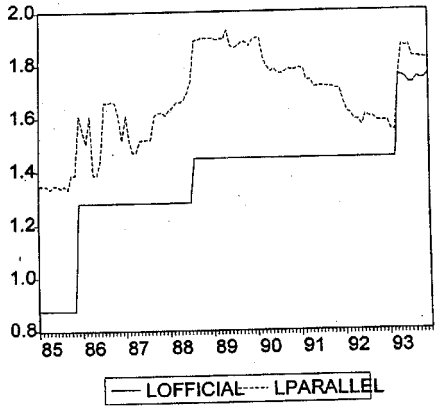

Table 1: Guyana-Exchange Rates and Premium

Year	Official Exchange Rate	Parallel Exchange Rate	Premium (%)	Maximum Premium (%)
1985	4.24	28.92	684.04	843.37
1986	4.28	43.75	1019.87	1209.3
1987	10.00	51.33	513.33	540.00
1988	10.00	50.75	507.5	530.00
1989	27.25	55.75	263.03	550.00
1990	40.00	85.08	213.52	233.33
1991	114.15	161.42	47.17	244.44
1992	125.13	167.92	34.22	141.13
1993	126.96	157.58	24.17	134.92

Table 2: Jamaica-Exchange Rates and Premium

Year	Official Exchange Rate	Parallel Exchange Rate	Premium (%)	Maximum Premium (%)
1985	5.56	6.27	12.77	19.8
1986	5.48	6.52	18.99	21.77
1987	5.49	6.34	15.48	18.36
1988	5.49	6.57	19.67	22.16
1989	5.74	7.32	27.53	34.52
1990	7.18	9.48	32.03	43.89
1991	12.12	16.33	34.74	76.12
1992	22.96	25.28	10.11	13.72
1993	24.95	28.85	15.63	24.86

Table 3: Trinidad and Tobago-Exchange Rates and Premium

Year	Official Exchange Rate	Parallel Exchange Rate	Premium (%)	Maximum Premium (%)
1985	2.5	3.96	58.4	66.67
1986	3.6	4.76	32.0	46.39
1987	3.6	4.71	31.0	40.28
1988	3.9	5.88	52.0	58.33
1989	4.25	6.62	56.0	62.35
1990	4.25	6.07	43.0	57.65
1991	4.25	5.64	33.0	40.47
1992	4.25	4.95	17.0	23.53
1993	5.36	5.87	9.5	15.56

Table 4: Guyana-Unit Root Tests

	Δs	Δe	ADF
$(1-\rho)$	-1.02	-0.948	
t-value	(-4.792)	(-4.37)	-2.586
$\mu,(1-\rho)$	0.0193, -1.254	0.0385, -1.152	
t-value	(2.043), (-5.258)	(2.07), (-4.899)	-3.495
$\mu,(1-\rho),\gamma_c$	0.0306, -1.286, 0.0002	0.0461, 0.236, -0.00013	
t-value	(1.551), (-5.264), (-0.6545)	(1.224), (-4.879), (-0.232)	-4.05

Table 5: Jamaica-Unit Root Tests

	$\Delta^2 s$	$\Delta^2 e$	ADF
$(1-\rho)$	-3.849	-2.338	
t-value	(-9.385)	(-6.559)	-2.586
$\mu,(1-\rho)$	0.00077, -3.85	0.000747, -2.3404	
t-value	(0.1299), (9.337)	(0.199), (6.529)	-3.495
$\mu,(1-\rho),\gamma_c$	0.00056, -3.85, 3.8×10^{-6}	-0.0022, -2.35, 5.18×10^{-5}	
t-value	(0.042), (-9.285), (0.0186)	(-0.0265), (-6.512), (0.398)	-4.05

Table 6: Trinidad-Unit Root Tests

	Δs	Δe	ADF
$(1-\rho)$	-1.316	-1.009	
t-value	(-5.543)	(-4.3696)	-2.586
$\mu,(1-\rho)$	0.00639, -1.3715	0.01, (-1.1648)	
t-value	(1.115), (-5.6498)	(1.758), (-4.753)	-3.495
$\mu,(1-\rho),\gamma_c$	0.0153, -1.3955, -0.00016	0.01546, -1.176, -9.36×10^{-5}	
t-value	(1.228), (-5.69538), (-0.8046)	(1.289), (-4.761), (-0.5119)	-4.05

Table 7: Granger Causality Tests

Country	$\Delta e \rightarrow \Delta s$	F-value	$\Delta s \rightarrow \Delta e$	F-value
Guyana	Yes	2.08	no	0.32
Jamaica	Yes	5.48	yes	4.61
Trinidad	yes	4.44	no	0.25

Table 8: Guyana-Cointegrating Equations

Eigenvalue	**Likelihood Ratio**	**Critical Value (1%)**	**Hypothesis**
0.221 0.074	29.15 6.88	24.60** 12.97	H0: r=0 H0: $r \leq 1$

Cointegrating Coefficients

Official	**Parallel**	**C**	
0.67 (0.14)	-1.56 (-0.23)	4.74 (0.41)	
Normalized Coefficients			
1.00	-2.35 (-0.067)	7.35 (0.30)	

Table 9: Jamaica-Cointegrating Equations

Eigenvalue	**Likelihood Ratio**	**Critical Value (1%)**	**Hypothesis**
0.232 0.033	30.59 3.45	24.60** 12.97	H0: r=0 H0: $r \leq 1$

Cointegrating Coefficients

Official	**Parallel**	**C**	
1.73 (0.32)	-1.83 (-0.31)	0.497 (0.14)	
Normalized Coefficients			
1.00	-1.06 (-0.02)	0.29 (0.05)	

Table 10: Trinidad-Cointegrating Equations

Eigenvalue	**Likelihood Ratio**	**Critical Value (1%)**	**Hypothesis**
0.21 0.06	27.19 5.75	24.60** 12.97	H0: r=0 H0: $r \leq 1$

Cointegrating Coefficients

Official	**Parallel**	**C**	
0.31 (0.99)	-0.86 (-0.86)	1.72 (0.60)	
Normalized Coefficients			
1.00	2.74 (0.83)	-5.48 (-1.20)	

Table 11: Guyana-Reduced Form Estimates

Variables	Coefficient	Elasticities	Marginal Effects
Constant	-1.53 (-3.467)		
$Election_{t-1}$	1.9879 (2.479)	4.37	0.4373
$Currac_{t-2}$	-1.886 (-6.893)	17.16	1.716
$CapCon_{t-1}$	3.122 (7.6556)	24.35	2.435
$Multiple_{t-1}$	0.8387 (5.273)	6.542	0.654
$\Delta(s-p)_{t-2}$	-0.6201 (-8.815)	36.848	
$\Delta(s-p)_{t-5}$	-0.6325 (-6.008)	0.661	
$\Delta(m-p)_{t-1}$	0.0191 (2.686)	6.889	
$\Delta Export_{t-2}$	-0.0028 (-0.5531	0.0353	

Table 12: Jamaica-Reduced Form Estimates

Variables	Coefficient	Elasticities	Marginal Effects
Constant	0.0032 (5.504)		
$Elections_{t-5}$	0.0013 (2.479)	1.303	0.23
$Changov_{t-2}$	0.00362 (2.99)	2.419	0.284
$\Delta(s-p)_{t-2}$	-0.1698 (-4.4358)	12.542	
$\Delta(s-p)_{t-5}$	-0.3922 (-5.51)	4.279	
$\Delta Credit_{t-4}$	0.0101 (2.446)	0.65536	
$Inflation_{t-3}$	0.00343 (3.961)	37.81	

Table 13: Trinidad-Reduced Form Estimates

Variables	Coefficient	Elasticities	Marginal Effects
Constant	-2.914 (-0.8522)		
$Election_{t-1}$	-1.156 (-0.761)	0.09	0.31
$Currac_{t-1}$	6.589 (3.784)	1.403	1.81
$Currac_{t-4}$	-7.05 (-3.551)	1.55	1.94
$\Delta(s-p)_{t-1}$	-0.5377 (-3.622)	0.08	
$\Delta(s-p)_{t-3}$	-0.2644 (-2.66)	0.02	
$\Delta Credit_{t-2}$	0.0151 (3.676)	0.009	
$\Delta Credit_{t-5}$	0.0113 (3.137)	0.858	
ΔOil Revenues$_{t-1}$	-0.5999 (-2.892)	0.013	

Table 14: Reduced Form Diagnostics

Diagnostics	Guyana	Jamaica	Trinidad
R^2	0.59	0.56	0.46
F(8.91)	16.36	16.9	9.6
DW	1.89	1.94	1.94
AR 1-5	[0.871]	[0.583]	[0.786]
RESET	[0.873]	[0.671]	[0.655]
Normality	[0.873]	[0.477]	[0.18]
ARCH (4)	[0.83]	[0.644]	[0.438]