An Explanation of the Success of an Unannounced Foreign Exchange Regime Change

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Abstract

Starting in 2004 the Guyanese foreign exchange rate has been remarkably stable relative to earlier periods. This paper explores the reasons for the success of the unannounced regime change from a flexible to a *de facto* peg. The paper notes that the task of monetary policy is made easier if moral suasion comes to bear on the dominant trader (s) in a highly concentrated foreign exchange market, which is dominated by a few commercial traders. Long-term or non-volatile capital inflows also make the exchange rate less susceptible to sudden reversal. The econometric evidence is consistent with the notion that trader market power has contributed to the decreased volatility of the exchange rate. The paper also presents a model that analyzes monetary policy effects in the presence of a mark-up or threshold interest rate.

Key Words: exchange rate, foreign exchange market, monetary policy

JEL Codes: F31, F40, F41

1. Introduction

As part of a broad macroeconomic reform agenda implemented in 1988, Guyana adopted a floating exchange rate in 1990 (Egoume-Bossogo et al 2003; Thomas and Rampersaud 1991). The parallel or street rate was merged with the official rate as one aspect of the comprehensive macroeconomic and financial sector reform agenda. A notable spread, prior to 1990, existed between the official and parallel rates; however, as the reforms intensified the spread declined and the rates converged (Fardmanesh and Douglas 2008). The agenda of foreign exchange market reform was not limited to Guyana. It was a widespread reform movement in other parts of the world such as the

Caribbean and African economies (Fardmanesh and Douglas 2008; Galbis 1993). The banking and financial sector reforms included: promoting financial market development, decontrolling interest rate, implementing market-based monetary policy through a Treasury bill auctioning framework, privatizing state-owned banks, and dismantling direct credit schemes (Das and Ganga 1997; Egoume-Bossogo et al 2003).

From around 2004, however, the exchange rate moved from a relatively more flexible to a virtually fixed rate demonstrating limited variability. This regime shift went unnoticed to most except the IMF which started to classify Guyana as having a *de facto* pegged exchange rate regime (IMF 2006). Heretofore, the academic literature has not analyzed this silent transition; thus this paper intends to make a contribution in that regard. Upon examination of the institutional features of the foreign exchange market, the paper argues that the foreign exchange market is highly concentrated where a few commercial banks dominate the trading of foreign currencies. Therefore, we postulate that trader market power and high concentration (in the foreign exchange market) helps in the stabilization of the rate. In addition, given that commercial banks, in the aggregate, possess a large portfolio of assets in domestic currency (loans, treasury bills and excess reserves), it is not in their interest to see the nominal exchange rate depreciate because of the potential inflation pass-through. Therefore, to the extent that moral suasion is used as a monetary management tool, it is more likely to succeed given the institutional features of the Guyana foreign exchange market[1].

[1] Of course, the central bank has never announced that moral suasion is part of its toolkit.

Moreover, the paper also hypothesizes that the nature of capital inflows facilitate and buttress the market power role of the commercial banks in stabilizing the rate[2]. Portfolio or hot money inflows are very small relative to stable long-term capital inflows. The latter include foreign direct investments, remittances, aid funds, and multinational loans. Remittances form an important source of foreign exchange inflows; therefore, to the extent the altruistic motive to remit is dominant, this form of foreign exchange inflow eases the exchange rate volatility and reinforces the strategic exchange rate formation role of the large commercial bank traders[3].

The paper utilizes a three-tier methodology to present its case. Firstly, we present a narrative approach outlining stylized facts and features of the Guyana foreign exchange market. Secondly, we present a simple model that illustrates how a threshold domestic interest rate influences the central bank's management of commercial bank reserves (as is done under the financial programming model). The threshold is identified by an aggregate commercial bank liquidity preference curve that becomes horizontal at the interest threshold, which is assumed to be a mark up over the foreign interest rate. Thirdly, we provide econometric evidence which models exchange rate volatility and concentration as measured by the Herfindahl-Hirschman index.

The paper is structured as follows. Section 2 presents background information that outlines the facto pegged rate and other key macroeconomic variables. Section 3 examines the composition of capital inflows. Section 4 explores the structure and features

[2] Sudden swings in capital inflows – especially short-term inflows – can be devastating and result in bankruptcies, destruction of the credit channel, and impose an adverse effect on human capital (Calvo 1998).

[3] Agarwal and Horowitz (2002) found the altruistic motive to be the important factor in determining the inflow of remittances into Guyana.

of the foreign exchange market. Section 5 presents several arguments why the rate stabilized. Section 6 presents a theoretical model which shows a binding threshold mark-up interest rate could generate a stable exchange rate in the presence of monetary expansion. Section 7 provides econometric evidence that shows that exchange rate volatility is negatively related to concentration (the market power thesis). Section 8 concludes.

2. Background Information

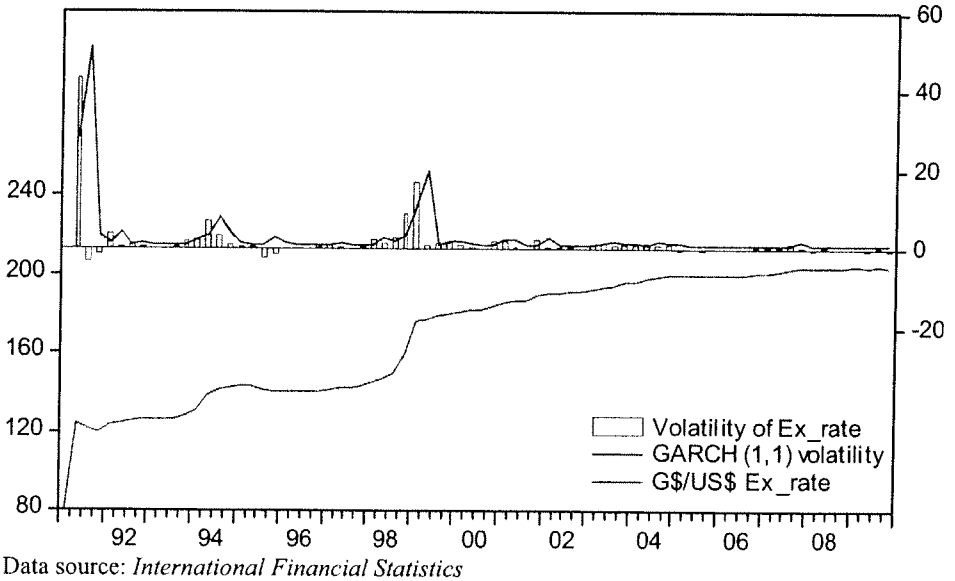
In November 1989 several bank and non-bank traders (or cambios) were licensed to buy and sell foreign currencies at freely determined rates. By March 1990 the cambio market system – in which bank and non-bank traders freely buy and sell foreign currencies – was implemented. Figure 1 shows the Guyana dollar/US$ exchange rate from first quarter 1991 to last quarter 2009. This is the essential rate as over 90 percent of foreign currencies traded are the United States dollar. On the left- axis is the G$/US$ rate. It is obvious the rate depreciated substantially in the early period of the formation of the cambio market system; as at end 2009, the exchange rate stood at G$ 204 for one US$. However, by fourth quarter of 2004 the rate stabilized remarkably relative to previous periods.

It is easier to spot the relative stability by looking at the bars (right-axis), which shows the change in the exchange rate from one period to the next. Thus a large spike shows a large and volatile change in the exchange rate from period to period. On the other hand, stability is indicated by a less volatile oscillation of the bar spikes. Moreover, when the spike is above zero it signals depreciation, while a spike below zero shows an appreciation of the Guyana dollar. Also reported is the GARCH (1, 1) measure of

volatility[4]. This measure also shows remarkable relative tranquillity after the 2004 period.

Table 1 presents selected macroeconomic indicators. The data suggest that the external debt ratio continued to decline in the post-2004 period; a noticeable accumulation of foreign reserves in 2008 and 2009; and a surplus in the current account balance in 2008 and 2009. The unprecedented accumulation of foreign exchange reserves and the surplus occurred long after the exchange rate stabilized. Otherwise, there is no other conspicuous change in the data that could give a clue as to what accounted for the stability of the rate in the post-2004 era. There was also no noticeable shift in the monetary aggregates that would explain the regime change.

Figure 1. The G$/US$ exchange rate (left-axis) and volatility (right-axis) – 1991:Q1 to 2009:Q4



Data source: *International Financial Statistics*

Table 1. Selected macroeconomic indicators

[4] We follow the suggestions and procedures outlined by Enders (2010) when determining the fit for the GARCH (1, 1) model. The GARCH (1, 1) model was sufficient to capture the conditional volatility of the series.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Real GDP Growth (%)	-1.4	2.3	1.1	-0.7	1.6	-1.9	5.1	5.4	3.1	2.3
Annual Inflation (%)	6.1	2.6	5.3	6.0	4.7	6.9	6.6	12.3	8.1	2.9
Current Account/GDP (%)	-15	-18	-15	-11	-9	-19	-28	-18	14	9
Capital Account/GDP (%)	19	16	12	8	5	22	30	16	13	18
External Debt/GDP (%)	170	170	187	162	152	148	115	67	73	74
Reserve Money Growth (%)	14	11	10	10	8	11	5	8	7	24
M1 Growth (%)	15	0	6	17	12	9	27	13	13	9
M2 Growth (%)	11	9	5	8	8	8	16	14	13	10
International Reserves (US$-Mill)	305	287	284	276	232	252	280	313	356	631

Source: Caribbean Centre for Money and Finance; *International Financial Statistics*

3. The Nature of Capital Inflows

In light of the fact that the exchange rate can be affected by capital inflows, this section outlines the type of capital inflows into the Guyana economy. We are particularly interested in whether the type of capital inflows can suddenly reverse course and exit. The data on key components are presented in Table 2. The main items are long-term foreign direct investments and remittances. A study in the Guyana context found that remittance inflows are motivated by senders' altruism (Agarwal and Horowitz 2002). Long-term loans and grants to the government also form a main inflow that is not susceptible to sudden reversal. Short-term capital inflows, which are made up mainly of foreign bank deposits held in Guyana, are relatively small compared with the other categories. A precipitous decline in these potentially volatile deposits in 2008 did not appear to influence the exchange rate in a substantial manner.

Table 2. Capital inflows (US$ millions)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Short-term inflows	19	16	22	21	34	49	50	52	40	50
Foreign direct investments	67	56	44	26	30	77	102	110	184	208
Workers' remittances	47	44	40	47	74	167	216	287	329	300
Long-term loans and grants	66	66	45	68	61	102	107	105	187	135

Source: Bank of Guyana *Annual Report* (various years)

4. Features of the FX Market

The number of bank and non-bank foreign exchange (hereafter FX) traders is presented in Table 3, which also provides a summary of the volume of purchases by the two categories of traders. We did not report the percentages from the sales quantities as they did not change the results in any significant way. It is clear that the volume of foreign currencies purchased by the traders has increased since 2000. There was a noticeable increase of US$71 mill in total purchases in the year 2004. For the year 2009 there was an increase of US$77 mill, accounted for mainly by a steep increase of purchases by non-bank traders. The table shows that commercial banks have dominated the trades, accounted for approximately 90 percent of FX purchases.

Table 3. Total foreign exchange purchased by traders (US$ million)

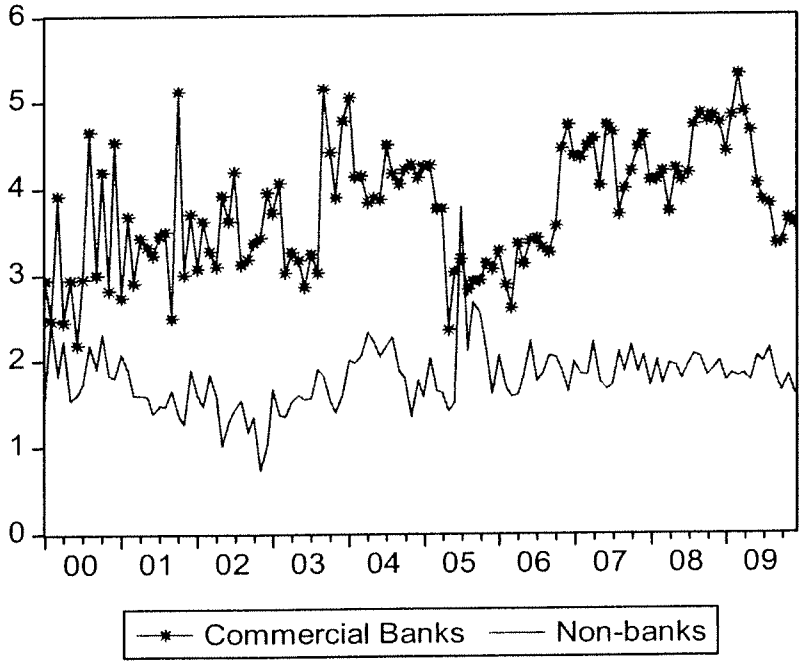
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Commercial banks	359	378	420	479	534	604	671	860	1052	1065
Non-banks	45	47	51	53	69	70	64	83	72	137
Total purchases	403	425	471	532	603	674	735	943	1125	1202
				Percentages						
Commercial banks	89	89	89	90	89	90	91	91	94	89
Non-banks	11	11	11	10	11	10	9	9	6	11
				Number of Traders						
Commercial banks	7	7	7	6	6	6	6	6	6	6
Non-banks	24	24	23	21	21	21	21	21	21	21
Total FX traders	31	31	30	27	27	27	27	27	27	27

Source: Bank of Guyana *Annual Report* (various years)

The main currencies traded in the market are the US dollar, Canadian dollar and the Euro. The US dollar accounts for the largest percentage of all FX trades, persistently accounting for approximately 90 percent of all currency trades. The Canadian dollar or Euro often switches places for the second spot. There is no central market for foreign currency trading; thus trades occur over-the-counter; and there is no trading of forward exchange rate contracts in Guyana – thus the exchange rate is a spot rate.

Figure 2 is consistent with the notion of the existence of market power in the FX market. The spread for commercial banks is higher for most of the sample period for which data are available. Notwithstanding the fact that the bid-ask spread can be determined by other factors[5], it is instructive to note that the commercial banks possess the higher spread. As indicated by the data given in table 3, the commercial banks are the largest traders in addition to being fewer. The bank concentration would have been enhanced in 2003 given the merger of the state-owned commercial bank (Guyana National Cooperative Bank) with the private bank (National Bank of Industry and Commerce).

Figure 2: Average bid-ask spreads of bank and non-bank cambios (G$), 2000-2007

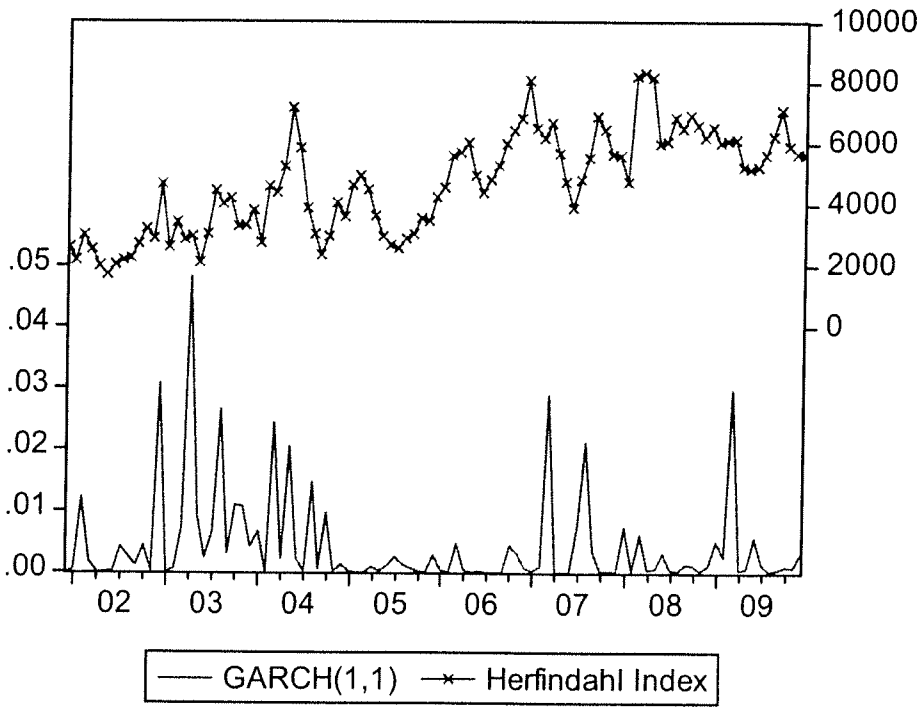


Data Source: Bank of Guyana

[5] For an examination of different determinants of FX market bid-ask spread see Melvin and Tan (1996) and Sager and Taylor (2006).

Since 2004 the level of concentration in the market has increased (see figure 3). The high concentration in the market is clearly visible from the computation of the Herfindahl-Hirschman index. When this index is graphed with the volatility of the G$/US$ exchange rate there appears to be a clear inverse relationship between the two variables suggesting the higher concentration leads to lower volatility

Figure 3: Market concentration and GARCH (1, 1) volatility – 2000: Jan to 2009: Dec



Source: Authors' calculations

5. Why the Stabilization of the Exchange Rate?

There has been no announcement of a formal exchange rate regime shift. However, the high concentration of FX trading volumes would make it easy for the large

commercial banks to set the rate and the others will have to follow. In other words, there could be a case of price leadership in the determination of the rate, whereby the large volume traders set the rate and the small volume traders follow. The large commercial banks possess a nationwide branch network which allows them to mobilize FX with ease relative to the non-bank cambios. Moreover, the wide branch network allows for a greater lock-in effect for the public to do over-the-counter trades. Given the presence of security guards and other security measures, the larger banks also allow for better physical security when exchanging funds. The small traders are often a single entity in the main cities.

The degree of market concentration enhances the ability of the central bank to use moral suasion, assuming it is used at all[6]. In this case, it is better to influence the dominant volume traders or price leaders as they trade most of the foreign currencies. Even if the smaller traders would like to set different rates they do not mobilize the volumes to do trades that shift the market fundamentally. In addition, should the central bank rely on moral suasion, its task is made easier given the nature of capital inflows that are not susceptible to sudden swings.

One might ask what motivation the price leaders would have to desire a stable rate or cooperate with the policy makers in the event if moral suasion is used as a policy. If banks could hoard foreign exchange and the rate depreciates, then they would realize a profit in terms of local currency. However, commercial banks, which also trade foreign

[6] For an empirical analysis of the relationship between bank competition and financial stability see Berger et at (2008). Vives (2001) also presents a helpful review of different aspect of the literature relating to bank competition, stability, regulation and competition policy. These authors look at the issue from the point of view of the loan market. In contrast, this paper proposes the hypothesis that banks which are the dominant foreign exchange traders, and have large asset outlays in domestic currency, could result in the stabilization of the exchange rate.

currencies, are more importantly lenders with large loan portfolios in Guyana dollars. They also possess an asset portfolio that is liquid in the domestic government securities and excess reserves. Therefore, it is not in their interest to have the Guyana dollar depreciate rapidly given that importers will pass on the higher import prices to consumers. Thus with rising inflation resulting from the depreciation, the banks would actually realize a loss in loan value and those who borrowed will gain. Also, a rapid depreciation could lead to a flight of foreign currency deposits (this is given in table 2 as short-term inflows). Table 4 reports the asset composition (in percentages) of commercial banks. The table shows that the major asset components are in domestic currency.

Table 4. Asset composition of commercial banks (percentages)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Foreign assets	7	9	10	14	15	18	17	24	22	17
Credit to government	18	17	18	24	26	25	26	21	22	25
Credit to private sector	46	44	41	34	28	27	27	28	29	26
Reserves and deposits at central bank	14	15	16	16	16	17	16	12	11	14
Other assets	15	16	15	12	14	14	14	14	16	17
Total percentages	100	100	100	100	100	100	100	100	100	100

Data source: Bank of Guyana *Annual Reports* (various years)

6. Bank Liquidity Preference and the Exchange Rate

According to the Bank of Guyana (BOG), its main focus of monetary policy is the effective management of reserves in the banking system. The latter is accomplished by a financial programming tool that facilitates open market operations consistent with forecasts for inflation and international reserves (BOG 2009; Ganga 2000). In other words, commercial banks possess a demand for reserves – defined as actual reserves plus required reserves – which the central bank must supply based on forecasts for inflation and international reserves. In addition, the central bank varies its tools of monetary policy

consistent with the reserves forecasts of the financial programming model (Ganga 2000).

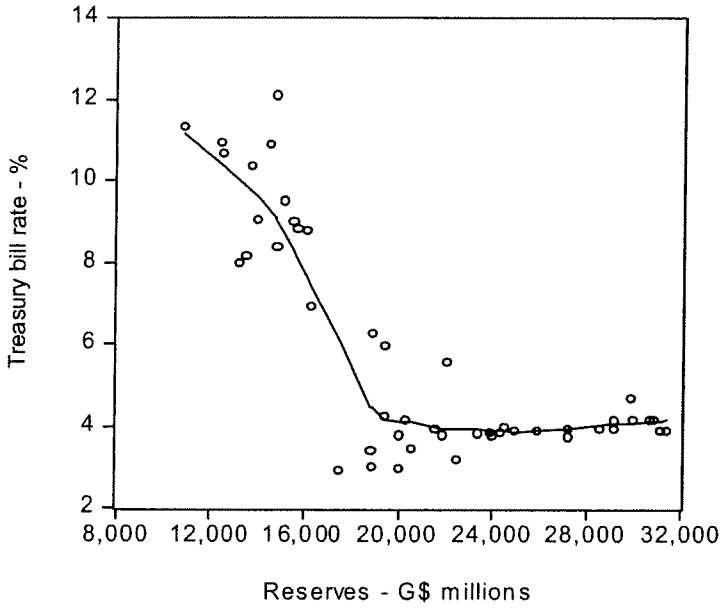
The empirical demand curve for reserves is presented below figure 4[7]. The curve is fitted using quarterly data taken from the *International Financial Statistics*. The reserves level was calculated by subtracting currency in circulation from reserve money. The interest rate is the 3-month Treasury bill rate, which was also sourced from the *International Financial Statistics*. Analytically, the curve is the aggregate banking sector demand curve for reserves, which the central bank manages using open market operations. The empirical curve is downward sloping and it becomes horizontal at approximately 4% Treasury bill rate. This can be termed a threshold or minimum interest rate at which point the banks accumulate reserves passively. Open market operations, which shift a vertical reserve supply curve along the liquidity preference curve, will have no effect on the rate of interest over the flat segment of the curve.

Exactly what is driving the flat segment of the curve is beyond the scope of this paper. Suffice to say, while it is akin to the textbook explanation of the Keynesian liquidity trap, in the case of Guyana the horizontal segment does not occur at a 0% interest rate; rather it occurs at around 4%, which implies that banks view non-remunerated reserves and Treasury bills as perfect substitutes at above zero. One potential explanation given for this occurrence would be Frost (1971) who explained that a kinked demand for excess bank reserves in the United States is due to various transaction costs. At the point where the market interest rate falls towards the marginal transaction cost, the curve is kinked. Another explanation comes from Khemraj (2006) who proffered the thesis that the flat curve represents a minimum mark-up rate; the thesis

[7] The curve was fitted using the method of locally weighted regressions with a smoothing factor of 0.4. For a detailed explanation of this technique see Cleveland (1979).

holds that the mark-up is done vis-à-vis a foreign benchmark interest rate – namely the US Treasury bill rate[8]. The latter hypothesis is more applicable in an era of financial openness on the capital account. As noted earlier in the paper, Guyana implemented far-reaching reforms in the financial sector. Once the market rate falls to the minimum rate, banks accumulate reserves at a greater extent than investing in the domestic asset.

Figure 4. Liquidity preference for commercial banks (1998: Q1 to 2009: Q4)



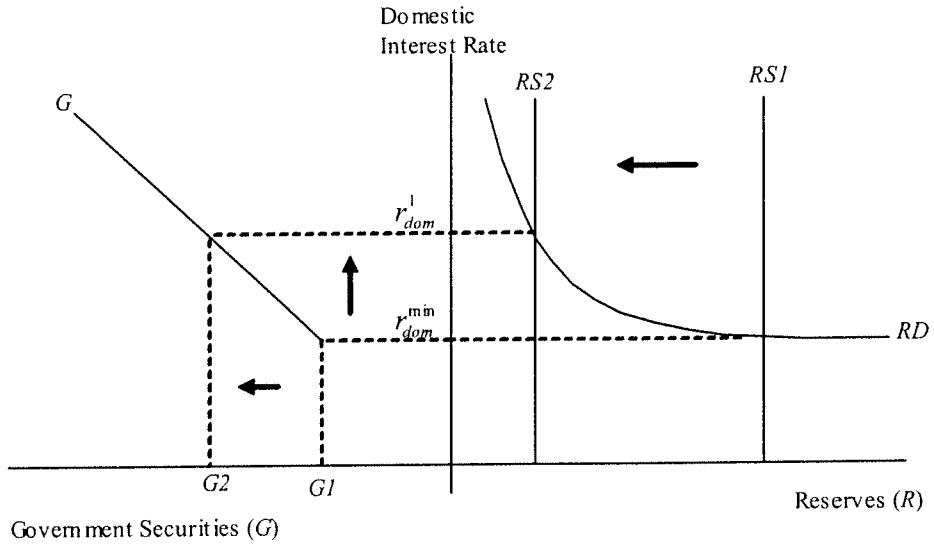
Data source: Bank of Guyana *Statistical Bulletin*

Therefore, the model which is presented herein to explain the connection between exchange rate dynamics and monetary policy, as conceptualized by the Bank of Guyana, is based on the empirical observation of an aggregate bank liquidity preference curve. Moreover, the model takes into consideration the banking sector's liquidity preference

[8] For this idea to hold there must be a negative relationship between commercial bank reserves and the difference between the Guyana Treasury bill rate and the US Treasury bill rate. This is shown in Appendix 1. The 3-month Treasury bill rate was used for both economies. The relationship shows that as the spread widens reserves decline. The negative linear relationship is consistent with the mark-up thesis.

rather than the public's demand for money, which could be unstable owing to the instability of the money multiplier. In addition, as noted by Khemraj (2006), in an oligopolistic banking sector the banks determine interest rate and the public accepts it. Therefore, it is important to take into consideration the banks' ability to determine interest rate outcomes asymmetrically. Although it is beyond the scope of this research, the paper proposes the notion that the threshold rate is determined as a mark-up over the rate of interest on a benchmark asset. At the interest threshold non-remunerated reserves and interest-earning Treasury bills are perfect substitutes.

Figure 5. Monetary policy and the threshold rate



Assume the domestic threshold rate is given by the simple equation $r^{min}_{dom}(1+m) = r_F$; whereby r^{min}_{dom} = the domestic minimum rate that is reached at the flat curve, m = the mark up factor that could be determined by bank preferences, risk, market power and other factors, and r_F is the foreign risk-free rate that serves as the benchmark

for Guyanese banks. The basic idea is sketched in figure 5. The latter figure shows that when the threshold rate ($r_{dom}^{\min}$) is binding, an expansion of bank liquidity along the flat liquidity demand curve (*RD*) – to the right of *RS1* – would have no effect in driving down further this rate, which is assumed to be set favorably relative to r_F . Commercial banks would need to mobilize foreign exchange from the domestic market to meet the foreign exchange needs of long established business customers (especially those who have outstanding business loans and exposure to international trade). As postulated earlier, commercial banks also would prefer to maintain a stable exchange rate given their large exposure of assets in domestic currency. On the other hand, should the central bank contract bank reserves by selling them government securities (*G*), then the domestic rate could increase above the threshold to r_{dom}^{1} . In this case there is the concomitant effect of an increase in government securities held by the banks from *G1* to *G2*.

The diagrammatic framework could be looked at more formally. Equation 1 is the augmented UIP, whereby s_t = the spot exchange rate.

$$s_t = \phi s_{t-1} + r_{dom}(1+m) - r_{Ft} \qquad (1)$$

Where $\phi < 1$. Given the nature of the liquidity preference curve (figure 4), it is possible to approximate the curve as a reciprocal function in which the threshold rate is the asymptote. R^* represents the equilibrium level of reserves at the point where $RD = RS$. β is the coefficient in the function where $\beta > 0$ and $r_{dom}^{\min} > 0$.

$$r_{dom} = r_{dom}^{\min} + \beta R^{*-1} \qquad (2)$$

Substituting equation 2 into 1 gives

$$s_t = \phi s_{t-1} + r_{dom}^{\min}(1+m) + \beta(1+m)R_t^{*-1} - r_{Ft} \qquad (3)$$

The term $r_{dom}^{\min}(1+m)$ is assumed to be constant at least in the short-term – hence there is to time index on the expression. Solving equation 3 for its time path using a procedure outlined by Enders (2010) gives equation 4, which allows us to derive the dynamic multipliers (equations 5a to 5d) showing the effectiveness of monetary policy when the threshold interest rate is binding. s_0 = the initial exchange rate utilized in the recursive process.

$$s_t = \frac{r_{dom}^{\min}(1+m)}{1-\phi} + \phi^t s_0 + \sum_{i=0}^{t-1} \phi^i \beta(1+m)\frac{1}{R_t^*} + \sum_{i=0}^{t-1} \phi^i r_{Ft-i} \tag{4}$$

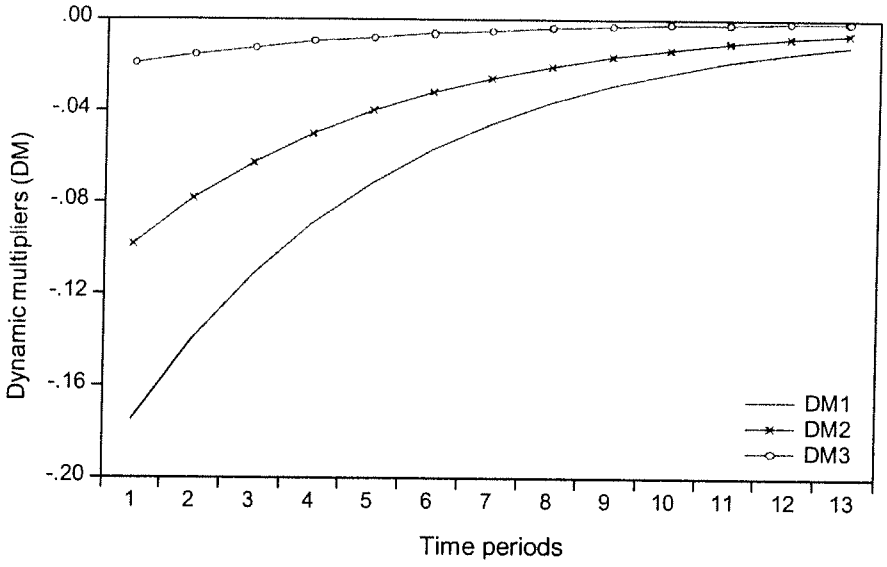
$$\frac{\partial s_0}{\partial R^*} = -\beta(1+m)R^{*-2} \tag{5a}$$

$$\frac{\partial s_1}{\partial R^*} = -\phi\beta(1+m)R^{*-2} \tag{5b}$$

$$\frac{\partial s_2}{\partial R^*} = -\phi^2\beta(1+m)R^{*-2} \tag{5c}$$

$$\frac{\partial s_n}{\partial R^*} = -\phi^n\beta(1+m)R^{*-2} \tag{5d}$$

Figure 6. Dynamic multipliers showing monetary policy effect at the interest threshold



Source: Authors' calculations

To be able to analyze the effect of monetary policy at the interest threshold, consider figure 6 which graphs the derived multipliers (equations 5a to 5d). The multipliers are given for three levels of bank reserves. We assume $\phi = 0.8$, $\beta = 1.5$ and $m = 0.05$. The intuition straightforward: we increase reserves to see what happens when the threshold is binding. The figure shows that as reserves increase at the threshold, the response is negative but gets closer to zero. As noted earlier, the Bank of Guyana manages bank reserves along a system-wide bank demand curve for reserves. The threshold is determined by the mark-up of the commercial banks. Therefore, monetary policy has less of an exchange rate impact on the exchange rate as the threshold comes into effect.

7. Some Econometric Evidence

In this study we employ a basic GARCH (1, 1) model to determine whether market concentration (measured by the Herfindahl-Hirschman index – HHI) impacts on the volatility of the G$/US$ exchange rate. The HHI is constructed by taking the sum of squares of the market shares of the average balance held by each cambio. Our model is similar to Egoume-Bossogo *et al* (2003), except that we include a measure of market concentration. These variables are included in the mean and variance equations (see table 5). By including the variables in the variance equation we will be able to determine how these factors impact on the volatility of the $/US$ exchange rate. Similar to Egoume-Bossogo *et al* (2003) we adjust and the mean and variance equations to incorporate seasonal effects. The exact specification of the mean and conditional variance equations is as follows:

$$\Delta s_t = \mu + \varphi HHI_t + \sum_{\tau=1}^{12} D_\tau + \varepsilon_t \text{ where } \varepsilon_t \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1}^2 + \gamma_3 HHI_t + \sum_{\tau=1}^{12} D_\tau$$

Table 5: Econometric results

	Coefficient	Std. Error	z-Statistic	Prob.
Mean equation				
μ	0.027	0.0613	0.442	0.659
HHI	0.005	0.0012	4.237	0.000
D_1	0.058	0.0894	0.654	0.513
D_2	0.051	0.0793	0.647	0.518
D_3	0.046	0.0922	0.503	0.615
D_4	0.134	0.0881	1.523	0.128
D_5	0.013	0.0676	0.198	0.843
D_6	0.069	0.0640	1.077	0.281
D_7	0.013	0.0732	0.178	0.859
D_8	0.131	0.0906	1.452	0.147
D_9	-0.015	0.0824	-0.180	0.857
D_{10}	0.184	0.1257	1.460	0.144
D_{11}	0.047	0.0765	0.614	0.539
Variance Equation				
Gamma_0	0.038	0.0159	2.394	0.017
Gamma_1	0.071	0.0505	1.406	0.160
Gamma_2	0.515	0.1075	4.790	0.000
HHI	-0.040	0.0031	-12.821	0.000
D_1	-0.031	0.0282	-1.109	0.267
D_2	-0.027	0.0195	-1.384	0.166
D_3	0.008	0.0458	0.179	0.858
D_4	-0.041	0.0386	-1.071	0.284
D_5	-0.047	0.0212	-2.237	0.025
D_6	-0.036	0.0159	-2.273	0.023
D_7	-0.026	0.0166	-1.545	0.122
D_8	-0.003	0.0198	-0.149	0.881
D_9	-0.033	0.0219	-1.511	0.131
D_{10}	0.038	0.0729	0.524	0.600
D_{11}	-0.071	0.0416	-1.702	0.089
Diagnostic tests				
No. Obs.	119			
ARCH Test	1.32 (p-val = 0.250)			
Q-stat (12)	-0.038 (p-val = 0.247)			
Q^2-stat (12)	0.072 (p-val = 0.695)			
AIC	0.4338			
LL	41.0947			
JB-Statistics	4.267 (p-val = 0.118)			

Consistent with our thesis that the dominant players would take advantage of their market power to minimize the volatility of the exchange rate, we expect a significant negative coefficient for this variable in the variance equation. Seasonal dummy variables are added to the equations to capture peculiar seasonal effects. It is possible that seasonal variation may be present in our data; early studies have noted this tendency also (Thomas and Rampersaud 1991). There is no *a priori* sign restriction for these variables. However, a significant positive coefficient for the dummy variable may be interpreted to mean that the average exchange rate is relatively larger during certain periods. The converse interpretation may be attributed to a significant negative coefficient for the dummy variables.

We utilize monthly data from February 2000 to December 2009 and the quasi-maximum maximum estimator (QMLE) to estimate our GARCH model (Enders 2010). The adequacy of our model is examined with several information criteria and non-linearity test including the Akaike information criteria (AIC), Log-Likelihood (LL) values, ARCH-LM test and Ljung-Box Q-statistics. Before estimating out model, we tested the variables to make sure they are stationary (Enders 2010).

The results indicate that the concentration variable is statistically significant in both the variance and mean equations. In the mean equation the variable has a positive coefficient suggesting that higher concentration may lead to the depreciation in the exchange rate. However, in the variance equation, the variables is carries a negative sign. This confirms our thesis that higher market concentration contribute to lower volatility in the exchange rate. The magnitude of the coefficient for the concentration variable reflects

the low level of variability in the exchange rate. The diagnostic test results are mainly favorable.

7. Conclusion

This paper proposed an explanation for the success of the unannounced foreign exchange regime change. The key argument is: the monetary authority's moral suasion, assuming this policy tool is indeed utilized, becomes easier to implement once there is concentration in the foreign exchange market. In this case, the monetary authority needs to control via moral suasion the rate formation of the price leader, which dominates in the quantity of FX trades. The large commercial banks, moreover, are likely to cooperate with the monetary authority given their substantial exposure in domestic currency assets that could decline in the event of a rapid depreciation of the Guyana dollar and the subsequent inflation pass-through. Therefore, in contrast to the existing literature which looks at competition and stability from the point of the loan market (see Vives 2001; Berger et al 2008), this paper examines the how concentration in FX market could contribute to macroeconomic stability. A second institutional feature that allows for the stability is the nature of capital inflows which are mainly in the form of altruistic remittances, long-term multilateral loans, and foreign direct investments. These inflows are less susceptible to sudden reversal. Therefore, this paper shows how the institutional structure of an economy can determine economic outcomes.

Following the observation of a flat aggregate bank liquidity preference curve, the paper proposes the hypothesis that the flat segment of the curve reflects a mark-up threshold interest rate. At the flat segment the market interest rate (marginal revenue) is just equal to the marginal cost of the interest-earning asset – thus it makes sense for the

banks to accumulate cash reserves with greater intensity relative to the interest-earning asset. The aggregate bank liquidity preference curve allows for the analysis of monetary policy shocks in the presence of a mark-up threshold interest rate. By doing so, the paper connects the oligopolistic tendency of the money market with that of the foreign exchange market. Monetary policy shocks (movements in the reserve supply curve) are determined by the Bank of Guyana, which notes that its policy stance focuses on managing bank reserves.

References

Agarwal, Reena and Andrew Horowitz (2002). "Are international remittances altruism or insurance? Evidence from Guyana using multiple-migrant households." *World Development*, Vol. 30: 2033-2044.

Berger, Allen, Leora Klapper and Rima Turk-Ariss (2008). "Bank competition and financial stability." *Policy Research Working Paper 4696*, Washington DC: World Bank.

BOG (various years). *Annual Report*. Bank of Guyana, Georgetown, Guyana.

Calvo, Guillermo (1998). "Capital flows and capital market crises: the simple economics of sudden stops." *Journal of Applied Economics*, Vol. I: 35-54.

Cleveland, William (1979). "Robust locally weighted regression and smoothing scatterplots." *Journal of the American Statistical Association*, Vol. 74: 829-836.

Das, Udaibir and Gobind Ganga (1997). "A retrospect and prospect on the reform of the financial sector in Guyana." *Social and Economic Studies*, Vol. 46: 93-129.

Egoume-Bossogo, Philippe., Ebrima Faal, Raj Nallari, and Ethan Weisman (2003). *Guyana: Experience with Macroeconomic Stabilization, Structural Adjustment, and Poverty Reduction*. Washington, DC: International Monetary Fund.

Enders, Walter (2010). *Applied Econometric Time Series*, 3rd edn., Hoboken, NJ: Wiley.

Fardmanesh, Mohsen and Seymour Douglas (2008). "Foreign exchange controls and the parallel market premium." *Review of Development Economics*, Vol. 12: 72-89.

Frost, Peter (1971). "Banks demand for excess reserves." *Journal of Political Economy*, Vol. 79: 805-825.

Galbis, Vicente (1993). "Experience with floating interbank exchange rate systems in five developing countries." *IMF Working Paper 93/36*, International Monetary Fund.

Ganga, Gobind (2000). "Credit, excess liquidity and monetary policy issues in Guyana." *Social and Economic Studies*, Vol. 49: 199-224.

IMF (2006). "De facto classification of exchange rate regimes and monetary policy framework." http://www.imf.org/external/np/mfd/er/2006/eng/0706.htm.

Khemraj, Tarron (2006). *Excess Liquidity, Oligopoly Banking and Monetary Policy in a Small Open Economy*. PhD Dissertation, New York: New School for Social Research.

Melvin, Michael and Kok-Hui Tan (1996), "Foreign exchange market bid-ask spreads and the market price of social unrest." *Oxford Economic Papers*, Vol. 48: 329-341.

Sager, Michael and Mark Taylor (2006). "Under the microscope: the structure of the foreign exchange market." *International Journal of Finance and Economics*, Vol. 11: 81-95.

Thomas, Clive and Rajendra Rampersaud (1991). "The cambio system of an independent exchange rate float: the case of Guyana." *Social and Economic Studies*, Vol. 40: 115-147.

Vives, Xavier (2001). "Competition in the changing world of banking." *Oxford Review of Economic Policy*, Vol. 17: 535-547.

Appendix 1

Figure A1: Bank reserves and interest spread – 1998: Q1 to 2009: Q4