Monetary policy and excess liquidity: the case of Guyana

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Abstract

This paper examines the monetary policy framework of Guyana. Guyana's monetary Policy is motivated by the IMF's financial programming model. The quantity of excess reserves in the banking system is seen as critical in determining bank credit and ultimately the external balance and inflationary pressures. Therefore, the central bank is always willing to mop up excess liquidity by selling Treasury bills. The paper examines the potential sources of persistent excess reserves. It then tests using the VAR methodology whether excess reserves exert the postulated effect on the price level and exchange rate.

Key words: excess liquidity, financial programming, monetary policy, Guyana.

JEL Classifications: E51, E52, G21

1. Introduction

Guyana's banking system is inundated with persistent non-remunerative excess reserves. This paper defines excess reserves (or excess liquidity) as total commercial bank reserves minus required bank reserves. The required reserve ratio is set by the central bank (Bank of Guyana). The Bank of Guyana also reports excess liquid assets that are made up primarily of domestic Treasury bills, which are often sold by the central bank to mop up excess reserves. The monetary policy framework is guided by the IMF's financial programming model.

The essential feature of the financial programming model is the excess of money supply over the desired quantity demanded will result in external payment imbalances, exchange rate depreciation and consequently domestic price inflation. Excess banks liquidity, then, according to this thesis, portends potential problems as banks rid themselves of the excess non-remunerative funds by lending more. The excess funds, therefore, must be removed from the system by selling the banks Treasury bills. The policy is not without its costs since the government must pay interest on the Treasury bills that are used for monetary policy purposes.

This paper has three objectives: (i) to examine the financial programming model; (ii) to review the literature on the possible determinants of excess bank reserves; and (iii) to perform an empirical investigation using the VAR methodology to decipher to what extent excess reserves determine the price level and exchange rate.

The paper is organised as follows. Section 2 looks at the monetary policy framework of Guyana (the financial programming model). Section 3, by reviewing the literature, outlines several possible determinants of persistent excess bank liquidity. Section 4 performs an empirical exercise (via VAR methodology) in order to determine whether excess reserves play an important causal role that is postulated by the current monetary policy framework. Section 5 concludes.

2. Guyana's Monetary Framework

Background Information

The Guyanese economy is one in transition from a Socialist oriented state to one that is trying to embrace the market as the giver of all good things. A country sandwiched between the two superpowers in the cold war era, and with a bankrupt economy by 1988, Guyana launched the Economic Recovery Programme (ERP) in 1989. The Programme comprised of radical changes in all aspects of economic life such as the elimination of price controls and subsidies, the implementation of a floating exchange rate, privatisation, fiscal reform, and the adoption of indirect monetary policy[1]. The IMF and World Bank eventually sanctioned the new economic initiatives and got on board providing crucial funding to enable the switch from state control to market mechanism. These events are well documented elsewhere (see Das and Ganga, 1997; Ganga, 1998); therefore, the paper will specifically deal with the shift in monetary policy in keeping with the theme of the paper.

Monetary policy prior to 1991 focused on direct instruments such as interest rate control, credit ceiling, and direct lending to government and selected private sector entities. The Bank of Guyana (hereafter BoG) also made use of reserve and liquid asset requirements to control bank excess liquidity. A major turning point in monetary policy operations took place in June 1991 with the adoption of indirect instruments. A competitive bidding system for short-term Treasury bills was instituted, first on a monthly basis, then biweekly in June 1994, and finally weekly in February 1996 (Das and Ganga, 1997; Egoume-Bossogo *et al*, 2003). Buyers, mainly institutional investors, bid for the instruments, which are usually sold to the lowest bidders, thereby determining the rate of interest through the market (at least that is the intention). Specifically the rate of interest on 91-day Treasury bills is the anchor rate of the banking system determining both the bank rate and the prime-lending rate.

[1] Alexander et al (1995) define direct versus indirect monetary policy instruments. Direct instruments set or limit prices (interest rates) or quantity (credit). The quantity-based direct instruments often place restrictions on commercial banks' balance sheet. Indirect instruments, in contrast, operate through the market by influencing the demand and supply conditions of commercial bank reserves. Embedded within the IMF's financial programming framework is the view that the reserve position of the banking system determines bank credit and broad money supply.

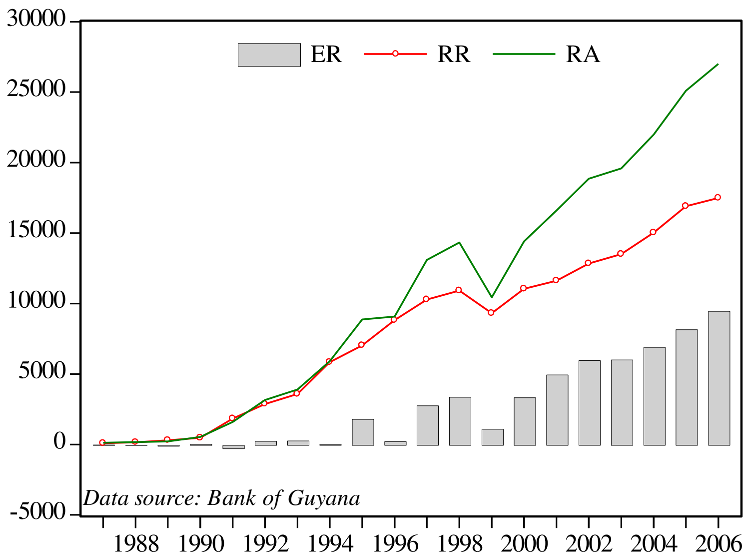
The current monetary policy framework, however, is not without its costs. The first problem has to do with the interest costs of perpetually mopping up excess reserves (Khemraj, 2006a). See Appendix 1 (Table A) for the interest cost associated with this policy. The second has to do with the potential crowding out of private investments as commercial banks hold excess reserves and Treasury bills instead of making growth-augmenting loans to private businesses (Khemraj, 2006b).

Excess Liquidity

Banks usually hold a fraction of deposits as required reserves. At certain times banks may find that the amount of reserves they actually hold is greater than the amount they must hold. However, this is likely to be transitory as banks will try to rid themselves of the excess funds by buying financial instruments or making loans in the interbank market or to the non-bank public. But this is not the situation in Guyana since high levels of excess liquidity are a permanent feature of Guyana's banking system (see Fig. 1).

The authorities fear that the heavy liquidity overhang, if not constantly taken out of the economy, could result in macroeconomic instability. Therefore, the central bank sells on a weekly basis 91-day, 182-day, and 364-day Treasury bills. By selling these short-term papers the BoG hopes to influence liquidity levels consistent with the targeted growth of broad money (M2) and reserve money (or the monetary base). One interesting aspect of open market operations is the BoG never needs repurchase assets from the markets since there is always the excess of bank reserves.

Figure 1, Actual reserves (RA), required reserves (RR), and excess reserves (ER): 1987 – 2006



An important feature of the Guyanese banking system – which to date has been ignored in the literature – is the tendency for the aggregate commercial banking system's liquidity preference curve to become flat at a very high Treasury bill rate and loan rate. Figures 2 and 3 demonstrate this important stylised fact about the Guyanese banking system. The liquidity preference curves are fitted using locally weighted polynomial regressions (LOESS) of degree one. This technique enables us to extract underlying non-linear relationships[2]. The liquidity preference curves are extracted from scatter plots of non-remunerative excess reserves against two opportunity costs variables: the 91-day Treasury bill rate and the loan rate.

[2] The technique of weighted local regressions was proposed by Cleveland (1979) and Cleveland and Devlin (1988). The subset of data used in each weighted least squares fit is comprised of αN, where α = the smoothing parameter and N = number of data points. A higher parameter, α, gives a smoother fit, but the fitted curve is less "local". Throughout the exercise a smoothing parameter of 0.3 is used. The liquidity preference curves are fitted using quarterly data from the first quarter of 1988 to the last quarter of 2005.

Figure 2, Excess reserves and 91-day Treasury bill rate (Quarterly data: 1988Q1 – 2005:Q4)

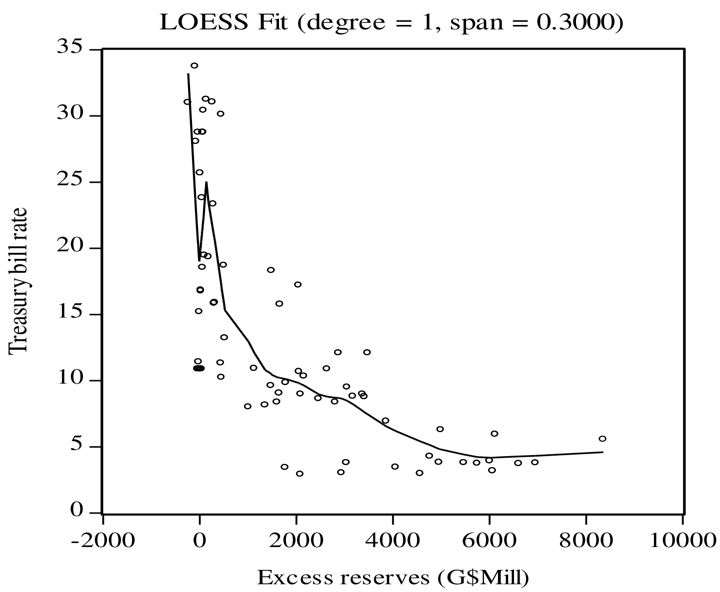
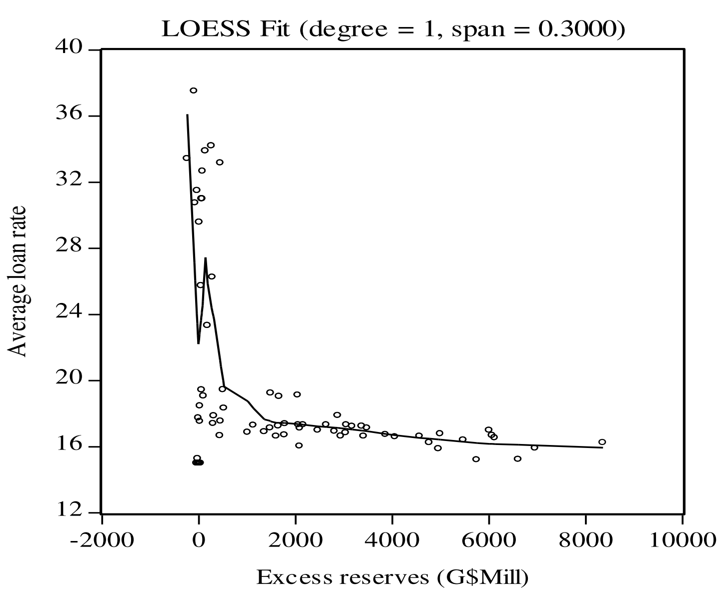


Figure 3, Excess reserves and the average loan rate (Quarterly data: 1988Q1 – 2005:Q4)



The liquidity preference curve in Figure 2 becomes perfectly elastic at around five percent; while in Figure 3 it becomes flat at approximately 16 percent. Khemraj (2006 c) argues that this is indicative of two important features: (i) commercial banks mark-up their interest rates exogenously (hence the *minimum rate hypothesis*); and (ii) it is indicative of market power. The minimum rate can be derived from a profit-maximising Cournot oligopoly model of the banking firm. Hence, the minimum rate is consistent with profit-maximising behaviour in both the Guyanese loan market and the Treasury bill market. The key policy ramification of the flat curves is liquidity shocks emanating from the BoG (open market operations through sales of Treasury bills) will not affect interest rates because commercial banks possess market power in both markets. Consequently, the banks set interest rates exogenously and do not change interest rates endogenously when the central bank alters its monetary policy stance. This will occur over the flat range of the liquidity preference curves. For low interest rates up to the point where the curves are flat indirect monetary policy in Guyana (and similar economies) is ineffective[3]. Of course, policy makers and society have to decide whether indirect monetary policy (which will only tend to be effective at high interest rates) is more important than objectives such as growth and unemployment.

Financial Programming Model

IMF economic stabilisation in developing countries is usually motivated by the financial programming model. The model consists of a set of macro accounting identities linking the government fiscal balance and monetary aggregates to outcomes on the balance of payment, which has implications for the targeted level of net international reserves. A set of behavioural equations, necessary to make proper economic analysis and policy, is added to the accounting identities. In order to present the model it is good to start with

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[3] Khemraj (2006c) found similar flat liquidity preference curves in other Caribbean countries with very liquid banking sectors.

the central bank balance sheet and the consolidated balance sheet of the entire banking system. The balance sheet constraint of the central bank is given in identity 1, while that of the entire banking system – central bank plus commercial banks – is represented by identity 3. Identities 2 and 4, respectively, show the weighted growth rates of the monetary base (*MB*) and broad money (*M2*). *NFA* stands for net foreign assets; *NCG* means net credit to government; *CB* represents claims on commercial banks by central bank (mainly discount window lending); while *CPS* means claims on the private sector.

(1) $MB^4 = NFA^5 + NCG + CB$

(2) $$\frac{\Delta MB_t}{MB_{t-1}} = \frac{\Delta NFA_t}{NFA_{t-1}} \bullet \frac{NFA_{t-1}}{MB_{t-1}} + \frac{\Delta NCG_t}{CNG_{t-1}} \bullet \frac{NCG_{t-1}}{MB_{t-1}} + \frac{\Delta CB_t}{CB_{t-1}} \bullet \frac{CB_{t-1}}{MB_{t-1}}$$

(3) $M2^6 = NFA + NCG + CPS$

(4) $$\frac{\Delta M2_t}{M2_{t-1}} = \frac{\Delta NFA_t}{NFA_{t-1}} \bullet \frac{NFA_{t-1}}{M2_{t-1}} + \frac{\Delta NCG_t}{NCG_{t-1}} \bullet \frac{NCG_{t-1}}{M2_{t-1}} + \frac{\Delta CPS_t}{CPS_{t-1}} \bullet \frac{CPS_{t-1}}{M2_{t-1}}$$

The overall balance of payments is financed by the change in international reserves (*IR*). Therefore,

(5) $\Delta NFA = \Delta M2 - (\Delta NCG + \Delta CPS) = X - M + K = -\Delta IR^7$

Where K = net capital inflows of the non-banking sector. Identity 5 is an important one as it assumes an increase in credit to government and to the private sector over the increase in money stock (*M2*), which when the money market is in equilibrium must equal to money demand, is reflected in a decline in net international reserves. This forms the core of the monetary approach to the balance of payments. It is for this reason that

[4] *MB* = currency in circulation outside banks (*CC*) + demand deposits (*DD*)
[5] Included in the net foreign assets is the quantity of net international reserves.
[6] *M2* is made up of *CC* + *DD* + Time deposits (*TD*)
[7] In balance of payment compilation methodology an increase in IR has a negative sign, while a decrease has a positive sign (see IMF, 2000).

the typical financial programme seeks to control money growth by placing ceilings on credit to government and private sector, with the former usually being most restricted. Another important ingredient of the programme is a stable money demand function, which can vary in sophistication. As is evident from equation 6 the commonly assumed money market equilibrium holds; and Y = real income, i = interest rate, v = income velocity, e = vector of other variables. The domestic credit components are derived residually from the forecast of the change in NFA and the projected value for money supply. Thus the policy variable, domestic credit ($NGG + CPS$), is determined.

(6) $MD\ (Y, i, v, e) = M2$

The target for $M2$ comes from the ubiquitous quantity equation – $Mv = PY$. The monetarist assumption is often made – assuming that velocity, v, is stable (which hinges on a stable money demand function) – that changes in money supply are translated into changes in the price level. Therefore, once inflation and growth targets are obtained, a projected $M2$ level is found; domestic credit, then, must fall in line.

A close relative of the stable money demand function and velocity is a stable money multiplier. The money multiplier is depicted in equation 7. Dividing both the numerator and denominator of equation 7 by DD gives the money multiplier in ratios, which are represented by the lower case letters. Required reserve ratios against DD and TD are given by r_d and r_t, respectively; while r_e represents the ratio of excess reserves to DD. According to the typical base-multiplier approach, if mm is constant, then changes in the monetary base (also known as reserve money) are reflected in changes in $M2$. Equation 8 implies, once the target level of $M2$ is obtained, and mm is at least predictable, the possible strategy of the central bank is to set MB in line with the target.

(7) $$mm = \frac{M2}{MB} = \frac{CC + DD + TD}{CC + r_d DD + r_t TD + r_e DD} = \frac{c + 1 + b}{c + r_d + br_t + r_e}$$

(8) $$\Delta M2 = mm\, \Delta MB$$ [8]

Couched within the financial programming framework is the Reserve Money Programme (RMP). The RMP takes into consideration the fact that reserves provide a link between the balance sheet of the central bank and of the commercial banks. Reserves that are on the liability side of the BoG's balance sheet show up on the asset side of the consolidated balance sheet of the commercial banking sector (see Appendix 1, Table B for a hypothetical weekly programme). Therefore, it is assumed that the central bank can influence total bank reserves by controlling its assets (namely government Treasury bills) when it conducts open market operations. Unlike direct monetary policy that seeks to directly influence the intermediate target, the programme seeks to operate on the reserve position of the banking system by influencing the supply of and demand for reserve money. The programme espouses three important assumptions (see Singh, 1997; BOG, 2001, p.37). Firstly, it is the reserve position of banks that determines their ability to extend credit to the economy. Secondly, the money multiplier is assumed to be stable or at least predictable; therefore, it is possible to influence money supply by hitting targets for reserve money. Thirdly, inflation is a monetary phenomenon, being determined by an excess of money supply over money demand *a la* the quantity theory of money.

3. Determinants of Excess Liquidity

[8] Equation 8 reflects the conventional view that the monetary base is exogenous or can be controlled by the central bank in order to control the broad money supply via a stable multiplier. However, there have always been economists – neo-classical and Post-Keynesian alike – who have rebuffed this view. For instance, see Lavoie (1984), Goodhart (2002), Lombra and Torto (1973), and Guttentag (1966).

The starting point in the analysis of why banks demand non-remunerative excess reserves is the optimum reserve management models. In these models banks choose a quantity of excess reserves which maximises profits or minimises losses. Several authors who have taken this approach are Baltensperger (1980; 1974), Frost (1971), Orr and Mellon (1961), Morrison (1966), and more recently Agenor, Aizenman, and Hoffmaister (2004). These authors have derived the optimum quantity of reserves a representative bank will hold; while the demand for the asset at the level of the banking system is accomplished by invoking the standard representative agent argument that each bank is more or less alike. This literature gives the following insights: (i) banks increase their demand for reserves when the adjustment costs associated with a liquidity deficit rises[9]; (ii) required bank reserves increase (decrease) while excess bank reserves falls (rises) when the statutory required reserve ratio increases (decreases); and (iii) reserve levels rise when cash and output volatility (two proxies for uncertainty) increase since banks face a liquidity risk.

There is a very small literature explaining the demand for excess liquidity in developing countries. One important paper is that of Caprio and Honohan (1993). The paper argues that credit rationing by banks can account for the build-up excess liquidity. However, credit rationing – which by itself has been the subject of a large literature – is a recurring phenomenon in both advanced and developing economies. The basic hypothesis, according to Stiglitz and Greenwald (2003), holds that banks know there is a maximum rate of interest – which is below where the market equilibrium would be – that maximises expected return; any interest rate above the desired maximum is likely to

[9] Adjustment costs typically include the cost of borrowing reserves from the central bank (the discount rate) and transaction costs. Transaction costs are high when the financial system is underdeveloped, in particular when there is no secondary market to liquidate securities.

attract risky borrowers. Hence, the banks are aware that expected profit does not increase over the entire range of loan rate increase. Beyond the critical rate of interest at which banks maximise expected profit the loan supply curve is backward bending; hence, the accumulation of excess liquidity in bank portfolios.

Caprio and Honohan (1993) also propose the money overhang hypothesis, which they claim is more relevant to former planned economies in which there was a period of goods rationing in the commodity market. Unsatisfied demand in the commodity markets causes the public to hold higher money balances that show up as higher deposits and excess reserves. An important factor, according to Caprio and Honohan (1993), which fuels the money accumulation, is the expectation by households that the constraints in the product market will soon be removed. It therefore makes sense to accumulate money balances today rather than reduce labour supply in order to enjoy more leisure and greater consumption in the future.

Agenor, Aizenman, and Hoffmaister (2004) estimate a demand function for excess bank liquidity in order to explain whether Thailand suffered a credit crunch during the Asian financial crisis. They put forward the hypothesis that a stable empirical demand function for excess liquidity is consistent with a credit crunch in which banks voluntarily accumulated excess liquid assets, while an unstable function is consistent with the view that banks demanded the asset involuntarily. Another paper by Fielding and Shorthand (2005) examines the determinants of excess bank liquidity in Egypt. The paper notes that despite the liberalisation of the foreign exchange and credit markets and the removal of financially repressive interest rate controls, Egyptian banks still hold large quantities of excess reserves. This behaviour is attributed to political violence that cause banks to seek conservative investment channels.

In another recent paper Saxegaard (2006) conducts a comprehensive survey of commercial bank liquidity in the Central African Economic and Monetary Community (CEMAC), Nigeria and Uganda. The paper divides bank demand for excess liquidity into precautionary and involuntary components. In order to separate the two demand components, the paper extends the regression model of Agenor, Aizenman, and Hoffmaister (2004) to include variables that can account for the involuntary build-up of excess liquidity. The paper finds that variables such as foreign aid, newfound oil revenues, government deposits in banks, and weak loan demand (owing to high loan rates) account for the involuntary reserve accumulation in several African countries. In contrast, precautionary excess liquidity – which is determined mainly by currency withdrawal volatility and the ratio of narrow money to broad money – is not likely to cause inflationary pressures. In other words, the rise of precautionary liquidity will not engender changes in bank portfolio composition. However, involuntary excess liquidity can stimulate aggressive bank lending once demand conditions are favourable; such lending, in turn, can put pressure on the exchange rate and increase prices. For that reason Saxegaard implores central banks to always mop up involuntary excess liquidity.

Khemraj (2006a) identifies several possible determinants of excess liquidity. These include: (i) large underground economy which generates bank deposits (and hence reserves) endogenously; (ii) remittances that cause a build-up of deposits (and reserves) as the public converts the foreign currency into local currency; and (iii) unsterilised foreign exchange market interventions[10].

Khemraj (2006c) posits two alternative hypotheses to explain the phenomenon of persistent excess liquidity. The first hypothesis holds that banks demand minimum interest rates in both the loan market and the government bond/Treasury bill market. Banks have oligopoly power in both markets and as a result they mark-up their desired interest rate over transaction costs and an exogenous base rate. The exogenous base rate is taken to be the foreign risk-free rate such as the United States 3-month Treasury bill rate or the London Interbank Offered Rate (LIBOR). The hypothesis holds that the bank accumulates excess liquidity when the desired loan rate (which the marginal borrower is willing to pay) is below the marginal transaction costs plus the exogenous foreign risk-free rate (plus a suitable risk premium to cover for the unknown borrower).

However, after the banking sector has been liberalised, exchange control jettisoned, and interest rates de-controlled, banks are free to hold any portfolio of asset. In particular, there is no explicit restriction placed on the quantity of foreign assets that private banks can hold. Therefore, the hypotheses presented so far do not explain why profit-maximising private oligopoly banks will refuse to convert all non-remunerative excess liquidity into a safe foreign asset. This paradox is explained by Khemraj (2006c) through the proposition (of a second hypothesis that works together with the *minimum rate hypothesis*) that banks face an unofficial *foreign currency constraint*. Banks simply

[10] Sterilisation involves simultaneously selling Treasury bills to mop up the liquidity injected when the central bank buys foreign currencies from the foreign exchange market. If there is total sterilisation then one can observe a sterilisation coefficient of -1; while partial sterilisation is represented by a coefficient value of between 0 and -1. Khemraj (2006c) estimates a sterilisation coefficient of approximately 0.85 for Guyana. Therefore, the central bank is successful in neutralising, on average, 85 percent of injected liquidity.

cannot find all the foreign exchange, for various reasons, at every point in time to convert all excess reserves into deposits in a foreign counterpart bank. Indeed, a measure of the foreign currency constraint (total purchases of US dollars minus total sales of US dollars) is a highly significant explanatory variable in the equation of excess reserves.

4. Empirical Analysis

A major objective of this paper is to find out whether excess reserves play a causal role in determining bank loans, prices and exchange rate. The implied monetary policy transmission mechanism emanating from the financial programming model places an important causal role on excess reserves. Indeed, the BoG takes this matter seriously as it is willing to persistently mop up excess reserves by selling Treasury bills, thereby incurring substantial interest costs.

This paper utilises a VAR model in order to analyse the dynamic interaction among four endogenous variables[11]: (i) *EXRES* = excess reserves; (ii) *LOANS* = loans to private sector; (iii) *EXRATE* = nominal exchange rate (G$/US$)[12]; and (iv) *CPI* = price level as approximated by the consumer price index (CPI).

A brief overview of the econometric methodology

The paper utilises the relatively new methodology of generalised impulse responses that was proposed by Pesaran and Shin (1998). The method was also recently utilised by Watson (2003) and Wang and Dunne (2003). The technique allows for the impulse responses to be invariant of the ordering of the variables. In particular, there is no need

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[11] There is no interest rate variable in the model. The reason for excluding the Treasury bill rate or the loan rate is the underlying non-linear relationship between excess reserves and interest rate. This is clearly demonstrated in figures 2 and 3 above. A foreign interest rate such as the LIBOR or the 3-month US Treasury bill rate could also be included because excess reserves would be sensitive to the return on foreign assets. However, there is also a non-linear relationship between excess reserves in Guyana and these two foreign interest rates (see Khemraj, 2006c).

[12] Increase in EXRATE implies a depreciation of the Guyana dollar vis-à-vis the US dollar; while a decrease in EXRATE means the Guyana dollar appreciated.

to place arbitrary restrictions on the contemporaneous coefficients of the VAR as would have to be done when one uses the Choleski decomposition of the variance-covariance matrix of residuals.

The starting point of the analysis is the following moving average representation of the standard VAR model (equation 9). Y_t is an $n \times 1$ vector containing the four endogenous variables under investigation. $A_j = \Phi_1 A_{j-1} + \Phi_2 A_{j-2} + ... + \Phi_p A_{j-p}$; where $j = 1, 2, ...$ and $A_j = 0$ for $j < 0$. Let the known history of the economy at time $t - 1$ be contained in a non-decreasing information set Ω_{t-1}, the generalised impulse (GI) response function for a shock to the system at u_t^0 is given by equation 10. $E(.|.)$ is the conditional mathematical expectation taken with respect to the VAR system; and Ω_{t-1}^0 is a particular realisation of the process at $t - 1$.

(9) $$Y_t = \sum_{j=0}^{\infty} A_j u_{t-j}$$

(10) $$GI_x = E(X_{t+N} | u_t = u^0, \Omega_{t-1}^0) - E(X_{t+N} | \Omega_{t-1}^0)$$

Assume that $u_t \sim N(0, \Sigma)$ and $E(u_t | u_{it} = \delta_i) = (\sigma_{1i}, \sigma_{2i}, ..., \sigma_{ni})' \sigma_{ii}^{-1} \delta_i$; where $\delta_i = \sigma_{ii}^{-1/2}$ denotes the one standard error shock. Let e_t be an $n \times 1$ vector of observed residuals, then the GI for a one standard deviation shock to the *i-th* equation in the VAR model on the *j-th* variable at horizon *N* is given by equation 11. The key feature to notice about the GI is invariant to the ordering of the variables in the VAR. This advantage over the recursive ordering or contemporaneous coefficients is particularly useful for the purpose of this paper since we are trying to analyse a novel version of the transmission mechanism in which excess reserves is given a causal interpretation. As far as the author is aware this has never been done for the Guyana situation and possibly for the entire Caribbean.

(11) $$GI_{ij,N} = \frac{e_j^{/} A_N \Sigma e_i}{\sqrt{\sigma_{ii}}}$$

Pre-testing the data

The first issue concerns with whether each time-series is stationary. In this regard, each variable is examined for unit roots by inspecting plots of the autocorrelation functions and also by using the ADF test. However, only results for the ADF tests are reported. The test for the variables in levels includes a trend and a constant term, while the test in first differences includes only a constant term. The order of the ADF is chosen on the basis of the AIC criterion. Table 1 presents the test results. Each variable is non-stationary in levels; however, they all became stationary after differencing once.

Table 1, Dickey-Fuller tests

Variable	Excess reserves	Loans to private sector	Exchange rate	CPI
ADF level	-2.05	-1.13	-2.51	-1.65
ADF 1st diff.	-7.99*	-4.71*	-3.14**	-12.42*
* means significant at 99%; ** means significant at 95%				

Given the findings above, it is customary to search for cointegrating relationships among the variables. The Johansen cointegration test, however, did not detect a cointegration relationship among the variables. This finding conflicts with theoretical expectations that the price level and the nominal exchange rate should be cointegrated owing to purchasing power parity theory (in the goods market) and the uncovered interest parity condition in the money market. That a long run relationship – between nominal exchange rate and price level – could not be detected in the data could be due to two factors: (i) the time period over which the study is conducted (January 1994 to June 2006) is not long enough to uncover a long-term relationship; or (ii) Guyana still is undergoing structural reforms that tend to retard the expected theoretical relationship. Cointegration test results also could not detect a long run relationship between excess reserves and the price level – a finding that clearly contradicts the current viewpoint. The non-cointegration of the two variables is plausible if banks demand excess reserves because they require a minimum rate of interest in the loan and Treasury bill markets (see figures 2 and 3 above) or they face a foreign currency constraint which precludes them from investing all excess reserves in a safe foreign asset. This matter will receive further analysis when the impulse response functions are examined.

Estimating the VAR

Several authors advise that the VAR should be estimated in first differences when the variables are found to be I (1). However, other authors such as Sims (1980) and Enders (1995, p. 301) recommend against differencing even if each variable contains a unit root. The goal of VAR analysis, according to Enders (1995), is not parameter estimation, but instead the primary concern is to uncover the dynamic interrelations among the variables; differencing the variables, moreover, "throws away" important information regarding the co-movements in the levels of the data. This paper, therefore, estimates the VAR system in levels using OLS. The analysis uses monthly data over the period January 1994 to June 2006. Excess reserves data were obtained from Bank of Guyana *Statistical Bulletins*; while all the other series were sourced from the *International Financial Statistics.*

When estimating a VAR the optimal lag-length is crucial. Too few lags could result in the misspecification of the model, while too many lags waste degrees of freedom. For example, if nine lags are used in our four equation system we have a total of 153 parameters to estimate from only 150 observations; while eight lags will require estimating 136 parameters. Therefore, the author cannot rely on the traditional tests and information criteria – as were for example utilised by Watson (2003) – to gauge the appropriate lag length of the VAR. The most important issue in this case is to ensure the residual of each equation in the system is devoid of serial correlation problems. Testing for serial correlation (using the LM serial correlation test) up to seven lags reveals no such problem.

Analysis of impulse response functions

The impulse response functions are very similar for different lag structures. Therefore, the paper reports in figures 4, 5 and 6, respectively, impulse response functions for four, five and six lags. The most interesting graphs are presented in order to study the transmission process from excess reserves to the other key variables. The first thing to observe is the very similar nature of the impulse responses over different lag lengths. Similar observations – not reported – were also made for VARs with lags of three and seven.

For the purpose of this study it is important to note the responses of the three variables to a one standard deviation shock in excess reserves (EXRES). The first thing to note is there is no response in loans to the private sector (for four months) after the shock in EXRES. The short-term response of LOANS would be very important to policy makers from a stabilisation perspective. After approximately four months the response in

LOANS to EXRES turns negative – a result that is contrary to the view of financial programming.

Figure 4, Generalised impulse responses to one standard deviation shock (4-lag VAR)

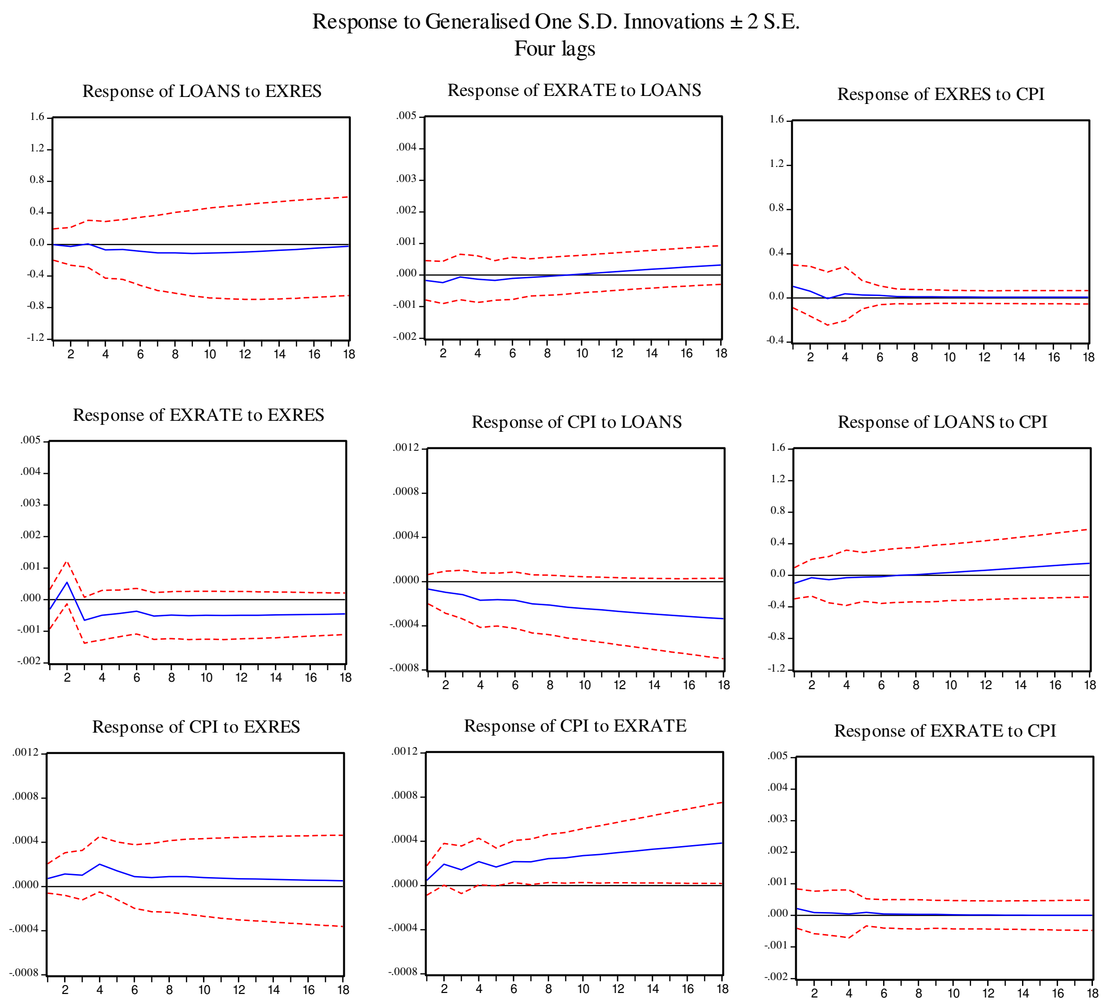


Figure 5, Generalised impulse responses to one standard deviation shock (5-lag VAR)

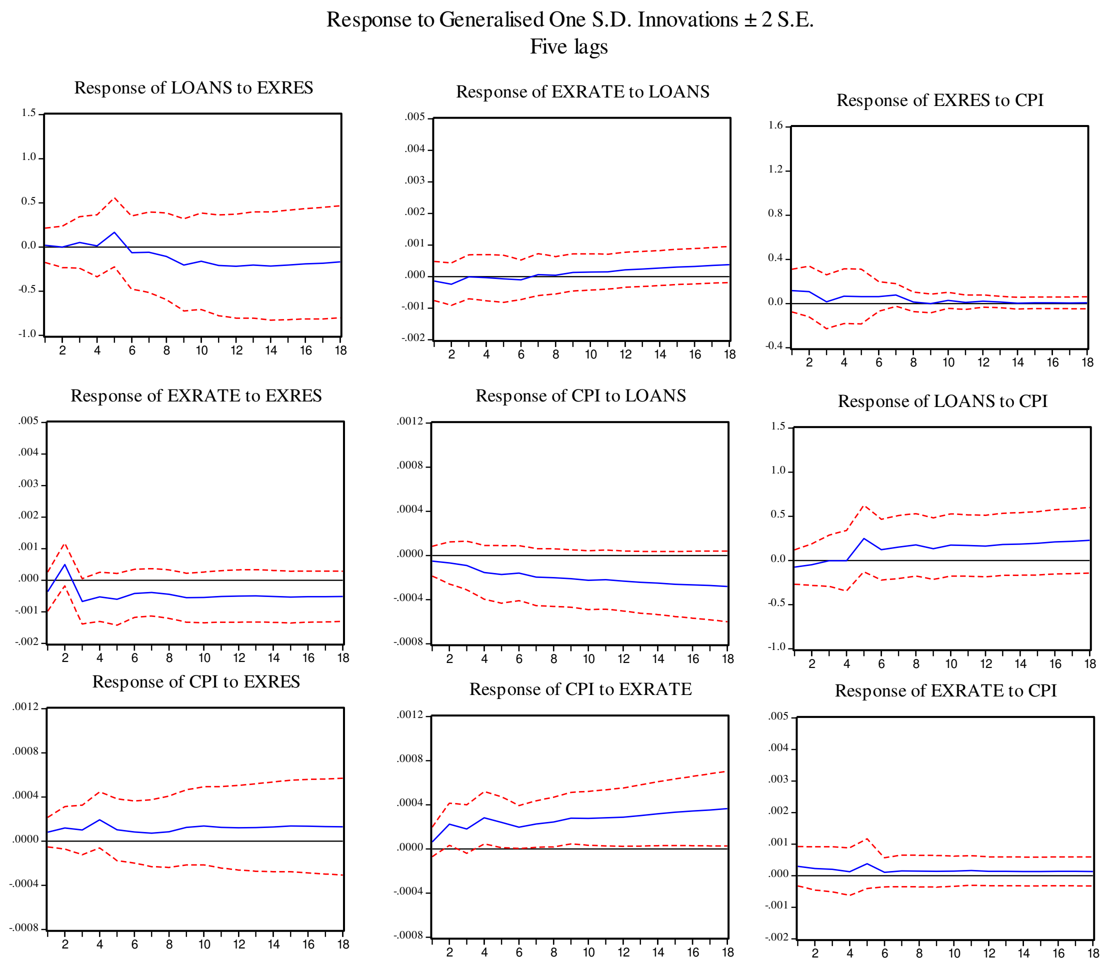
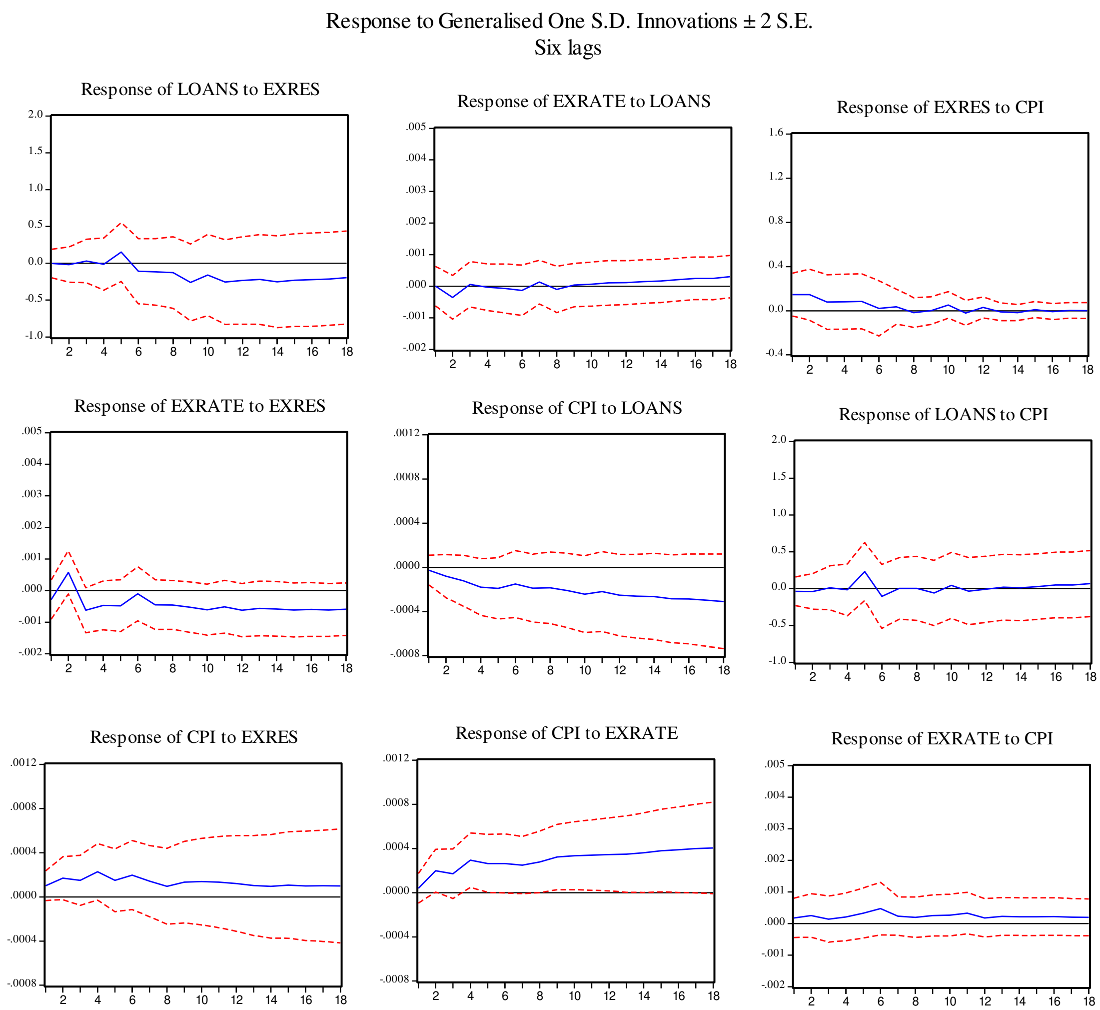


Figure 6, Generalised impulse responses to one standard deviation shock (6-lag VAR)



The nominal exchange rate (EXRATE) responds positively to the one standard deviation shock in EXRES. However, the response is transitory as EXRATE returns to its equilibrium value after two months. The CPI also responds positively to the shock in EXRES. The response, however, persists for at least eighteen months. The responses of

EXRATE and CPI to EXRES leave a black box as it is not certain how EXRES can increase EXRATE and CPI without stimulating LOANS. Therefore, it is hard to give this influence causal credence. Excess reserves, furthermore, diminish the money multiplier and thus broad money (see equations 7 and 8 above); hence, adding further doubt to the causal role of this variable. That the CPI responds positively to EXRES is likely due to important third factors – such as remittances and the large underground economy – which stimulates broad money (hence excess reserves) and consumption simultaneously. Remittances stimulate bank deposits as agents convert the foreign currency (namely the US and Canadian dollar) into domestic currency. To the extent the illegal underground economy brings in foreign currencies that are exchanged for the local currency the same effect results as in the case with remittances. Also agents who earn income denominated in local currency but work in the underground economy will boost bank deposits directly when they hold bank accounts or indirectly when they do business with legitimate enterprises that own bank deposits.

Another important result is the finding that EXRATE does not respond positively to a one standard deviation shock in LOANS. Surprisingly, CPI responds negatively to the same shock in LOANS. These two results do not vindicate the conventional view. However, there is positive and persistent pass-through of the one standard deviation shock in EXRATE on CPI. That the CPI is driven by external forces is not surprising since Guyana imports a large percentage of what it consumes. Guyana also imports fuel and other capital goods whose prices ultimately pass-through to domestic consumer prices.

Two other results worth mentioning are the response of EXRES and LOANS to a one standard deviation shock in CPI. We would expect banks to diminish holdings of non-remunerative excess reserves when there is a positive shock to CPI (since the real value of the cash reserves declines); however, EXRES responds positively and then have a tendency to fluctuate around equilibrium from around the sixth month after the shock. This positive response is consistent with the argument above that third factors account for the ostensible relationship between the CPI and excess reserves. The negative response of LOANS is suggestive that banks are acting exogenously of general conditions in the economy (note that it is better to hold an asset that earns interest in the presence of inflation rather than one which earns zero return).

The response of EXRATE to the one positive standard deviation shock in CPI is positive and tends to persist for at least eighteen months. This finding, of course, is consistent with expectations. In the event of positive price shocks there is likely to be a flight of capital – hence the pressure on the exchange rate. Notice, however, that this response is milder than the response of CPI to positive EXRATE shocks.

5. Conclusion

This paper examined Guyana's monetary policy framework, which focuses extensively on mopping up excess reserves through selling (by the central bank) Treasury bills. The paper demonstrated that this key policy operation emanates from the IMF's financial programming model, which holds that an excess of money supply over the desired quantity of money demand will manifest itself in balance of payments problems, exchange rate depreciation and upward price pressures. Excess reserves, therefore, is not only a manifestation of excess money supply – according to this view – but also a key determinant of bank credit. Therefore, if left unchecked excess reserves will lead to reckless bank lending and upward price pressure.

Using generalised impulse response functions from a VAR model, the paper tested the idea that shocks to excess reserves can determine the exchange rate and prices. The results overall are not consistent with the established view. The causal role ascribed to excess liquidity is merely prima facie and does not amount to underlying causality. While a one standard deviation shock to excess liquidity elicited a positive and persistent response in the consumer price index, the same one standard deviation shock leads to almost zero response in loans to the private sector. Also, the response of the exchange rate is very short lived and tepid. The paper argued these findings can be explained by underlying third variables – such as remittances and the underground economy – that boost bank deposits (hence excess bank liquidity) and consumption. These findings question the relevance of indirect monetary policy in an economy with an oligopolistic banking sector and underdeveloped money and capital markets. More direct tools of monetary policy will have to be used to achieve the goals of stability and sustained growth. These direct policies, however, might conflict with the current IMF stabilisation programme. Guyanese society has to decide whether it wants to continue focusing on a questionable stabilisation framework or pursue policies that are conducive to sustaining long term growth.

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Appendix 1

Table A, The interest costs of monetary policy (G$ mill)

	Treasury bills issued				Interest cost			
	Total	91-day	182-day	364-day	Total	91-day	182-day	364-day
1993	22173	13673	4000	4500	na	na	na	na
1994	23939	19088	2640	2211	4057	2599	765	693
1995	22788	17745	2250	2794	4423	3626	449	348
1996	27535	6763	3156	17616	3168	2336	350	482
1997	25678	4569	4406	16703	2652	348	350	1954
1998	25930	2700	4700	18530	2185	322	410	1453
1999	35207	4303	4952	25952	2787	450	632	1705
2000	44013	4947	8453	30613	4625	432	789	3404
2001	48090	3640	7600	36850	4568	373	882	3313
2002	49892	2973	10189	36730	4147	207	520	3420
2003	75121	5251	16617	53253	2521	100	202	2219
2004	68075	16480	17764	33830	1967	125	317	1525
2005	73468	14955	19267	39246	1979	160	407	1412

Source: Bank of Guyana Annual Reports

Table B, Hypothetical monetary policy exercise (G$ mill)

Hypothetical weekly reserve money programme
Open market operations (G$ millions)

	Target	Projection	Deviation
Net Foreign Assets	5031	5031	0
Gross reserves	42141	42141	0
Foreign liabilities	-37110	-37110	0
Net Domestic Assets	18046	19414	-1368
Credit to public sector	-34458	-33090	-1368
Other deposits	-788	-788	0
Valuation adjustment	41003	41003	0
Other	12289	12289	0
Reserve Money	35221	36589	-1368
Currency in circulation	10931	12299	-1368
Liab. Comm. Banks	12145	12145	0
Required reserves	9716	9716	0
Free reserves	1609	1609	0
Vault cash	820	820	0

Open market operation: withdrawal of liquidity G$ 1368 mill.

Table B outlines the typical central bank balance sheet. Here it is assumed government expenditure was higher than projected, which means cash have been injected into the banking system. The reserve money growth of G$1368 million must then be withdrawn by selling Treasury bills by an equal amount.