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# **Financial Crises and Money Demand in Jamaica**

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## **Financial Crises and Money Demand in Jamaica**

*Abstract: .This paper estimates the money demand function for Jamaica using a Structural co-integrating VAR. This approach provides estimates of the long run structural relations and also reveals the complex short run feedbacks of monetary policy on key macro variables. In recent years Jamaican governments have adopted an inflation targeting framework for policy and have moved towards reliance on interest rates rather than direct money control as the primary instrument. This policy presumes that monetary transmission runs from the interest rate to directly affect the level of output which then feeds into the inflation process. However, in an economy with limited financial sector development interest rate transmission may be more circumspect, having a strong direct affect on money demand which then influences aggregate demand and output and hence inflation. These feedbacks are investigated within the error correction model.. Stability of Money demand is vital for predictable policy, and is investigated using CUSUM tests for parameter stability. The Jamaican financial sector suffered a major crisis in the mid 1990's, the paper considers whether the stability of money demand was compromised. It is argued that the finding of stable money demand suggests that the specific policy responses may have successfully bolstered confidence and prevented financial implosion.*

**JEL Classification: C51, C52, E41, E52**

**Key Words: Caribbean, Jamaica, money demand.**

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## **Financial Crises and Money Demand in Jamaica**

### *Introduction.*

This paper seeks to investigate two core issues. Was there a stable long run money demand relationship in Jamaica and hence was there a sound basis for implementing indirect monetary policy? Was the money demand relationship stable throughout the domestic financial crises of the 1990's? The issue of stability is important since it suggests that the government's unorthodox rescue strategy helped to maintain the necessary basis for monetary policy implementation.

Jamaica is a small open economy, and has operated a domestic currency since independence in 1962 and a stock exchange since 1969. The Jamaican Central Bank is responsible for monetary policy and the maintenance of price stability. Until the 1990's a fixed exchange rate regime was maintained, but in the context of a repressed financial system and low real interest rates, it failed to operate as an effective inflation anchor. With devaluation and the subsequent adoption of a floating rate in 1992 the financial system was liberalised and an explicit inflation targeting policy was adopted. The focus shifted to open market control of the operating targets provided by the monetary base and associated interest rates instruments. However, in the context of the small open economy with a limited financial sector domestic interest rates may not transmit in expected Keynesian fashion through output (Mishkin, 1995), but rather transmit directly to demand and inflation. (Lattie, 1999). If such a monetary policy is to offer an effective inflation strategy it is important that there is a stable long run relation between monetary conditions and behaviour of the public. This relationship is captured in the demand for money which provides important information for appropriate monetary actions.

The importance of the money demand relation for policy formation has made it a popular but disputed research topic. (Aristes, 1991: Arize, 1994, Chow, 1966: Treichel, 1997: Khamis, 2001: Bahmani Oskoe 1994, 2001, 2002 and many others). In the Caribbean a number of early studies (Bourne, 1974: Mclean, 1982: Watson, 1988: Worrell, 1985) used single equations and were unable to clearly distinguish long and short run relations or feedbacks. More recent Jamaican studies (Ghartey, 1998, Watson, 2001) utilise co-integration methods but differ from one another and the current paper in terms of their specification (see section 2) and the data period. Ghartey covers only up to 1993, Watson never specifies his time period although it most probably runs to 1998. Neither piece considers the link between the domestic financial crises of the 1990s and stability of money demand. A recent paper considers this link for Venezuela (Bjornland, 2005). Bjornland adopts a similar open economy cointegrating VAR approach to this paper and the relation between the two sets of results is discussed.

Financial crises could be expected to cause problems for monetary policy as they tend to destabilise money demand so limiting the effectiveness and predictability of monetary policy. (Garcia- Herrero, 1997). Jamaica has been shaken by two major financial crises. The first arose in the 1980's within the context of the radicalised domestic politics and the international debt crisis. The second major financial crisis erupted in the mid 1990's and was associated with liberalisation and the speculative behaviour of weakly regulated financial institutions. In the second crisis the

Jamaican government avoided IMF assistance and the requisite policies emphasising foreign exchange stabilisation and closure of troubled institutions. In contrast it sought to maintain liquidity by rescuing institutions and ensuring depositor protection. The paper argues that this approach helped to maintain confidence in financial institutions, and so helped to maintain a stable money demand relationship and to avoid a systemic crisis.

The first section of the paper briefly reviews the structure and operation of the Jamaican financial system, the second discusses the form, and estimates the money demand function and its stability. The presentation differs from conventional single equation money demand, since the investigation uses a long run structural cointegrating model which reveals internal and external disequilibria and feedbacks.

### **Character of the Jamaican Financial System.**

This section briefly reviews the historical development of the financial institutional structures and the general architecture and remit for monetary policy.

#### *Institutional Structure*

The Jamaican financial system emerged with independence in 1962. The Bank of Jamaica Act (1960) established an independent Central Bank charged with safeguarding the value of the currency through the operation of monetary policy and ensuring overall stability of the system through supervision and regulation of deposit taking institutions. The initial monetary policy relied on direct measures of control through reserve requirements and sought to regulate growth of money in line with the objective of price and exchange rate stability, whilst also allowing for sufficient monetary expansion to finance growth in economic activity ([www.boj.org.jm](http://www.boj.org.jm)). The Financial Sector Reform Programme (1985), shifted policy by reducing the statutory reserve requirement from 48% to 20%, removing the secondary reserve requirements<sup>1</sup>, and moving towards open market operations to control interest rates. With the move to inflation targeting the Bank became responsible for setting the target subject to approval of the Ministry of Finance. The Bank then had to determine and manage the operating targets through the interest rate. However, the success of the indirect controls relies on a known and stable relationship between financial conditions and public behaviour.

The deposit taking institutions supervised by the Bank and through which it conducts policy are: commercial banks, building societies and institutions licensed under the financial institutions act (merchant banks and trust companies.) As a group the commercial banks are dominant, with an extensive branch network they account for about 50% of the total assets of the financial system. (Peart, 1995). The near bank sector grew aggressively during liberalisation in the early 1990's.

#### *Developments in the Financial Sector.*

From independence until the reforms enacted under a World Bank Structural Adjustment Programme in 1985, Jamaica operated with a typical repressed financial system defined by high statutory reserve requirement, administered interest rates, fixed exchange rate, underdeveloped money and capital markets and consequent

domination of financial intermediation by the commercial banks (Tsing & Corker, 1991, Peart, 1995). The resultant shallow finance strategy generated a slow growing financial system with a limited capital or money market (Peart, 1995). A further consequence was that local enterprises were highly dependent on bank funding, which then meant bank loan portfolios were often concentrated.

The first attempt at financial deepening came in 1985 and involved a concerted attempt to move towards indirect instruments of control. Secondary reserve requirements were abolished, interest rates moved to a market determined structure, treasury bills were sold through open market operations. The result was increased intermediation and a disentangling of monetary and fiscal policy (Peart, 1995). However, the financial surge associated with reparation inflows following Hurricane Gilbert in 1989 interrupted reforms and statutory primary and secondary reserve requirements were reintroduced.

A second phase of reform came with the liberalisation of 1990/91, the deregulation of interest rates, the floating of the exchange rate and the opening of international financial flows. As shown in graph 1 & 2 and discussed below these reforms produced a period of steady growth in the M2 : GDP ratio and positive real interest rates, both indicative of financial deepening (Lynch, 1996). Liberalisation generated greater volatility in nominal interest rates so that both risk and the incentive to undertake risk were increased. This period generated particularly rapid growth of non-bank intermediaries which often acted outside prudential limits and many loans were poorly assessed. The commercial banks sought to use the lower regulation of the NBFISector, by establishing financial conglomerates and then shifting risk onto the less supervised institutions. The growth of this shadowy sector reflected the rapid deregulation and rising interest rates, these encouraged risky investment but did not significantly increase saving. The overall result was a massive growth in private sector credit, 70% in 1993, and a consequent consumption boom, but by 1997 almost 30% of loans were non performing. (Kirkpatrick & Tennant, 2002 p.1936). High risk activity was being pursued in the insurance sector, which marketed short term high rate products while investing heavily in real estate so that the time profile of assets and liabilities became severely mismatched. The interlocking of these entities meant that the illiquidity crisis of the non banks quickly spread across the sector with several commercial banks requiring liquidity support in 1995/96 and the Ministry of Finance placed a number of institutions under temporary external management. In response to the growing crisis, depositors started withdrawing savings from weak indigenous institutions and relocating to foreign banks (Kirkpatrick & Tennant, 2002). This behaviour suggests a breakdown in established domestic money demand relations.

### *Crisis*

Demirguc-Kunt (2001) uses cross country evidence to support the argument that liberalisation increases the probability of financial crisis, Jamaica appears to have succumbed to the typical problems associated with premature liberalisation. The majority of developing countries experiencing financial crises have accepted IMF wisdom that tight fiscal and monetary policy plus rapid and radical institutional restructuring are the best way to restore confidence (Heller, 1997). Critics (Nixon, 1999, Radelet, 1998, Stiglitz, 1999, 2002), have argued that when implemented in

cases such as Thailand or Argentina these packages subjected depositors to substantial losses and exacerbated recession so causing further loss of confidence in the financial sector.

In contrast to this standard approach the Jamaican government adopted a fiscally more expensive strategy, acting to safeguard all depositors with the aim of maintaining confidence. After the initial rescues, the government set up the Financial Services Adjustment Company (FINSAC, 1997) to intervene and rehabilitate. This involved initial rescue followed by a series of rationalisations and mergers, evident in the numerical shrinkage of all the sub-sectors (Table 1). Although an unorthodox approach which created a large government deficit, the short run money supply effect was largely sterilised by use of securities to finance the deficit so that the package remained compatible with short term inflation targeting. However the extent of liabilities taken on by FINSAC in the rescue was equivalent to some two thirds of GDP and has created a spectre of medium term public sector insolvency as the total debt to GDP ratio is now around 140%, suggesting imminent servicing problems and new risks to the financial and real sector.

*Table 1: Number of Supervised Financial Entities*

Institutions	1985 <sup>a</sup>	1996	1997	1998	1999	2000	2001
Commercial Banks	10	9	9	9	6	6	6
FIA Licensees	8	28	27	18	14	11	11
Building Societies	n.a.	14	10	8	5	5	4
Credit Unions	n.a.		73	67	65	60	58

Source : website : [http://www.boj.org.jm/superv\\_deposit\\_taking.asp](http://www.boj.org.jm/superv_deposit_taking.asp)

a- taken from Peart , 1995 p.15

*Evidence on the Overarching Financial Strategy.*

The practice of Jamaican monetary policy indicates a period from 1960 –1985 where there was financial repression involving a high reserve requirement, the non price rationing of credit, and an administered interest rate. This shallow finance approach is often associated with limited intermediation and slow growth of the financial sector as measured by M2:GDP. A deepening of finance is usually associated with market based interest rates and consequent growth of the financial system (Shaw, 1973) and this should have occurred with liberalisation in 1985.

Graph 1 shows that the Jamaican financial system grew rapidly through the 1960's presumably reflecting the buoyant economy, and inflows of FDI. A high income elasticity of demand for money, common in early development would have allowed for this rapid expansion in liquidity without a threat to inflation. However, the second phase of rapid expansion occurred between 1979-83 when the domestic economy had suffered several years of poor growth, high inflation and negative real

interest rates (Graph 2). The reforms of 1985 seem to have been accompanied by a fall in growth of M2 : GDP which actually contracts until 1992 when it again shows positive and steady expansion.

Comparing the growth of M2 & M3 indicates relative expansion of the latter from 1981-83 and again in 1987-88. Since M3 includes non bank deposits this relative expansion suggests growth of non bank financial institutions (NBFIs). The surprising aspect is that the share of NBFIs increased in the 1980's but not during the liberalisation of the early 1990's, they then shrank with the years of crisis so that M3 was not much greater than M2 by 1996. Comparing this overall monetary behaviour with that of the real interest rate (Graph 2), does not suggest a clear or stable short run link, real interest rates were negative from 1979-82 and were generally unstable until showing a more prolonged positive value from 1992.

The steady positive growth in M2:GDP from 1992 is surprising given the deep financial sector crisis from 1994 onwards. This behaviour raises two interesting possibilities. First, there might be a poor link between interest rates and financial growth which suggests that demand for money /liquid assets is inelastic with respect to the real interest rate, meaning that any monetary policy would have a limited impact. This raises some doubts about the appropriateness of an inflation targeting strategy pursued through interest rates and open market policies unless complex feedbacks occur. Second the steady growth from 1992 suggests that the Jamaican government's rescue policy was successful in stabilising the financial system.

Figure 1

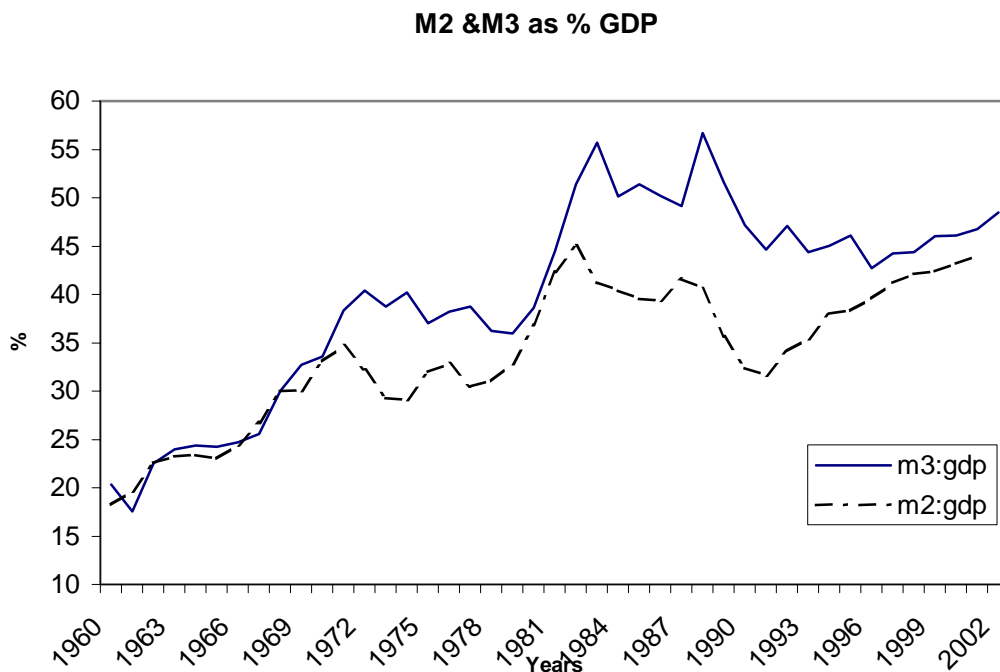
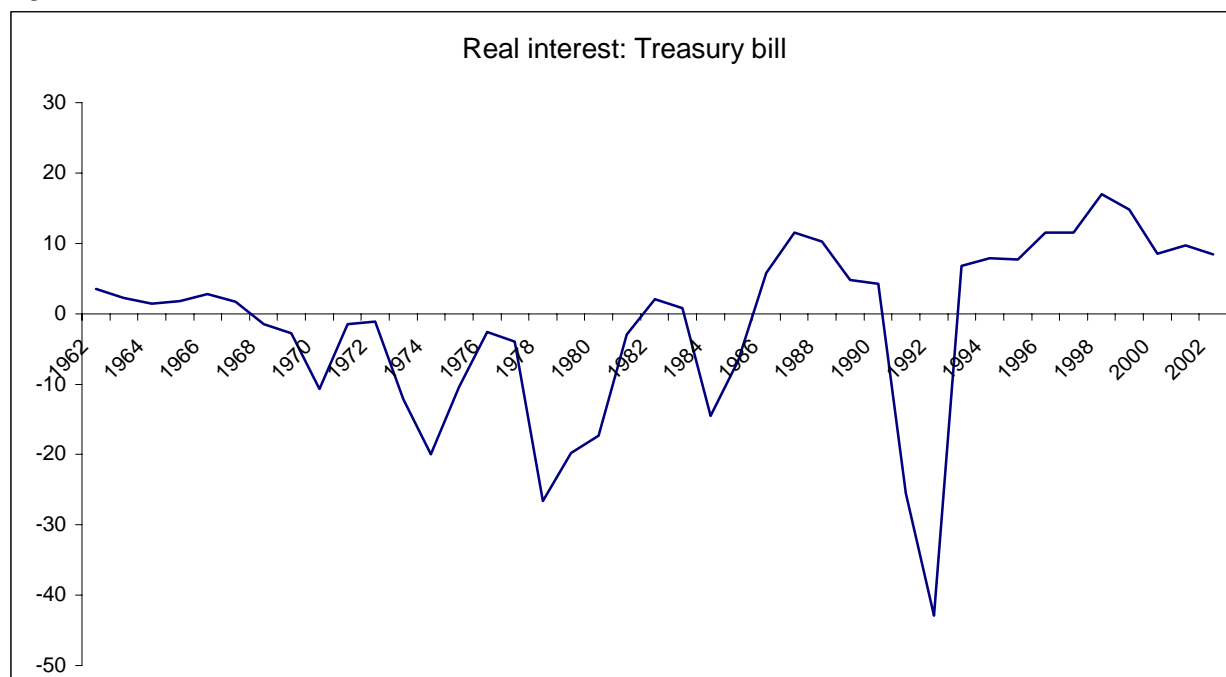




Figure 2



Source : All data from WDI data base available from ESDSS web site

## 2. Existence and Stability of the Jamaican Money Demand Relation.

Demand for money is important when selecting an appropriate monetary policy. Inflation targeting requires that there is a known and stable transmission mechanism between monetary policy instruments and the macroeconomy. The following section considers the determinants of money demand and investigates the stability of the underlying relation during and after the Jamaican financial crises.

Open market approaches to monetary policy generally presume that interest rates have a short run effect on activity, with the consequent deviation of output from its long run equilibrium feeding back to affect inflation (Mishkin, 1995). This view of the interest rate transmission assumes that money supply adjusts to ensure money market equilibrium. In less developed financial systems, domestic interest rates are likely to have only a small impact on output, so that interest policy works through the credit channel and more directly through money supply to affect inflation. In this latter context, a money market equilibrium condition must be specified since it reveals the extent to which changes in interest rates and the consequent supply of money feed through to generate demand pressures and inflation. In this scenario domestic monetary equilibrium is restored by adjustments of money demand. In both cases it is important to know the sensitivity of money demand to interest rates and hence the responsiveness to monetary policy.

Economic theory specifies that real money demand depends on a transaction and opportunity cost component. In open economies currency substitution and exchange rate risk may also be important influences (Arango and Nadiri, 1981). The money demand function generally uses real income to capture the transaction component; and nominal interest rate to capture the opportunity cost and asset component; and

an exchange rate level and variance may be included to capture currency substitution and risk.

If interest rates act through the money supply, the extent of feed through onto money demand will reflect the demand for transaction balances. If the elasticity of demand for transaction balances is low, then a small increase in the money supply will have a significant effect on aggregate expenditure and inflation. Conversely if income elasticity of money demand is high ( $>1$ ) then it is possible for the money supply to grow faster than real income without a threat to price stability. This means, that if income elasticity (transaction demand) is unstable it will become difficult to predict the effects of monetary policy. The second component of money demand should be measured by a risk adjusted interest rate to capture opportunity cost and asset concerns. In the estimation process this paper used nominal interest to capture the opportunity cost of money. However, nominal interest is unlikely to fully reflect expected changes in inflation and hence risk (Laidler, 1985). This problem is likely to be particularly acute when there is either financial repression or financial crisis, both of which occurred in Jamaica during the period of study. In the Jamaican context risk considerations would cover exchange depreciation, surprise inflation, and institutional insolvencies all of which increase during financial crises.

In order to capture the dynamics of money demand and its particular responses to shocks, two long run relations are hypothesised to link the key variables : money, output, inflation, exchange rate and interest rate whose adjustment to domestic and external disequilibria can be investigated. Garratt et al (2003) show that this approach allows the imposition of restrictions implied by long run structural relations whilst still allowing unrestricted estimation of the short run coefficients. In the case of the small open economy this paper hypothesises that domestic monetary equilibrium (money demand) and external equilibrium (real exchange rate stability) are possible key long run relationships.

The existence of the hypothesised long run relations are tested by looking at the cointegrating equations for the system. The identified long run relations are then tested in the context of an error correction model for the system. The strength of this approach is that it reveals both the speed of adjustment to shocks which may cause temporary deviations from the long run equilibrium conditions and also reveals the short term dynamics from coefficients on the lagged difference variables.

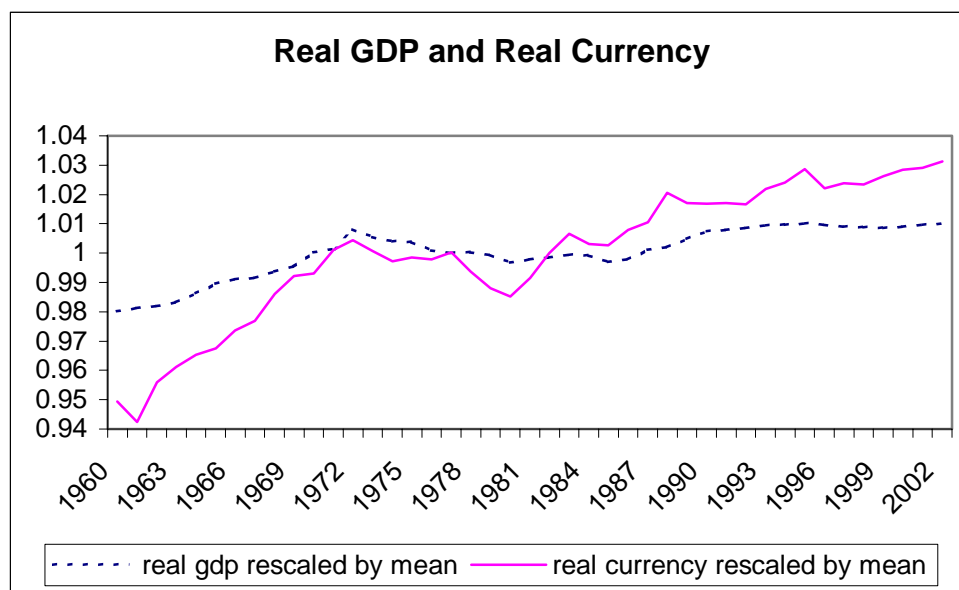
### *Data*

The paper looks at annual data, ideally higher frequency would be used but this is not available for GDP.<sup>2</sup> All data is obtained from World Bank's WDI data base available from ESDSS web site. Currency in circulation (M) was measured by M2, the real value was derived by deflating with the consumer price index (P), real GDP (Y) was used as a measure of transactions in the demand for money function. The nominal interest rate (R) was used to measure the opportunity cost of holding currency rather than real or financial assets. The Treasury Bill Rate (TBR) was used since it reflected a close alternative asset. The exchange rate (F) was measured by the exchange index and was initially included to take account of currency substitution arising as a hedge against domestic financial risk. (Arango & Nadiri 1981).

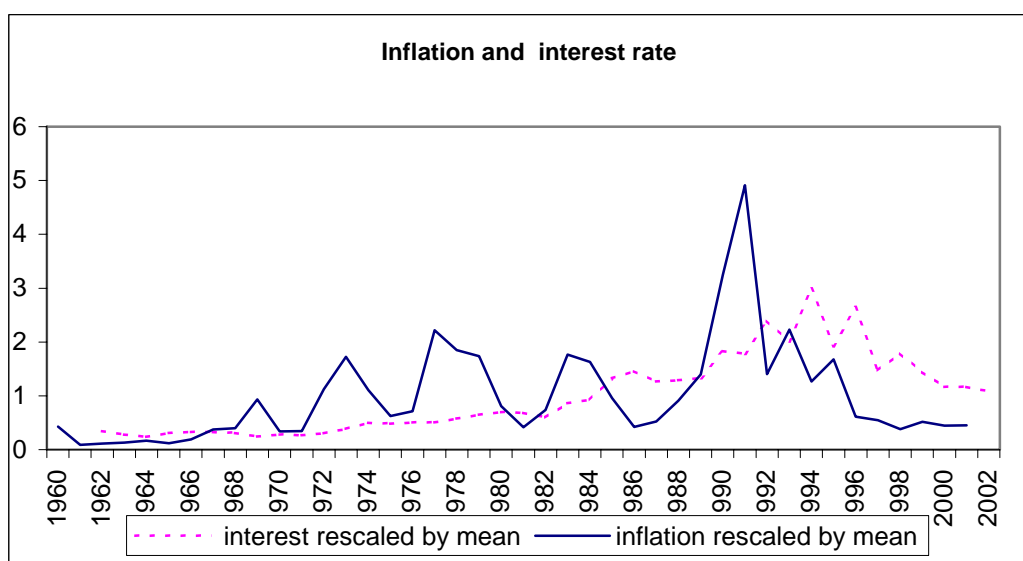
Long run currency demand should show a positive relation with real transactions and a negative relation with opportunity cost. the relation with exchange rate could be in either direction. A devaluation may create expectations of further devaluation and hence induce currency substitution or its dominant effect maybe to increase the value of foreign portfolios held by domestic residents, creating a significant wealth effect and increasing money demand (Arango & Nadiri 1981). A long run relation exists if the variables are cointegrated. The real exchange stability condition requires that the nominal exchange, price, output and interest rate variables are cointegrated.

Figure 3

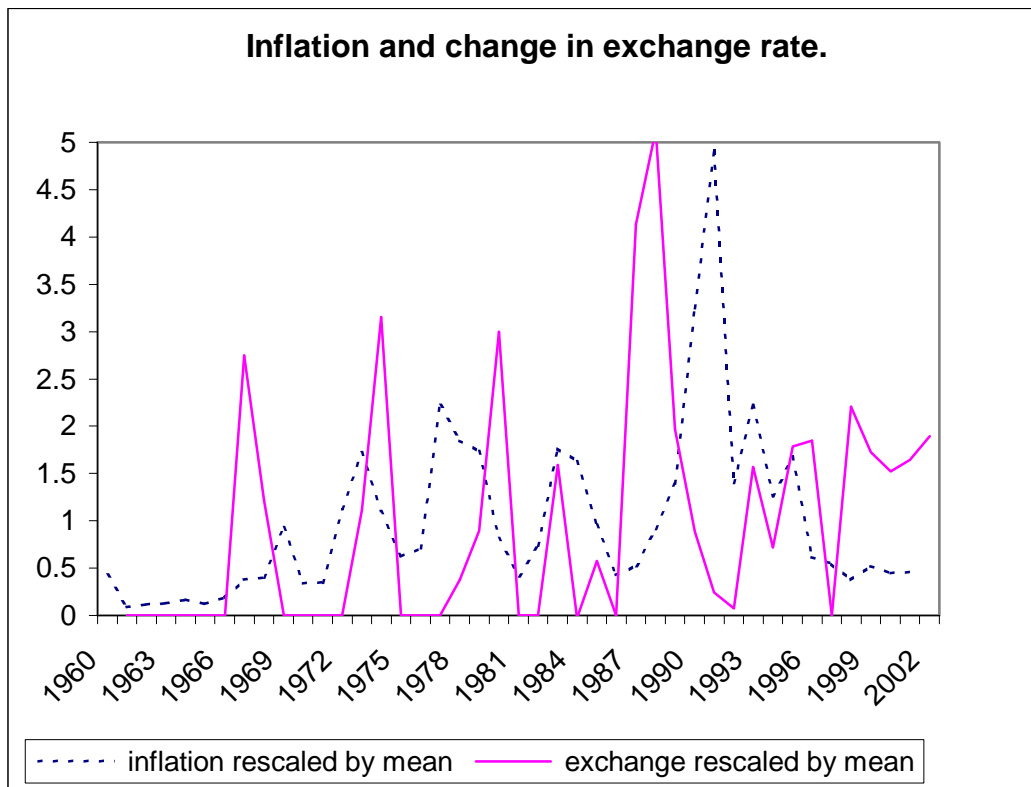
a)



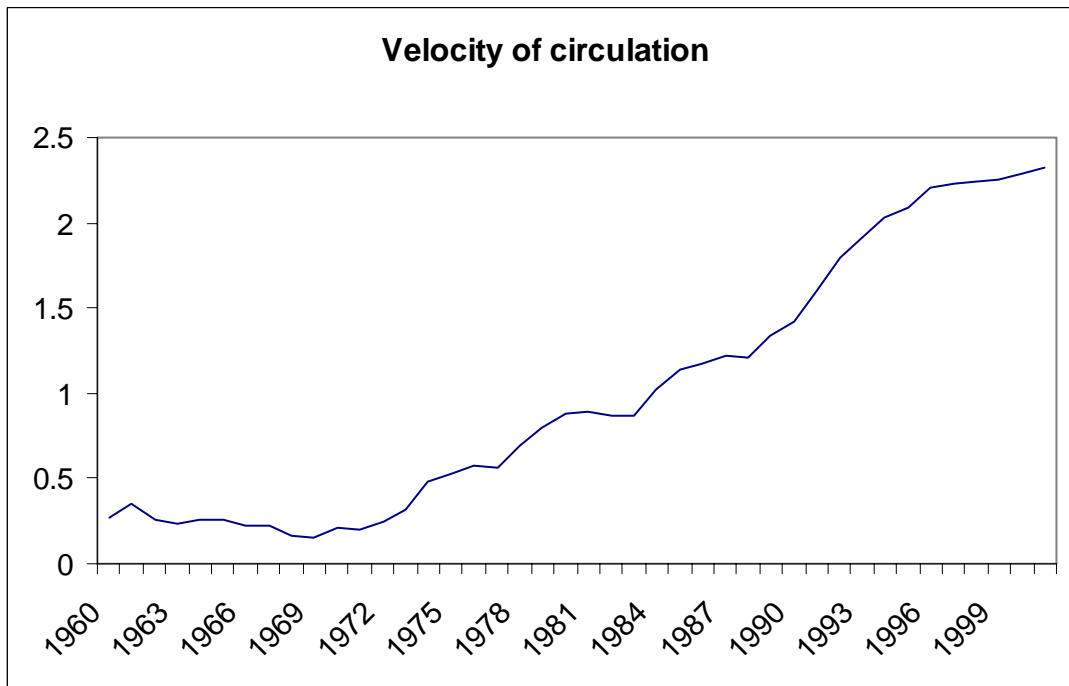
b)



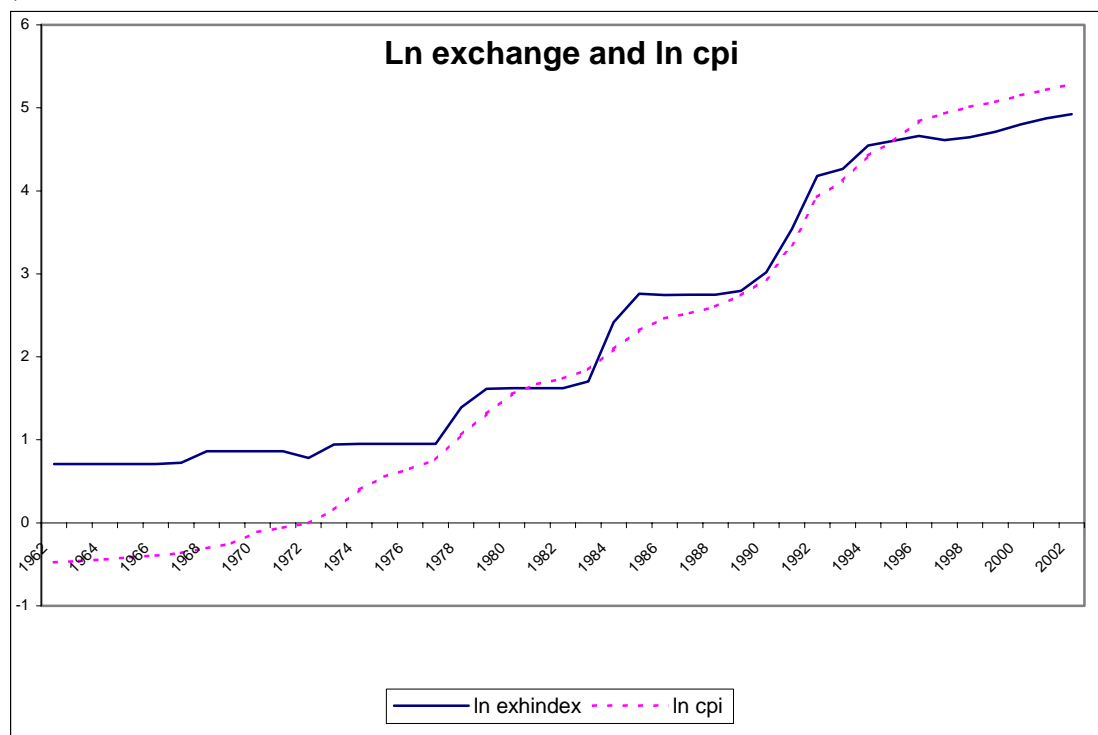
c)



d)



e)



Source : All data from WDI.

The figures above present the information on the main series involved in the currency demand relation. Graph 3 (a) shows that real currency (m-p) (lower case indicates log values) declined from 1972-1981, this also involved a decline in M2:GDP (Graph 1) and suggests a period of demonetisations and financial sector shrinkage. This probably reflected inflationary instability and the political uncertainty of the democratic socialist period both of which would have contributed to the process of illegal capital flight in search of quality. Real currency then entered a period of renewed expansion from 1981 to 1987. But this was stalled by the burst of inflation between 1987-91 and further exacerbated by the financial sector crisis of 1993/4, these again caused some demonetisations. But the faltering growth returned to trend once the FINSAC rescue safeguarded depositors and repaired confidence in and credibility of the financial system. Real GDP (transaction variable) and real currency show a positive relationship although GDP exhibits weaker growth and a smoother path.

Graph (b), shows that until financial liberalisation in the mid 1980's, interest rates were low and stable, while inflation became unstable from 1970, only returning to low and more stable behaviour in the late 1990's. Interest rates remained flat until the 1980's, but rising inflation and financial repression generated significantly negative real interest rates. Interest rates show some catch-up adjustment in the 1980's becoming briefly positive following 1985 liberalisations. Inflation spiralled until 1991, when the more comprehensive internal and external liberalisation ushered in a period of positive real interest rate, and the nominal interest rate becomes more variable as it is used as an instrument of financial control. Post 1985, inflation and interest rates begin to show greater similarity in behaviour, with inflation showing

greater fluctuations and generally preceding interest changes. After the initial years (1994-96) of financial crises, interest and inflation shift to a downward trend.

Graph (c) shows no clear relation between the exchange rate and inflation although it appears that devaluation tends to be a precursor of an inflationary spurt. Graph (d) show velocity  $\{y-(m-p)\}$  as stable in the low inflation period, but increasing steadily thereafter, with sharper rises following inflation bursts. Graph (e) shows a close relation between log exchange index and log cpi.

In total, the graphs indicate a possible long run cointegrating relationship between  $m$ ,  $y$ ,  $R$  and  $p$  corresponding to a long run money demand relation, and a second possible relation between  $f$ ,  $p$  and velocity  $(y-(m-p))$  indicating a real exchange rate equilibrium.

### *Money Demand Function*

The majority of money demand studies (Arize, 1994, Chow, 1966; Treichel, 1997; Khamis, 2001; Bahmani Oskoei 1994,2001,2002, Ghartey, 1998) have concentrated on single equations and have not therefore exploited the strength of the Johansen method in revealing multiple long run relations. This paper seeks to investigate the Jamaican financial sector with such a structural VAR system. Two recent papers estimate Jamaican money demand, Ghartey (1998) estimates only the single cointegrating relation despite a  $\lambda$  test suggesting two. Watson (2001) proposes a Structural VAR system to investigate Jamaican money demand, but chooses to specify a closed domestic money sector, which seems unrealistic for an small open economy. The remainder of this section proposes long run internal and external financial relationships which it seeks to identify as cointegrating vectors, it then looks at the error correction process and short run adjustment.

The long-run Money demand function used is of a standard logarithmic form (Zarembka, 1968), no exchange variable is included since the rate was fixed for much of the period and therefore could not have a long run influence:

$$M^d = \alpha Y^\beta P^\lambda e^{\delta R + \varepsilon}$$

which is estimated as

$$m_t = \alpha + \beta y_t + \delta R_t + \lambda p_t + \varepsilon_{1t} \quad (1)$$

$$\beta > 0, \delta < 0, \lambda = 1$$

The exchange rate equation is estimated as

$$f_t = a + by_t + cp_t + dR_t + \varepsilon_{2t} \quad (2)$$

$$b > 0; c = 1; d < 0$$

$m$  : log nominal money in circulation (M2)

$y$  : log real GDP

$f$  : log exchange rate index (J\$/US\$, hence increase with devaluation)

$R$  : nominal interest rate

$p$  : log consumer price index

The hypothesised long run relation should be represented by two cointegrating vectors, which means that there need to be two just identifying restrictions on each equation. These are the two normalisation restrictions and the restriction that the exchange rate does not appear in the money demand function and money does not appear in the real exchange rate equation. In the short run, both the internal and external disequilibria terms can influence all variables.

In order to imbed these two long run relations in a model, it is necessary to check whether all relevant variables are I(1). The annual data runs from 1962-2002, the augmented Dickey Fuller (ADF) test computed for the levels and first differences of the variables are reported in Table 1 and indicate that all relevant variables can be treated as I(1) with the unit root hypothesis rejected on their first differences. This makes it valid to investigate cointegration.

Table 2 ADF statistics

Variable	ADF	Variable	ADF
m	0.1	$\Delta m$	3.4*
p	-1.0	$\Delta p$	-3.1*
R	-1.75	$\Delta R$	-13.8**
y	-2.7	$\Delta y$	-4.6**
f	-0.06	$\Delta f$	-4.0**
m-p	-1.73	$\Delta(m-p)$	-3.8**

\* Reject unit root at 5%, \*\* Reject unit root at 1%,

To test and estimate the long run relationships a second order VAR with unrestricted intercept and restricted trends was selected and the Johansen test was applied to the five core variables. Both the eigenvalue and trace statistics suggested the existence of two cointegrating vectors at the 5% level. This supports the underlying theoretical specification of the model.

The cointegrating equations were estimated with a trend and revealed the existence of the hypothesised long run internal and external relationships. The estimated cointegrating relations are:

$$m = 17.35 + 1.56y + 1.46R + 0.72p + 0.05t + \varepsilon_{1t} \quad (3)$$

s.e.            0.11    .28    .04    .006  
t                13.35   5.23   18.04   8.18

$$f = 28.05 + 1.25y + 1.62R + 1.15p - 0.08t + \varepsilon_{2t} \quad (4)$$

s.e.            .34    .80    .11    .02  
t                3.75   1.62   10.11   4.6

These two cointegrating relationships have sensible economic interpretations, the first being a long run domestic currency demand equation and the second a real exchange (or foreign currency demand) relationship, (this equation excludes a foreign price level variable on the assumption that this has shown relatively little variation).

All the coefficients are significant and carry the expected signs, except for the interest rate. The equations provide evidence for long run relationships. In accordance with theory, money demand is strongly dependent on transaction needs: the income elasticity is greater than one, indicating scope for the growth of the money supply to exceed that of output without being highly inflationary. The interest rate is normally assumed to capture the opportunity cost (real returns on financial assets plus cost of inflation) of holding money. This opportunity cost relation should imply a negative coefficient on interest, however the estimated semi elasticity is significant and positive. The unexpected result may be explained in two ways. Firstly, it may be a data problem: in the context of a shallow financial system the treasury bill rate and deposit rate move together (Correlation: 0.9 for Jamaican rates). In this context it is possible that the treasury bill rate is proxying for 'own rate' rather than opportunity cost (Crockett & Evans, 1980). Alternatively it may reflect problems associated with risk since the measured interest is not a risk adjusted rate. Unaccounted risk aspects could relate to inflation and institutional insolvencies, both of which increased in the financial crises of the early 1990s, and coincided with the much greater interest rate variability resulting from financial liberalisation. The consequence may be that adjustments in the reported rate have not accurately captured the relevant underlying risk adjusted rate. In practice the liberalisation of the 1990's was associated with higher real interest rates, financial deepening and a greater holding of money reflected in the rising velocity of circulation (graph 3(d)). Thus the interest rate may be acting as a proxy for liberalisation. The significant and positive trend suggests increased monetisation of the economy over time.

The second cointegrating equation can be interpreted as a real exchange rate relationship. The estimation gives the expected positive coefficients for real output and price level, but gives an unexpected positive coefficient on the domestic interest rate. The unexpected effect may again link to unaccounted risk. Financial liberalisation and consequent increases in interest rates in the 1990s coincided with adverse currency movements. The higher interest rates may not have been sufficient to compensate for the perceived increase in risk of devaluation, hence despite raised interest rates, people moved out of the domestic currency and caused the devaluation.

While the above cointegrating equations indicate long run equilibrium relations the short run dynamics of the system are given by a vector error correction model (VECM). Deviations from the equilibria can occur as a result of shocks and the coefficient on the cointegrating equations (error correction terms) reveal the systemic feedback, while the short term dynamics are given by coefficients on the lagged first differences. The VECM results in table 3 show the short run parameters and feedback systems arising from exchange and money disequilibria.

The overall results given in Table3 appear reasonable with both long run relations having some significant coefficients. For deviations in money demand, the



adjustment coefficients for  $\Delta m$ ,  $\Delta p$ , &  $\Delta R$  and are all significant and negative while the feedback of money on  $\Delta y$  is positive but smaller and not significant. These results indicate that the long run domestic equilibrium relation has significant impact and that there is a complex feedback system. The effect on inflation is perverse, but could reflect the omission of a productivity effect which was being generated in the goods and labour market. The short effects of lagged changes of the other variables on the money demand equation do not appear to be significant while the error correction coefficient indicates that agents adjust money holdings by 76% of the previous years deviation. Deviations from the long run real exchange equilibrium have a significant positive feedback on money demand suggesting that devaluation has a predominant wealth effect. This occurs as devaluation causes the domestic value of foreign assets to rise with a consequent increase in the demand for domestic currency. This significant wealth effect suggests that there has been a build up in the holding of overseas assets to avoid inflation and exchange risks. Real exchange deviation also has a significant positive impact on GDP, suggesting that the positive impact of cheaper exports has outweighed any adverse import cost.

**Table 3: Results for VECM**

	$\Delta m$	$\Delta f$	$\Delta y$	$\Delta R$	$\Delta p$
Cointeg.equation(1) Domestic disequilibria Adjustment coefficient	- 0.76* (0.21)	- 0.22 (0.47)	0.17 (0.09)	- 0.23* (0.10)	- 0.62* (0.24)
Cointeg.equation(2) External disequilibria Adjustment coefficient	0.17* (0.08)	-0.41* (0.19)	0.10* (0.04)	0.08 (0.04)	-0.01 (0.10)
$\Delta m$ (-1)	0.53* (0.19)	0.41 (0.44)	0.15 (0.08)	0.13 (0.10)	0.31 (0.22)
$\Delta f$ (-1)	0.19 (0.12)	0.90* (0.28)	-0.16* (0.05)	0.10 (0.06)	0.36 (0.14)
$\Delta y$ (-1)	-0.14 (0.32)	0.88 0.72	0.03 (0.13)	-0.01 (0.16)	-0.02 (0.37)
$\Delta R$ (-1)	-0.25 (0.26)	-0.38 (0.59)	0.24* (0.11)	0.08* (0.13)	0.71* (0.30)
$\Delta p$ (-1)	-0.61 (0.34)	-1.21 (0.78)	0.16 (0.15)	0.25 (0.17)	-0.45 (0.34)

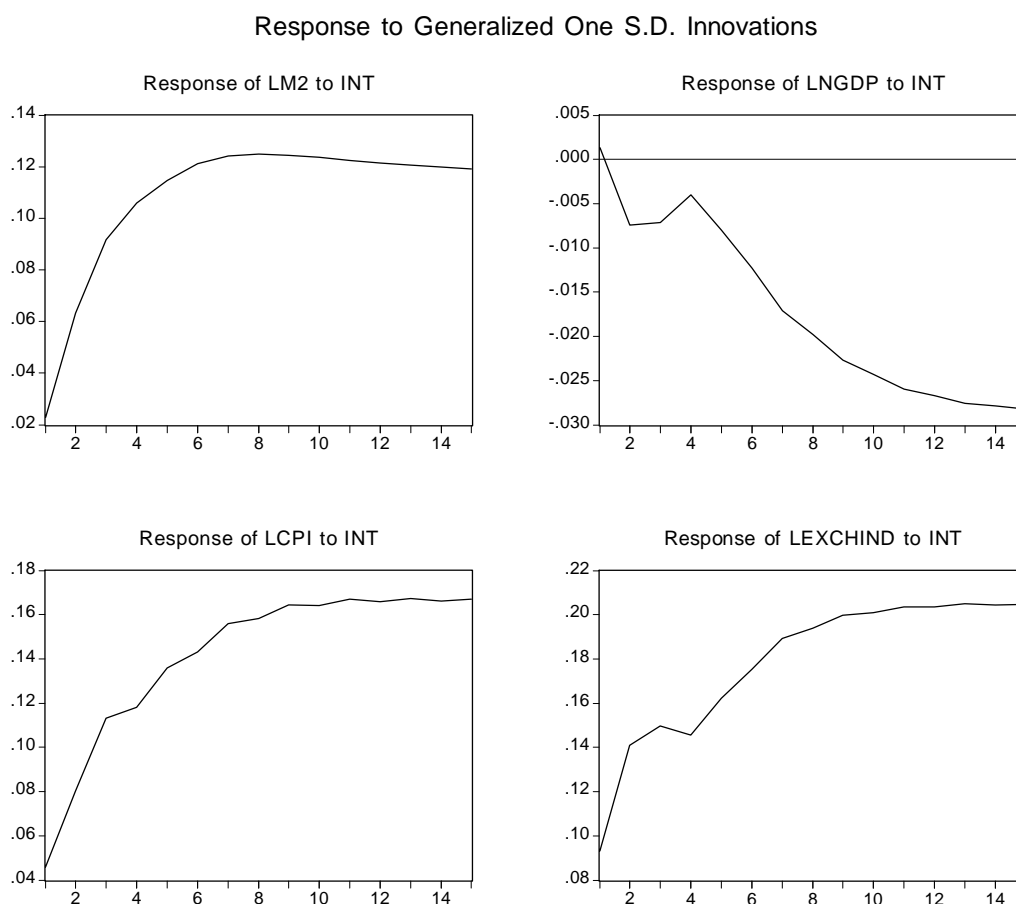
Notes: Parentheses give standard error, '\*' indicates significance at 5%

Overall the results identify long run money demand and purchasing parity relationships and reveal the feedback systems for Jamaica. As an input for policy formation, the estimates indicate that money demand takes just over a year and exchange rate takes over two years to adjust to short run deviations. However, the interest rate relations, negligible short run effects and perverse long run effects, are slightly problematic for open market monetary policy.

The effect of a shock to the policy variable, treasury bill rate (TBR) on money demand and real GDP can be seen in the impulse responses (figure 4). As indicated

in the estimations and discussion above, the demand for money shows an unexpected increase in response to a tightened monetary policy (shock to TBR). This reinforces the earlier evidence that in an undeveloped financial market, such as in Jamaica, there are few alternative assets, so that money demand is sensitive to the deposit rate (which shadows TBR). Other perverse effects are apparent in inflation which increases and the exchange rate which devalues with the interest shock. Real output declines .

Figure 4



1.Variable names: LM2 = log M2: INT = Treasury bill rate: LCPI = Log consumer price index, LEXCHIND = log exchange rate index.

*Stability of the Money Demand Equation.*

The discussion so far indicates some problems for implementing an inflation targeting policy. A possible cause of the identified perverse responses may be instability of the money demand relationship which then generated the unexpected interest coefficients. This section therefore investigates the parameter stability.

The underlying determinants of money demand could have been affected by the 1990s financial crisis. The crisis would have caused a loss of confidence in economic performance; in the banking and hence monetary system; and in the currency as it suffered large and unpredictable devaluations.

Parameter stability was investigated using CUSUM and CUSUM SQUARE tests.<sup>3</sup> These require direct OLS estimation which was performed by generating and including a deviation variable (Bahmani-Oskooee 2001, 2002). The approach uses the coefficient of a cointegrating vector to generate a deviation variable,  $Z$ . In the current money demand context these terms are:  $Z_1 = m_t - m_t^*$ ,  $Z_2 = f_t - f_t^*$ , where  $*$  indicates the long run value generated by the estimated equation. The money demand equation can then be directly re-estimated by OLS and the cointegrating relationship has been imposed.

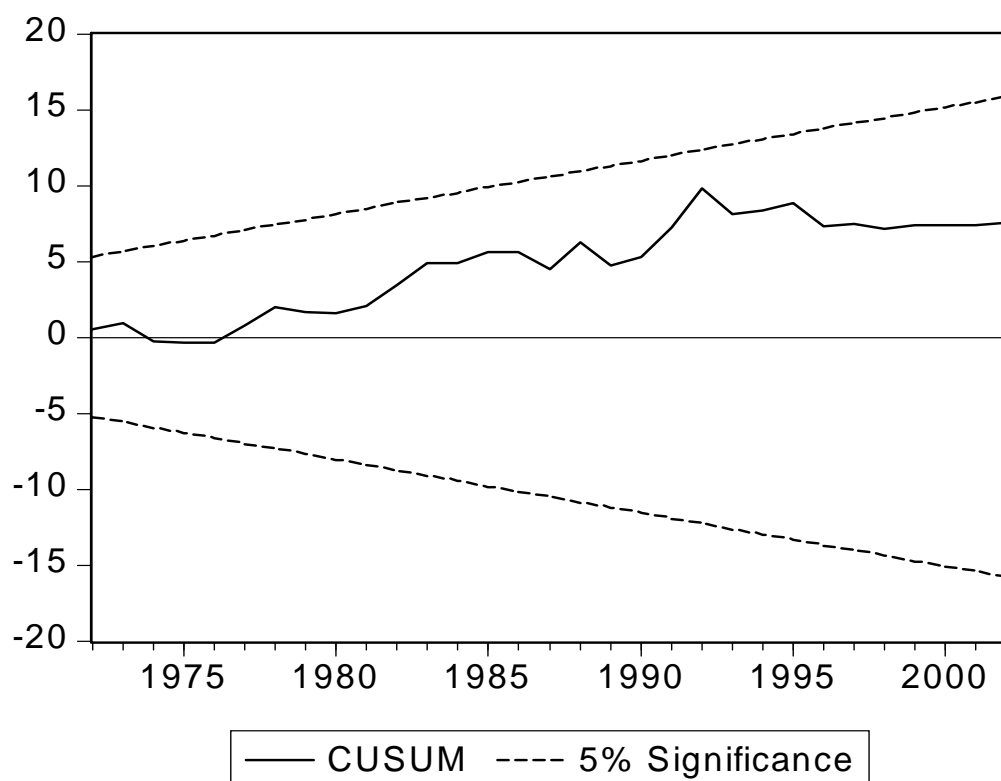
The money equation estimated was:

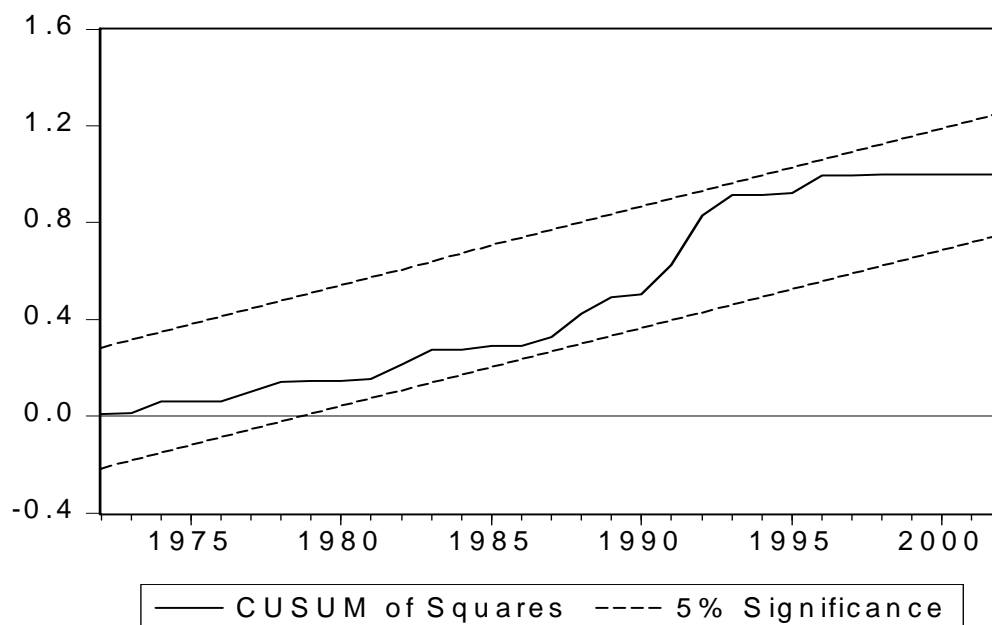
$$\Delta m_t = \alpha_{11} Z_{1t-1} + \alpha_{12} Z_{2t-1} + \beta_{11} \Delta m_{t-1} + \beta_{12} \Delta f_{t-1} + \beta_{13} \Delta y_{t-1} + \beta_{14} \Delta R_{t-1} + \beta_{15} \Delta p_{t-1}$$

Parameter stability was then investigated using a CUSUM and CUSUM SQUARE test. The graphical results (below) show both tests remaining within the 5% significance boundary indicating reasonable stability. However, both tests show increased instability in the early 1990s period of extreme crisis but with some reversion in the second half of the decade. This apparent reversion to the stable parameter relationship suggests that the government's unorthodox rescue of financial institutions was successful in maintaining confidence in the domestic monetary system.

When the above analysis is compared with Bjornland (2005), there are both similarities and differences. Both here and in Bjornland, the analysis uses a cointegrating VAR and in both cases results indicate structural stability of money demand despite a financial crisis. However, whilst this paper develops the structural system built on two co-integrating vectors (CV), Bjornland, identifies two CVs, for money and GDP, but then focuses on the single money demand CV. There is also a difference in the interpretation of the wealth effects associated with devaluation.

Graph 5





## Conclusions

The investigation of money demand within the framework of a small model has revealed the existence of two cointegrating relations which correspond to a domestic and external monetary equilibria. The domestic equilibrium gives the money demand equation. When the structural relation was estimated in a VEC system it revealed strong but apparently perverse long run effects of interest rates. The unexpected relationships, suggest that standard monetary policy may yield perverse outcomes in an economy such as Jamaica which has a poorly developed financial sector,

The Jamaican Central Bank uses open market interest rates to pursue its inflation target and in this context a stable money demand is necessary for policy to have predictable results. The CUSUM investigation showed acceptable parameter stability despite the serious financial crisis of the 1990's. This suggests that the early fall in money demand following the crisis was explained by traditional variables. This stability also suggests that the importance of accommodative financial strategy should not be judged with reference only to speed of recovery (Honohan, 2003) but with reference to its success in maintaining confidence, and hence an environment where outcomes of monetary policy continue to be predictable.

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## Endnotes.

<sup>2</sup> Ghartey (1998) generates quarterly GDP but this approach was rejected for fear that it would mask some of the short run volatility and hence confuse the dynamics.

<sup>3</sup> These tests were used as they do not require a hypothesised break point

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