

The Money Multiplier for The Bahamas

By John Rolle*

Research Department, Central Bank of The Bahamas

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Abstract

Using quarterly data for the period 1990 to 2000, this brief analyzes estimates of the money multiplier for The Bahamas. The multiplier has particular relevance for monetary policy, because it establishes a link between the monetary base or high powered money, which the central bank is in a position to influence and money supply changes that impact interest rates and real economic variables. The overall conclusion is that the multiplier exhibits significant seasonality, related almost entirely to quarterly shifts in the public's holding of currency and fluctuations in banks' excess reserves. Given the small size of the short run multiplier however, the impact of seasonality is much less important than the high level of autocorrelation of quarterly changes in the average money supply. In the absence of the restrictive monetary policy stance, the data suggest that the multiplier would have continued to increase over the course of the 1990's, in line with the proportionally reduced level of currency in active circulation. While there is scope to incorporate the multiplier in policy programming exercises the central bank has to be considerate of the current regulatory structure and depth of the financial system as this has implications for the evolution of the multiplier over the medium term.

*The views expressed in this paper are those of author alone, and not necessarily the central bank of The Bahamas'. The author welcomes comments on the paper.

The Money Multiplier in The Bahamas

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1. INTRODUCTION

Using quarterly data for the period 1990 to 2000, this brief analyzes estimates of the money multiplier for The Bahamas. The multiplier has particular relevance for monetary policy, because it establishes a link between the monetary base or high powered money, which central banks are in a position to influence and money supply changes that impact interest rates and real economic variables. Basing policy on the multiplier relationship however, requires some knowledge of its stability and necessarily, how it is trending over time. Policies that assume a stable multiplier for example, can either lead to excessive or inadequate responses in key variables such as interest rates, the exchange rate and prices. Recognizing that most economic time series also contain elements of autocorrelation, policy makers have to be in a position to distinguish between the short-run and long-run effects of operations targeted at the money supply. In particular, in the short run a significant amount of any change in the money supply could arise in response to past stimuli and not recent changes in the base. A failure of policy to consider this could frustrate the achievement of critical short-run macro-economic objectives. An example for The Bahamas would be establishing end-of-year targets for external reserves, where the link would be made between controlling the rate of monetary expansion and its resulting impact on credit growth.

This brief uses a simple flow of funds framework to demonstrate the significance of the money multiplier for The Bahamas. The analysis shows that despite having fixed exchange rates and capital controls, the central bank has to be in a position to effectively programme policies, and that knowledge of the multiplier is therefore vital. The various components of the multiplier

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are also examined to identify both behavioral and policy components of interest to the central bank. This is followed by an analysis of trends since 1990, including the extent of seasonality and a determination of short and long-run relationships between high powered and broad money. The paper concludes with some general observations on monetary policy in The Bahamas and with some discussions on how the research can be extended.

2. MONETARY POLICY AND THE MULTIPLIER

The money multiplier shows the link between the consolidated deposit and currency liabilities of the banking system and those of the central bank. Most textbook analysis takes the system as just comprising commercial banks and the central bank, where traditionally only commercial banks offered checking deposits which met the liquid, transaction characteristic of cash. This distinction was also convenient for studying the United States where the direct central banking relationship only exists for commercial banks. Moreover, common treatment of the multiplier focused on narrow liquid definitions of money (currency and demand deposits), since the fractional reserves imposed against US commercial banks only applied to checking deposits¹. Since ultimately it is the central banking and fractional reserve relationships that are of interest, a proper analysis in The Bahamas should include all domestic banking institutions. We also take the approach of using the broadest definition of money to better highlight the link with credit financing.

The base, or demand liabilities of the central bank is the sum of issued currency, plus the reserves of the banks. This can be written as

$$B = C + R_D + R_C \quad (1)$$

¹ This is also true for many other countries, including --....

Where B is the base or high powered money and currency consists of cash held by the public (C) and the portion of bank reserves held in vault cash (R_C); and the remainder of bank reserves are deposited with the central bank (R_D). In the narrowest sense, the money supply (M_1) is comprised of the public's Bahamian dollar (B\$) cash holdings plus Bahamian dollar demand deposits owed by the consolidated banking system to the private sector. Overall money (which we shall denote as M) also includes domestic currency savings and fixed deposits (or quasi money), and residents' foreign currency deposits. The link between the base and the money supply is given by the following expression

$$M = mB \quad (2)$$

where m is the money multiplier. From this expression, a given change in the base should therefore produce a change in money of m times that amount, assuming of course that the multiplier is stable.

Now consider the balance sheet of the banking system:

$$M = NDA + NFA + OIN \quad (3)$$

This says that money, or total liabilities of the banking system to the non-bank sector, is used to fund net domestic assets (NDA) or credit to non-banks, net foreign assets (NFA) and other items net (OIN)², including banks' capital. Net foreign assets can be further decomposed into the external reserves of the central bank (ER) and the net foreign assets of the rest of the banking system (NFA_B). Using this information and the earlier definition of the money supply in equation (2) the balance sheet can be rewritten as

$$mB = NDA + NFA_B + ER + OIN \quad (4).$$

² This is usually a negative figure for The Bahamas, indicating other net liabilities.

Monetary policy in The Bahamas is generally concerned with the flow of funds through the banking system, particularly credit financing. Other than changes in money, equation (4) suggests three other sources of credit financing, namely drawdowns in banks' net foreign assets and external reserves and decreases in other items net, which generally translate into increases in banks' capital position.³ A typical flow of funds equation for the Bahamas therefore becomes

$$\Delta(mB) = \Delta NDA + \Delta NFA_B + \Delta ER + \Delta OIN$$

or upon rearranging,

$$\Delta(mB) - \Delta NDA - \Delta NFA_B - \Delta OIN = \Delta ER \quad (5)$$

Equation (5) is the form that is of interest to the central bank. It shows that any net domestic credit financing which the banking system is unable to obtain from its own resources has to be satisfied through a reduction in the central bank's external reserves. Conversely, net resources that are not used to finance credit must accumulate as external reserves. For the Bahamian financial system, money supply growth is the main source of credit financing, followed to a lesser extent by changes in the net foreign assets positions, although this source is constrained by exchange control regulations. Moreover, the experience has shown that capital flows (OIN) are not a significant period-to-period source of financing. From a financial programming standpoint, the central bank would therefore be justified in making simplified assumptions about changes in OIN and NFA_B . For our purposes, we assume that both are zero, thus simplifying the flow of funds analysis to

$$\Delta(mB) - \Delta NDA = \Delta ER \quad (6)$$

³ In the Bahamian case NFA_B most often negative, making its reduction equivalent to an increase in net foreign liabilities.

The problem for the central bank is to ensure that the stock of external reserves remains adequate to support the fixed exchange rate. Two examples of intermediate targets for external reserves that would satisfy this objective would be the ratio of reserves to domestic currency or the money supply, and average number of months of import cover. Both would require that as the monetary aggregates or the economy evolves changes in the stock of reserves measure up to some targeted level, say ER^* . Having specified its reserve target, the central bank would then have to establish ceilings or floors for the net change in domestic credit, based on how the money supply is expected to evolve. In turn, money supply forecasts would be linked to how the base or high powered money is projected to evolve over time. As long as there is stable demand for the components that make up the monetary base, it would be easy for the central bank to complete the programming exercise. As we show shortly, assuming stable demand for these components (the public's cash and banks' reserves) is equivalent to taking the money multiplier as being fixed. However, the only fixed component in the money base is banks' statutory reserves. Banks also retain excess reserves, which fluctuate in response to opportunity costs considerations, as is also the case for the public's cash holdings.

Suppose however that the multiplier is stable. Then using asterisks to denote targets

$$mE_{t-1}[\Delta B_t] - \Delta NDA_t^* = \Delta ER_t^* \quad (7)$$

where the subscripts denote the relevant period, and E is the expectations operator. If the central bank has no precise knowledge about the multiplier this also introduces imprecision in the setting of the domestic credit target, and consequently interferes with the authorities' ability to meet the external reserve target. Suppose for example that the relative demand for high powered money is decreasing overtime, which is equivalent to saying that the multiplier is rising. Then the bank would underestimate money supply changes and place too much restriction on domestic credit growth. This would produce more than the desired level of growth in external

reserves. While reserves accumulation might be construed as a positive development, doing so at the expense of restrictive credit policies implies that resources would be diverted from some real economic activities, which in the extreme could have an adverse (deflationary) effect on the economy. An equally dangerous prospect for the central bank would be if the relative demand for high powered money were trending upwards, which would mean a declining multiplier. In this case the tendency would be to underestimate the potential for domestic credit expansion, and the programme would achieve less than the desired level of reserves accumulation.

Once we admit that the multiplier can also vary along with changes in the base then the central bank also has to forecast changes in the multiplier. The programming problem would be restated as

$$m_{t-1}E_{t-1}[\Delta B_t] + \overbrace{E_{t-1}[\Delta m_t]B_{t-1} + E_{t-1}[\Delta m_t \Delta B_t]}^{\text{Previously assumed to be zero}} - \Delta NDA_t^* = \Delta ER_t^* \quad (8)$$

which clearly illustrates the source of the uncertainty posed by equation (7).

3. THE MULTIPLIER COMPONENTS

In this section we break out the multiplier into its various parts and discuss factors both monetary and otherwise that influence these items. We will also identify potential leakages from the money creation process that can have a negative effect on the size of the multiplier, and flows that amplify the size of the multiplier because they add to the money supply but are not subject to fractional reserve requirements. In the limiting case, it is possible for the money supply to be composed exclusively of deposits that are subject to reserve requirements (reserve money deposits), and for the entire base to be composed of bank reserves. Then, the multiplier would be reduced to $1/r$, where r is the fraction of reserves held against reserve money deposits. If banks do not hold excess reserves, r becomes equivalent to the statutory reserve ratio and in the

Bahamian case would produce a long-run multiplier of 20. Otherwise, any tendency to hold excess reserves would immediately begin to reduce the size of the multiplier.

In equation (1) we identified the three items that make up the base. These are banks' reserve deposits held at the central bank and vault cash, and domestic currency in the hands of the non-bank public. On the other hand, the money supply (M3) consists B\$ deposits held by the public and public corporations (which we shall denote as D), foreign currency deposits held by the public (F) and cash held by the public. To be consistent with the notations used for money, we could identify three liability components which are subject to reserve requirements. These are Bahamian dollar deposits owed to (i) the public and non-central government (D—less public corporation deposits placed directly with the central bank⁴); (ii) government balances with banks (G) and (iii) non-residents balances (N). Thus the multiplier expression in equation (1) can be rewritten as

$$m = \frac{M}{B} \quad \text{or} \quad m = \frac{D + C + F}{C + R} = \frac{D + C + F}{C + r^*(D + G + N - P)} \quad (9)$$

Where in the denominator of the last term we have made use of our definition of reserves, and r^* is the combination of the required reserve ratio (r) plus the excess reserve ratio (r^+). Next dividing all terms in the numerator and the denominator by money deposits (D) the expression can be alternatively given as

$$m = \frac{1 + c + f}{c + r^*(1 + g + n - p)} \quad (10)$$

We can now summarize how each of these variables affects the size of the multiplier.

⁴ These are included in money but excluded from reserve requirements.

- i) **Currency held by the public (c):** As the public increases the ratio of currency held in proportion to total deposits, the money multiplier decreases. It is a leakage of primary reserves, against which credit cannot be extended.
- ii) **Government deposits (g):** As the government's share of total deposits in the banking system increases, the money multiplier decreases. This represents a leakage from money, but a source of reserve.
- iii) **Non-resident deposits (n):** Increased Bahamian dollar deposits by non-residents provide resources that contribute to the money base but do not add to money. They therefore have a negative impact on the size of the multiplier. However, exchange control regulations limit non-residents' access to these facilities, placing them within the influence of the central bank.
- iv) **Public corporations' deposits held at the central bank (p)** have a positive effect on the size of the multiplier, representing potential linkages from reserves. Again the central bank can influence this ratio, to the extent that it has a voice in where the corporations place their deposits. Nevertheless, its impact on the multiplier is significantly dampened by the reserve ratio.
- v) **Residents' foreign currency deposits (f)** have a positive impact on the money multiplier, being a source of primary deposits against which, in the limit, banks have an infinite ability to expand credit. Of course, exchange controls determine which residents are able to accumulate foreign currency liabilities and claims vis-à-vis the banking system.
- vi) **Excess reserves of the banking system (r^+)** reduce the size of the multiplier in the same way as increases in the public's holding of currency. In theory, the central bank has little control over this variable since it is an integral part of financial institutions' liquidity management strategy. Nevertheless, the existence of capital controls, coupled with

limited outlets for domestic credit creation can force institutions to hold involuntary excess reserves.

4. FINDINGS FOR THE BAHAMAS

Table 1 summarizes the average quarterly estimates of the multipliers for M1 and M3 since 1990, along with key ratios for the items that make up the M3 multiplier. The table also shows summary measures of volatility and seasonality. Using the narrow definition of money, the multiplier averaged 1.94 over the decade as compared to 9.16 for broad money. In terms of trends, both estimates were highly positively correlated over the period (83.6%), although the broad money multiplier was more volatile having the smaller mean/standard deviation ratio. Both multipliers exhibited a firming trend over most of the decade, with an average decline setting in after 1997. Charts 1 and 2 illustrate this, with the smoothed polynomial trends superposed to filter out period-to-period fluctuations.

As regard the broad money multiplier that is the focus of the remainder of the paper, the quarterly ratio relative to the base firmed on average from approximately 9.0 in 1990 to more than 10.5 in mid-1996. The lowest estimate was obtained in 1999, when the ratio reached 7.5 in the first quarter of that year, before settling near 8.5 in the first half of 2000. As Figure 1 also suggests, seasonality does not explain all of the fluctuations in the multiplier, with the seasonally adjusted estimates tracking the original series very closely. It turns out that the most significant determinants of the multiplier were trends in the reserves and currency ratios, which also underpinned the observed seasonality.

Seasonally, the multiplier was shown to be highest in the third quarter, some 2.6% above the moving average trend, followed by a 1.3% above average trend during the first quarter. These findings reinforce what is already known about the pattern of money and credit expansion for The Bahamas. In particular, the expansionary impact of foreign currency inflows has been

stronger for domestic credit financing during the first and third quarters as compared to the other two quarters, when the multiplier was estimated to be respectively below the average trend by 1.7% and 2.1%. As Table 2 shows, approximately 79.5% of the 1990-2000 fluctuations were explained by variations in the excess reserves ratio. Another 19.4% corresponded to shifts in the public's holdings of currency. As a group, movements in the deposit ratios represented by government, public corporations, non-resident, and foreign currency balances combined for less than 1.5% of shifts in the multiplier, and were statistically insignificant.

As regard the influence exerted from the reserves and currency, the inverse relationship of both ratios to the multiplier also therefore stands out most in the third quarter when they are respectively 0.1% and 4.0% below trend. Negative third-quarter shifts in excess reserves however, appear more significant than currency movements, which seem to have the dominant effect on the multiplier during the fourth quarters.

On average, r^* was more volatile than c over the study period, but in 1997 the ratio was almost unchanged from the 1990 level in the 6.0% range, while the currency ratio had visibly declined by almost a third, from as high as almost 6.0% to less than 4.5% of deposit money. Thus while the latter had a weaker seasonal influence on the multiplier, it was very significant in contributing to its average decline through 1997. After 1997 the reserve ratio rose at a steepened pace and the currency ratio recovered slightly. Both would have therefore contributed to the subsequent falloff in the multiplier.

5. EXPLAINING DEMAND FOR CURRENCY AND RESERVES

Given the significance of excess reserves and the public's demand for currency, a combination of both economic and monetary factors can help explain the observed trends in the multiplier. The precise nature of the relationships however, would have to be inferred from more explicit modeling and estimation of the respective demand functions. From a transaction

standpoint, both declining consumer price inflation and the weakness in economy would have contributed to the declining relative demand for currency over the first half of the 1990s. In addition, the financial system has benefited from positive developments that have permitted the public to satisfy their transactions needs with lesser cash. The first of these has been the proliferation of automated teller machines, which are now widely available throughout the most developed northern islands of The Bahamas. Use and availability of local currency credit cards have also increased. Currently, 6 of the 9 licensed commercial banks issue Bahamian dollar credit cards as compared to just one in 1990. While residents would also have had access to foreign currency credit cards throughout the period in question, the cards were more costly, since local currency transactions were subject to foreign currency conversion charges. The increasing availability of local currency cards has therefore made these facilities more affordable for use in domestic transactions in lieu of cash. As to why the currency ratio rebounded slightly after 1997, this seems to have corresponded to the marked acceleration in economic growth, which would have reinforced consumer confidence and encouraged a proportionately greater transactions demand for cash.

The earlier weakness in the economy also offers a good explanation for the rise in banks' demand for excess reserves over the first half of the 1990s, as the alternative would have been a more accelerated pace of domestic credit expansion. But credit demand would have been constrained by the same factors that depressed consumer confidence. In a less restrictive exchange control environment some of these excess resources might have also been applied outside The Bahamas. Added to the economy's income constraint, banks were also not in a position to offer easier financing terms, particularly for consumer credit, since the central bank adopted a restrictive stance in order to protect the balance of payments. For a short period (1995-1997) credit became more expansionary, as the economic recovery gained momentum and

foreign investments provided significant resources for liquidity. However, balance of payments considerations reasserted themselves and the central bank tightened consumer credit conditions again, prompting another round of excess reserves accumulation.

6. SHORT VERSUS LONG CONSIDERATIONS

Formal econometric analysis of the money multiplier relationship is complicated by the lack of depth in Bahamian financial markets, capital controls and the absence of indirect monetary policy tools. Although financial institutions are not required to keep reserves against foreign currency deposits, exchange controls severely restrict residents' access to these deposits, and therefore limit banks' ability to raise or dispose of resources via this medium. Demand for local currency deposits and by extension the derived demand for high-powered money is therefore distorted. At the same time capital markets have begun to develop, giving institutional investors and some large depositors alternative outlets for their investments. Although the experience has shown that the net impact on financial sector liquidity has not been significant, active liquidity management has still become an issue. From this standpoint, the opportunity cost of maintaining reserves has declined in relative terms, and with it presumably some involuntary excess reserves have given way to voluntary holdings.

Indirect policy instruments work through the price (interest rate) channels and in theory, achieve the best allocation of resources. In contrast, the central bank of The Bahamas has relied exclusively on direct tools. The latest episode of administered interest rates was during 1987-1994, with restrictive consumer credit measures in place from 1990-1993 and during 1998-1999. The central bank also made regular adjustments to the official discount rate as signals for adjustments in commercial banks' base lending rates, which generally had the effect of lowering both deposit and loan rates. Net effective spreads were not affected by these changes, which therefore meant that the net opportunity cost of maintaining excess reserves was not adversely

affected. On the contrary, the average net effective spreads have risen since the mid-1990s, therefore increasing the opportunity costs of maintaining excess reserves. This should have encouraged banks to hold less excess balances, provided they could have been disposed of through credit channels.

While many of these factors can be explicitly modeled in a behavioral setting, we take a less direct, autoregressive approach, using changes in the money supply as the dependent variable and changes in the base or high powered money as the explanatory variable. Based on standard Chow tests on the stability of coefficients and the Breusch-Godfrey LM⁵ test for serial correlation, the best model was the one which employed changes of the four period moving average of M3 as the dependent variable. A shortened estimation period of 1996 (q1) to 2000 (q2) had to be used, as the Chow test confirmed that the slope coefficients had changed significantly over the 1990-2000 period.

The results summarized in Table 3 suggest that the short-run multiplier is significantly less than one (0.16), while the long-run ratio is about 13. It is not surprising that the crude versions of the multiplier obtained from the division of money by the base differ from this long-run estimate. Given that high powered money expanded at an average annual rate of almost 10% during 1990-2000, the small short-run multiplier suggests that the cumulative impact would still not have been fully captured in money. This disparity since 1997 would have been more amplified given that the rate of expansion in high powered money was approximately doubled. Altogether, this implies that the crude, period-on-period multipliers would be lower than the long-run estimates. The autoregressive specification suggests that in the short run, approximately 98.8% of the previous quarter's change in the average money supply would be

⁵ For discussion of this test see Johnston (1984)

reflected in the current period's change in average money, and that 15.6% of the current quarter's change in the base would carry over to the average money supply. Given the size of the short-run multiplier, the impact of seasonality on average money supply changes would be relatively unimportant in comparison to the autoregressive component in money, and therefore any short-run policy programming exercise, spanning one or two quarters, would be subject to minimal uncertainty.

7. CONCLUSIONS AND IMPLICATIONS

Even though crude versions of the multiplier understate the relationship between changes in the money base and the money supply, they do not detract from its use in short-run programming exercises, if the multiplier is relatively stable over short periods. Thus, either the econometric specification or ratio analysis would be valid forecasting methods for the money supply. The most important lesson to be taken from this exercise is that there is scope to explicitly incorporate the multiplier in policy programming that targets the level of external reserves. Nevertheless, the central bank has to be considerate of the current structure of the financial system, both from a development and regulatory perspective, as this has implications for the evolution of the multiplier over the medium term. Under capital controls, banks would have amassed involuntary amounts of excess reserves, which given any move towards liberalization could lead to an increase in the multiplier. In a liberalized setting, the long-run multiplier would also respond positively to fewer restrictions on residents' ability to hold foreign currency deposits or to obtain foreign currency loans, placing a larger proportion of money creation outside of the direct control of the central bank, although some control could be retained with the imposition of reserve requirements on foreign currency deposits. On the other hand, deepening of the capital markets could have an opposite, positive effect on the demand for high

powered money, since banks would have to employ more active liquidity management strategies, as investors shift funds in and out of the markets.

This brief suggests a number of areas for future research. In particular, it would be useful to conduct a more extensive, annual study to better evaluate the long-run stability of the multiplier. This would include estimates of the behavioral relationships underpinning the major components of deposit money and currency, from which the impact of monetary policy measures on the multiplier could be evaluated. Finally, past policy measures could be evaluated to assess their optimality.

Appendix of Tables and Charts

Table 1: Estimates of Multiplier Components and Seasonality

	$m(m1)$	m	c	$r+$	p	g	f	n	r^*
Average	1.94	9.16	0.05	0.02	0.01	0.02	0.02	0.00	0.07
Maximum	2.23	10.71	0.06	0.05	0.01	0.03	0.02	0.00	0.10
Minimum	1.64	7.49	0.04	0.00	0.00	0.01	0.01	0.00	0.05
Volatility*	0.01	0.08	0.09	0.49	0.65	0.21	0.16	0.30	0.13
Seasonal Indices**									
Quarter 1	1.004	1.013	0.993	0.927	0.868	1.025	0.979	1.003	0.980
Quarter 2	0.992	0.983	0.983	1.140	1.483	0.997	0.937	1.042	1.038
Quarter 3	1.024	1.026	0.990	0.838	1.029	0.989	1.080	1.025	0.963
Quarter 4	0.980	0.979	1.034	1.130	0.754	0.989	1.009	0.934	1.021

Note:

* *Standard deviation divided by average.*

**Calculated as average quarterly ratios to centered four period moving averages.

Table 2: Analysis of Variance for Multiplier (1990-2000)

Source of Variation:	Share of Variation	F-stat	P-Value
Excess reserves ratio	79.50%	155.08	0.00
Currency in active circulation	19.40%	682.32	0.00
Public corporations' deposits	0.05%	1.71	0.20
Non-resident B\$ deposits	0.03%	1.14	0.29
Residents' F/C deposits	0.06%	2.03	0.16
Gov deposits	0.01%	0.19	0.66
Other	0.97%		

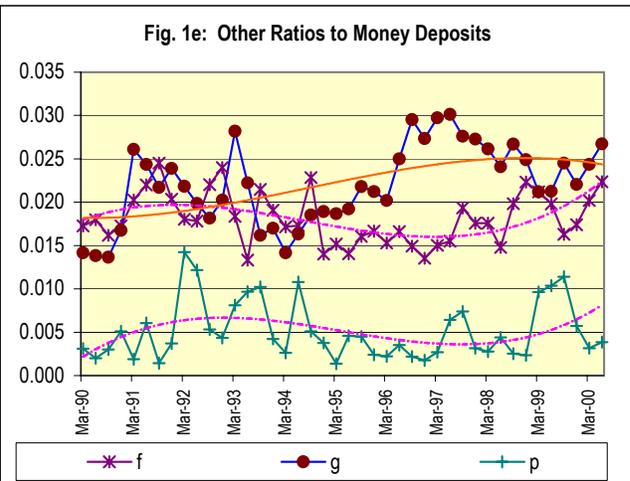
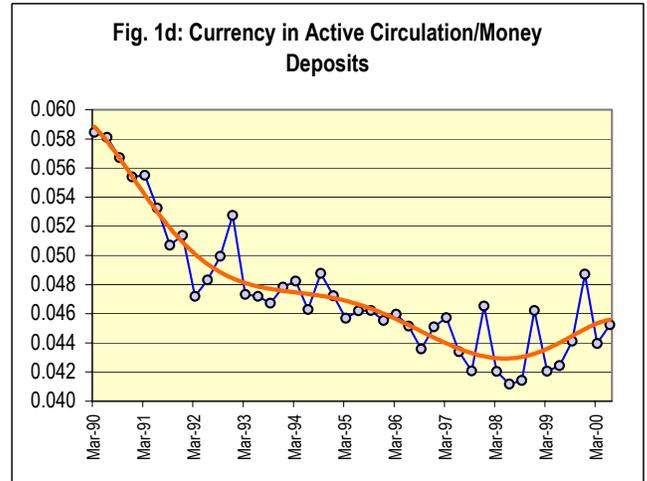
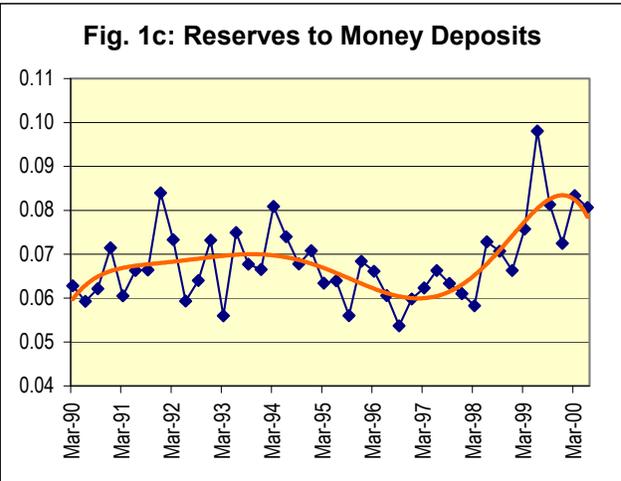
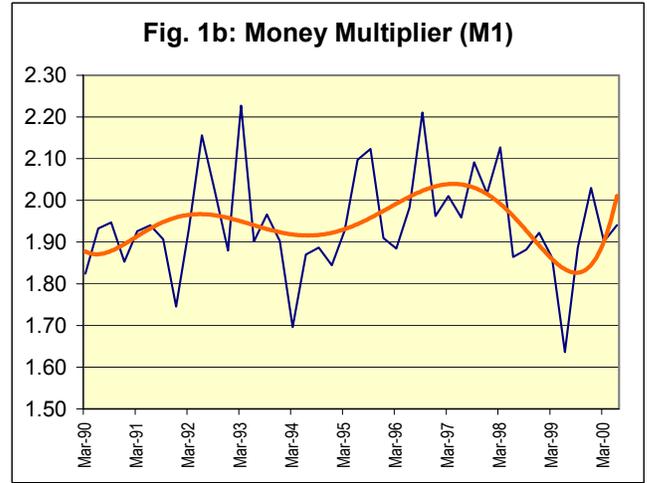
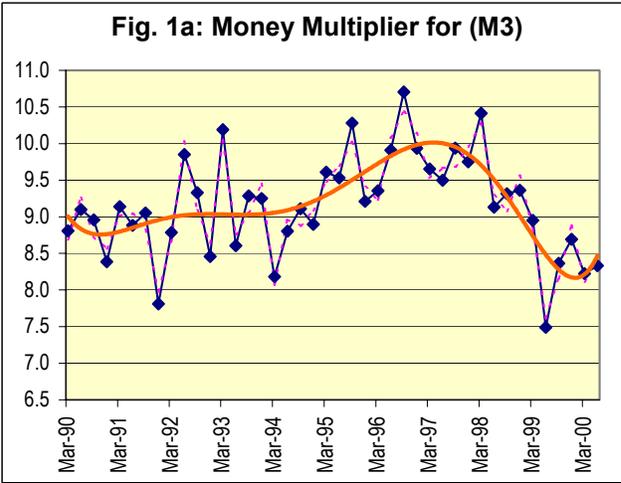
Note: Based on linear regression (with constant term) estimates based on stepwise addition of independent variables in descending order of importance (highest correlation of residuals from previous step against variables not yet included in model). Share of variation based on the change in R-square from one step to the next.

Table 3: Estimates of Short and Long-Run Multipliers

Variable	Estimated Coefficients	
	Short-run	Long-run
ΔB_t	0.156 (1.82) p = 0.09	13.55 (157.59) p = 0.00
ΔM_{t-1}	0.988 (28.53) p = 0.00	---

Sample: 1996:1 2000:2
Number of Observations: 18
Adj R-squared 0.86
F-statistic 106.35
Durbin-Watson 1.93
Breusch-Godfrey LM (F-Stat for 4 lags) : 0.892 (p=0.50)

Note: t-statistics bracketed ()



Note: Smoothed solid line is estimate of 6th order polynomial trend. Broken line in Figure 1a is seasonally adjusted estimate of multiplier.

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