The Determinants of Money Multiplier in Tanzania

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Abstract

The main purpose of this paper was to investigate the behaviour and stability of the money multiplier in Tanzania by using un-deseasonalised data for the period 1986:II-2005:I. The results show that short-term interest rates were not significant determinants of the money supply in Tanzania. This finding supports the theory on exogeneity of money supply determination. Even though, both descriptive and regression analyses indicated that the elasticities of the narrow and broad money together with their multipliers were unstable prior to the implementation of market clearing monetary policy regime started in 1993. Moreover, the results attest to existence of a sluggish adjustment of equilibrium money stock to changes in monetary base. This is a typical outcome in economies with nascent financial markets; and, suggests that expansionary monetary policy through open market operations would be inflationary. In general the result suggests that the central bank in Tanzania can, in the due cause, be able to a big extent to control monetary expansion by controlling the base money. Granted, the slight instability in the money multipliers could be controlled for in monetary programming by either accommodating in monetary base or influencing the behaviour of the nonbank sector by other policy measures.

JEL Classification: E50

1. Introduction

In one of the traditional credit creation models, changes in the stock of money supply are considered to be linked to the high powered money vide the money multiplier, elsewhere referred to as credit multiplier. In such a model, that some commentators considers very mechanistic (Johnson, 1974; Ajayi, 1972) and characterized by "definitional problems...when used in a developing economy"(p.257), central banks are assumed to have effective control and attain the targeted growth in money supply through the changes in monetary base, elsewhere referred to as high-powered money, if the relevant monetary multiplier is stable and its movements are predictable with some accuracy (Zaki, 1995:98).

This paper seeks to use the monetary multiplier approach, also dubbed the ratios

model (Gowland, 1991:236), to analyse the behaviour and stability of the monetary multiplier in Tanzania.[1] On this account, the findings heretofore will attest to the extent to which the central bank in Tanzania, that is, the Bank of Tanzania (BoT), can command changes in money supply by its control over the monetary base. This purpose of this paper is identify and analyze the determinants of money multiplier in Tanzania.

Three factors motivated the analysis in this paper. First, "(m)odern economics has been bred chiefly in Europe and the United States, and despite its aspiration toward generality it bears the stamp of institutions and issues characteristic of these areas" (Goldsmith, 1969:vii). For this reason, among others, empirical studies are biased in favour of economically advanced countries and a few emergent developed economies. In developing countries, where the mainstream are increasing being "consumed", there exists a dearth of rigorous empirical studies. As regard the money supply process and the money multiplier, in particular, there exists only a few studies on Tanzania (Ndanshau, 2004; Kida, 1999; and Kimei, 1986). Unfortunately such studies are outdated and therefore do not capture adequately or analyze rigorously the developments that have taken place in the real and monetary sectors since the government commenced to implement the structural cum economic reform programmes supported by the IMF (International Monetary Fund), the World bank and other donor agencies since the mid-1980s.

Second, following the implementation of economic reforms, and specifically the financial sector reforms, the BoT has shifted from a rationed economy monetary regime to first a credit ceiling regime (CCR) and thereafter to a market clearing monetary policy regime (Kimei, 1996). Characteristic in the latter regime has been credit ceiling complemented by

[1] The flow of funds approach is not used in this study because it is considered most appropriate for economies in which either interest rate or the exchange rate is a target of monetary policy (Artis and Lewis, 1990:3)

indirect monetary policy instruments, including the discount rate, and the minimum reserve requirement, and foreign exchange operations market (FEMO) to contain monetary expansion in the desire band for price stability. However, successful use of these monetary policy instruments in Tanzania depend upon the stability of the money multiplier. For as Jordan (1980) notes, the effectiveness of stabilization policy depend upon the reliability with which the central bank can, among others, "determine the growth of the money stock with sufficient precision, if it is deemed desirable to do so" (p. 268). If the money multiplier is unstable and unpredictable, as maintained by the Keynesians, the BoT would be unable to control and attain the desired rates of monetary expansion through programming of the reserve money.

The third factor that motivates this study is the liberalization of the financial sector implemented as part of the overall economic reforms programmes since the mid-1980s. The financial sector reforms led to incredible financial innovations in Tanzania that, among others, have led to an increase in the number and variety of financial institutions and instruments. The influence of financial innovations and structural changes that took place in the financial system may not be free of influence on the behaviour and stability of the money multiplier in Tanzania. This study, therefore, venture to fill the gaps in the existing studies on money supply determination by investigating the behaviour and stability of the money multiplier in Tanzania.

The paper is organized as follows. The following section presents a historical account on the developments of money, supportive institutional and legal framework, and regime shift in the conduct of monetary policy in Tanzania during the period 1967-2007. Section 3 reviews the relevant theoretical and empirical literature; and, the methodology of the study is presented in Section 4. The empirical findings on the relative importance of and

behavior of the determinants of money supply is dealt with in section 5. Section 6 concludes with a presentation of the main findings, policy implications, and areas for further research.

2. Analytical framework

The monetary base model consists one of the approaches used to analyze money supply process in an economy. The model, in its simplest form that features in most textbooks of money and banking, is presented by the following equation:

$$M = mH \qquad (1)$$

where M is nominal stock of money, H is unadjusted monetary base and m is the money multiplier.

In the traditional theory, from the uses side the M in (1) constitutes currency in the hands of the nonbank public, elsewhere referred to as currency in circulation (CC), and demand deposits (DD) held with commercial banks such that:

$$M = CC + DD \qquad (2)$$

In theory, equation (2) captures the portfolio choice of the firm households with respect to the allocation of their money balances (M) between CC and DD. On the basis of (2), it follows that the higher the proportion of the M held as CC, which is known as currency ratio (k), the lower will be the primary deposits in DD. In this respect,

$$CC = kDD \qquad (3)$$

On the other hand, following (2) and (3),

$$DD = (1-k)M \qquad (4)$$

However, in fractional reserve banking system banks hold as reserves (R) a proportion of DD, referred to as reserve ratio (r), such that:

$$R = rDD \qquad (5)$$

and

$$DD = \tfrac{1}{r} R \qquad (6)$$

The quotient in (6), referred to as credit multiplier or deposits multiplier, influences the rate of expansion of credit disbursed and therefore the expansion of the DD and money supply (M).

However, the R in (5) and also (6) is, by definition,

$$R = H - CC \qquad (7)$$

This implies that the R is a residual such that, *ceteris paribus*, the larger (lower) the CC the lower (larger) the R available for credit creation by the banks.

The central banks, however, imposes statutory minimum reserve (SMR) requirement on bank deposits. As in textbooks, if it is assumed that the DD are the only financial liabilities of the banks and the latter are fully banked, it follows that:

$$R = RR = rrDD \qquad (8)$$

where RR are the required reserves and rr is the legal reserve ratio which equals the total reserve ratio (r) in (5).

On the basis of (7), the deposit creation equation (6) now reads as,

$$DD = \tfrac{1}{r}\left[H - CC\right] \qquad (9)$$

Substitution of (3) in (9) gives the following equation:

$$DD = \tfrac{1}{r} H - \tfrac{1}{r} kDD. \qquad (10)$$

By some manipulation (10) reads thus,

$$DD = \tfrac{1}{r+k} H. \qquad (11)$$

By substituting (11) in (3) the following currency equation is obtained:

$$CC = \frac{k}{r+k} H. \qquad (12)$$

Further substitution of (11) and (12) in (2), gives an equation that captures the linkage that exist between the various determinants of the money supply as,

$$M = \frac{1+k}{k+r} H. \qquad (13)$$

Since the M only sums CC and DD, the quotient in (13) is hereafter referred to as the narrow money multiplier ($m1$), whose behaviour and stability is determined by two behavioural variables, *viz*, the currency ratio (k) and the reserve ratio (r).

The traditional monetary base model as presented in (1) and expanded upon in (13) demands for some adjustment to befit its use in the analysis of the behaviour and stability of the money multiplier in Tanzania. Foremost, where measured as a ratio of the money supply to the monetary base as in (1), the monetary multiplier depend on how money supply is defined (Coats and Khatkhate, 1980:17). In Tanzania there exists three monetary aggregates of which the most relevant here are two: one is the conventional narrow money ($M1$), as already defined, and the other is the broad money ($M2$) defined as[2]

$$M2 = CC + DD + SD + TD \qquad (14)$$

The sum of savings deposits (SD) and time deposits (TD) constitutes what is defined here as other deposits (OD).[3]

Following the traditional theory, only demand deposits (DD) are subjected to SMR.

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[2]The third monetary aggregate is the so-called extended broad money ($M3$), defined to include $M2$ and foreign currency deposits (FD), was innovated after the liberalisation of the financial sector in 1991 that rendered legal the holding of foreign currency and foreign currency deposits by the nonbank public. In some occasions the BoT targeted the M3 but reverted to M2. Notable also is that the deposits mobilised by the non-bank financial intermediaries (NBFIs) are not included in M2 but are monitored by the Bank of Tanzania.

[3]Jordan (1980) specifically notes that since banks are required to hold reserves for SD and TD, information on the public's desired holding of such assets relative to the DD is necessary in order to determine "how much the stock of money will change following a change in the stock of monetary base"(p.276). This aspect is not covered in previous studies in Tanzania. For example, see Kida (1999). OD excludes foreign currency deposits mainly because M2 is the target of monetary policy in Tanzania.

However, given (14), the OD and some short-term assets in Tanzania are also subjected to SMR. Since the OD are demanded by the nonbank public, it can be assumed here that their holding is at the expense of the non-interest earning DD such that the relevant behavioural equation is:

$$OD = raDD \qquad (15)$$

where, by assumption, ra is a proportion of DD demanded for transfer into OD.

Unlike other countries, for example Venezuela and the United States of America (USA), the DD and OD of the banks in Tanzania are subjected to the same SMR such that, given (6) and (15), an equation for the banks' required reserves (RR) against their total deposits is:[4]

$$RR = rr(1+ra)DD \qquad (16)$$

While, as a matter of policy, the central bank prescribes the SMR, the commercial banks may, in addition, voluntarily or involuntarily hold excess reserves (RE) (Caprio and Honohan, 1991). In Tanzania, for example, banks are known to have been characterized by a large volume of RE since the liberalization of the financial sector in 1991. For this reason the total reserves of the banks are measures as,

$$R = RR + RE \qquad (17)$$

where, by assumption,

$$RE = re(DD + OD) \qquad (18)$$

and re is the excess reserve ratio that depends on the business plans of the banks and other exogenous factors (Caprio and Honohan, 1991).

[4]In some countries, for example, the USA separate legal reserve ratio are applied to even government deposits. In such a case the total reserves of the banking system would be presented as:
$R = RR_{DD} + RR_{SD} + RR_{TD} + RR_{G}$, representing legal reserves for the demand, savings, time, and government deposits. See Jordan (1980).

On account of the above specifics on the monetary system and policy approach in Tanzania, first, substitution of (13) and (15) in (14) and taking note of the definition in (5),

$$H = CC + rr(1+ra)DD + re(DD + OD) \qquad (19)$$

By substituting (12) in (18),

$$H = CC + \left[rr(1+ra)DD\right] + \left[re(DD + raDD)\right] \qquad (20)$$

such that, by manipulation (19),

$$DD = \frac{1}{k1+rr(1+ra)+re(1+ra)} H. \qquad (21).$$

Substitution of (19) in (3) and (12) followed by some manipulation gives

$$CC = \frac{k}{k+rr(1+ra)+re(1+ra)} H \qquad (22)$$

$$OD = \frac{ra}{k+rr(1+ra)+re(1+ra)} H \qquad (23)$$

Substitution of (21), (22) and (23) in (14), followed by some manipulation yields

$$M2 = \frac{1+k+ra}{k+rr(1+ra)+re(1+ra)} H \qquad (24)$$

The quotient in (24) constitute the broad money multiplier ($m2$) that modifies the $m1$ in (11) by including specific behavioural factors (re and ra) that influences the money stock ($M2$) usually targeted by the central bank in Tanzania.

A germane point to note here is that the behaviour and stability of the monetary multiplier as in (1) or in its expanded form in (11) and (24) has, historically been a center of controversy, mainly between the adherents of the so-called monetarists and the Keynesian schools. The controversy has runs down a spectrum of "money doesn't matter" to "money matters" to "money matters much" to "money matters most" and to "money alone matters" (Samuelson, 1969:7). In the context of the monetarists "money matters" because the money multiplier is stable. In monetary policy context, therefore, the monetarists' position is that the central

monetary authority is able to peg the exchange rates, inflation rates, the level and rates of growth of nominal national income and the quantity of money supplied (Gokbudak, 1995:2). The opposite argument is held by the Keynesian economists who maintains that "money does not matter" or "matters very little" because the monetary multiplier is unstable, and shifts unpredictably such that monetary policy actions can not be banked upon in stabilization programmes. Instead, the Keynesians subscribe to a view that monetary policy actions should rest on discretion rather than rules, a view maintained by the monetarists.

As a result of the controversy that has existed and policy concern, the money multiplier has been at the centre of empirical studies in monetary economics in and outside the developing countries. Chona (1976) found that the money multiplier in India was very stable in the short-run such that it was possible to predict fairly the likely effect of changes in monetary liabilities on the money stock. Similarly, another study in India by Kulkarni and Miller (1986) found that the monetary multipliers were predictable because the currency ratio and the excess reserve ratio were predictable. Also, another study on India by Jha and Rath (n.d.) found that the monetary multiplier was stable prior to liberalization of the financial sector and unstable thereafter. A study on India by Poudyal (1991) also found the narrow monetary multiplier to vary from quarter to quarter, and that for broad to be very stable. In the SSA countries, a study on Sierra Leone by Davies (2002) found that the money multiplier for both $M1$ and $M2$ were quite stable, implying that money supply was exogenous.

3. The estimation model, methods and data

The analysis here is two-fold. A descriptive analysis of the behaviour of the money multiplier and its determinants based on the two concepts of money stock in Tanzania and equations (1), (13) and (24). In addition, an econometric analysis is based on the following semi-log

linear equations, that is,[5]

$$\ln M1_t^s = \alpha_0 + \alpha_1 \ln H_t + \alpha_2 i_{TB,t} + \alpha_3 i_{d,t} + \alpha_4 i_{L,t} + \alpha_5 rr_t + \alpha_6 \ln M1_{t-1} + u_t \quad (25)$$

$$\ln M2_t^s = \beta_0 + \beta_1 \ln H_t + \beta_2 i_{TB,t} + \beta_3 i_{d,t} + \beta_4 i_{L,t} + \beta_5 rr_t + \beta_6 \ln M2_{t-1} + e_t \quad (26)$$

The two equations are variants of that used by Baghestan and Mott (1988) being used here because they provide for the tests of the relevance of both Keynesian and monetarists theoretical propositions and the controversies amongst them in the context of Tanzania, which is one of the developing countries in Africa. However, first, unlike Baghestan and Mott (1988), monetary base (H) has been preferred to reserves (R) because is normally controlled by the BoT to influence the growth of $M2$ in Tanzania (Bank of Tanzania, 2005:iv).[6] Second, one period lagged measures of money stock are included in the two equations to capture disequilibrium between equilibrium money stock and changes in the monetary base (Mott, 1988). It is also worth noting *a prior* that equations (25) and (26) include, among others, three policy relevant variables, namely the monetary base (H), the statutory reserve ratio (rr) set by the central bank, and discount window rate (i_d) charged by central bank in lending to banks new reserves.[7]

The null hypothesis that picks up the Keynesians' stance is the that the multiplier (α_1 and

[5]First, regression method is only one methods in the literature. The other are definitional and behavioural methods. See Burger *et al.* (1971:8). Second, pre-tests indicated superiority of the semi-log functions over linear functions.

[6]According to Baghestan and Mott (1988), and also Gibson (1972), R should be preferred to H because it permits adjustment for reserve requirements and it helps avoid inclusion of variables to explain the division of H into CC and R" as in (5) above (p.486). However, the R has also been noted to have been characterised by serious errors in data that makes questionable its credibility and use in monetary programmimg in Tanzania. See, Ndanshau (2005).

[7]Some comentators on and/or critics of the traditional monetary base model maintains that economic variables, specifically interest rate and income, also impacts significantly on the monetary multpliers (see Gauger, 1998). However, such developments are controlled for in this study to better explore the relevance of the contesting traditional views on money multpliers in Tanzania, a developing economy with an

β_1) are unstable, implying that the central bank lacks strong influence on money stock, however defined. The alternative hypothesis, as maintained in the monetarists' view, is that both measures of the money multiplier are very stable; and, unlike the Keynesians, the money stock is staunchly and positively related to monetary base (H).[8] The second hypothesis anchors on the influence of short-term interest rates (i_L, i_d) on the portfolio choice by the banks. Following the Keynesians the return to commercial banks from making loans (i_L), measured here by the short-term lending interest rate charged by the commercial banks, is expected to exerts a negative influence on bank demand for excess reserves and, as a result, be positively related to money supply (Teigen, 1964; Gibson, 1972). An opposite influence on money stock is considered to arise from a fall or rise in the cost of acquiring from the central bank additional reserves for lending (i_d). Its rise (fall) reduce (increase) acquisition of new reserves, reduce (increase) loans (demand deposits) and therefore the money supply. The i_d is measured here by the discount rate of the central bank in Tanzania. The coefficients of adjustment ($1-\alpha_6$ and $1-\beta_6$) in (25) and (26) are expected to lie between zero and unity and be very small due to the underdevelopment of financial markets in Tanzania.

For the purpose of this study and in appreciation of the nature of the economy and developments in the financial systems in Tanzania since the early 1990s, first, the 90-days treasury bill rate (i_{TB}) is introduced in (25) and (26) as a short-term measure of an opportunity cost of holding excess reserves by banks. The modelling of the i_{TB} in the

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underdeveloped financial infrastructure and markets, and emerging to practice monetary policy programming as where the theories were arted, that is, the economically advanced economies.

[8]It should be noted that the nature of causality between M and H has been of interest in the literature. See, among others, Nachane and Ray (1989) and Teigen (1964). This issue is not persued here.

analysis is prompted by a fact that during the sample period banks off-loaded part of reserves in government securities, especially treasury bills, because were safe, carried high return and private sector investment remained sluggish. This considered, the treasury bill rate is expected to be negatively related to money supply. Second, are institutional factors, more significantly shifts in policy regime in the 1990s. Among others, after the liberalization of the financial sector in 1991, monetary policy regime shifted from a credit ceiling regime to a market clearing regime (Kimei, 1996). In tandem treasury bills markets and foreign exchange auctions were launched in July 1993; and, interest rates liberalised fully in August 1993 and, interbank foreign exchange market (IFEM) introduced in June 1994. The latter, as Kimei (1996) informs, paved way for creation of a mechanism for open market operations in foreign exchange as an additional means for liquidity management in the economy. By no doubt, the shift in policy regime and the attending developments in the monetary and real sectors of the economy, influenced the behaviour of the banks and nonbank public and therefore the monetary multipliers during the sample period. In this regard, a shift variable (D), which takes a value of unity in the period 1986:I to 1994:III and zero thereafter is introduced in (25) and (26). The break in the sample is set at 1994:III because the plots of the major variables in Figures 1 and 2 shows structural breaks in their behaviour occurred around that period. Furthermore, though it is a rule, a stochastic error terms (u_t and e_t) are introduced in the equations to capture possible random fluctuations that may have characterise the relationship between money stock and the monetary base (Rasche, 1972; Brunner and Meltzer, 1968). As Rasche (1972) explains, if the random effect is large, the forecasted growth rate of money stock will exhibit a large error around its desired path.

To test for the stability of the money multipliers, which are the most relevant regression coefficient (α_1 and β_1) in this study, two methods are put into use, *viz*, the Chow's break

point test and CUSUM test available in *EViews 5*.[9] Principally, the stability test is expected to establish the degree of fluctuations in α_1 and β_1 and "changes in the variance of the residuals as the sample period is altered" (Lombra and Kaufman, 1984:1150). As a primer to the econometric analysis, Exploratory Data Analysis (EDA), including normality tests and graphical analysis, is carried out "to get a feel" of the variables used in the analysis.[10]

Table 1 about here

Table 1 shows that the mean, median and standard deviation of $M2$ were relatively larger than than that of the rest of the variables, particularly $M1$, H and R. It is notable, however, all the variables were slightly positive skewed, serve for i_{TB} and i_D. Moreover, the coefficient of kurtosis are just about 3 for all variables, except i_{TB} and i_D. The EDA, therefore suggests that all varaibles except i_{TB} and i_D, were just about normally distributed.

Figure 1 shows that both all the principal variables exhibits fluctuations of which some are very dramatic, for example the plots for statutory minimum reserve ratio (rr) and the short-term interest rates (i_L, i_{TB} and i_D), and both M1, M2 and MO that, by and large, trended upwrad. In general the virtual plots in Figure 1 suggest that all the principal variables may not have been stationary.

Figure 1 about here

On account of the suspected nonstationarity of some of the key variables a investigation of the stationarity is carried out by using the Argument Dickey Fuller (ADF) test that include a constant, trend and employs automatic lag length selection by using Shwartz Information Criteria (SIC). ADF equation used is as follows:

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[9]The CUSUM test also allows for the test of the predictability of the money multiplier but this is not pursued in this study.

[10]For a detailed treatment of the EDA, among others, see Mukherjee, White and Wuyts (1998).

$$\Delta y_t = \alpha_0 + \beta y_{t-1} + \sum \varphi_i y_{t-1} + e_t \qquad (27)$$

where y_t is the relevant random variable, Δ is a difference operator, and e_t is a white noised stochastic error term. A trend (t) has been included in the ADF test.

The null hypothesis tested in (27) is that $yI(1)$, because $\beta = 0,$ implying that the variables have unit roots. The alternative hypothesis is that $yI(0)$, that is, β 0, implying that the variables are level stationary. Serve for its inherent limitations (Gujarati, 2003:818-20; Johnston and Dinardo, 1997:116), the ADF test results presented in Table 1 shows that the absolute value of all the variables were $I(1)$ in levels and $I(0)$ in their first differences, except the broad money stock ($M2$).[11] It is note worthy, however, that unit tests of log transformations of $M2$ and also $M1$ and MO yielded statistically acceptable results (Table 2).

Table 2 ADF Test Statistics

Since the pre-test results showed that all the variables were $CI(1,1)$, possible existence of a long-run relationship amongst them was explored by subjecting to ADF test the error terms (u_t and e_t) obtained from estimation of (25) and (26). The estimation results showed indeed the two stochastic error terms were $I(0)$ at 5% test level. This finding implied existence of a long-run relationship amongst the variables in (25) and (26); and, therefore, estimation of (25) and (26) by the traditional Ordinary Least Square (OLS) method, as carried out heretofore, would not result into spurious results (Gujarati, 2003:822).

The analysis is based on un-deseasonalized quarterly time series data obtained from the quarterly *Economic Bulletin* and *Economic and Operation Reports* of the Bank of Tanzania (BoT) for the period 1986:II - 2005:1(Bank of Tanzania, various:b,c). For this reason, unlike some

of the previous studies on Tanzania (Kida, 1999; Rutasitara, 1986), the 1967-86 period is excluded in the analysis. This is for one main reason. Between the adoption of Arusha Declaration in 1967 and adoption of economic reforms in Tanzania in mid-1986, the money supply process was staunchly influenced by the government fiscal operations that were built into the annual Finance and Credit Plans (FCP) that was introduced in 1971/72 fiscal year to guide "mobilization and allocation of financial resources of the budget and bank credit according to national priorities" (Rutasitara, 1986:vii).[12] Since the BoT was required by the Government to both regulate and promote economic activity in the country, the FCP prepared by the central bank (BoT) and the Ministry of Finance (MOF) accommodated fiscal deficits that it had to live with as a exogenous variable. In fact, Kimei (1996) informs that during the initial ten years (1971/72 - 1981/82) of implementing the FCP "variations from planned net domestic credit and money supply were closely related to variations in net credit to government, which in turn traced variations in the government's recurrent budget deficits" (p.5). Given such a staunch influence of fiscal operations on the money supply process, the money multiplier model, rather than the flow of funds theoretical framework, is the most appropriate approach (Artis and Lewis, 1990).

4. The money multiplier: Its behaviour and stability

1. Descriptive results

The behaviour of the aggregated narrow ($m1$) and broad ($m2$) money multiplier based on

[11]The unit root test results for $M2$ suggests that ρ 1 because δ is positive.

[12]According to Kimei (1996), the practice of monetary targeting by FCP has been in place to-date but "details and monitoring of performance of the plans changed rather radically from 1986" (p.4).

(1) during the sample period is plotted in Figure 2.[13] As evident, during the sample period both the $m1$ and $m2$ wiggled dramatically; and, their exhibited a more or less the same time trend. For example, both exhibits similar cycles prior to a break in 1993:III, and similar cycles in the period 1995:III through 2005:I. On the basis of Figure 2, it is worth noting that both $m1$ and $m2$ rose somehow sharply in the 1990-91 period when the government liberalized the financial sector. Moreover, Figure 2 shows that both $m1$ and $m2$ fell sharply between 1993:III and 1995:IV, that is, just after the amendment by the government of the BoT Charter to empower it with price stability as its single most important objective.[14]

Figure 2 about here

Accordingly, the size of the narrow and broad money multipliers varied dramatically during the sample period. During the period 1986:II to 1993:III, the quarterly annual average size of $m1$ ranged from 1.95 to 2.10; and that of $m2$ ranged from 2.79 to 3.24 (Table 3). On quarterly basis, during the period 1986:II-1993:III the values of the mean and standard deviation of the $m1$ were, respectively, 2.01 and 0.08 and that for the $m2$ were 2.96 and 0.20. In contrast, and by excluding the structural break period (1993:IV-1995:II), during the 1995:III - 2005:I period the annual average size of $m1$ ranged from 1.24 to 1.48 and that of $m2$ ranged from 1.98 to 2.34 (Table 3). During the period, the quarterly based mean and standard deviation of the $m1$ were 1.34 and 0.09, respectively; and, that for the $m2$ were 2.11 and 0.14, respectively. Per these mean based statistics, during the period 1986:II-1993:III the coefficients of variation of the $m1$ and $m2$ was 0.04 and about 0.07, respectively. In contrast, during the 1995:III-2005:I both $m1$ and $m2$ had the same (0.07)

[13]The components based multipliers for narrow and broad money ($(m1^*)$ and $m2^*$) respectively based on (11) and (24) are not covered in the analysis because they exhibit "unexplainable behaviour." See Figure 2.

[14]CHECH possible Shift in multplier during the 1980s due to devaluations that led to substitution into forex; and also removal of ceiling on interest rate in the early 1990s.

coefficient of variation. In this regard, it is of interest to note that the structural change in the behaviour of the narrow and broad money multipliers in 1993:III (Figure 2) only affected the former and not the latter. This result could suggest that the broad money multiplier is probably more reliable than the narrow money multiplier.

Table 3 about here

By following Honohan and O'Connell's (1996) characterisation of monetary policy regimes in Africa, also used by Kimei (1996), it should be noted that the mean values of $m1$ and $m2$ were relatively higher in the period of credit ceiling monetary policy regime (1986-93) than in the period of market clearing monetary policy regime (1993-2005). Since the analysis of the money multipliers is based on (1) it can be maintained that the market clearing regime effectively served in mopping excess liquidity in the economy and in introducing some stability in the behaviour of the monetary multipliers. The endeavour to mop up excess liquidity in the economy during the market clearing regime is partly evidenced by a sharp fall in monetary base (H) from an average of about 15.2% in 1995 to an average of 2.8% in 1996 (Table 3).

Apart from the base money (H), the sharp increase of the required reserve ratio (rr) by 300% in 1994 partly attest to the influence of the central bank on the noted structural break in the behaviour of the monetary multiplier. As Figure 1 shows during the sample period the central bank changed five times the minimum reserve ratio (rr) but it remained constant during most of the market clearing monetary policy regime period. Implicitly, the behaviour of the $m1$ and $m2$ in most of the 1995:IV-2005:I period was influenced more by their behavioural components, that is, the currency ratio and possibly the excess reserve ratio. For example, Table 4 shows that the sharp decrease in $m1$ and $m2$ in 1994 was also associated with increases in the rates of growth of the currency ratios of the narrow money (as k or

$k1$) and that of the broad money ($k2$). Simply stated, the dramatic raise by the central banks of the rr in 1994 was reinforced by a rise of the currency ratio. Moreover, the increase in the rate of conversion of demand deposits (DD) into other deposits (OD), represented by a, also contributed to the fall of $m2$ in 1994.

Table 4 about here

In view of the above, Figure 3 shows that the behaviour of the $m1$ and $m2$ were, by and large, inversely related to k and $k2$. It is very visible in Figure 3 that the peaks (and troughs) in the behaviour of k and $k2$ coincided with troughs (and peaks) in the trend of the $m1$ and $m2$. A stronger inverse influence between the k and $m1$, on the one hand, and $k2$ and $m2$, on the other hand, appears more strongly in the post financial reform period, particularly so between 1991:II and 2005:I.

Figure 3 about here

Figure 3 shows that the influence of the reserve ratio (r) on the behaviour of the $m1$ and $m2$ resulted more from the excess reserve ratio (re), an outcome that owes its explanation from the infrequent variations of the required reserve ratio (rr) during the sample period. As evident in Figure 1 and Table 4 the central bank in Tanzania only changed fiver times the rr during the sample period; and, all changes were effected in the period between 1993:II and 1998:IV.

In general, the descriptive results suggests that the behaviour of the multiplier during the sample period was more accounted for by the excess reserves ratio, and the rate of conversion of demand deposits into other deposits. Even though, the currency ratio dominated the influence on money multipliers in most of the sample period. For this reason, the narrow and broad money multipliers in Tanzania may not have been stable as maintained in the monetarists' view. Granted, variations from the predicted money multipliers caused by

the behaviour of the nonbank public would have caused control errors in achieving the desired money stock growth rates through monetary policy actions directed to the monetary base.

2. Regression results

The semi-log-linear regression results presented in Table 5 shows that all estimated equations for $M1$ and $M2$ were of a good explanatory power. The adjusted R^2 and the F-statistics are very high and statistically significant at 1% test level. The estimated elasticities of $M1$ and $M2$ with respect to the monetary base (H) are about 0.42 and 0.27. Both coefficients are positive and statistically significant at the 1% test level. The results show that the estimated coefficients of the short-term lending interest rate (i_L) and the discount window rate (i_d) in both equations are not statistically significant (column 1 and 2). The coefficient of the lending rate also has unexpected negative sign in both equations. However, both coefficients of the 90 days treasury bills rate (i_{TB}) in the estimated equations for $M1$ and $M2$ are positive signed as expected and statitstically significant at 10% test level. The results also show that estimated the coefficients of the minimum reserve ratio (rr) in both equations are statistically significant at 1% test level. Similarly, the estimated coefficients of the lagged money balances (M_{t-1}) are statistically significant at 1% test level. Table 5 shows that the dropping from regression of the lending and discount rates did affect adversely the explanatory power of the estimated equations (column 3 and 4). Rather, the F-statistics indicate that the explanatory power of the two models improved; and, the signficance test level of the coefficient of the treasury bill rate increased to 1%. On the one hand, this importence of the lending rate is somehow consistent with the fact that the banks peg it on

weighted average treasury bills rates which is significant in the estiamted equations. On the other hand, the insigificance of the discount window, which is a proxy for short-term interest rates, is explained by the fact that the banks in Tanzania rarely recoursed to central bank for extra reserves. In fact, the central bank in Tanzania did not lend to the commercial banks since the year 2000. On this account the analysis and modifications hereafter are based on columns 3 and 4.

The results in columns 3 and 4 (Table 5) show, first, that the elasticities of $M1$ and $M2$ are less than unity, implying that a unit change in monetary base caused a less than proportionate change on money supply during the sample period. It is notable, however, that the estimated elasticity of the narrow money with respect to the monetary base (0.40) is relatively larger than that of the broad money (0.27).[15] In other words, changes in monetary base impact more on narrow than on the broad money. This implies that the narrow money is more responsive to changes in monetary base than is the $M2$. However, given the dominance of currency based transactions in the "non-monetary sectors" in Tanzania, the finding suggests that changes in monetary base (H) served more to increase currency in the hands of the nonbank public. In other words, if not checked, increases in monetary base could fuel inflation.

Second, the coefficients of the 90-days treasury bill (i_{TB}), used as one of the proxies of short-term interest rates, are statistically significant at 1% test level (column 3 and 4). This finding suggests possible endogeneity of the money supply in Tanzania. This possibility is reinforced by the fact that during the sample period banks in Tanzania are known to have been characterised by excess reserves largely off-loaded in government papers partly because of

[15]Technically, on the basis of (11) and (24) the denominator of the narrow money multiplier has more ratios than the broad money.

safety and high return. In this respect, while involuntary holding of excess reserves by banks may have existed due to their inability to lend to the private sector, the holding of such reserves could have also been demand-drive. Third, the estimated coefficients of the reserve requirement ratio (rr) are statistically significant. This is consistent with its active use by the central bank in order to achieved the programmed monetary growth bands to achieve price stability during the sample period. The results suggests that a unit change in the minimum reserve ratio exerted a slightly larger influence on narrow than on the broad money. Fourth, the estimated coefficients of adjustment in all the equations are positive and very statistically significant at 1% test level. Notable, however, is that the adjustment coefficient of $M1$ is larger (0.42) than that of $M2$ (0.28). As expected, the estimated coefficients are small, suggesting sluggish adjustment of the equlibrium money stock to changes in the monetary base. In a developing economy like Tanzania where financial development is at its nascency such a sluggish adjustment should not be been unexpected.

Table 5 shows that the estimated coefficients of the shift variable (D) included in the estimated functions for $M1$ and $M2$ (column 5 and 6) are statistically significant at 1% test level. The estimated coefficients are negative signed and are therefore consistent with the observed downward shift in the monetary multipliers and other major variables included in the analysis (Figure 2). The finding suggests that structural change in the financial system in 1993:III exerted a strong negative influence on the money multipliers for $M1$ and $M2$. It should also be noted that the inclusion in regression of the shift variable did not cause any change in the signs of the coefficients of other variables. It, however, improve tremendously the explanatory power of the estimated equations and the significance level of the individual variables in the estimated equations. Moreover, the shift variables rendered insignificant the estimated coefficients of the treasury bill rate and the required reserve ratio. Given the

structural break that definately characterised the financial system in Tanzania during the sample period, first, the resulting insigificance of the required reserve ratio could be considered credible. Its constancy over most of the sample period also augurs well for its insigificant on the changes in the money multplier and thereof the money supply. Second, the insiginificance of the treasury bill rate suggests that the money supply may not have been endogenously determined afterall. Implicitly, the maintained existence of excess reserves in banks in Tanzania may not have been demand drive but determined by other factors, among others, the credit ceiling imposed by the central bank during the market clearing monetary policy regime implemented since the early 1990s and inability to lend to the private sector (Caprio and Honohan, 1991). The latter holds water given the high lending interest rates that limited commercial banks' expansion of earning assets by lending to the private sector.

It is worth noting that stability test of equation (25) and (26) by using Chow's break point test at 1993:IV produced the results in Table 6.

Table 6 (Chow's test)

The Chow break point test results do not reject existence of a structural break in 1993:IV for both money supply functions estimated for $M1$ and $M2$. The instability of the estimated functions for $M1$ and $M2$ is also affirmed by CUSUM tests (Figure 4). However, Figure 4 shows that the cumulative sum of residuals (Wt) for the $M1$ and $M2$ function wondered close to zero and remained inside the $\pm 5\%$ boundary line of significance level up to 1995:II when a structural break occurred. This finding suggests that the dating of structural break in Chow test was imprecise, as could sometime occur (Gujarati, 2003; Johnston and Dinardo, 1997); and, that the structural break in the financial system resulted from changes in the legal and regulatory framework for governing the monetary sector, specifically at the amended

BoT Charter became effectively operation July 1, 1995.[16] As Figure 4 show, thereafter the Wt wondered outside the $\pm 5\%$ boundary line of significance until 2004:I when it reverted to the $\pm 5\%$ confidence band.

Figure 4 about here

Furthermore, the plots of the recursive estimates of the elasticity coefficient ($C(2)$) of $M1$ and $M2$ (Figure 5), suggests that the narrow and broad money multipliers were not stable during the sample period. The $C(2)$ for both functions exhibited some kinks as they drifted downward within the two standard deviations ($\pm 2S.E$). The plot is Figure 5 suggests that the $C(2)$ for both narrow and broad money functions were rather unstable prior to year 2000. Thereafter, both became relatively stable. This is particularly the case with the elasticity of broad money with respect to the monetary base ($C(2)$) in Figure 5-b. It is worth noting that both elasticities of the narrow and broad money with respect to the monetary base ($C(2)$) exhibits a more discernible structural break in 1997:II. This could be attributed to, among others, the effect on H of the introduction by BoT of 2-year treasury bonds as an instrument for mobilizing medium-term finance for the government and broadening the treasury securities market; and, introduction of repurchase agreements (REPOS) as a tool for fine-tuning liquidity in the economy (Bank of Tanzania, various:b). Another seemingly plausible cause of the structural break in $C(2)$ in 1997:II could, from the nonbank public side, increase in demand for currency due to uncertainty that preceded and followed the privatization of the National Bank of Commerce (NBC), which was state owned and accounted for over 90% of the assets of financial system in Tanzania. Seen in this context the money multiplier decreased sharply due to the increase in demand for currency in the

[16]The national Assembly passed the Act on February 17, 1995 to empower the BoT with a single policy

economy. This possibility can be gleaned in figure 3.

Figure 5 about here

If compared to the previous studies, the general instability of the narrow and broad money multipliers established by this study on Tanzania for the sample period covered is not consistent with results from studies on some developing countries, for example, in India (Chona, 1976; Kulkarni and Miller, 1986; Jha and Rath, n.d.; Poudyal, 1991) and Sierra Leone (Davies, 2002). From theory, the evidence on the slight instability and stability of the money multiplier over the sample period suggests that the money supply is not entirely endogenous determined as maintained by Keynesians. This implies that while the monetary authority may be to achieve monetary targets by effecting changes in the monetary base, the influence of the nonbank public is also important in monetary programming. Though not explicitly investigated in the analysis, the "proximate" instability of the money multiplier suggests that the currency ratio in Tanzania was also slightly unstable during the sample period. It should be noted that the established slight instability of the money multipliers in Tanzania is far from being unrealistic given the depth and breadth of financial innovations that characterized the financial sector since the mid-1980s.

5. Conclusion

The main purpose of this paper was to investigate the behaviour and stability of the money multiplier in Tanzania by using un-deseasonalised data for the period 1986:II-2005:I. The analysis has shown that the narrow and broad money multipliers exhibit the same behaviour and that the former was, as would be expected, smaller than the latter. Moreover, the descriptive analysis revealed an existence of a structural change in the behaviour of the

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objective of price stability.

money multiplier in the third quarter of 1993. The regression results of the study revealed that the monetary base and the currency ratio were very significant determinants of the money multipliers during the sample period. Proxies for short-term interest rates, used to measure the opportunity cost of holding excess reserves by banks, were found to be statistically insignificant. This finding, not unexpected for an economy with a nascent financial system, suggests that the money supply in Tanzania exogenously determined. Notable is also that the required reserve ratio was also found to be a statistically insignificant determinant of the money supply in Tanzania.

Stability tests, including Chow's break point and CUSUM tests revealed that the estimated money supply functions were unstable. Moreover, recursive estimates suggested that the estimated elasticities of money supply with respect to the narrow and broad money were relatively unstable prior to 1997:II and somehow stable thereafter. This evidence partly suggests that the money market clearing regime observed by the BoT since 1993 "restored order" in the monetary sector in Tanzania. Implicitly, the central bank in Tanzania can, in the due cause, be able to a big extent to control monetary expansion by controlling the base money. Granted, the slight instability in the money multipliers could be controlled for in monetary programming by either accommodating in monetary base or influencing the behaviour of the nonbank sector by other policy measures.

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Table 1: Summary Statistics for Skewness and Normality Tests of the Variables Used

Statistics	M1	M2	H	rr	R	i_L	i_{TB}	i_D	m1	m2
Mean	429987.9	672911.4	303654.7	7.8	77,972.7	22.6	14.5	18.5	1.6	2.5
Median	378874.1	575376.4	280844.3	10.0	71288.0	21.4	10.8	14.1	1.5	2.3
Maximum	1390876.	2212313.	977283.9	18.0	332,042.5	37.0	50.9	65.9	2.1	3.4
Minimum	26245.2	39713.0	13679.2	3.0	-60,679.1	13.5	2.5	6.0	1.1	1.8
Std. Dev.	361943.0	574474.0	270453.5	4.4	92,159.8	6.7	14.1	12.5	0.3	0.4
Skewness	0.9	0.9	0.7	0.4	0.8	0.8	1.8	2.0	0.1	0.2
Kurtosis	2.9	2.8	2.5	2.2	3.1	2.9	5.0	7.0	1.2	1.6
Jarque-Bera	9.9	9.4	7.3	2.7	8.2	9.0	54.9	103.5	10.0	7.3
Probability	0.01	0.01	0.03	0.2	0.02	0.01	0.00	0.00	0.01	0.03
Observations	76	76	76	76	76	76	76	76	76	76

Notes: M1=narrow money; M2=broad money; R_S=interest rate for SD; R_L=bank lending rates; R_{TB}=Treasury Bill rate; R_D=is the discount rate; and m1 and m2 are narrow and broad money multipliers.

Source: The data set used.

Table 2: Augmented Dickey-Fuller (ADF) Test Results

Variable	ADF t values in Level	ADF t values in First Difference
M1	-2.942	-0.696
M2	2.590	0.252*
H	-0.033	-10.424
R	-3.420	-8.558
i_L	-2.225	-9.176
i_{TB}	-2.139	-8.743
i_d	-2.853	-11.485
ln M1	-2.408	-3.428
ln M2	-2.628	-3.025
ln H	-1.697	-9.591

Note: a) Critical values are 1%=-4.083; -3.470=10%; and -3.162=10%.
b) The test includes an intercept and a trend.

Table 3: Annual Quarterly Averages of the Proximate Determinants of the Narrow and Broad Money Supply in Tanzania, 1986:I - 2004:IV

	k		K1		k2		ra		r_{OD}		rr		re		H		m1	m2
	Level	%∈	Level	%∈	Level	%∈	Level	%∈	Level	%∈	Level	%∈	Level	%∈	∈H	%∈	Level	Level
1986	1.05	1.72	0.51	0.76	0.35	3.11	0.10	-	0.93	-5.49	0.03		0.04	-	1,409.1	10.2	1.95	2.84
1987	1.05	1.40	0.51	0.57	0.36	0.48	0.14	19.38	0.86	1.63	0.03	0.00	0.09	57.13	1,560.3	8.6	1.96	2.79
1988	0.99	-3.24	0.50	-1.70	0.36	-1.08	0.15	-1.31	0.79	-3.73	0.03	0.00	0.09	0.59	1,787.8	7.1	2.01	2.81
1989	1.01	1.75	0.50	0.79	0.35	0.06	0.05	-902.38	0.86	3.87	0.03	0.00	-0.01	-4.39	2,348.1	6.9	1.99	2.84
1990	1.02	2.47	0.51	1.16	0.34	-0.36	-0.31	153.46	1.00	6.95	0.03	0.00	-0.37	97.39	4,206.1	9.2	1.98	2.96
1991	0.91	5.04	0.48	-2.62	0.31	-3.35	-0.53	11.01	1.04	0.20	0.03	0.00	-0.59	8.99	1,421.4	3.3	2.10	3.24
1992	0.96	5.18	0.49	2.48	0.32	2.86	-0.43	-38.88	1.03	1.44	0.03	0.00	-0.49	-34.82	7,962.5	10.8	2.05	3.12
1993	0.95	-1.35	0.49	-0.80	0.32	-0.03	0.24	13.16	0.99	-2.75	0.03	0.00	0.18	23.71	6,678.0	6.6	2.06	3.10
1994	1.02	4.60	0.51	2.15	0.34	2.37	0.28	9.64	1.00	1.72	0.12	300.00	0.04	-1029.09	13,559.9	9.9	1.98	2.96
1995	1.20	5.71	0.54	2.34	0.36	0.92	0.44	7.97	1.13	7.62	0.18	50.00	0.06	225.87	32,450.5	15.2	1.35	2.03
1996	1.33	-1.33	0.57	-0.57	0.37	-0.02	0.41	2.15	1.26	-2.22	0.12	-33.33	0.14	1505.65	7,389.9	2.8	1.34	2.07
1997	1.29	1.21	0.56	0.45	0.36	0.26	0.39	-1.06	1.28	1.54	0.12	-4.17	0.13	12.17	7,293.0	2.2	1.36	2.12
1998	1.29	-1.71	0.56	-0.77	0.36	-0.91	0.49	6.54	1.30	-0.47	0.10	-13.04	0.26	16.63	13,448.5	3.5	1.29	2.02
1999	1.33	5.07	0.57	1.97	0.36	2.32	0.48	2.17	1.38	2.22	0.10	0.00	0.24	3.95	22,485.0	5.5	1.29	2.06
2000	1.32	-4.30	0.57	-1.83	0.36	-2.36	0.55	3.60	1.37	-0.93	0.10	0.00	0.31	9.05	11,939.2	2.6	1.24	1.98
2001	1.17	-2.63	0.54	-1.21	0.34	-1.74	0.50	-0.99	1.32	0.23	0.10	0.00	0.26	1.14	6,984.5	1.4	1.30	2.10
2002	1.09	-1.98	0.52	-0.96	0.32	-0.34	0.48	7.82	1.27	2.60	0.10	0.00	0.26	39.97	27,833.0	6.1	1.34	2.16
2003	0.94	-1.60	0.48	-0.88	0.31	-0.41	0.37	0.68	1.12	-1.47	0.10	0.00	0.16	6.92	21,901.9	3.3	1.48	2.34
2004	0.98	0.97	0.49	0.45	0.32	0.33	0.41	6.25	1.11	1.17	0.10	0.00	0.20	18.21	46,116.8	5.5	1.43	2.23

Source: Based data in BoT Publications.

Table 4: Annual Quarterly Averages of Various Monetary Multipliers in Tanzania, 1986:I - 2004:IV

Year	*H*	*m1*			*m2*			*m1**			*m2**		
	%∈	Level	∈*m1*	%∈	Level	∈*m2*	%∈	Level	∈*m1*	%∈*m1**	Level	∈*m2**	%∈*m2**
1986	10.2	1.95	-	-	2.84	-	-	1.78	-	-	2.51	-	-
1987	8.6	1.96	0.01	0.36	2.79	-0.05	-1.85	1.72	B0.06	-3.41	2.30	-0.21	-8.23
1988	7.1	2.01	0.05	2.52	2.81	0.02	0.72	1.75	0.03	1.74	2.30	0.00	0.01
1989	6.9	1.99	-0.02	-0.85	2.84	0.03	1.25	1.92	0.17	9.48	2.81	0.51	22.03
1990	9.2	1.98	-0.01	-0.58	2.96	0.12	4.27	3.03	1.12	58.23	1.65	-0.15	-41.02
1991	3.3	2.10	0.12	6.08	3.24	0.28	9.49	5.71	2.67	88.08	-2.55	-4.21	-254.28
1992	10.8	2.05	-0.05	-2.46	3.12	-0.12	-3.66	5.83	0.12	2.12	-7.43	-4.87	190.95
1993	6.6	2.06	0.01	0.29	3.10	0.02	-0.78	1.64	-4.19	-71.91	2.15	9.58	-128.95
1994	9.9	1.98	-0.07	-3.51	2.96	-0.14	-4.40	1.56	-0.08	-4.75	2.27	0.12	5.50
1995	15.2	1.35	-0.64	-32.17	2.03	-0.93	-31.45	1.35	-0.21	-13.72	1.96	-0.31	-13.64
1996	2.8	1.34	-0.01	-0.54	2.07	0.03	1.67	1.34	-0.01	-0.54	1.88	-0.08	-3.89
1997	2.2	1.36	0.03	1.87	2.12	0.06	2.81	1.36	0.03	1.87	1.93	0.05	2.73
1998	3.5	1.29	-0.07	-5.37	2.02	-0.10	-4.77	1.29	-0.07	-5.37	1.70	-0.23	-11.91
1999	5.5	1.29	-0.00	0.12	2.06	0.04	1.90	1.29	0.0	0.12	1.74	0.04	2.27
2000	2.6	1.24	-0.05	-3.71	1.98	-0.08	-4.01	1.24	-0.05	-3.71	1.61	-0.13	-7.39
2001	1.4	1.30	-0.06	4.90	2.10	0.12	6.01	1.30	0.06	4.90	1.74	0.12	7.74
2002	6.1	1.34	0.03	2.68	2.16	0.06	2.82	1.34	0.03	2.68	1.82	0.08	4.85
2003	3.3	1.48	0.14	10.71	2.34	0.18	8.36	1.48	0.14	10.71	2.06	0.24	13.00
2004	5.5	1.43	-0.06	-3.77	2.23	-0.11	-4.55	1.43	-0.06	-3.77	1.93	-0.13	-6.30

Source: Generated from data in BoT Publications.

Table 5: Regression Results

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Variable	ln M1	ln M2	ln M1	ln M2	ln M1	ln M2
Constant	0.603* (0.153)	0.462* (0.122)	0.561* (0.134)	0.421* (0.107)	0.338* (0.126)	0.251** (0.098)
ln H	0.417* (0.064)	0.273* (0.054)	0.405* (0.061)	0.272* (0.052)	0.568* (0.064)	0.432* (0.055)
i_L	-0.001 (0.002)	-0.001 (0.001)				
i_{TB}	0.002*** (0.001)	0.002*** (0.001)	0.003* (0.001)	0.002* (0.001)	-0.001 (0.001)	-0.0004 (0.001)
rr	-0.018* (0.004)	-0.012* (0.004)	-0.017* (0.004)	-0.012* (0.003)	-0.004 (0.004)	-0.002 (0.003)
i_D	-0.001 (0.001)	-0.0007 (0.001)				
ln m1(-1)	0.562* (0.065)		0.576* (0.063)		0.440* (0.062)	
ln m2(-1)		0.719* (0.053)		0.723* (0.051)		0.590* (0.052)
D					-0.223* (0.047)	-0.191* (0.038)
Adj. R2	0.997	0.998	0.997	0.998	0.998	0.999
See	0.059	0.05	0.056	0.05	0.051	0.04
Akaike I.C.	-2.746	-3.204	-2.772	-3.240	-3.024	-3.527
Schwartz C.	-2.529	-2.988	-2.617	-3.085	-2.839	-3.341
F-stat.	4139.34*	7024.98*	6219.76*	10659.03*	6488.64*	11507.60*
D.W Stat.	1.72	1.75	1.71	1.73	1.85	1.96

Note: i) Significance test levels are *=1%, **=5%, and ***=10% test level.
ii) Figures in parentheses are standard errors of the coefficients.

Table 6: Chow's Break Point Stability Test

Chow Breakpoint Test for M1 Function: 1993Q4

F-statistic	11.42975	Probability	0.000000
Log likelihood ratio	55.23518	Probability	0.000000

Chow Breakpoint Test for M2 Function: 1993Q4

F-statistic	13.83543	Probability	0.000000
Log likelihood ratio	63.04185	Probability	0.000000

Figure 1:

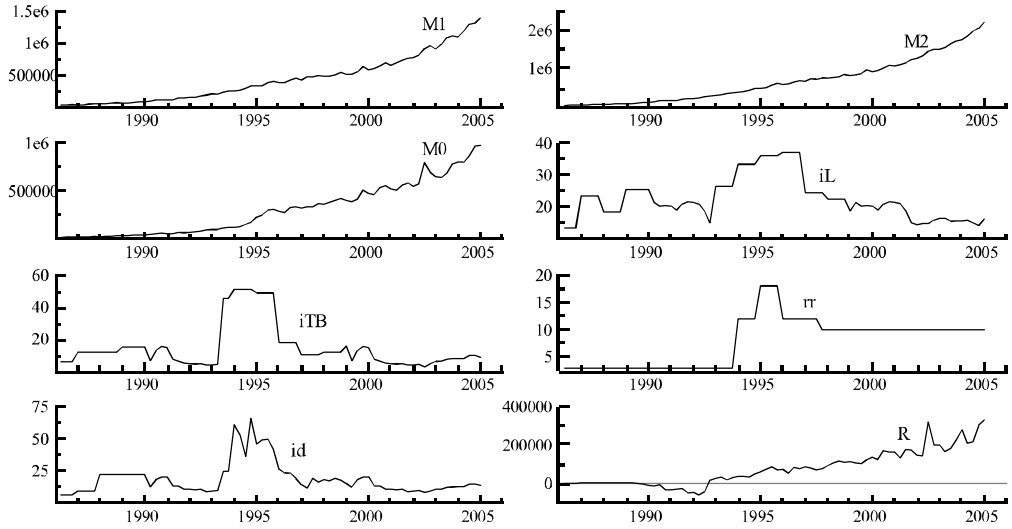


Figure 2

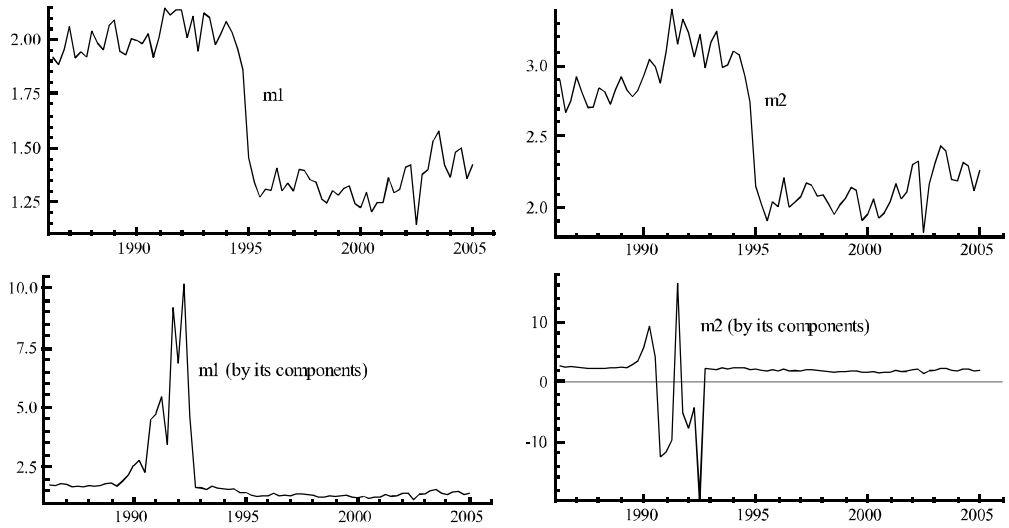


Figure 3: Visual Plots of the Aggregate Money Multipliers (m1 and m2) and Their Key Main Determinants, 1986:II – 2005:I

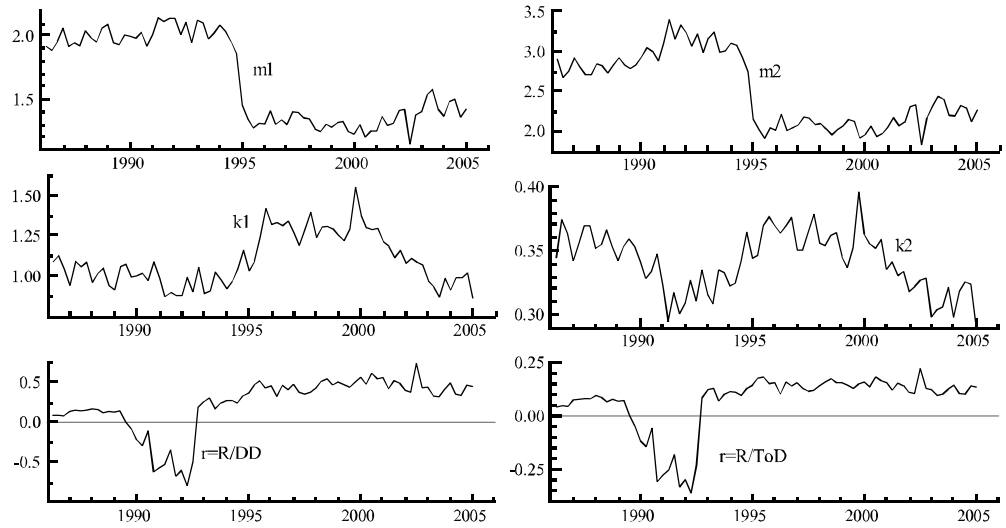


Figure 4-a: CUSUM Stability Test of the Estimated M1 Function for Tanzania

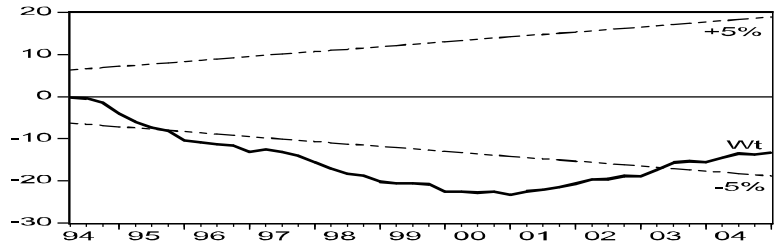


Figure 4-b: CUSUM Stability Test of the Estimated M2 Function for Tanzania

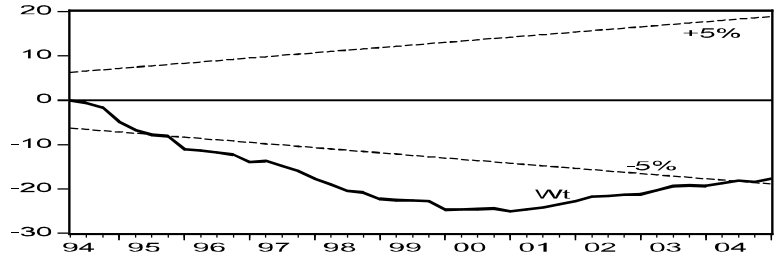


Figure 4-a: Recursive Test of the Stability of the Elasticity of H with Respect to M1

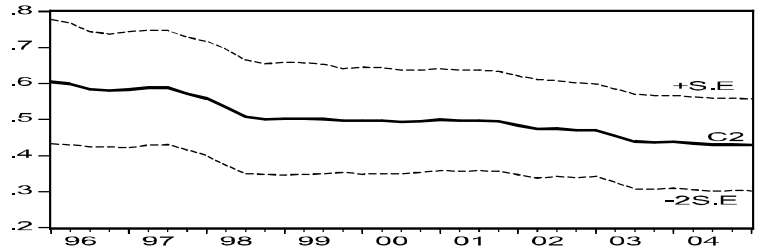


Figure 4-b: Recursive Test of the Stability of the Elasticity of H with Respect to M2

