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Central Bank Responses to IMF-Supported Programme Conditionality and Macroeconomic Volatility in Tanzania

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Abstract
This paper investigated how, in the course of achieving the IMF-supported programme quantitative conditionality, monetary aggregates, in particular, might cause volatility in macroeconomic variables in Tanzania. Specifically, the paper ascertained the extent to which achieving the IMF-supported programme quarterly targets amplified macroeconomic volatility. The results from an Error Correction Model indicated that although the IMF aims at helping member countries to stabilize their economies, paradoxically, findings revealed that in the course of fulfilling the IMF-supported programme conditionality, the process amplified macroeconomic volatility in Tanzania. Also the behavior of fiscal aggregates, such as government expenditure and deficit were noted to contribute to macroeconomic volatility in Tanzania. The paper suggests that the IMF needs to design appropriate performance criteria, which are manageable by a recipient country within a specified period. Also recipient countries need to implement their economic policies on a steady basis in order to be able to fulfill the agreed IMF-supported programme conditionality feasibly. It may be desirable for the Bank of Tanzania to move from a fixed to a flexible monetary targeting framework, which takes allowance of shocks in real and financial sectors, in order to reduce volatility in the economy. A flexible monetary policy framework would take into account base money changes as well as developments in other macroeconomic indicators.

Keywords: Central Bank Responses; Macroeconomic Volatility; and IMF Conditionality.

1. Introduction

This paper investigated how responses of the Bank of Tanzania to International Monetary Fund (IMF) - supported programme conditionality[2] represented by the IMF-supported programme quarterly targets impact on macroeconomic volatility[3]. If the quarterly targets, monetary aggregates in particular, are not achieved, the IMF may withdraw the programme (technical and financial support) from the recipient country. Although the IMF aims at assisting member countries to stabilize their economies, the use of monetary tools such as open market operations by Central Banks in order to meet the IMF-supported programme targets such as reserve money (M0); such actions may lead to interest rate and inflation volatilities. Similarly, selling and buying foreign currency to meet Net International Reserves (NIR) as one of the IMF-supported programme targets may translate to exchange rate volatility.

Many studies such as those by Mussa *et al.* (1999), DFID (2003), and IMF (2004c) focused on the role of IMF funds and stabilization of macroeconomic variables in the economy. The implication being that the IMF-supported programme conditionality reduces macroeconomic volatility. The authors claim that the IMF resources associated with conditionality have helped to reduce macroeconomic volatility in both developed and developing countries. The negative impact of IMF-supported programme conditionality on macroeconomic volatility has not been much researched. However, most counter arguments relate to political and social negative impacts of IMF-supported programme conditionality on recipient countries. For example, Wood and Lockwood (1999) as well as Goldstein (2000) pointed out that conditions are too intrusive and destructive of national ownership. Also Meltzer Report (2000), Easterly (2001) and Stiglitz (2002) have often criticized the IMF for applying one-size-fits-all economic policy prescriptions without being sensitive to the context and ignoring borrowers' domestic political constraints. This paper investigated how in the process of achieving IMF-support

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[2] Conditionality refers to covenants on formulation of policies that countries agree to honour when they participate in IMF-supported programmes. That is, IMF conditionality refers to policies a member country is expected to follow or meet in order to secure access to the resources of the IMF.

[3] Volatility refers to the frequency and severity fluctuations. It is a tendency of rapid and extreme fluctuations of a variable. In finance, the term is used to describe the size and frequency of the fluctuations in the price of a particular stock, bond or commodity.

programme quarterly targets, which represent the IMF conditionality, may result in macroeconomic volatility in Tanzania.

Volatility in macroeconomic variables is mostly perceived to have negative consequences on the economy. Welfare costs of macroeconomic volatility in developing countries are particularly large. They come, first, from the direct welfare loss of deviating from a smooth path of consumption, optimal for most people, who are naturally risk averse. No less important, macroeconomic volatility has a negative impact on output growth and thus on future consumption. Volatility has this negative effect through its links with various forms of uncertainty (economic, political, and policy-related) and with the tightening of binding investment constraints [(when volatility reflects large negative fluctuations) Aizenman and Pinto, 2005, Wolf, 2005].

Tanzania is among developing countries receiving both financial and non-financial assistance normally with conditionality from the International Monetary Fund (IMF) and World Bank. The IMF attaches two different types of conditionality to its loans and other related donor assistance for poor countries, quantitative and structural conditionality. Quantitative conditionality refers to macroeconomic targets determining, for example, the level of the fiscal deficit a government is allowed to run, net domestic assets, reserve money and accumulation of international reserves. Structural conditionality on the other hand pushes for institutional and legislative policy reforms within the country. Reforms include, for example, trade reforms, price liberalization as well as privatization.

In IMF-supported programmes, conditionality has traditionally focused predominantly on quantitative targets for macroeconomic variables deemed crucial for the restoration of a country's external viability. Most programmes include targets for the fiscal deficit, and/or public debt, expansion of domestic credit, reserve money and accumulation of international reserves. Since 1986, Tanzania has been implementing different reform programmes with IMF and World Bank. Therefore, the Bank of Tanzania and Ministry of Finance have to implement both monetary and fiscal policies to achieve the quantitative targets agreed in the IMF-supported programme so that the country can continue receiving IMF resources and technical support.

In line with the government's initiatives to alleviate poverty and strengthen the economy, the Bank of Tanzania (BoT) and the Ministry of Finance (MOF) have been implementing monetary and fiscal policies, respectively, with some macroeconomic indicators of the IMF-supported programme targets being monitored on a quarterly basis. Tanzania has had such targets since July 1996. Reserve money (M0) and net international reserves (NIR) are some of the used variables.

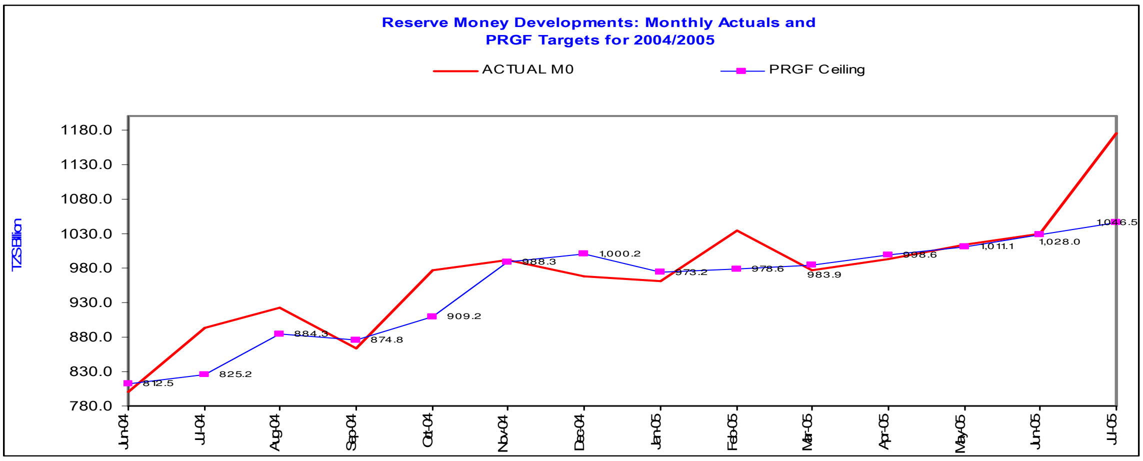
It is in the process of achieving IMF programme targets, volatility of macroeconomic variables including exchange and interest rates as well as the rate of inflation may result. The BoT has been implementing a tight monetary policy to reach its monetary targets or performance criteria (indicators). In the process of achieving the targets, statistics indicate that during the months between quarter ends, some of the variables such as reserve money, frequently record values that are well above the target. In contrast, they are closer to or even equal to the target at the end of each quarter. At the same time, actual net international reserves have been fluctuating below and above the targets. Fluctuations in reserve money affect both the interest rate and rate of inflation. In addition, fluctuations in net international reserves affect the exchange rate.

The NIR and M0 have been fluctuating with a sharp decline, particularly at the end of the quarter when targets are needed to be met. These are suspected to cause volatility in exchange and interest rates as well as the rate of inflation (see Figures 1.1, 1.2 below and Figures I and II in Appendix).

Figures 1.1 and 1.2 show a sudden shift towards meeting IMF-supported programme targets for both reserve money and international reserves, particularly at the end of each quarter. Figure 1.1 shows that actual reserve money declined from Tanzanian shillings (TZS) 920 billion in August 2004 to meet the IMF-supported programme target of about TZS 875 billion in September 2004. Also, reserve money declined from TZS 1,030 billion in February 2005 to meet the target of TZS 984 billion in March 2005. At the same time Figure 1.2 shows that net international reserves declined from United States of America Dollar (USD) 1,835 million in November 2005 to meet the target of USD 1,721 million in December 2005. Also net international reserves declined from USD 2,017 million in May 2006 to meet the target of USD 1,656 million in June 2006. These Figures indicate that neither reserve money nor net international reserves had a smooth path throughout the periods. The same movement between targets and actual was recorded in period between 2007 and 2009 (figures I and II in Appendix).

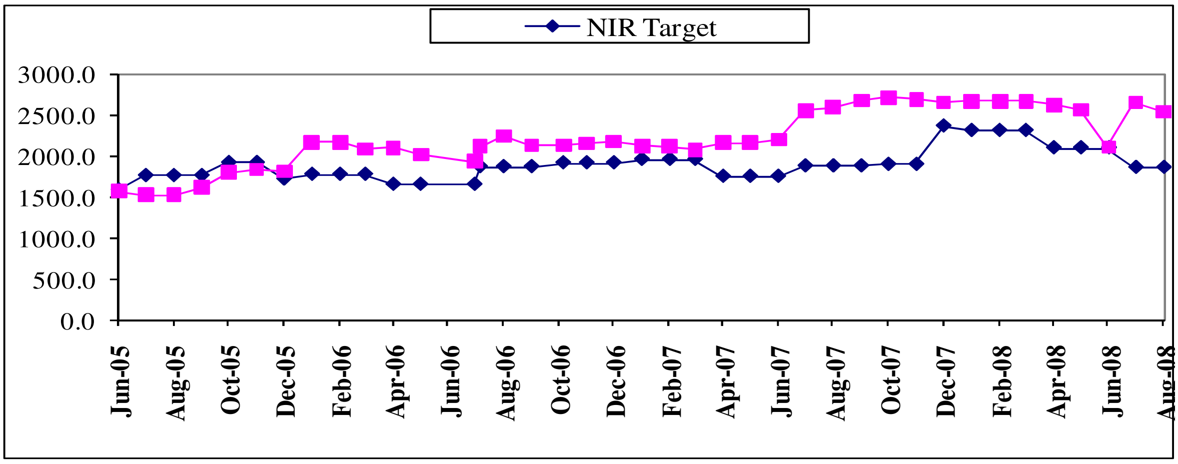
Such movement of actual reserve money and net international reserves to meet their respective targets provides some evidence on how the quantitative conditionality might cause volatility in macroeconomic variables, leading to macroeconomic misalignments, which consequently, constrain both economic growth and welfare improvement. Therefore, although the IMF aims at helping member countries to stabilize their economies and reduce macroeconomic fluctuations, such up-down movements of reserve money and net international reserve targets may result in macroeconomic volatility. There is a gap in information as to whether or not the IMF-supported programme conditionality, represented by programme quarterly targets, causes macroeconomic volatility in the economy. Therefore, it is against this background that this paper investigated the manner in which the implementation of IMF conditionality may impact negatively rather than positively in the country's economy.

Figure 1.1: Quantitative Performance Criteria and Benchmarks, Actual Against Target Reserve Money



Source: Bank of Tanzania- Daily Reserve Money Statistics Report (2005, 2007)

Figure 1.2: Quantitative Performance Criteria and Benchmarks, Actual Against Target Net International Reserves



Source: Bank of Tanzania- Daily Reserve Money Statistics Report (2005, 2009)

Against this backdrop, this paper pursues two objectives.

- To ascertain the extent to which achieving the reserve money target explains the volatility of macroeconomic variables (interest rate, exchange rate and rate of inflation).
- To ascertain the extent to which achieving the net international reserves target explains the volatility of the same macroeconomic variables.

Both the BoT and MoF have agreed to implement monetary and fiscal reforms to meet IMF-supported programme goals. In this setting, it is useful to shed light on the question as to whether or not tightening of monetary policy, particularly at the end of each quarter, resulting from meeting the IMF-supported programme conditions, causes volatility in macroeconomic variables, which may be costly to society and lead to slower economic growth. The paper may be used by policymakers as a guide and basis for negotiations with the IMF, especially on the impact and cost of conditions of programme to be supported.

What follows are section II, which reviews the theoretical and empirical literature and section III which addresses the issues of methodology and modelling. Section IV deals with empirical estimation of the extent to which IMF conditionality causes macroeconomic volatility in Tanzania. Section V provides a conclusion and policy implications.

2. Literature Review

According to the IMF, loan repayment would be at risk without conditions; to secure the revolving character of the Fund's resources conditionality is thus inevitable (IMF 2001a). According to the IMF, these policies are intended to help and ensure that the member country will overcome its external payments problem and thus be in a position to repay the Fund in a timely manner. Therefore, the reason for conditionality is to restore a viable external position in order to ensure the "revolving character" of the IMF resources, i.e., that the resources made available to a member by the Fund will be repaid over a stipulated period of time. The IMF conditionality might serve as a commitment device to address time inconsistency problems. The objective of conditions is to provide credibility (Bird, 1984; Collier et al. 1997; and Dreher and Vaubel, 2004a). Conditionality may represent a mechanism that forces recipient governments to commit to reforms, which might therefore enable an efficient release from the trap if, and only if, conditionality can be enforced (Fafchamps, 1996). According to Mayer and Alex (2008), financial assistance provided by the International Monetary Fund (IMF) and other International Financial Institutions (IFIs) aims to help member countries to reduce their economic policy distortions.

However, the IMF has often been criticized for applying one-size-fits-all economic policy prescriptions without sensitivity to the context and ignoring borrowers' domestic political constraints (Meltzer Report, 2000; Easterly 2001; and Stiglitz 2002). A number of political leaders from developing countries have expressed concern about IMF policies. Thus, in a speech, the first President of Tanzania, J. K. Nyerere in the early 1980s asked "when did the IMF become an international Ministry of Finance? When did nations agree to surrender to it their power of decision making?"[4] At roughly the same time the Prime Minister, Manley, of Jamaica predicted that "the IMF will be a source of complete economic disaster in the third world unless it has a look at itself[5]. According to (B. J, 1980), "the question which is bothering many economists and political leaders is whether a sufficiently large number of developing countries will be in a position to accept high conditionality and borrow from the Fund, and if they do borrow whether the inevitable consequence of recourse to the IMF would not be widespread political and economic instability in developing countries".

Tanzania is one of the developing countries which have accepted the IMF conditionality, and it has been implementing the IMF-supported programme's quarterly targets since July 1996. Reserve money, partly, money supply and net international reserves are some of the variables used as the IMF-supported programme targets to be met by Tanzania. According to the quantity theory of money, any increase in the money supply will result in an increase in the price level, which, if sustained, would be inflationary. Also in the absence of the liquidity trap, Keynesian theory emphasized the negative relationship between money supply and interest rates. According to the money market model of Case and Fair (1999), an increase in the money supply in the short-run causes a decrease in interest rates, because more money is supplied than is needed. In other words, when the central bank tightens monetary policy, it slows the process of private banks issuing and selling securities on the open market and pulling money (that could be loaned) out of the private sector, which will lead to an increase in interest rates. Repeated selling of government securities at the end of each quarter to meet the IMF-supported programme targets, which is contractionary monetary policy, will result in fluctuations of both the rate of inflation and interest rates in the economy.

In many countries, the central bank's unique responsibility is to achieve price stability. In this process, the target rate of inflation is fixed jointly by the central bank and the government. Although the central bank uses monetary tools to achieve the desired level of inflation, it has the further responsibility of enacting a tighter monetary policy that will enable the IMF-supported programme targets to be met at the end of each quarter. This calls for the extra selling of treasury bills and bonds, called liquidity paper, which will reduce the money supply and, in turn, raise interest rates in the economy.

Another form of central bank intervention is more direct. More specifically, direct intervention can be defined as the purchase and sale of foreign exchange by monetary authorities. The purchase (sale) by monetary authorities leads to an increase (decrease) in the monetary base if the intervention is not sterilized. When the authorities simultaneously or with a very short time lag take the necessary steps to offset the effects of the change in official foreign exchange on the domestic monetary base, it is called sterilized intervention. Non-sterilized intervention affects the exchange rate as well as the monetary base.

Fatum and Hutchison (1999) investigated whether daily intervention operations in the United States are related to changes in expectations over the stance of future monetary policy. They concluded that the interventions of the Federal Reserve Bank appear to have significantly increased the conditional variance of its funds futures rate, as the conditional variance was positively and significantly related to the magnitude of intervention operations.

[4] Speech by President Nyerere of Tanzani to Diplomats on January 1, 1980 at Dar es Salaam, reported in Third World News Forum, March 1980; cited from (B.J, 1980) paper.

[5] Interview with Michael Leapman, The Times. London, May 2, 1980; cited from (B.J, 1980) paper.

Daroodian and Caporale (2001) used a daily measure of exchange-rate intervention in the yen-dollar exchange market for the period January 1985 to March 1997. While they found a statistically significant impact of intervention on spot rates, they showed that the official sales of dollars against either currency are associated with dollar depreciation, and the intervention led to increased uncertainty in the foreign exchange market. Unnikrishnan and Ravi Mohan (2003), using the ARCH procedure for the period January 1996 to March 2002, found that the Reserve Bank of India intervention affected the exchange rate level and volatility in the expected direction. Dominguez (1998) explored the effects of foreign exchange intervention on the behaviour of dollar-mark and dollar-yen exchange rates. She found that secret interventions generally increase volatility. Her study indicates that intervention had effects on volatility that are situation specific and can be positive or negative.

Previously, the Bank of Tanzania was involved in both selling and buying foreign currency (which is part of international reserves) as one way of controlling base money in the economy. However, currently, the BoT only sells foreign currency, and so is no longer involved in buying foreign currency in the economy. Despite the selling of foreign currency by the BoT for the purpose of price stability, it also sells extra foreign currency at the end of each quarter, when it is above the IMF-supported programme target, to fulfill the IMF conditionality. In so doing, it results in a fluctuation in international reserves which is directly linked to exchange rate fluctuations. Therefore, the fluctuations in both reserve money and international reserves will cause a fluctuation in exchange and interest rates and the rate of inflation. The intervention of the BoT through selling foreign currencies in the economy may increase volatility if it contributes to market uncertainty or encourages speculative attacks on the currency. However, the BoT partially sterilizes its intervention in the foreign exchange market, and so it is not clear whether it would be effective or not. This issue needs to be re-examined.

Basing on the literature above, the following hypotheses were tested to verify whether the IMF conditionality caused macroeconomic volatility in Tanzania.

(i) Achieving reserve money targets causes volatility in interest rates and the rate of inflation
(ii) Achieving net international reserves targets causes volatility in the exchange rate

3. Methodology

3.1 Volatility Estimation

Before estimating the impact of IMF-supported programme conditionality on macroeconomic volatility, estimation of GARCH model has to be performed in order to generate volatility series of exchange rate, interest rate, core rate of inflation, reserve money and net international reserves. GARCH models characterize the conditional distribution of ε_t by imposing serial dependence on the conditional variance of innovations. In this model, the conditional variance is also a linear function of its own lags and has the form:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i e_{t-1}^2 + \sum_{j=1}^{p} \beta_i \sigma_{t-j}^2 \qquad (1)$$

Equation (1) is the variance equation, which contains three components: a constant, last period volatility (the ARCH term) and last period variance (the GARCH term).

A sufficient condition for the conditional variance to be positive with probability one is $\alpha_0 > 0$, $\alpha_j \geq 0$, j = 1,….q; $\beta_j \geq 0$, j = 1,…p. Necessary and sufficient conditions for positivity of the conditional variance in higher-order GARCH models are more complicated than the sufficient conditions given in Nelson and Cao (1992).

3.2 Model Specification

Modelling the impact of IMF –supported programme conditionality, quarterly targets in particular represented by reserve money (M0) and Net International Reserves (NIR) on macroeconomic variables was based on literature review. However, in order to capture both short-run and long-run relationship between variables in the model, cointegration and error correction term were adopted. Cointegration was used to capture long-run relationship while error correction term, which attempts to correct for deviations from the long-run equilibrium path or the disequilibrium transmitted in every period was adopted to capture short-run relationship.

3.2.1 Exchange Rate equation

According to Sarno and Taylor (2002), in economic field, there is no consensus in the literature about a preferred and generally accepted model of exchange rates. Thus, one has to select variables potentially affecting nominal exchange rate volatility as pointed out by Devereux and Lane (2003); Hviding, Nowak, and Ricci, (2004); and Hausmann, Panizza, and Rigobon (2006). In this paper, nominal exchange rate volatility (VEXCH) is hypothesized to be related to the following variables: volatility series of net international reserves (VNIR), Current Account balance (CAB), headline rate of inflation (HINFL) and error term (U_1). Its associated error correction model can be specified as:

$$DVEXCH = \alpha_0 + \alpha_1 DVNIR + \alpha_2 DCAB + \alpha_3 DHINF - \alpha_4 ect_{-1} + U_1 \qquad (2)$$

where D stands for the first difference and ect_{-1} is the error correction term.

3.2.2 Interest Rate Equation

Inflationary pressures affect interest rates because rates paid on most loans are fixed in the loan contract. A lender may be reluctant to lend money for any period of time if the purchasing power of that money will be less when it is repaid. Therefore, the lender will demand a higher rate known as an "inflationary premium." Thus, high inflation pushes interest rates higher, while deflation causes rates to decline. Domestic sources affect the rate of interest through selling of treasury bills and treasury bonds (Sánchez, 2005). Volatility of interest rate (VINT) is modeled on the volatility of reserve money (VM0), government deficit (DF), headline rate of inflation (HINFL) and error term (U_2). Its associated error correction model can be specified as:

$$DVINT = \beta_0 + \beta_1 DVM0 + \beta_2 DDEF + \beta_3 DHINFL - \beta_4 ect_{-1} + U_2 \qquad (3)$$

3.2.3 Inflation Rate Equation

According to Kandil and Hanan (2009), domestic determinants of inflation include: government expenditure, money supply, nominal effective exchange rate and a weighted average of price in major trading partners. The paper used the modified model of Magda and Hanan (2009), where volatility series of the core rate of inflation (VCINFL) is modeled on the volatility series of reserve money (VM0), government expenditure (GEXP) and error term (U_3). Its associated error correction model can be specified as:

$$DVCINFL = = \mu_0 + \mu_1 DVM0 + \mu_2 DGEXP - \mu_3 ect_{-1} + U_3 \qquad (4)$$

3.2.4 Regression Estimation with a Dummy Variable

The entire data set (June 1980 to December 2009) was analysed by incorporating a dummy variable, which was used to control for the regime changes for the periods before (Jan 1980 to June 1996) and during (July 1996 to Dec 2009) the period of achieving the IMF-supported programme quarterly targets. The dummy variable took zero and one value for the periods before and during the IMF-supported programme quarterly targets, respectively. If the coefficient of the dummy variable is significant statistically, it indicates that achieving the IMF-supported programme quarterly targets has an impact on the volatility of macroeconomic variables. The dummy variable was included when modelling ECMs for exchange and interest rates as well as the core rate of inflation.

3.3 Justification of Variables used

Most variables that IMF uses as benchmark criteria include reserve money, net international reserves, net domestic financing, net foreign asset and the like. In this paper, reserve money and net international reserves, which are monetary aggregates, represent IMF-support programme conditionality.

In order to make appropriate comparison between two sample periods, black market exchange rates proxy for market determined rates were used before exchange rate liberalization. At the same time, the first sample period horizon for interest rates started from January 1994 to June 1996 in order to avoid government controlled rates. This was due to absence of alternative interest rates, which were market determined before liberalization of the variable. In this paper, the IMF-supported programme quantitative conditionality was represented by IMF-supported programme quarterly targets, basically, reserve money and net international reserve targets, which are monetary aggregates.

The paper used two types of the rates of inflation, namely, headline rate of inflation (HINFL), which was used as an explanatory variable in modelling exchange and interest rates volatilities, as well as the core rate of inflation (CINFL)[6] from which its volatility series generated was used as endogenous variable when modelling volatility of the rate of inflation. The idea of modelling volatility series of core inflation rate was to determine per se impact of monetary aggregate, reserve money in particular, on volatility in the rate of inflation.

3.4 Data and Data Sources

This paper used secondary monthly time series data. Time-series data on monthly reserve money (M0), net international reserves (NIR), current account balance (CAB), government expenditure (GEXP), government deficit (DF), both official and black market exchange rates (TZS to USD) (EXCH), interest rate (INT) and the core rate of inflation (CINFL) and headline rate of inflation (HINFL) from June 1980 to December 2009 were analysed.

Two sample periods were analysed separately in this paper, the period before the introduction of the IMF-supported programme quantitative conditionality from July 1980 to June 1996 (except interest rate), and the period during adoption of the IMF-supported programme quantitative conditionality covered from July 1996 to December 2009. The main sources of data were International Financial Statistics (IFS) Year book 2009 and Bank of Tanzania Economic and Operations Reports (various issues).

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[6] This is the rate of inflation resulted from implemention of monetary policy. On the other hand, non-core rate of inflation is caused by food and energy. Therefore, headline inflation combine core and non-core rates of inflation.

3.5 Estimation Technique

The equations were estimated using 198 observations before implementation and 162 observations when the BoT started implementing its tight monetary policy to achieve the IMF-supported programme targets. Two econometric packages, Eviews and Stata, were used for estimation, depending on the nature of equation to be estimated. Volatility equations are estimated using Eviews, while Stata is used to estimate OLS equations and the ADF tests.

After this description of methodology, empirical results and their interpretation are presented in the next section.

4. Empirical Results

4.1Volatility Estimation

Volatility series of all variables used were estimated using GARCH model specified in equation (1). All volatility estimation procedures were followed before and after estimation.

To ensure that appropriate mean equations were specified, both Q and Q-squared tests were employed. To ensure that mean equations were appropriate specified. Also the ARCH test was carried out before and after volatility estimation to ensure that ARCH effect exists and does not exists respectively.

4.2 Preliminary Data Examination

Because the generated volatility series of all variables and other variables used in this paper are time series, then, before investigating the extent to which macroeconomic volatility was caused by achieving the IMF-supported programme quarterly targets of NIR and M0, examination of the data was carried out first.

A3. Descriptive Statistics

Preliminary diagnostic tests were conducted to check behaviour of the data used. Tables 1 and 2 in appendix present summary statistics of all variables used in the estimation in the first and second sample periods, respectively. Results give important information about the macroeconomic variables in Tanzania. The mean variance in the volatility series of core rate of inflation was much higher than that of volatility series of exchange and interest rates in the first sample period. On the other hand, the mean variance of the volatility series of interest rates was much higher than volatility series of exchange rate and the core rate of inflation in the second sample period. It implies that, on average, the core rate of inflation and interest rate fluctuate more than those of other macroeconomic variables in the first and second sample period, respectively. Also it was noted that the first sample period recorded a higher standard deviation in the rate of inflation volatility series than that of other macroeconomic variables. Also volatility series of interest rates were subjected to higher standard deviation in the second sample period than those of the other macroeconomic variable volatility series. The implication that can be drawn from this is that the degree of deviation of the core rate of inflation volatility in the first sample period and interest rate volatility of the second sample period from the mean value is far more than that of the other macroeconomic variables.

A4. Unit root test and result

It has often been argued that macroeconomic data are characterized by a stochastic trend and, if unresolved, the statistical behaviour of the estimators will be influenced by such a trend such that results may be spurious. Therefore, to resolve such problem a unit root test was conducted for the first and second sample period and results from the ADF tests for variables at both levels as well after the first difference are summarized in Table 4.1. Results suggest that none of variables in the model is stationary and that variables in the model are integrated of order one (i.e. I(1)). However, after taking the first difference, all variables are stationary and the variables are integrated of order zero (i.e. I(0)).

4.5 Regression results

4.5.1 Cointegration Results

After a unit root test for an individual variable then, test for existence of the long-run equilibrium relationships among variables was performed, where Johansen (1991) cointegration technique was used. After truncating lags that vary from 1 to 12, the Schwarz (SIC) and Akaike (AIC) criteria results suggested 4lags as appropriate in the cointegration analysis since the AIC has the lowest value.

Tables 3-5 in the appendix present the Johansen Cointegration Test results for all systems of equations for two sample periods, each with one cointegrating relation in which the coefficients of the variables are significant at the 5 percent level and have the correct signs. The test statistics indicate quite clearly that cointegration is a relevant phenomenon. Therefore, a stable long-run relationship between volatility series of macroeconomic variables, net international reserves, reserve money and other moderating variables used seems to exist. In other words, variables follow a common trend.

4.5.2 Impact of NIR volatility series (VNIR) on exchange rate volatility series (VEXCH)

The OLS method was applied to regress VEXCH on VNIR, CAB, HINFL and error correction term. The econometric results for D(VEXCH) by OLS of the preferred model are presented in Table 4.2.

Table 4.1: ADF Unit Root Tests

	First sample period					Second sample period				
		At levels		At first difference			At levels		At first difference	
Variable	Nature of selected ADF Equations	ADF test statistic	Order of integration	ADF test statistic	Order of integration	Nature of selected ADF Equations	ADF test statistic	Order of integration	ADF test statistic	Order of integration
VEXCH	2lags	-2.0994*	I(1)	-5.6776*	I(0)	2lags	-2.9590**	I(1)	-5.9506*	I(0)
VINT	4lags	-2.9849*	I(1)	-3.3061*	I(0)	4lags	-3.4561**	I(1)	-6.1083*	I(0)
VCINFL	4lags	-4.1559*	I(1)	-8.1272*	I(0)	1lags	-3.1927**	I(1)	-9.2781*	I(0)
VNIR	4lags	-3.9051*	I(1)	-6.1609*	I(0)	2lags	-2.6343*	I(1)	-6.7692*	I(0)
VM0	2lags	-2.1882**	I(1)	-8.7056*	I(0)	2lags	-3.4718**	I(1)	-6.2566*	I(0)
HINFL	4lags	-3.1694*	I(1)	-8.333*	I(0)	2lags	-1.7185***	I(1)	-7.9530*	I(0)
GEXP	4lags	-2.8601*	I(1)	-10.1041*	I(0)	4lags	-3.9734**	I(1)	-13.4796*	I(0)
DF	4lags	-2.7076**	I(1)	-8.1496*	I(0)	2lags	-6.5950*	I(1)	-13.5765*	I(0)
CAB	4lags	-3.5347*	I(1)	-8.5833*	I(0)	2lags	-3.9070**	I(1)	-11.3350*	I(0)

Source: Author's estimates.

*Note: *1 percent level, **5 and ***10 percent level of significance.*

Table 4.2: Regression Results of the Preferred Model for D(VEXCH) by OLS

Dependent Variable: D(VEXCH)								
Method: Least Squares								
	First Sample Period: July 1980 - Jun 1996				Second Sample Period: July 1996 - Dec 2009			
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.0058	0.0017	-3.4452*	0.0007	-0.1296	0.1521	-0.8522	0.1134
D(VNIR)	0.0026	0.0031	0.8271	0.4092	1.0225	0.1220	8.3841*	0.0000
D(CAB)	0.0238	0.0195	1.2209	0.2237	0.1096	0.0312	3.5112**	0.0121
ect-1	-0.2041	0.0598	-3.4132*	0.0009	-0.1143	0.0120	-9.5213*	0.0000
	R-squared	0.1175			R-squared	0.7991		
	Adjusted R-squared	0.0924			Adjusted R-squared	0.7704		
	Durbin-Watson stat	2.5222			Durbin-Watson stat	1.9257		
	Akaike info criterion	4.6782			Akaike info criterion	2.1234		
	Schwarz criterion	4.6272			Schwarz criterion	2.0752		

Note: *and ** indicate significant at 1 percent and 5 percent levels, respectively, and VEXCH is the exchange rate volatility series and VNIR is the net international reserve volatility series.

Source: Author's estimates.

For the first sub-period, July 1980 to June 1996, results indicated that volatility in the exchange rate was not influenced by volatility in NIR. Therefore, NIR fluctuations have no impact on exchange rate volatility. However, the coefficient of error correction term was correctly signed and statistically significant at 1 percent level. The coefficient of the lagged error correction term for exchange rate is -0.2041. It means that if volatility series for exchange rate exceeds its long run equilibrium by 1 percentage point, for example, because of a temporary NIR shock, 20.41 percent of this deviation was adjusted in the first period. Therefore, this speed of adjustment was relatively low.

In the second sub-period, July 1996 to Dec 2009, the relationship between volatility in the exchange rate and NIR was shown to be positive as hypothesized, and the coefficient of the NIR was statistically significant at 1 percent level. Also current account balance contributed positively to the volatility in exchange rate and its coefficient was significant at 5 percent level. Results indicate that volatility in the exchange rate is influenced by volatility in NIR. Also R^2 confirms that about 80 percent variation in exchange rate volatility is explained by volatility in NIR and current account balance. Thus, the assumption that volatility in the exchange rate is caused by IMF-supported programme conditionality through the intervention by BoT to achieve the IMF-supported programme quarterly targets cannot be ignored. Therefore, the hypothesis that achieving NIR targets causes volatility in the exchange rate was not rejected.

The error correction term was correctly signed and statistically significant at 1 percent level. Results indicated that 11.43 percent of disequilibrium of volatility series of exchange rate was corrected in the first period (Table 4.2). The speed of adjustment of the volatility series of actual exchange rate to the equilibrium was very slow compared to the findings for the first period.

The exchange rate is indisputably one of the most important macroeconomic variables. Movements in the exchange rate have a great bearing on key macroeconomic variables, including long-term growth rates, inflation, international competitiveness and the soundness of a country's financial sector, to name only the most significant ones. Stability of the nominal exchange rate plays a significant role in successful performance of the economy.

4.5.3 Impact of M0 volatility (VM0) on Interest Rate Volatility (VINT)

Volatility series for interest rates and reserve money were generated. In this case, the interest rate volatility series was regressed on the reserve money volatility series and error correction term using OLS. Table 4.3 presents econometric results for D(VINT) for the preferred model.

Table 4.3: Regression Results of the Preferred Model for D(VINT) by OLS

Dependent Variable: D(VINT) Method: Least Squares									
First Sample Period: Jan 1994 - Jun 1996					Second Sample Period: July 1996 - Dec 2009				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0158	0.0244	0.6482	0.5225	C	3.8042	1.7963	2.1178**	0.0657
D(HINFL)	-0.0560	0.0509	-1.1004	0.2812	D(VM0)	0.1740	0.0505	3.4455*	0.0013
D(DF)	0.0261	0.0143	1.8246***	0.0796	D(DF)	0.0485	0.0170	2.8467*	0.0050
ect-1	-0.0411	0.0481	-0.8543	0.3055	ect-1	-0.2210	0.1999	-1.105498	0.2431
	R-squared	0.3697				R-squared	0.7527		
	Adjusted R-squared	0.3213				Adjusted R-squared	0.7366		
	Durbin-Watson stat	1.6574				Durbin-Watson stat	2.2933		
	Akaike info criterion	-1.1573				Akaike info criterion	7.0890		
	Schwarz criterion	-1.0159				Schwarz criterion	11.1219		

Note: *, ** and *** indicate significant at 1 percent, 5 percent and 10 percent levels, respectively; and VINT is interest rate volatility series

Source: Author's estimates.

For the period before the IMF-supported programme quarterly targets (July 1980 to June 1996), results confirmed the absence of a significant relationship between volatility in interest rates and reserve money, while results during the period of achieving the IMF-supported programme quarterly targets confirmed its existence. However, government deficit was found to have a positive impact on interest rate volatility, and its coefficient was statistically significant at 10 percent level. Government deficit is normally financed through selling treasury bills and treasury bonds, which have a direct impact on interest rate. The error correction term was both correctly signed but statistically insignificant.

With July 1996 to December 2009 data, a period that corresponds to achieving the IMF-supported programme quarterly targets in Tanzania, results from Table 4.3 confirmed causal effect of volatility in reserve money on interest rate volatility. Results indicate that an increase in reserve money volatility increases volatility in interest rates. The positive impact of reserve money volatility on interest rate volatility was proved to be statistically significant at 1 percent level. It was evidenced that government deficit also contributed positively to interest rate volatility and its coefficient was significant at 1 percent level. The coefficient of R^2 indicates that about 75 percent variation in interest rate volatility is explained by volatility in reserve money and government deficit. Therefore, the hypothesis that achieving IMF quarterly targets causes interest rate volatility cannot be rejected. The main argument is that increased volatility in money supply induced by policy caused uncertainty about the direction of BoT monetary policy. Such a rise in uncertainty resulted in an increased demand for money, which in the absence of an accommodative BoT policy, caused nominal interest rates to raise. In addition, the error correction term was correctly signed but statistically insignificant.

4.5.4 Impact of M0 Volatility (VM0) on Core Rate of Inflation Volatility (VCINFL)

Appropriate procedures were followed to generate volatility series on both inflation and reserve money. Table 4.4 presents results of regressing inflation rate volatility series on volatility series of the reserve money and error correction term using the OLS method.

Table 4.4: Econometric Results for D(VCINFL) by OLS

Dependent Variable: D(VCINF)
Method: Least Squares

	First Sample Period: July 1980 - Jun 1996				Second Sample Period: July 1996 - Dec 2009			
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0993	0.7954	0.1248	0.9008	3.8042	1.7963	2.1178***	0.0657
D(VM0)	7.3841	0.6821	10.8261*	0.0000	0.0171	0.0136	1.2649	0.1464
D(GEXP)	0.0030	0.0002	19.4574*	0.0000	0.4760	0.0834	5.7045*	0.0000
ect-1	-0.0621	0.0312	-1.9929***	0.0776	-0.4511	0.1942	-8.3233*	0.0000
R-squared	0.7654				R-squared	0.6562		
Adjusted R-squared	0.7490				Adjusted R-squared	0.6456		
Durbin-Watson stat	2.1449				Durbin-Watson stat	2.1334		
Akaike info criterion	7.6419				Akaike info criterion	9.0584		
Schwarz criterion	7.6930				Schwarz criterion	9.1156		

Note: * and *** indicate significant at 1 percent and 10 percent levels, respectively; and VCINFL is the core rate of inflation volatility series and VM0 is reserve money volatility series.

Source: Author's estimates.

Taking the July 1980 to June 1996 sample period, results imply that the volatility of the reserve money series exerted a significant impact on the volatility series of the core rate of inflation. Also evidence indicates that government expenditure has a positive impact on volatility of the core rate of inflation, and its coefficient is significant at 1 percent level. The results revealed that about 76 percent variation in the volatility of the core rate of inflation was explained by variation in reserve money and government expenditure. According to results of the error correction term, 6 percent of disequilibrium is corrected in the first period.

On the other hand, regression results from the second sample period of July 1996 to December 2009 imply that the volatility of reserve money has no influence on the core rate of inflation volatility. However, government expenditure still has a positive impact on the core rate of inflation volatility, and its coefficient was statistically significant at 1 percent level. Therefore, the hypothesis that achieving the reserve money target causes the core rate of inflation volatility was rejected.

The result revealed that the coefficient of the error correction terms in the model was statistically significant and correctly signed. This confirms that volatility series of inflation rate in Tanzania has an automatic adjustment mechanism and that the economy responds to deviations from equilibrium in a balancing manner. Findings indicated that about 45 percent of disequilibrium of the volatility series of the core rate of inflation was corrected in the first period, which was relatively high compared to that of the first sample period.

Further analysis was carried out by introducing a dummy variable to capture the period before and during the IMF-supported programme quarterly targets in Tanzania in order to supplement results from the aforementioned analyses. Results are presented and discussed in the following Sub-section.

4.5.5 Regression Estimation with a Dummy Variable

The entire data set (July 1980 to December 2009) was analysed by incorporating a dummy variable, which was included in order to ascertain the impact of IMF-supported programme quarterly targets on macroeconomic variables. Therefore, a dummy variable was used to control for regime changes for the periods before and during achieving the IMF-supported programme quarterly targets.

The regression results, which model the impact of NIR on the exchange rate as well as reserve money on interest rates together with the rate of inflation are presented in Tables 4.5, 4.6 and 4.7. From the regression results, it is observed that while the dummy variable affects positively exchange and interest rates volatilities, and its coefficient is significant at 1 percent level, the same variable affects positively the core rate of inflation volatility, and its coefficient is significant at 5 percent level. This implies that achieving IMF quarterly targets causes macroeconomic volatility as hypothesized. Also results confirm the positive impact of volatility net international reserve and reserve money volatility on exchange rate as well as interest rate volatility, respectively.

Table 4.5: Impact of Dummy Variable on Exchange Rate Volatility

Dependent Variable: D(VEXCH)				
Method: Least Squares				
Sample(adjusted): 1980:02 2009:06				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.0073	0.0459	-0.1586	0.8741
D(VNIR)	-0.0081	0.0678	-0.1195	0.9049
D(CAB)	0.0429	0.0061	7.0443*	0.0000
D(HINFL)	-0.0040	0.0133	-0.3027	0.7623
DUMMY	0.2441	0.0070	34.9014*	0.0000
R-squared	0.7794			
Adjusted R-squared	0.7768			
Durbin-Watson stat	1.9296			
Akaike info criterion	1.9417			
Schwarz criterion	1.9965			

Source: Author's estimates.

Note: * indicate significant at 1 percent level, and DUMMY is a dummy variable.

Table 4.6: Impact of Dummy Variable on Interest Rate Volatility

Dependent Variable: D(VINT)				
Method: Least Squares				
Sample(adjusted): 1994:02 2009:12				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.0793	1.7755	0.0447	0.9644
D(VM0)	1.0584	0.1361	7.7749*	0.0000
D(DF)	0.0000	0.0000	0.4426	0.6586
D(HINFL)	0.4006	0.7002	0.5721	0.5680
DUMMY	0.2238	0.0264	8.4849*	0.0000
R-squared	0.6163			
Adjusted R-squared	0.5924			
Durbin-Watson stat	1.6583			
Akaike info criterion	7.3741			
Schwarz criterion	7.4593			

Source: Author's estimates.

Note: * indicate significant at 1 percent level and DUMMY is a dummy variable.

Table 4.7: Impact of Dummy Variable on Inflation Rate Volatility

Dependent Variable: D(VCINFL)				
Method: Least Squares				
Sample(adjusted): 1980:02 2009:06				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.0312	0.6539	0.0477	0.9620
D(VM0)	0.1212	0.1250	0.9691	0.3332
D(GEXP)	1.0112	2.1844	0.4629	0.4521
DUMMY	0.1633	0.0773	2.1132**	0.0316
R-squared	0.2804			
Adjusted R-squared	0.2577			
Durbin-Watson stat	2.0498			
Akaike info criterion	7.2518			
Schwarz criterion	7.2956			

Note: ** indicate significant at 5 percent level, and DUMMY is the dummy variable.

Source: Author's estimates.

Results from the volatility model that incorporated a dummy variable supported results that obtained when the data were treated separately in two sub-periods.

From the two separate supporting regression results, it can be concluded that achieving NIR and M0 targets caused volatility in exchange and interest rates as well as the rate of inflation. It implies that when the Bank of Tanzania employed a monetary policy in order to meet the IMF-supported programme quarterly targets, it resulted in macroeconomic volatility. Selling and buying international reserves with the intention of achieving the IMF-supported programme quarterly targets normally affect the nominal exchange rate. Also to achieve the reserve money targets at the end of the quarter, the Bank of Tanzania sells or buys treasury bills/bonds, which will affect interest rates. I addition, a reduction or an increase in reserve money, which is part of money supply in the economy, affect the general price level that will have an impact on the rate of inflation.

5. Conclusion and Policy Recommendations

5.1 Summary and conclusion

Tanzania is among developing countries receiving both financial and non-financial assistance normally with conditionality from the International Monetary Fund (IMF) and World Bank. The IMF attaches two different types of conditionality to its loans and other related donor assistance for poor countries, quantitative and structural conditionality. Quantitative conditionality refers to macroeconomic targets determining, for example, the level of the fiscal deficit a government is allowed to run, net domestic assets, reserve money and accumulation of international reserves. Structural conditionality on the other hand pushes for institutional and legislative policy reforms within the country. Reforms include, for example, trade reforms, price liberalization as well as privatization. In the course of achieving quantitative targets agreed in the IMF-supported programmes, the Bank of Tanzania and Ministry of Finance have to implement both monetary and fiscal policies, which may result in volatility of key macroeconomic variables including exchange and interest rates together with the rate of inflation.

The main objective of this paper was to investigate whether or not the response of the Bank of Tanzania in fulfilling IMF-supported programme conditionality resulted in volatility of macroeconomic variables in Tanzania. More specifically, the paper sought to ascertain the extent to which achieving the reserve money target explained the volatility in macroeconomic variables. Also to ascertain the extent to which achieving net international reserves target explained the volatility in macroeconomic variables. To ascertain the extent to which achieving IMF-supported programme quarterly targets of net international reserves and reserve money amplified volatility of macroeconomic variables in Tanzania, two approaches were used in order to be confident with the results.

The *first approach* was to regress volatility series of the exchange rate on the generated volatility series of the net international reserves, current account balance as well as headline rate of inflation. At the same time volatility series of interest rates was regressed on volatility series of reserve money, government deficit as well as headline rate of inflation. Also the core rate of inflation volatility series was regressed on reserve money as well as government expenditure. Some of variables such as current account balance, headline rate of inflation, government deficit as well as government expenditure were added in the models as moderating variables.

Results from the period, which was before the IMF quarterly targets, indicated an insignificant impact of the volatility series of net international reserves and reserve money on the volatility series of exchange and interest rates. However, volatility in reserve money was observed to be positive and had significant impact on the core rate of inflation. Regression results for the period associated with IMF-supported programme quarterly targets indicated a positive and significant impact of volatility series of net international reserves and reserve money on volatility series of exchange and interest rates, respectively. However, core rate of inflation was found be unaffected by reserve money. Therefore, results indicated that achieving the IMF-supported programme quarterly targets amplified macroeconomic volatility in Tanzania. Therefore, hypotheses that achieving reserve money and net international reserve targets caused volatility in macroeconomic variables were not rejected.

The *second approach* included a dummy variable in the entire data set with the dummy variable taking zero and one values for the periods before and during the IMF-supported programme quarterly targets, respectively. The dummy variable was significant for all three macroeconomic variables signifying that achieving quarterly targets caused macroeconomic volatility. Results from this approach supported results that were obtained when data were treated separately in two Sub-periods. From two separate supporting regression results it can be concluded that volatility in exchange and interest rates as well as in the core rate of inflation were amplified by achieving NIR and M0 targets. It implies that when the BoT employed a monetary policy aimed at meeting the IMF-supported programme quarterly targets, it magnified macroeconomic volatility. Selling and buying foreign currency (international reserves) with the intention of achieving the IMF-supported programme quarterly targets normally affects the nominal exchange rate. Also to achieve reserve money targets at the end of quarter, the BoT sells or buys treasury bills/bonds, which affect interest rates. At the same time a reduction or an increase in reserve money, which is part of money supply in the economy affects general price level, in this manner, impact on the rate of inflation. From two approaches used in this paper, it was concluded that hypotheses that achieving reserve money and net international reserve programme targets caused volatility in macroeconomic variables were not rejected.

Generally, results indicated that in the course of achieving the IMF-supported programme quantitative conditionality, monetary aggregates, in particular, caused volatility in macroeconomic variables in Tanzania. In addition, fiscal aggregates such as government expenditure and deficit were found to amplify macroeconomic volatility.

5.2 Policy implications

Results of this paper suggest that among others, volatility of macroeconomic variables in Tanzania was amplified by IMF-supported programme conditionality. The implication is that the IMF-supported programme conditionality seems to have caused moral hazard because although IMF-supported programme targets were met during programme periods (at the end of the quarter), months between quarter-end experienced great diversions from the smooth path of the targets. One implication from this is that it is important to design appropriate or suitable performance criteria, which are manageable by a recipient country within a given period. This may need a capacity building for the recipient country's personnel, which will enable the country to negotiate for affordable targets set by the IMF.

It may also be said that it may be desirable for the Bank of Tanzania to move from a fixed to a flexible monetary targeting framework, which allows shocks in real and financial sectors in order to reduce volatility in the economy. A flexible monetary policy framework would take into account base money (reserve money) changes as well as developments in other macroeconomic indicators. Also recipient countries need to implement their economic policies on a more permanent basis in order to be able to fulfill the agreed IMF-supported programme conditionality without much pressure.

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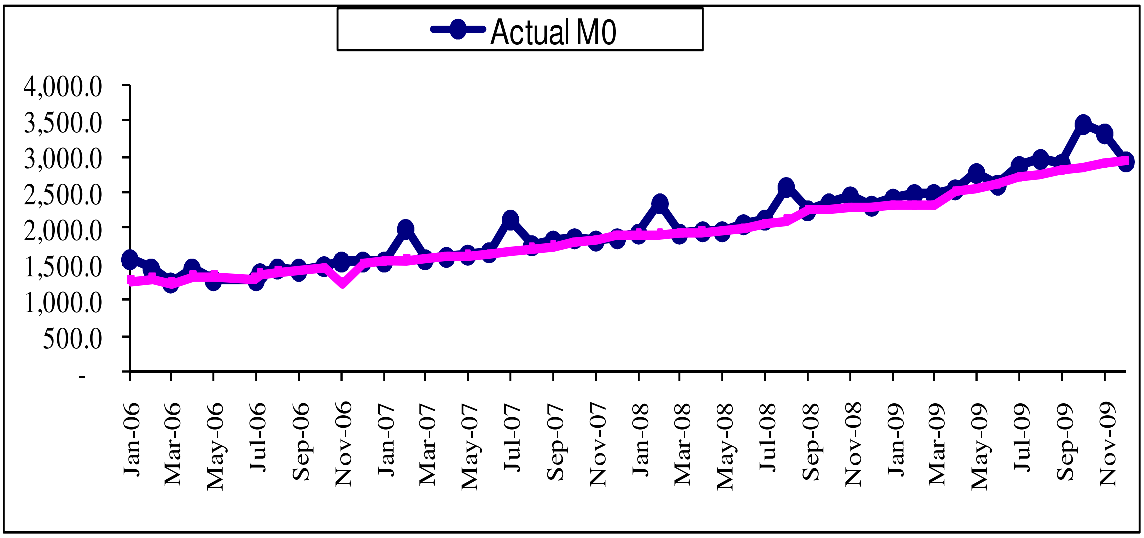
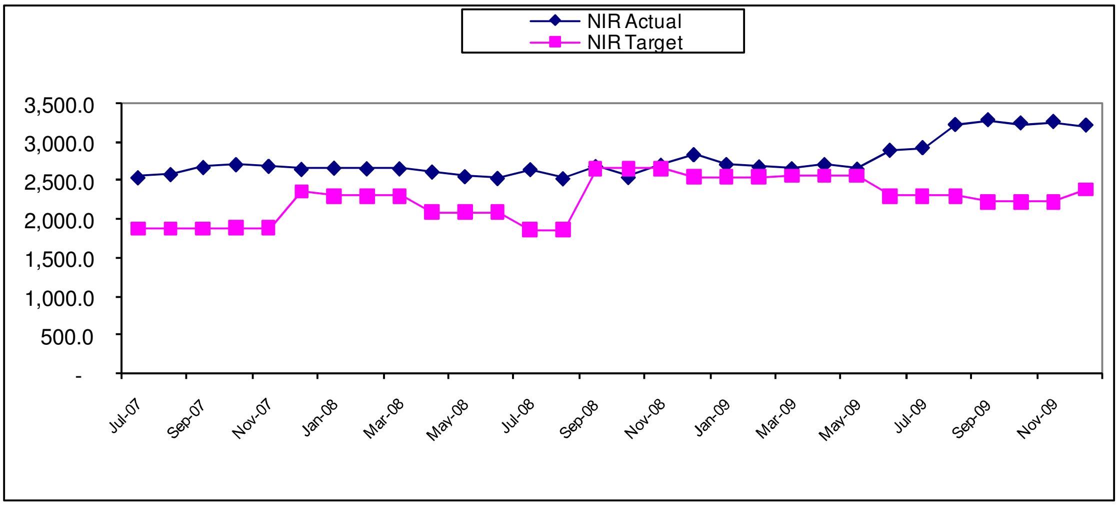
Appendices

Figure I: Reserve Money (June 2006 to June 2007)



Source: Bank of Tanzania- Daily Reserve Money Statistics Report (2009) and own drawn

Figure II: Net International Reserves (July 2007 to Dec 2009)



Source: Bank of Tanzania- Daily Reserve Money Statistics Report (2008, 2009) and own drawn

Table 1: Descriptive Statistics for First Sample Period

Sample Period: July 1980 – Jun 1996 for all variables except interest rate: Jan 1994 – Jun 1996									
	VEXCH	**VINT**	**VCINF**	**VNIR**	**VM0**	**HINFL**	**GEXP**	**DF**	**CAB**
Mean	0.64	0.14	18.62	0.62	0.67	30.09	11640.83	-1481.70	-8399.00
Median	0.75	0.09	12.65	0.43	0.79	29.86	5907.25	-541.15	-981.50
Maximu	1.13	0.46	111.81	7.14	0.97	44.65	61173.00	11223.00	16344.88
Minimum	7.56E-05	7.65E-03	4.68	0.03	0.00	19.44	1221.00	13298.36	47999.00
Std. Dev.	0.42	0.13	15.46	1.03	0.32	5.14	12714.89	3589.35	13413.26
Skewness	-0.36	1.32	2.12	4.56	-1.03	0.22	1.49	-0.61	-1.47
Kurtosis	1.53	3.34	9.91	25.98	2.52	2.35	4.52	5.26	3.92
Observations	192	30	192	192	192	192	192	192	192

Source: Author's estimates.

Table 2: Descriptive Statistics for Second Sample Period

Sample Period: July 1996 – Dec 2009									
	VEXCH	**VINT**	**VCINFL**	**VNIR**	**VM0**	**HINFL**	**GEXP**	**DF**	**CAB**
Mean	6.63	20.96	11.69	33.80	33.83	8.23	228846.80	-81937.86	-91340.54
Median	2.79	14.14	2.55	22.86	36.79	6.45	159764.50	-44331.14	-57912.09
Maximum	24.19	122.65	70.73	91.78	73.92	18.84	1113831.00	136971.50	247988.40
Minimum	0.00	0.99	0.01	0.01	0.02	3.35	11249.00	-719583.10	-636750.70
Std. Dev.	7.82	24.04	16.61	30.99	21.88	4.10	198786.60	109682.50	119833.90
Skewness	1.10	2.16	1.75	0.39	-0.11	0.98	1.37	-2.26	-1.16
Kurtosis	2.74	8.33	5.32	1.50	1.74	2.79	4.96	10.67	5.54
Observations	162	162	162	162	162	162	162	162	162

Source: Author's estimates.

Table 3: Cointegration Results for VEXCH, VNIR, CAB and HINFL

Series: VEXCH VNIR CAB HINFL

First Sample Period: July 1980 - Jun 1996					Second Sample Period: July 1996 - Dec 2009				
Unrestricted Cointegration Rank Test (Trace)					**Unrestricted Cointegration Rank Test (Trace)**				
Hypothesized		**Trace**	**0.05**		**Hypothesized**		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****	**No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.2386	91.7273	47.8561	0.0000	**None ***	0.1850	57.1218	47.8561	0.0053
At most 1 *	0.1441	40.7560	29.7971	0.0019	**At most 1**	0.0818	25.0130	29.7971	0.1610
At most 2	0.0603	11.6642	15.4947	0.1738	**At most 2**	0.0408	11.6182	15.4947	0.1762
At most 3	0.0002	0.0343	3.8415	0.8530	**At most 3**	0.0318	5.0717	7.8415	0.1243
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**				
Hypothesized		**Max-Eigen**	**0.05**		**Hypothesized**		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****	**No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.2386	50.9713	27.5843	0.0000	**None ***	0.1850	32.1088	27.5843	0.0122
At most 1 *	0.1441	29.0918	21.1316	0.0031	**At most 1**	0.0818	13.3948	21.1316	0.4166
At most 2	0.0603	11.6299	14.2646	0.1253	**At most 2**	0.0408	6.5465	14.2646	0.5441
At most 3	0.0002	0.0343	3.8415	0.8530	**At most 3**	0.0318	5.0717	7.8415	0.1243

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

1 Cointegrating Equation(s): Log likelihood -2653.13				**1 Cointegrating Equation(s):** Log likelihood -2653.13			
Normalized cointegrating coefficients (standard error in parentheses)				**Normalized cointegrating coefficients (standard error in parentheses)**			
VEXCH	**VNIR**	**CAB**	**HINFL**	**VEXCH**	**VNIR**	**CAB**	**HINFL**
1.0000	0.2152	0.0393	0.0156	1.0000	0.2397	0.0441	1.9585
	0.0393	0.0027	0.0073		0.1178	0.0300	0.7614

Source: Author's estimates.

Table 4: Cointegration Results for VINT, VM0, DF and HINFL

First Sample Period: Jan 1994 - Jun 1996					Second Sample Period: July 1996 - Dec 2009				
Unrestricted Cointegration Rank Test (Trace)					**Unrestricted Cointegration Rank Test (Trace)**				
Hypothesized		**Trace**	**0.05**		**Hypothesized**		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****	**No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Valu**	**Prob.****
None *	0.8306	96.5458	47.8561	0.0000	**None ***	0.1745	69.1173	47.8561	0.0002
At most 1 *	0.5952	46.8346	29.7971	0.0002	**At most 1 ***	0.1163	39.0052	29.7971	0.0033
At most 2	0.4399	21.5113	24.3211	0.5575	**At most 2**	0.0775	19.5952	25.4947	0.2114
At most 3	0.1719	5.2802	9.8415	0.2160	**At most 3**	0.0432	6.9354	9.8415	0.1840
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**				
Hypothesized		**Max-Eigen**	**0.05**		**Hypothesized**		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****	**No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Valu**	**Prob.****
None *	0.8306	49.7112	27.5843	0.0000	**None ***	0.1745	30.1121	27.5843	0.0232
At most 1 *	0.5952	25.3233	21.1316	0.0121	**At most 1**	0.1163	19.4100	21.1316	0.0856
At most 2	0.4399	11.2311	14.2646	0.2410	**At most 2**	0.0775	12.6597	14.2646	0.0883
At most 3	0.1719	5.2802	9.8415	0.2160	**At most 3**	0.0432	6.9354	8.8415	0.1084

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Cointegrating Equation(s) Log likeliho -168.1467				**1 Cointegrating Equation(s):** Log likeliho -3075.004			
Normalized cointegrating coefficients (standard error in pare				**Normalized cointegrating coefficients (standard error in parenthese**			
VINT	**VM0**	**DF**	**HINFL**	**VINT**	**VM0**	**DF**	**HINFL**
1.0000	3.7038	0.1340	0.1262	1.0000	1.5215	0.0004	1.1693
	0.8344	0.0170	0.0151		0.3631	0.0001	1.3532

Source: Author's estimates.

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Table 5: Cointegration Results for VCINFL, VM0 and GEXP

Series: VCINFL VM0 GEXP

First Sample Period: July 1980 - Jun 1996					**Second Sample Period: July 1996 - Dec 2009**				
Unrestricted Cointegration Rank Test (Trace)					**Unrestricted Cointegration Rank Test (Trace)**				
Hypothesized		**Trace**	**0.05**		**Hypothesized**		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****	**No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.1430	48.6365	29.7971	0.0001	**None ***	0.1567	35.7529	29.7971	0.0091
At most 1	0.0941	13.7789	15.4947	0.2106	**At most 1**	0.0436	8.9902	15.4947	0.3663
At most 2	0.0069	1.2958	3.8415	0.2550	**At most 2**	0.0126	1.9859	3.8415	0.1588
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level					Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**				
Hypothesized		**Max-Eigen**	**0.05**		**Hypothesized**		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****	**No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.1430	28.8576	21.1316	0.0034	**None ***	0.1567	26.7627	21.1316	0.0072
At most 1	0.0941	11.4831	14.2646	0.1101	**At most 1**	0.0436	7.0043	14.2646	0.4886
At most 2	0.0069	1.2958	3.8415	0.2550	**At most 2**	0.0126	1.9859	3.8415	0.1588

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

1 Cointegrating Equation(s): Log likelihood -2852.188			**1 Cointegrating Equation(s):** Log likelihood -2852.188		
Normalized cointegrating coefficients (standard error in parentheses)					
VCINFL	**VM0**	**GEXP**	**VCINFL**	**VM0**	**GEXP**
1.0000	1144.5960	0.0292	1.0000	1.6398	0.1372
	211.5260	0.0057		0.4769	0.0072

Source: Author's estimates.