The Role of the Exchange Rate and Dollarization in the Monetary Transmission Mechanism: The case of Tanzania

By

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Abstract

Over the past two decades the Tanzanian Shilling has been increasingly displaced by the United States dollar. This change has been prompted by instability of the local currency, and by the practices of foreign firms, which have used a dual pricing system at rates disadvantageous to the local currency. The implications of Tanzania's dollarization are traced through whether it has impacted the monetary transmission mechanism. The study uses a Bayesian Vector Autoregression. The results indicate that positive shocks on the interest rate contract money supply, which leads to lower output growth and inflation, while the exchange rate appreciates. The degree of dollarization also has a negative impact on the monetary supply of the local currency, as the central bank seeks to maintain a relatively constant rate of total money supply. This has the effect of lowering the inflation and interest rates, and is also associated with further depreciation of the exchange rate. The positive shock on the exchange rate (depreciation) is associated with an increase in dollarization. The aggregate demand shock fuels inflation and, in Tanzania's case, it has increased money supply, due to the persistent demand for real monetary balances.

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1.1 Introduction

There is growing informal dollarization in the Tanzanian economy. This is evidenced by the increasing use of the US Dollar in day-to-day domestic transactions. If assets or credits on loans are denominated in foreign currency, nominal exchange rate developments may change their value in terms of domestic currency, which also influences borrowing capacity (Égert and MacDonald, 2006). This paper evaluates exchange rate channels for the transmission of monetary policy to output and inflation in a partially dollarized economy. It also examines the effectiveness of the exchange rate pass-through.

Traditionally, monetary policy has been one of the most effective instruments through which the central bank is able to influence macroeconomic and financial controls. A well designed monetary policy system might contribute towards sound economic and financial outcomes, while a poor monetary policy framework might have counterproductive effects. Therefore, in order to run a prosperous economy it is crucial to understand how monetary policy works, through what mechanisms its policy actions are transmitted, what factors affect its transmission mechanisms, which channels are most effective and why they are effective. The transmission of monetary policy indicates how changes in monetary sectors are transmitted to real sectors. This process starts with a change in the interest rate that affects investment spending and consumption, which influences aggregate demand. The change in aggregate demand would then lead to a change in prices, as a part of the interest rate channel in the monetary policy transmission system. There are many other potential channels, which will be discussed later.

Monetary policy in Tanzania has focused on money supply targets since 1993, which implies that this policy framework allows interest rates to fluctuate freely (although they are obviously influenced by monetary supply). This contributes to the volatility of interest rates in the country. The choice to target money supply was due to the relatively underdeveloped financial markets, unavailability of high frequency data and the structural rigidities in the economy. This framework in currency is in a transitional phase, towards that of inflation targeting, which requires an expansion of institutions and good general institutional conditions (Brito and Bystedt, 2010). The growth of institutions, such as the much needed development of the financial sector, helps to reduce the probability of missing inflation targets (Hove, 2010). Despite the fact that the current focus is to move towards inflation targeting, the money supply target has proven to be reasonably successful in controlling inflation over the past decade of 2000s (IMF Policy Paper, 2014).

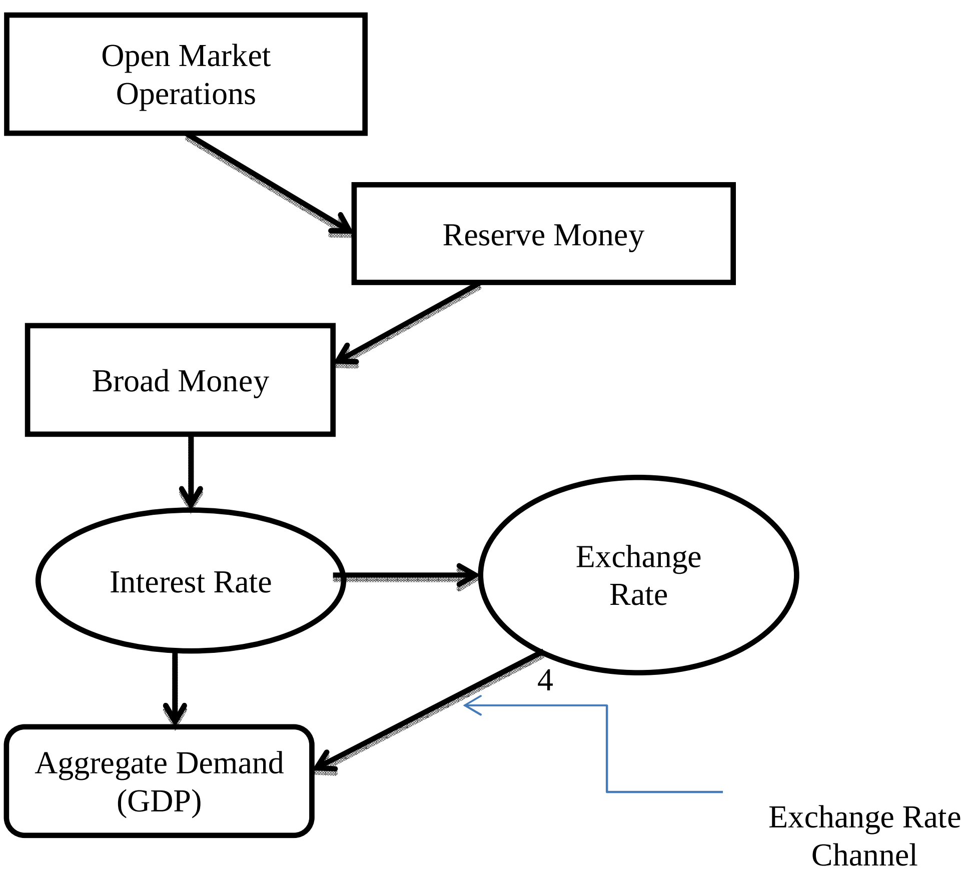
1.2 Monetary Policy Implementation and Transmission

Monetary policy transmission mechanisms refer to the different ways through which monetary policy operating targets are transmitted to influence economic objectives such as low inflation rate and high economic growth. Although transmission mechanisms differ among countries, there are mainly six channels. These are: interest rate, exchange rate, bank lending, balance sheet, asset prices, and formation of expectation. Monetary policy transmission channels are not entirely independent, but rather supplement each other (Dabla-Norris and Floerkemeier, 2006). For example, the exchange rate channel is an interest channel in an open economy. Also, the income effect of the interest rate channel on net wealth goes through the cost of servicing short-term and floating-rate debt, thus affecting the balance sheet channel.

Since 1995, the Bank of Tanzania has moved to indirect instruments of monetary policy. These include open market operations; repurchase agreements; discount windows; foreign exchange market operations; statutory minimum reserve requirements; and moral suasion. Open Market Operation (OMO) is the leading instrument, through the sale and purchase of government securities. Under a floating exchange rate regime, the exchange rate channel can be categorized in two stages. The first stage of the transmission mechanism shows how short-term interest rates impact exchange rates, while the second stage is the pass-through from exchange rates to import and domestic prices, followed by an adjustment in real variables, such as imports, exports, investment and others. A contractionary monetary policy is characterized by a decrease in money supply (broad money), which raises the domestic interest rate and appreciates the exchange rate due to the inflow of capital. The end result is a fall in aggregate demand. Monetary policy that increases domestic interest rates relative to foreign interest rates enhances the strength of the domestic currency, and vice versa. The exchange rate often portrays the international side of a country’s monetary policy (Taylor, 1995). A tight monetary policy raises the domestic real interest rate and increases the value of domestic currency relative to foreign currency, which is exchange rate appreciation. The focus of this study is on the exchange rate channel because of its numerous influences on both aggregate demand and aggregate supply (Juks, 2004).

The experience of Tanzania indicates that monetary policy implementation prior to the mid-1990s was subordinated to fiscal imperatives, initially to the financing of large and ultimately unsustainable fiscal deficits. This resulted in higher levels of inflation that eroded real income, hampered productive investment and reduced export competitiveness. Since the second half of 1990s monetary policy was conducted in support of decisive fiscal consolidations (Buffie et al., 2004). Monetary policy was conducted with the intention of reducing the government's domestic financing needs. All these efforts aimed at reducing the growth rate of money supply and the level of inflation which in turn can boost export competitiveness. Monetary policy shocks that give rise to an expansionary (non-sustainable) monetary policy increase the domestic price level, appreciate the real exchange rate and reduce export competitiveness. Figure 1 describes the Exchange Rate Channel of monetary policy transmission for Tanzania.

Figure 1: Exchange Rate Channel of Monetary Transmission Mechanism



The Exchange Rate Channel (ERC) of monetary policy transmission refers to how shocks on monetary variables (reserve and broad money) impact aggregate prices, output and demand through the effects of the domestic interest rate on the exchange rate. Expansionary monetary policy has a tendency to decrease interest rates and vice versa; the change in domestic interest rates affects the exchange rate, which is then transmitted to other variables, such as prices and trade. The study answers the following questions in relation to the monetary policy transmission mechanism in Tanzania as a partially dollarized economy. How much of the variation in the exchange rate is derived from the variation in monetary variables, that is, money supply/interest rate? How much of this accounts for fluctuations in nominal macroeconomic aggregated variables, that is, prices?

1.2.1 Monetary Transmission Mechanism Model

The variables that have been included in this model include measures of output, consumer prices, interest rates, monetary supply, exchange rates and dollarization. This dataset includes a relatively low number of observations, which gives rise to few degrees of freedom. This would necessitate the use of Bayesian techniques, which have been applied to estimate the respective parameter values, while Markov switching processes have been incorporated in the model structure to account for the structural breaks in the data.

The parameters in the model are estimated with Bayesian techniques for which we make use of a normal-inverse-Wishart prior, as we are primarily interested in the dynamics of the economic variables and how they affect one another. In contrast, the popular use of the Minnesota prior would restrict the cross equation dynamics, so that the effect of the lags of the own variable dominate the description of any subsequent behaviour of that variable.

In this case, we assume that the prior takes the distribution that is described by the two moments $p(\beta, \Sigma)$. As it is assumed that the variables exhibit stationary behaviour, the first moment of the prior takes the value, $\beta = 0$.[2] The matrix for Σ takes an appropriate inverse-Wishart distribution to allow for the derivation of the posterior from:

$$p(\beta,\Sigma \mid \ell, y) \propto p(y \mid \ell, \beta, \Sigma)\, p(\beta, \Sigma)$$

In this case, $p(\beta,\Sigma \mid \ell, y)$ represents the posterior probability for the parameter values that may be associated with the given data and likelihood function, and $p(y \mid \ell, \beta, \Sigma)$ represents the data density for the likelihood function.

To allow for the structural breaks in the data we incorporate a Markov-switching process in the model. This practice has been popularised in several important macroeconomic investigations, including Sims and Zha (2006) and Sims at al., (2008). Evidence of prominent structural breaks was noted previously when considering some of the variables in chapter three and these features of the data are discussed in more detail below.

The manner in which the Markov-switching process has been incorporated in the model to account for structural breaks largely follows Koop and Korobilis (2010), who allow for a single switch between regimes. However, in contrast totheir procedure, we allow for multiple breaks across two regimes. The transition probabilities, which range between zero and one, are then treated in much the same was an endogenous dummy variable, so that the effects of the structural breaks are contained.[3]

Identification of the Model

As the initial model will take the form of a reduced-form expression that employs a Choleski decomposition, the ordering of the variables will be of importance (Christiano et al., 1999). To

[2] This is later confirmed by the impulse response functions, which suggest the effects of shocks are temporary.

[3] Both of the notable structural breaks in 2001/2002 and 2010/2011 were contained in the periods of "unusual" behaviour, as described by the resulting transition probabilities that had a value of one (and for which equivalent dummy variable values would have been assigned).

develop some form of intuition for the ordering we start with a simple parsimonious model and develop it further, to ensure that we derive results that are reasonably consistent.

The first representation of the model takes the form of a closed-economy model that relies on recursive structural relationship between measures of output, inflation and interest rate and the corresponding shocks. The structural moving average form of the model could be written as:

$$\begin{bmatrix} y_t \\ \pi_t \\ i_t \end{bmatrix} = \begin{bmatrix} \theta_{1,1} & 0 & 0 \\ \theta_{2,1} & \theta_{2,2} & 0 \\ \theta_{3,1} & \theta_{3,2} & \theta_{3,3} \end{bmatrix} \begin{bmatrix} \varepsilon_{y,t} \\ \varepsilon_{\pi,t} \\ \varepsilon_{i,t} \end{bmatrix} + \theta_1 \varepsilon_{t-1} + \ldots$$

Where y_t represents GDP growth, π_t represents inflation and i_t represents nominal interest rates. When the variables are ordered in this recursive manner, we are able to recover the structural shocks from the covariance of the reduced form residuals using the Choleski decomposition that contains the identification restrictions. These restrictions imply that the variable ordered on top will only react to its own shock, while the variable ordered on the bottom will react to all shocks. Or alternatively, it takes a single period before the monetary policy shock will affect output and inflation. However, the nominal interest rate will include the effect of this shock immediately.

A similar structure has been followed in Bjørnland and Thorsrud (2014), where contemporaneous changes in output can only result from shocks to output, while shocks to output and inflation can shift inflation contemporaneously. Lastly, all of the shocks can affect the interest rate contemporaneously. This type of reaction function would be largely consistent with macroeconomic theory for a closed-economy model, as described in Clarida et al. (2002).

Since the Tanzanian central bank has made use of an explicit role for monetary supply, m_t, we include it in the model as follows,

$$\begin{bmatrix} y_t \\ \pi_t \\ m_t \\ i_t \end{bmatrix} = \begin{bmatrix} \theta_{1,1} & 0 & 0 & 0 \\ \theta_{2,1} & \theta_{2,2} & 0 & 0 \\ \theta_{3,1} & \theta_{3,2} & \theta_{3,3} & 0 \\ \theta_{4,1} & \theta_{4,2} & \theta_{4,3} & \theta_{4,4} \end{bmatrix} \begin{bmatrix} \varepsilon_{y,t} \\ \varepsilon_{\pi,t} \\ \varepsilon_{m,t} \\ \varepsilon_{i,t} \end{bmatrix} + \theta_1 \varepsilon_{t-1} + \ldots$$

where shocks to the monetary supply will affect the interest rate contemporaneously, while the central bank will respond to inflation and output shocks contemporaneously by making a change to monetary supply.

As the exchange rate reacts to a number of external factors, most researchers treat exchange rate as a relatively exogenous process. In this case we place exchange rate as the first variable, where the only effect of contemporaneous shocks are due to factors that have an impact on the exchange rate, x_t. The structural moving average representation would then take the form:

$$\begin{bmatrix} x_t \\ y_t \\ \pi_t \\ m_t \\ i_t \end{bmatrix} = \begin{bmatrix} \theta_{1,1} & 0 & 0 & 0 & 0 \\ \theta_{2,1} & \theta_{2,2} & 0 & 0 & 0 \\ \theta_{3,1} & \theta_{3,2} & \theta_{3,3} & 0 & 0 \\ \theta_{4,1} & \theta_{4,2} & \theta_{4,3} & \theta_{4,4} & 0 \\ \theta_{5,1} & \theta_{5,2} & \theta_{5,3} & \theta_{5,4} & \theta_{5,5} \end{bmatrix} \begin{bmatrix} \varepsilon_{x,t} \\ \varepsilon_{y,t} \\ \varepsilon_{\pi,t} \\ \varepsilon_{m,t} \\ \varepsilon_{i,t} \end{bmatrix} + \theta_1 \varepsilon_{t-1} + \ldots$$

The degree of dollarization would be affected by the exchange rate and those factors that impact on the external value of the domestic currency, we place the measure of Dollarization (D_t) under the exchange rate. Hence the ordering for the six variables look as follows,

$$\begin{bmatrix} x_t \\ D_t \\ y_t \\ \pi_t \\ m_t \\ i_t \end{bmatrix} = \begin{bmatrix} \theta_{1,1} & 0 & 0 & 0 & 0 & 0 \\ \theta_{2,1} & \theta_{2,2} & 0 & 0 & 0 & 0 \\ \theta_{3,1} & \theta_{3,2} & \theta_{3,3} & 0 & 0 & 0 \\ \theta_{4,1} & \theta_{4,2} & \theta_{4,3} & \theta_{4,4} & 0 & 0 \\ \theta_{5,1} & \theta_{5,2} & \theta_{5,3} & \theta_{5,4} & \theta_{5,5} & 0 \\ \theta_{6,1} & \theta_{6,2} & \theta_{6,3} & \theta_{6,4} & \theta_{6,5} & \theta_{6,6} \end{bmatrix} \begin{bmatrix} \varepsilon_{x,t} \\ \varepsilon_{D,t} \\ \varepsilon_{y,t} \\ \varepsilon_{\pi,t} \\ \varepsilon_{m,t} \\ \varepsilon_{i,t} \end{bmatrix} + \theta_1 \varepsilon_{t-1} + \ldots$$

All of the data used in this investigation was obtained from the International Monetary Fund (IMF) database for International Financial Statistics (IFS). The data is available at a quarterly frequency for the period 2001q1 to 2013q3. Prior to this period, measures of gross domestic output were not collected at this frequency. All variables are not stationary but stationary at first differences. The measure of output (y_t) is seasonally adjusted with the aid of the X13 seasonal filter. Thereafter, the stochastic trend in the natural logarithm of the series was identified with the aid of the Hodrick-Prescott filter, where the smoothing coefficient for quarterly data was set at 1,600. After removing the stochastic trend, we obtained the cyclical component of economic output. This measure was then compared to the growth rate in economic output, along with a number of others that included those which made use of a Beveridge-Nelson, Band-Pass, Christiano-Fitzgerald and linear filter.[4] As the periods of positive and negative economic growth (as measured by the logarithmic change in seasonally adjusted real gross domestic product) appeared to coincide with the periods where the Hodrick-Prescott filter appeared, this suggests that there were notable contractions and expansions in the business cycle, and this measure was used in the subsequent analysis. Indeed, the correlation between this measure of the business cycle and output growth was 0.6. However, the difference between these measures was not found to be all that significant. The measure of consumer prices was also clearly subject to notable seasonal variation. Therefore, to ensure that this measure is consistent with that of output, we also applied the X13 seasonal filter to this measure. The measure of inflation (π_t) is then derived from the quarter-on-quarter logarithmic change in the seasonally adjusted consumer price index.

Domestic monetary supply (m_t) was measured from M2. The reason for not using extended broad money supply is that we are primarily interested in the role of the central bank and its ability to influence interest rates through control of the domestic currency. The foreign currency deposits in the economy, which is included in the M3 definition, is treated as a separate feature and is the focus of the measure of dollarization. In addition, if we had included foreign balances

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[4] See, Beveridge and Nelson (1981), Christiano and Fitzgerald (2003), Baxter and King (1999), Hodrick and Prescott (1997), and King and Rebelo (1993).

in our measure of monetary supply and dollarization, then we would have double counted this feature. The quarter-on-quarter logarithmic change in the level of this variable has been used for further modelling purposes.

The interest rate is measured as the central bank discount rate, which has been annualised. This is the rate at which the central bank charges commercial banks. It is worth noting that the discount rate has become relatively constant as of 2010, this suggest that the central bank also targets interest rates.

The measure of the exchange rate (x_t) is the nominal exchange rate between the United States Dollar and the Tanzanian Shilling. To ensure that it is consistent with the other variables, we make use of the quarter-on-quarter logarithmic change for this series.

There are a number of possible measures of dollarization (D_t) that could be used (mentioned in chapter 3). The amount of foreign currency in the economy at a point in time could largely be measured by the difference in M3 and M2 monetary supply. This could be expressed as a fraction of M2 to convey information about the ratio of foreign monetary supply to domestic monetary supply. Alternatively, we could express the foreign holdings as a percentage of total monetary supply, which would also be a useful indictor. However, one of the problems that would be associated with using these measures to characterise the degree of dollarization in Tanzania is that domestic monetary supply (M2) is much more volatile than foreign monetary holdings. It is thus more often the case that changes in M2 would give rise to a change in these measures of dollarization (rather than a change in foreign holdings). As such we make use of the quarter-on-quarter change in the natural logarithm of foreign monetary holdings to describe the degree of dollarization in the economy, while the effects of a change in domestic monetary supply are captured separately in the model. This measure of dollarization includes two notable structural breaks in 2001/2002 and 2010/2011, which are accounted for in the model.

It is also worth noting that the measure of the difference between M3 and M2 monetary supply would capture the total amount of foreign currency holdings in the economy. This would include the portion of circulated foreign currency that is used for transactional purposes in Tanzania, and the portion of foreign currency reserves that is not in circulation and is held by the central bank. The information content of this measure could therefore be contradictory at times. For example, where there is little confidence in the economy, individuals may wish to make additional use of foreign currency for transactional purposes (leading to an increase in the demand for foreign currency), while foreign investment would decline (leading to a decrease in foreign currency reserves that are held by the central bank).[5] Appendix

Figure 1 in the appendix presents these variables after transformation. The results of the model are summarised with the following impulse response functions. The first of these shows the effects of a monetary policy shock, that follows a positive innovation of one standard deviation in the interest rate in Figure 3 (see Appendix).

The positive spike in interest rates is associated with a sharp reduction in monetary supply on impact. It takes about ten quarters for money supply to return to its steady-state value, whereupon it takes a bit of time to stabilize (which is partly because all the variables are endogenous in this framework). The positive innovation in the interest rate gives rise to sharp reduction in output, while the rate of inflation starts to decline after four quarters. In this case the extent of the decline in output is greater than the decline in inflation, which is consistent with the findings of most macroeconomic models. The higher interest rate also results in a reduction in the depreciation of the external value of the currency, as it strengthens during the impact period. The appreciation in the exchange rate that would have resulted from the increase in foreign capital would give rise to an increase in foreign reserves. These results in an increase in the measure of foreign capital in the economy, as is shown in Figure 4 (see Appendix).

The aggregate demand shock would result in an innovation in the cyclical component of output. This fuels inflation and in this case it has increased monetary supply, due to the persistent

[5] Unfortunately, as there is no data that distinguishes foreign currency reserves from foreign currency in circulation, we do not have any other option than to use the growth rate in broad foreign currency holdings as a measure of dollarization.

demand for real monetary balance. In addition, the nominal exchange rate depreciates, as the amount of foreign currency holdings declines. These results are shown in Figure 5 (see Appendix).

The effect of an unexpected increase in inflation is captured by the cost push shock that follows an innovation to the rate of inflation. The effect of such a shock on other endogenous variables is characterised in Figure 6 (see Appendix). The relatively high environment would appear to be associated with low interest rates, although one would expect that the central bank would react to the increase in inflation by raising the nominal interest rate.

The positive innovation to monetary supply is associated with a significant reduction in the interest rate. This gives rise to an initial increase in output and a significant increase in inflationary pressure. The exchange rate also experiences a significant deterioration with the result that the foreign holdings of the central bank, and other factors that contribute to dollarization, decline. The effects of such a monetary supply shock are depicted in Figure 7 (see Appendix).

A positive exchange rate shock would result in a depreciation of the external value of the domestic currency, as shown in Figure 8 (see Appendix). This is associated with inflationary pressure, which leads to an initial reduction in monetary supply and a rise in nominal interest rates (which is somewhat short-lived). The depreciation in foreign currency is also associated with an increase in dollarization as it would be more desirable to hold foreign currency when the economy is affected by an exchange rate shock that depreciates the value of the domestic currency. An innovation of one positive standard deviation to the level of dollarization in the Tanzanian economy would result in a reduction in the monetary supply of local currency (M2), as the central bank seeks to maintain a relatively constant rate of total money supply (including foreign currency holdings). This reduction in domestic monetary supply eases inflationary pressure, which allows the central bank to lower interest rates. The lower interest rate would then fuel depreciation in the currency. These results are shown in Figure 8 (see Appendix).

1.3 Concluding Remarks

The results suggest that the exchange rate pass-through is not significant. In addition, foreign currency deposits are positively related to exchange rate depreciation and interest rate increases are associated with a reduction in money supply. This in turn leads to a decline in real GDP. The shock from aggregate demand would appear to increase the inflation rate, while the de-facto dollarization in this economy lowers the inflation rate through a reduction in money supply. This is also explained by the negative relationship between foreign currency deposits and the inflation rate, which influences the exchange rate. When the firm opts to conduct transactions in foreign currency, there would appear to be a depreciation of the Shilling, which is a form of hedging. Honohan (2007) has explained this as the direct effect of partial dollarization in an economy. It should be noted that this study is limited by the fact that the data on foreign currency in circulation is not available, requiring instead that foreign currency deposits are used as the principal data. The results show that the use of foreign currency in Tanzania does not harm the monetary transmission mechanism. The findings also indicate that there is a possibility that other factors affect the exchange rate, which may be beyond the direct control of central banks, such as the amount of foreign currency in circulation. This implies that policymakers' ability to influence the movement of the RER is limited. In the long run, however, appropriate structural changes and competitive policy can be designed and implemented to minimize external shocks. This study recommends the pursuance of sound monetary policy as an instrument for achieving RER stability. The increasing credibility of the Bank of Tanzania's inflation targeting framework and the relatively low and stable rate of inflation in the current regime has established a solid policy basis for a more stable RER in the future. There is a need for coordinating exchange rate and monetary policies. These policies that seek to maintain a competitive RER should be accompanied by appropriate monetary policy to control inflation. Implementing a policy-mix that achieves stability in both the internal and external value of the currency should be the objectives of the central bank.

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Appendix

Figure 1: Variables after Transformation

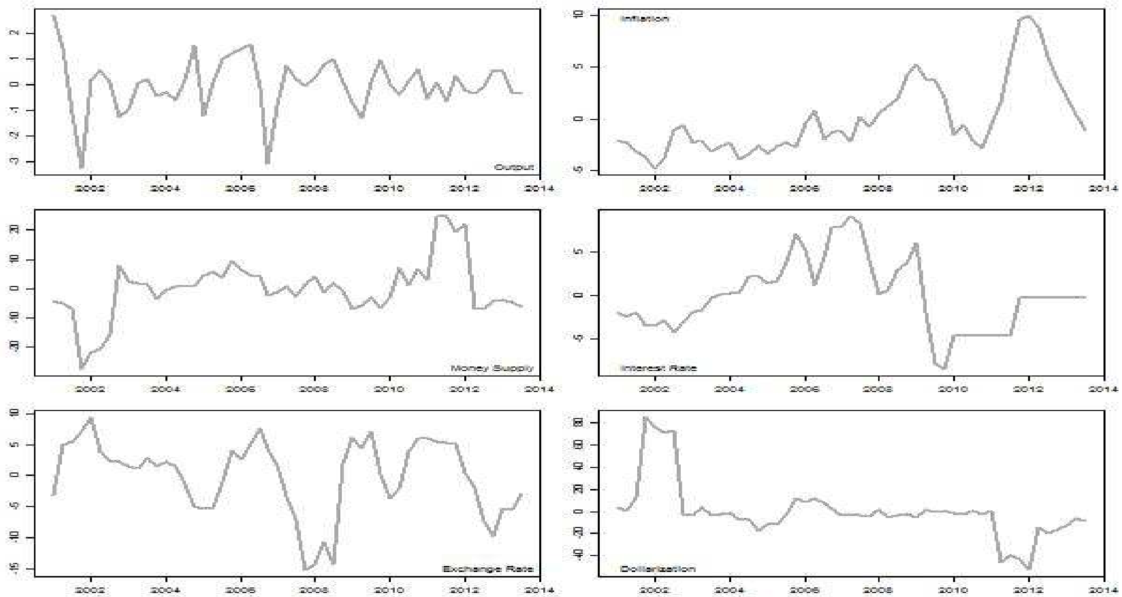

Figure 2 : Bayesian VAR -Monetary Policy Shock

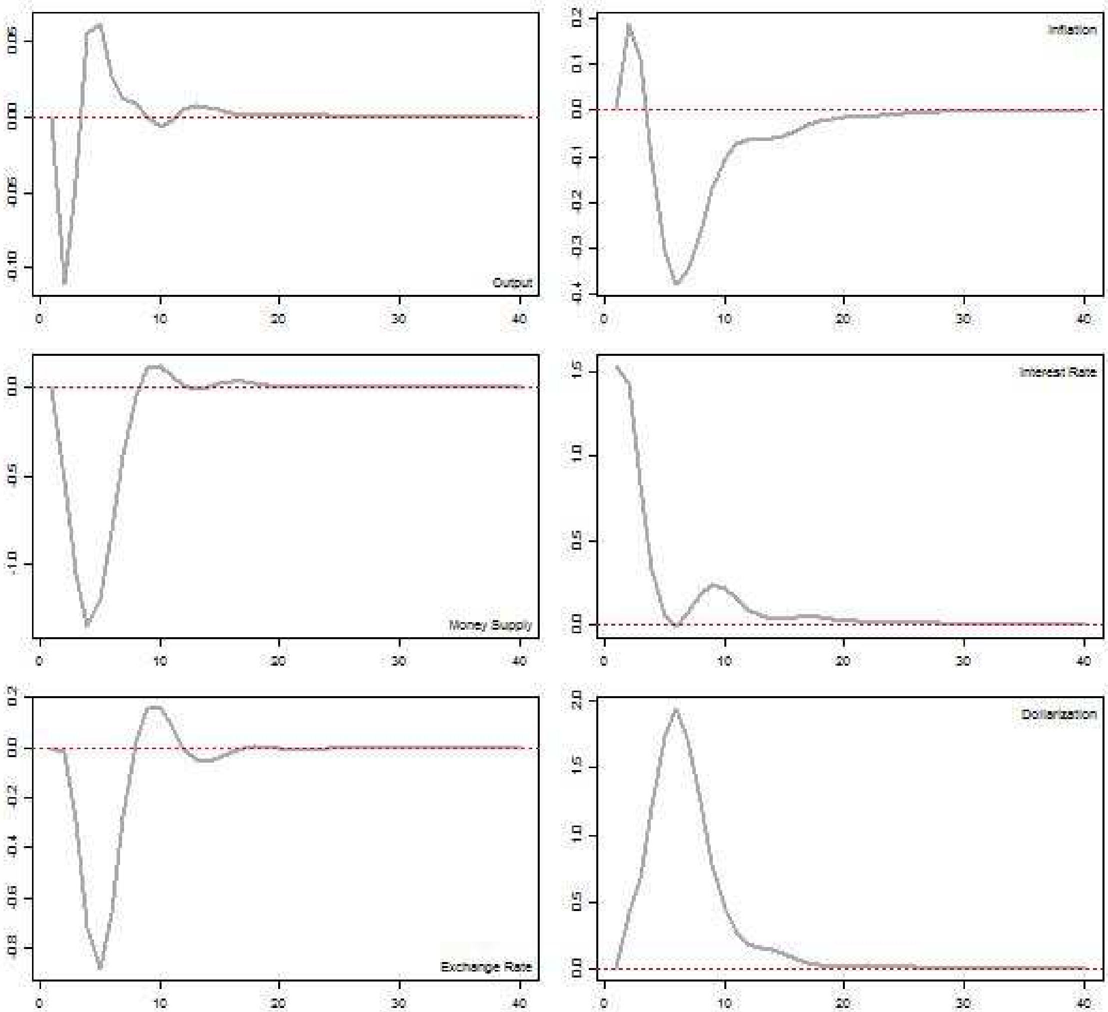

Figure 3 : Bayesian VAR -Aggregate Demand Shock

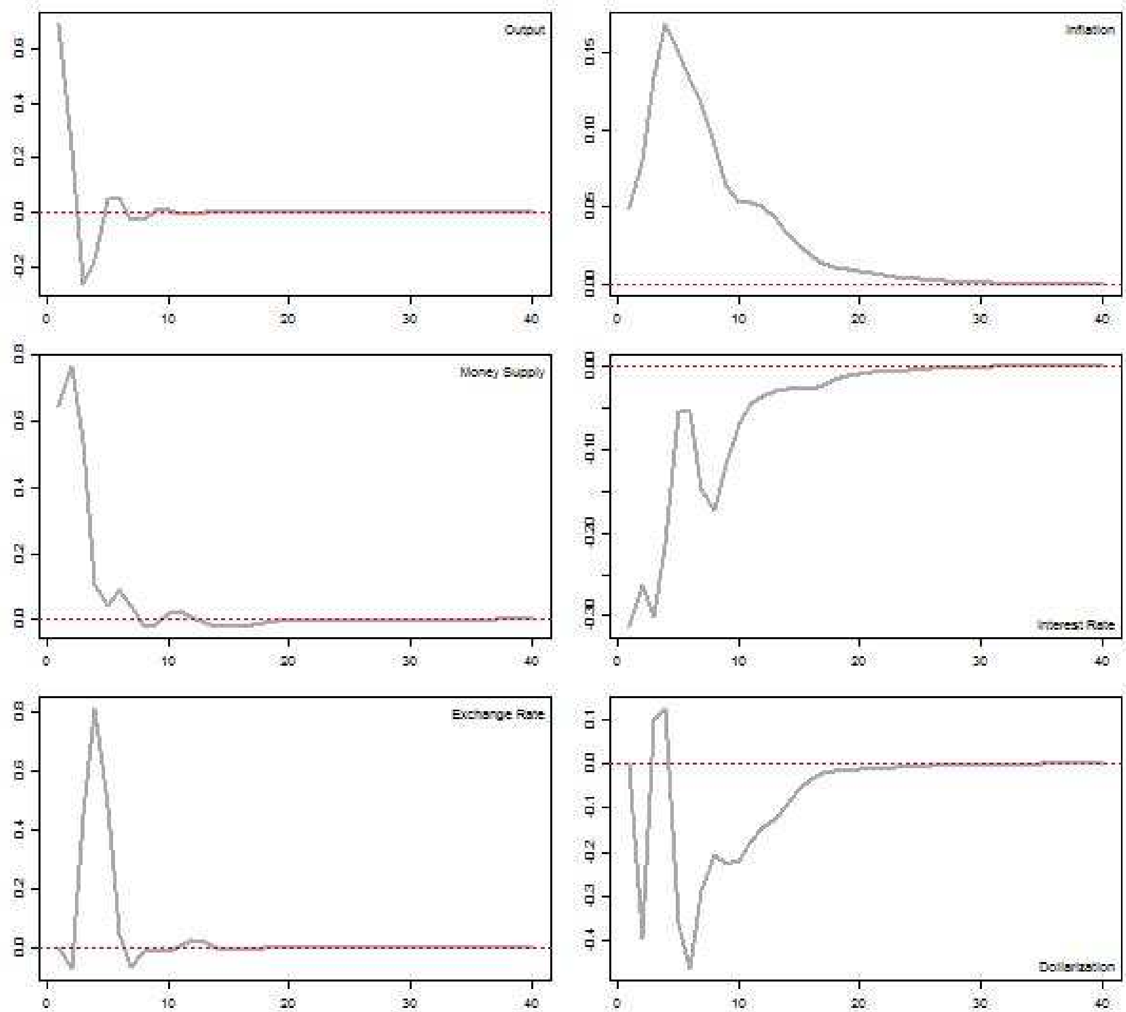

Figure 4 : Bayesian VAR -Cost Push Shock

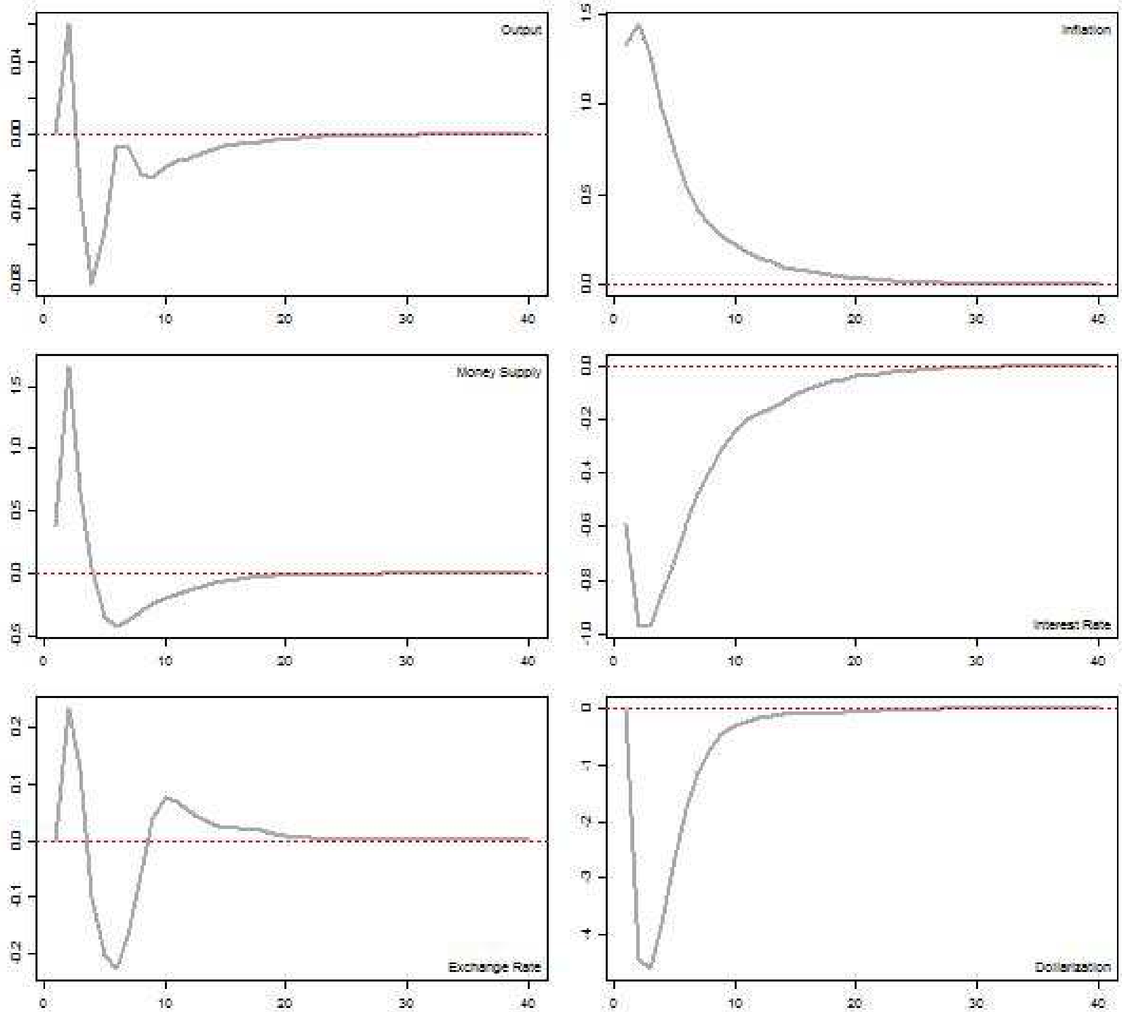

Figure 5: Bayesian VAR - Monetary Supply Shock

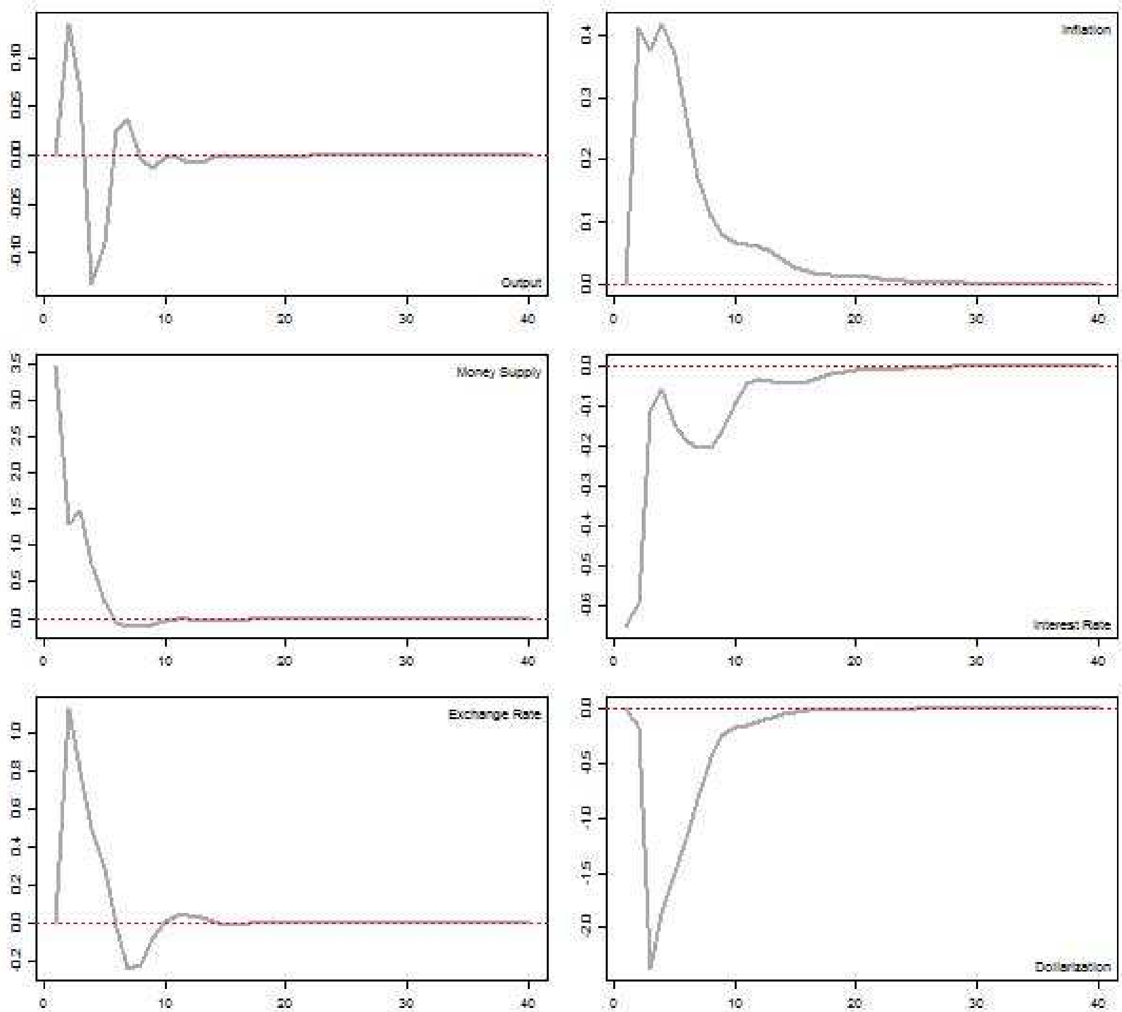

Figure 6: Bayesian VAR - Exchange Rate Shock

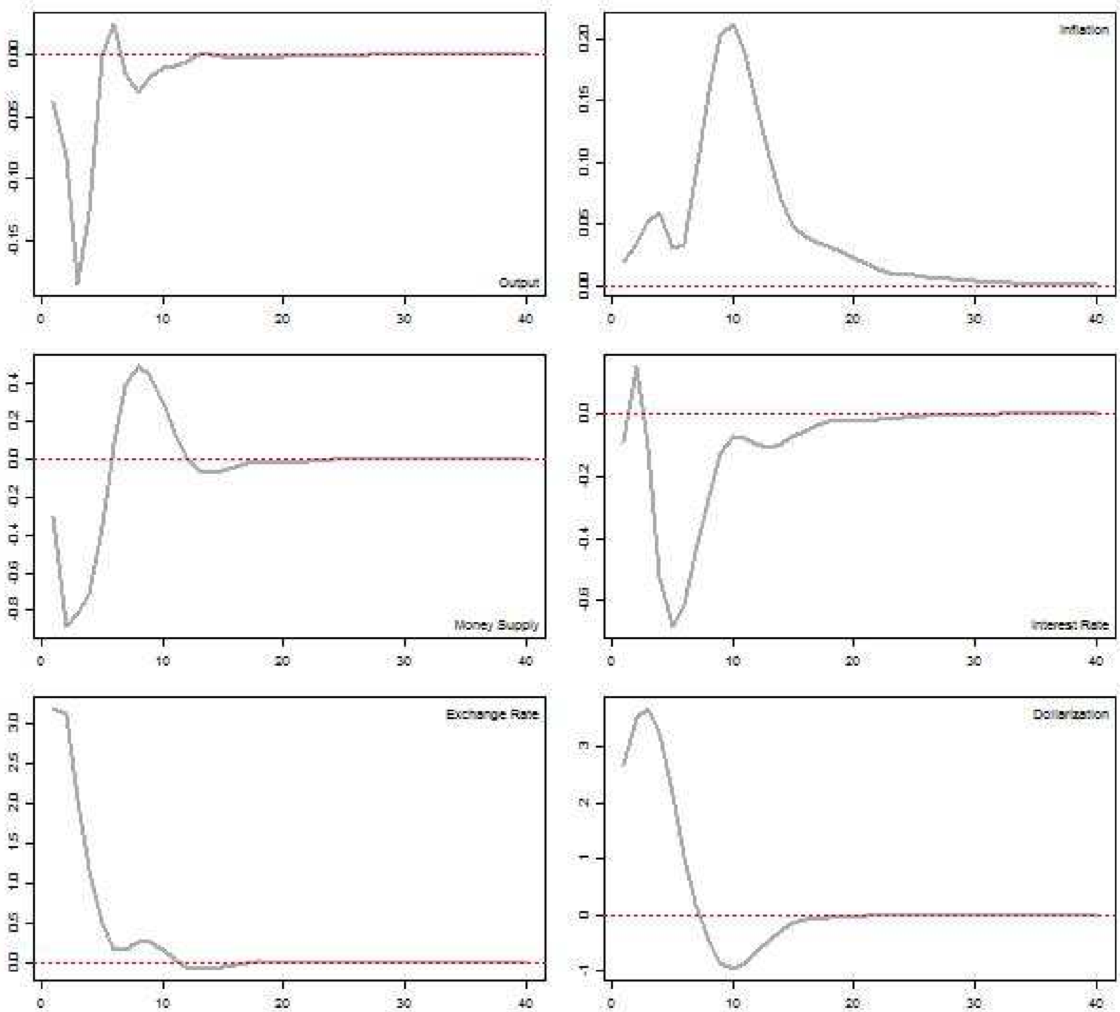

Figure 7 Bayesian VAR - Dollarization Shock