



The Role of Exchange Rate in Small Open Economies: The Case of Tanzania

By

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Abstract

This thesis addresses exchange rate behaviour in a de-facto partially dollarized economy. 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 three related investigations: whether the Tanzania Shilling to United States Dollar exchange rate overshoots, whether it has impacted the monetary transmission mechanism, and whether dollarization has substantively affected the pattern of Tanzania's foreign trade.

The first study uses the Structural Vector Autoregression to test if the overshooting hypothesis holds for the TZS-USD exchange rate. The results suggest that foreign currency deposits are encouraged by the volatility of the exchange rate. In addition it is noted that the exchange rate demonstrates delayed overshooting, while a contractionary monetary policy leads to appreciation in the exchange rate for at least a year before returning to equilibrium. The determinants of the exchange rate in Tanzania are trade openness, real interest differentials, labour productivity and government expenditure.

The second study uses a Bayesian Vector Autoregression to investigate the monetary transmission mechanism in the presence of dollarization. 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.

The third study uses a Dynamic Stochastic General Equilibrium to describe the conduct of monetary policy in a small, open, and partially dollarized Tanzanian economy. The structure of the model incorporates the expectations of agents and the dynamic relationships are explained in terms of structural representations that characterize the behaviour of the firm, household and central bank. The parameters in the model are estimated with Bayesian techniques, after it has been applied to Tanzanian data. The effects of individual shocks, including those that may be used to describe the conduct of monetary policy, are then considered. These simulations suggest that despite the existence of partial dollarization in the Tanzanian economy, monetary policy has important, short-term, real effects.

The fourth study uses an Autoregressive Distributed Lag approach to investigate the short and long run exchange rate sensitivity of foreign trade. Principal components analysis is also used to reduce the dimension of the dataset. It finds evidence that the depreciation of the Shilling typically has an immediate positive impact on the trade balance, and exchange rate depreciation increases the trade balance in both the short and long run. However, exports show signs that support the J-curve hypothesis, though the associated parameters are not significant. Imports are not reduced by a rise in the Shilling, as traditional theory would suggest. This is ascribed to the country's de-facto partial dollarization. Since over 40 per cent of money supply are currently held in dollar denominated accounts, trade is largely immune to domestic currency fluctuations. This study also notes that the use of foreign currency has tended to rise during periods of substantial economic growth. Although no causality is argued, this does suggest that the parallel use of foreign and domestic currencies is not detrimental to Tanzania's economic growth.

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Special acknowledgement to my family, particularly my parents (Louis and Ngoyako), brother (Primi and wife Pendo), sister (Janet and husband Innocent) for encourage me and for taking care of my “heart” son (Menashe). Your prayers, love and support have been my anchor. I greatly appreciate Gospel Ramah Church (my Cape Town family), my spiritual parents (Pastor Tshalo and Beatrice Katshunga) for their unmeasurable assistance. Mamello Nchake has been very generous to me, thank you my dear friend. To Kofi Vondolia thank you.

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Dedication

To EL SHADDAI

“In whose hand is the soul of every living thing, and the breath of all mankind.” Job 12:10

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Chapter One

1 Introduction and Background

1.1 Background and Motivation of the Study

Many developing countries have opted for foreign currency, particularly the US Dollar, as their medium of exchange (Menon, 2007). Since 2000, foreign currency deposits have composed an increasing percent of local money supplies, averaging 40 percent in Botswana, 50 percent in the Democratic Republic of Congo, 40 percent in Tanzania and 30 percent in Uganda. The inflation rate in almost all of the above economies declined over time. These economies moved from double digit inflation during the 1980s and the 1990s to single digit inflation during the 2000s (Table 1.1). Most of the countries listed in Table 1.1 have a managed floating exchange rates, underdeveloped financial systems, and a high dependence on primary agricultural and/or natural commodities. However, Nigeria and Botswana are middle income countries, and their economies are driven by oil, service-oriented sectors and minerals.

Table 1.1: Inflation Rate and Export/Import share of GDP

	Inflation Rate (annual %)				Exports (% of GDP)			Imports (% of GDP)		
	1980s	1990s	2000s	2013	1990s	2000s	2013	1990s	2000s	2013
Botswana	11	11	9	6	52	49	55	44	41	60
Kenya	12	17	11	6	28	24	18	31	32	33
Nigeria	21	31	12	8	35	38	18	25	26	13
Swaziland	15	10	8	6	61	80	55	76	87	59
Tanzania	30	23	7	8	16	20	25	35	29	43
Uganda	111	15	6	5	10	15	24	22	27	35

Source: World Development Indicators

Generally, developing countries, particularly low-income economies, import more than they export (Table 1.1). The ratios of imports to GDP for most countries in Table 1.1 (such as Kenya,

Swaziland, Tanzania and Uganda) have mostly been higher than the ratios of exports to GDP since 1990. Exchange rates are one of the factors that contribute to these trade deficits. The exchange rate measures external competitiveness, which determines a country's share in the world market (Caballero and Corbo, 1989; Taylor, 2000). The country becomes more competitive when exports increase (Leichter et al., 2010). However, exchange rates in developing countries are usually very volatile and that adversely affects the tradable goods sector (Cline and Williamson, 2008). A volatile exchange rate creates instability of exports and imports. This leads to unstable aggregate demand and prices. In developing economies, monetary policy creates a volatile exchange rate (West, 2003; Gali and Monacelli, 2005). This is because, despite the claim that these economies follow flexible exchange rate regimes, monetary authorities are often still targeting the nominal exchange rate (Levy-Yeyati and Sturzenegger, 2005; and Calvo and Reinhart, 2002).

Since the work of Dornbusch (1976), the most popular argument is to explain exchange rate fluctuations using the interaction of monetary shocks and sticky prices¹. Thus, in an open economy, monetary policy shocks induce an immediate change in the nominal exchange rate that translates into a change in the real exchange rate, as long as prices adjust slowly. For example, an increase in money supply will push the domestic interest rate down, which, in the presence of perfect capital mobility, will lead to capital outflows. This will lead to an immediate and sharp depreciation of the nominal exchange rate. In this process several different transitory exchange rate equilibria are achieved before a new sustainable equilibrium prevails. In the long run where all variables are flexible, the rise in relative prices of tradable goods will result in inflationary pressure when all resources are fully utilized. The uncovered interest parity suggests the expectation of future appreciation in the exchange rate due to lower domestic interest rates to maintain equilibrium in the foreign exchange market. This offsets the initial depreciation, and as a result, the long-run depreciation of the exchange rate is smaller than the short-run depreciation. Monetary policy shocks overshoot exchange rate in the short-run (Dornbusch, 1976; Dornbusch

¹ Exchange rate simply can be defined as a domestic price of a foreign currency.

and Fischer, 1994). The short-run is that period of time when prices are still sticky. If the price could adjust immediately to its new, long-run level after a money supply increase, the dollar interest rate would not fall because prices would adjust immediately and prevent the real money supply from rising. Thus, there would be no need for overshooting to maintain equilibrium in the foreign exchange market. The exchange rate would maintain equilibrium simply by jumping to its new, long-run level right away.

This dissertation starts by estimating the real exchange rate and the probability of real exchange rate overshooting. Monetary policy shocks play a major role in the volatile behaviour of the exchange rate (Faust and Rogers, 2003). The overshooting model explains that this results from sluggish behaviour of prices. In the event of a monetary policy shock, the exchange rate will temporarily overshoot and later correct itself (Dornbusch, 1976). A volatile exchange rate affects the tradable goods sector and can lead to unstable aggregate demand and prices. This dissertation also examines the monetary policy transmission mechanism, which takes into account the monetary policy decisions and the channels through which the general price level and economic activity are affected. It describes the channels through which the nominal money stock or the short-term nominal interest rate affects the real variables, such as aggregate output (Ireland, 2006). For instance, the interest rate channel takes into account a policy-induced change in the short-term nominal interest rate that affects aggregate output and employment. The features surrounding the exchange rate channels are the same but this channel considers open economies. This study also examines the transmission channels of monetary policy in a de-facto partially dollarized economy. In this case, while the Tanzanian Shilling is the only legal tender in the country, the United States Dollar is also frequently used (known as de-facto currency). In addition the study investigates the exchange rate sensitivity of foreign trade in Tanzania, such as the responsiveness of foreign trade to changes in the exchange rate. The results of this study would be of interest to many other African economies that have relaxed government controls (exchange controls and trade restrictions) since the mid-1980s (Rutasitara, 2004).

1.2 Objectives of the study

The overall objective of the study is to understand the exchange rate mechanism in Sub-Saharan Africa, where Tanzania is presented as a case study. This thesis aims to achieve the following objectives:

- i) Review the phases of Tanzania's macroeconomic policies.
- ii) Analyse the determinants of the real exchange rate (RER). In this process the study tests the purchasing power parity (PPP) hypothesis. It estimates the real exchange rate and the probability of exchange rate overshooting when the foreign currency is used in a domestic economy.
- iii) Examine the exchange rate channel of the monetary transmission mechanism, and examine the exchange rate pass-through to prices.
- iv) Identify the effects of the exchange rate movements on foreign trade flows, in particular the exchange rate sensitivity of trade flows in both the long and short terms.

The major contribution of this thesis is to investigate how the exchange rate responds to shocks from monetary policies in a de-facto partially dollarized African economy.

1.3 Relevance and Contribution of the Thesis

Enhancing export competitiveness is important if Tanzania wants to pursue an export-led growth strategy. Trade is considered to be an engine of economic growth and recent experiences, particularly in East Asia, have provided strong evidence of a positive link between export growth and economic growth. The pursuit of an exchange rate policy that promotes export competitiveness of a country would be greatly facilitated if policy-makers identify and establish the determinants of exchange rates. Even though monetary and exchange rate policies are important in economic management, there are very few empirical studies which have focused on Tanzania to: i) link the real exchange rate fluctuations and export performance, and ii) explain the effect of monetary policy on the real exchange rate.

The main argument against dollarization is that the use foreign currency makes monetary policy less effective. It is from this point of view that the study seeks to improve our understanding of the transmission mechanism of monetary policy and exchange rate in a partially dollarized economy. The study focuses on low income countries. Several characteristics of the Tanzanian economy made it an appropriate choice as a case study. First, the country's real GDP growth was above 6 percent per annum from 2001 to 2010, making it one of the most sustained growth rates in Sub-Saharan Africa. Second, the inflation rate was reduced to single digits from 1999 to 2008. Third, foreign currency deposits composed more than 40 percent of the broad money supply (M2) from 2001 to 2010. Fourth, the nominal exchange rate has steadily depreciated since 1986, with the only exception being in 2007 and 2008, when the exchange rate appreciated. Fifth, Tanzania displayed positive trends with regard to economic openness from 2000 to 2008. Sixth, the capital market is still underdeveloped. It is the aim of this study to find out how monetary policy mechanisms have been used to achieve the lower rate of inflation and the sustained growth of real GDP over time.

Kessy (2011) examines the determinants of financial dollarization in the East African region, and found high but steadily declining financial dollarization in Tanzania. In another study, Rutasitara (2004), found for the period 1967 - 1995, Tanzania's exchange rate regime changed from fixed to flexible, but the problem of abnormally high inflation crossed over both regimes (Rutasitara, 2004). This implies that inflation was a problem in Tanzania even after the abandonment of the fixed exchange rate regime. The Autoregressive Distributed Lag (ARDL) model is chosen to examine exchange rate overshooting. This is based on its robustness when sample sizes are small and its ability to accommodate both stationary and non-stationary variables. ARDL is used to estimate the real exchange rate and the probability of exchange rate overshooting in a de-facto partially dollarized economy.

Another motivation for this study is the observation that although the use of foreign currencies increased in the 2000s, inflation was manageable at single digits. This led us to investigate the monetary transmission mechanism to find out what triggers inflation in Tanzania. The study employs a Bayesian Vector Autoregression (VAR) analysis to investigate the channels of

monetary transmission. To investigate the response of trade to exchange rate, we paid attention to the proposed J-curve, where in the short run the trade balance deteriorates before improving in the long run, due to low elasticity of demand (Magee, 1973). The J-curve hypothesis is tested for Tanzania's trade with nine major trading partners. Principal components analysis was used to reduce the dimension of the dataset. The findings from this thesis will facilitate a better understanding of the role of exchange rates in small open economies, and how this role has evolved over time.

1.4 Organization of the Thesis

The thesis is divided into seven chapters.

- Chapter Two highlights some of the macroeconomic issues in Tanzania and general characteristics of small, open economies in Sub-Saharan Africa. It emphasises the performance and policies of the exchange rate, partial dollarization, monetary policy and trade.
- Chapter Three brings together the practice of partial dollarization and the empirical findings. It discusses the impact of partial dollarization on monetary policy and the exchange rate.
- Chapter Four investigates the probability of exchange rate overshooting and estimates the real exchange rate in order to understand the determinants of the exchange rate.
- Chapter Five investigates different channels of the monetary transmission mechanism taking into account the degree of partial dollarization.
- Chapter Six uses a Dynamic Stochastic General Equilibrium (DSGE) to investigate monetary policy in Tanzania.
- Chapter Seven explores the exchange rate sensitivity of the foreign trade flows.
- Chapter Eight summarizes the empirical findings and discusses policy implications. It also suggests areas of future research arising from the findings of the thesis.

Chapter Two

2 Macroeconomic Performance and Policies in Tanzania

2.1 Background

The United Republic of Tanzania was formed by the amalgamation of the mainland (Tanganyika) and the island of Zanzibar in 1964. The country's national strategy after independence was to alleviate poverty, ignorance, and disease (Voipio and Hoebink, 1999). To achieve this, the government gave priority to the wellbeing of the people (for example providing free education and hospital services) and pursued rural development programmes guided by the principles of socialism and self-reliance. Tanzania is endowed with rich natural resources and has easy access to international trade through its direct access to the Indian Ocean and the African Great Lakes. The country is bordered by Kenya and Uganda to the north, by Zambia, Malawi and Mozambique to the south, by Rwanda, Burundi and the Democratic Republic of the Congo to the west and by the Indian Ocean to the east. Tanzania is considered to be among the most progressive African reformers, due to the comprehensive set of reforms introduced in the mid-1980s (Kimanuka, 2009). In addition, the country has also had a relatively high degree of political stability, since independence.

This chapter reviews the macroeconomic performance of Tanzania for the period of 1970 - 2013. It also compares Tanzania's performance to other low-income countries regarding inflation, real GDP growth, monetary and exchange rate policies, trade policies and fiscal policies.

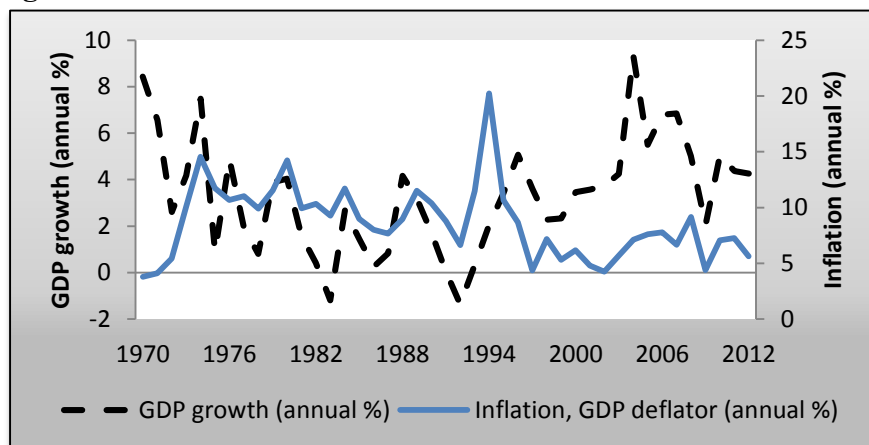
2.1.1 Overview of Sub-Saharan Africa's Inflation and Output Performance

Sub-Saharan Africa experienced severe external shortfalls of energy from the two oil price shocks of the 1970s, during which world prices of primary products were also relatively volatile. Exports from Sub-Saharan Africa are largely comprised of primary products. Hence, the volatile world prices of primary products in most African countries led to the fluctuations in the terms of trade in the late 1970s and early 1980s (Lancaster and Wangwe, 2000). The region was

characterized by growing deficit in the trade component of the balance of payments, increasing domestic budget deficits and stagnant growth rates in agricultural and industrial production (Kimanuka, 2009).

Because of poor economic management, economic growth in the region weakened throughout the 1980s and 1990s. This gave rise to the need for structural adjustment programmes advocated by the International Monetary Fund (IMF) and the World Bank (Kiondo, 1991). Those programmes focused on promoting market forces to allocate resources, which would decrease the need for government intervention. It was hoped that these policies would alleviate the key difficulties experienced by most of Sub-Saharan African countries. These problems included high public deficits, high external indebtedness, high rates of inflation, low foreign reserves, and poor governance. It was argued that Sub-Saharan African countries needed economic reforms because these problems originated from their own domestic policies. The region’s economic performance began to improve in the mid-1990s, owing to economic reforms and a recovery in primary product prices (Lancaster and Wangwe, 2000). The average inflation rate fell to single digit levels in the mid-1990s, for the first time since the early 1970s. On average, the inflation rate in the SSA region has reduced to single digits since 1996 (Figure 2.1).

Figure 2.1: Sub-Saharan Africa - GDP Growth and Inflation Rate



Source: BOT statistics

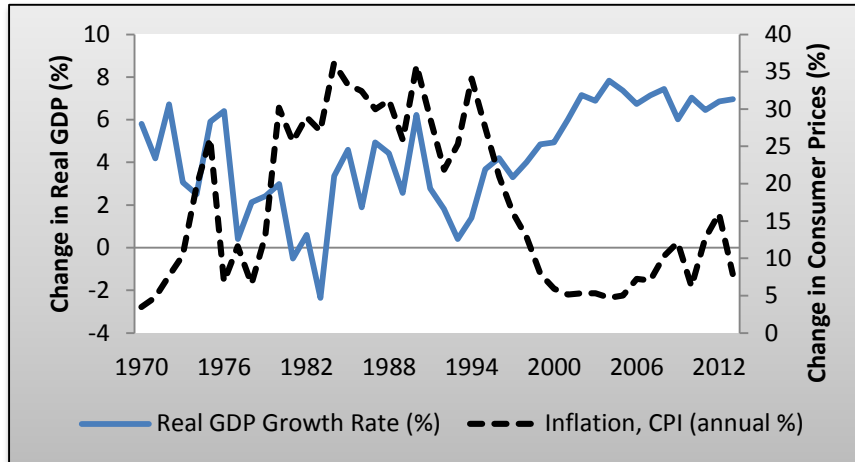
The presumptions of the IMF and the World Bank were that liberalization (such as removal of all controls on exchange rate, prices, imports) would result in sustained economic growth. After

nearly three decades of liberalization, it is worth noting that not all countries have experienced sustained economic growth. As a result, economic growth for the entire Sub-Saharan African region, as measured by GDP growth is still very uneven (Figure 2.1). Some of the volatility of GDP (economic) growth in the region can be understood as originating from political instability, notably in the Democratic Republic of Congo, Sudan, Nigeria and Angola. It has also been suggested that some of the major factors that hinder growth in this region include poor governance and corruption. In addition, the region is still vulnerable to external shocks, as its exports to the rest of the world are in primary commodities.

2.2 Inflation and Output Performance of Tanzania

Tanzania, a Sub-Saharan African country, was characterized in the 1970s by poor infrastructure, underdeveloped markets, poor institutions (governance), lack of expertise and unpredictable rainfall, which adversely affected agricultural production. The government embarked on three 5-year development plans. The first plan was during 1964 – 1969, to fight illiteracy, poverty and poor health. The second plan was from 1969 to 1974, to amend the first economic plan to reflect socialist goals that resulted from the Arusha declaration of 1967. The third plan was during 1975 – 1980, which emphasized rural development over industry. However this plan was not carried out due to the economic crisis of the mid-1970s (in which the country experienced drought, oil and food-price shocks). When assessing the three 5-year development plans, it has been suggested that they did not yield the anticipated results of development. Evidence of this may be found in the economic indicators, such as GDP and inflation, which were quite volatile during the 1970s and 1980s (Figure 2.2). During this period, the government instituted public ownership of all factors of production where the economy was effectively placed under state control (Green, 1980). The result of this is that macroeconomic performance of Tanzania in the early 1970s was strong, compared with its performance in the early 1980s. During 1970 - 1975 the GDP growth averaged 4.5 percent, which dropped to an average of 0.8 percent in 1980 - 1985. Looking at the same periods, the average inflation rate was 9 percent per annum in 1970 - 1975, but rose to an average of 30 percent for period 1980 - 1985 (Figure 2.2).

Figure 2.2: Real GDP Growth and Inflation Rate per annum



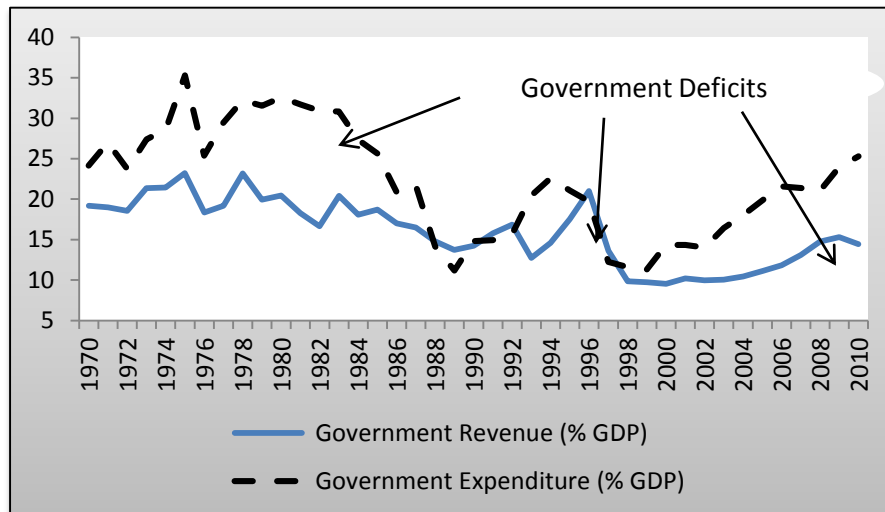
Source: BOT statistics

The poor economic performance of the late 1970s and the early 1980s, emanated mainly from inappropriate domestic policies such as unsustainable levels of relaxation of import rules adopted from 1977 to 1978 in favour of importers of machineries and intermediate goods, which worsened the pre-existing foreign exchange crisis (Green, 1980). Another contributing cause was Tanzanian's war with Idi Amin in Uganda during 1978 – 1979, which cost the government about USD 500 million (BOT report, 2010). Exogenous factors, such as poor weather and the international economic downturn, also played a role in this crisis. There were droughts in 1973 and 1974 and heavy floods in 1979, which led to high levels of food imports. Another external factor was the oil price shocks in 1973 and 1979, which raised the petroleum bill to over 50 percent of exports, compared to 10 percent in the early 1970s (Green, 1980). The balance of payments was in a state of crisis, owing to declining export volumes and prices, and rising import prices. This caused a shortage of foreign exchange and an accumulation of external debt. Furthermore, during that period, tax revenues decreased due to inefficiency in tax collections, pushing the budget deficit even higher. By the end of the 1970s the lack of foreign exchange created a shortage of almost all goods.

In 1981, the government embraced a number of stabilisation programmes to restore economic growth, the National Economic Survival Program (NESP). This was followed by the Structural Adjustment Program (SAP) in 1982. During this period, the government was under severe stress,

as a result of the high fiscal deficits (Figure 2.3), which were financed by printing money. As a consequence, inflation increased to over 36 percent per annum in 1984, the highest recorded rate of inflation in Tanzania.

Figure 2.3: Fiscal Performance of Tanzania



Source: BOT statistics

The goals of the NESP and SAP were to increase foreign exchange earnings, control government expenditure and increase the trade balance. However, the two programmes did not achieve the expected results for two main reasons (Ndulu and Mutalemwa, 2002). The first was an incomplete approach to the crisis. Complete structural transformation was needed, not just stabilization. The programmes lacked guidelines on how the economy was going to be restored, and focused on the end-results, rather than the operational steps needed to restore the economy. The second was that the two programmes were not a sufficient means of generating the large amount of foreign exchange that was needed.

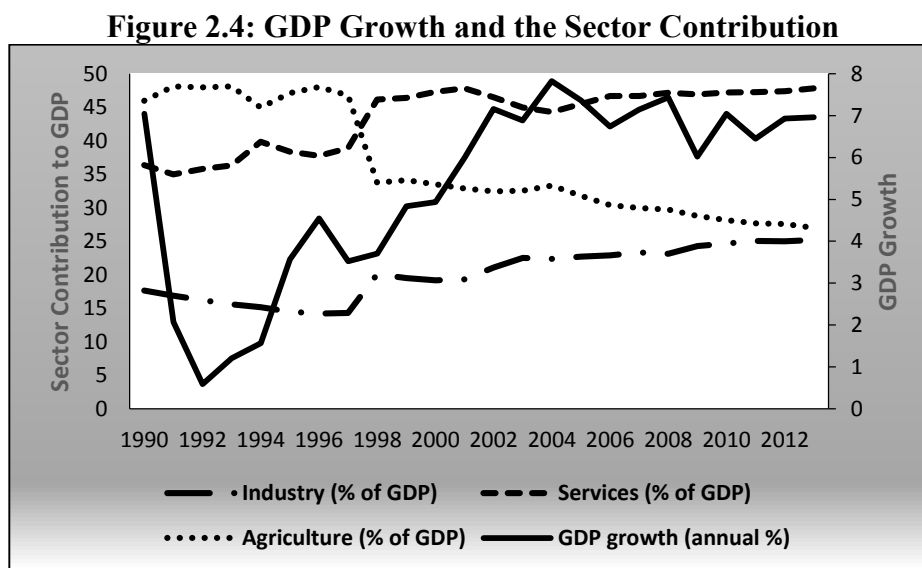
After the mid-1980s, the government implemented macro-economic reforms to sustain a stable macro-economic environment and promote economic growth. The government adopted the first Economic Recovery Program (ERP I) in June 1986. That program sought to overcome the economic crisis by using a SAP approach, with foreign assistance from Tanzania's major donors. During the second half of the 1980s, the average real GDP growth rate was 4 percent per annum, but with an inflation rate that was averaging 30 percent per annum, as excess domestic credit

caused a sharp growth in money supply. Even though exports of non-traditional products increased during this period, their prices declined and the balance of payment position did not improve. A second program, ERP II which started in 1989 and ended in 1991, put more emphasis on market reforms and the social aspects of adjustment. The rate of inflation was above 20 percent per annum throughout the period of ERP I and ERP II. High import prices, inadequate supplies of food and other essential items, and weak economic growth all contributed to higher prices during this period.

The economy of Tanzania in the early 1990s showed no improvements after reforms, and this is often explained by a lack of commitment by the government to reform. In essence, the decision to reform was motivated by the need for external financial support rather than the need for change (Bigsten and Danielsson, 1999). The period of 1990 - 1994 recorded an average real GDP growth rate of 2.5 percent per annum and an inflation rate of about 29 percent per annum, reflecting poor economic management and governance, specifically, an inability to control credit expansion to public enterprises, massive tax exemptions, poor revenue collection and tax evasion (Malima, 1994).

The second half of the 1990s was characterized by the government's pursuit of prudent fiscal and monetary policies. This included the IMF's Enhanced Structural Adjustment Facility (ESAF), which aimed at strengthening the previous recovery efforts and ensured more private sector participation in economic activities. The success achieved from prudent fiscal management reforms instituted under President Mkapa's regime in 1995 are evident. Since 1997 the real GDP growth rate has had an upward trend, surpassing 6 percent growth per annum in 2001 and remaining high until 2010. This sustained growth has made Tanzania's growth rate one of the highest in Sub-Saharan Africa. Inflation recorded single digits in 1999 at 7.8 percent, and then dropped to around 4 percent per annum in 2004. The success of containing inflation continued up to 2008 when the rate temporarily rose to 10.3 percent. The major contributor to this change in Tanzania's GDP is the notable change in the compositions of output in the economy, from agriculture to the service sector. The contribution from the industrial sector has also increased

over time, mainly due to the growth of the mining sector. However since 1998, the overall leading contributor to growth is the service sector (Figure 2.4).



Source: BOT statistics

2.3 Exchange Rate Policy in Tanzania

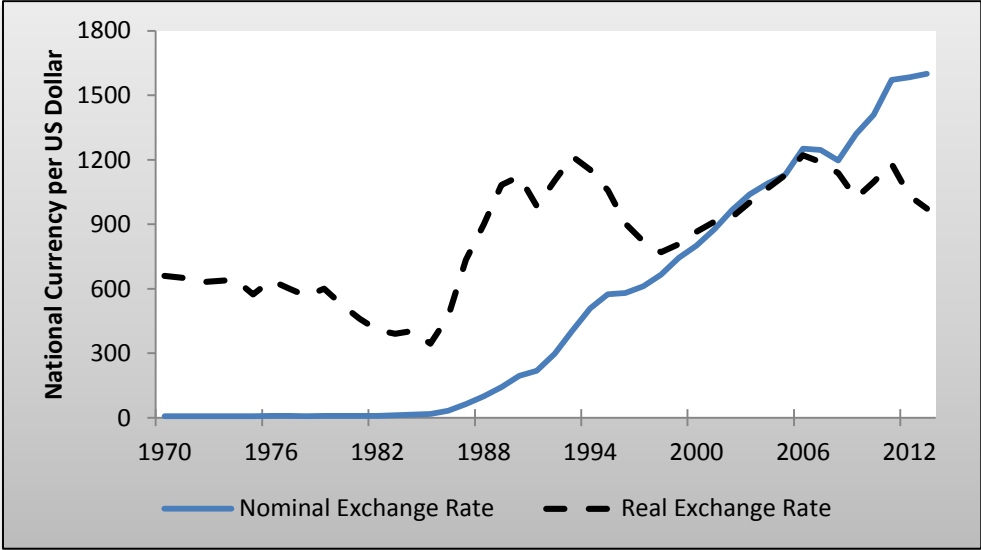
Poor exchange rate policies are among the causes of the poor economic performance of Sub-Saharan African countries (Mistry, 1994). Exchange rate policies have been identified as the root of the agricultural production downfall and increasing dependence on imports. Tanzania pursued a fixed exchange rate regime before 1986, with exchange controls and trade restrictions used as tools of balance of payment management. During that time, the Tanzanian Shilling was fixed against the Pound Sterling and US Dollar.

During the early 1970s, exchange rate adjustment was not necessary since there were sufficient foreign exchange reserves. However, these conditions no longer applied during the severe economic crisis in 1976, which followed the 1971 intervention by the Bank of Tanzania (BOT) and Treasury to control import licensing and foreign exchange planning (Green, 1980). During this period, there were acute shortages of foreign exchange and goods, as well as rising inflation. This led to strong parallel markets in goods and foreign exchange. To manage the crisis, the reserve bank (which at that time was not independent from government) intensified controls on

prices, interest rates, and exchange rates, and continued with the central allocation of domestic credit and foreign exchange. During this period, the Tanzanian Shilling was pegged to the IMF's special drawing rights, which at that time was linked to the US Dollar, and finally to a weighted basket of Tanzania's main trading partners. Minimal exchange rate devaluations were implemented over this period, amounting to 10 percent in 1979, 10 percent in 1982, 20 percent in 1983 and again in 1984, and 17 percent in 1985. The 1984 devaluation was a condition the country accepted for additional assistance from the IMF, to ease the exchange controls used at that time. This, however, failed to work due to inelastic prices of agricultural products and other natural factors such as poor weather.

The crisis of the late 1970s and early 1980s brought attention to exchange rate policy as one of the controversial policy instruments that were used in developing countries, with Tanzania as a typical example. In addition, there was also reluctance to devalue the Shilling for fear of its inflationary impact (Rutasitara, 2004). The IMF nonetheless insisted on a devaluation of the Tanzanian Shilling as they argued that it was overvalued at that time.

Figure 2.5: Nominal and RER trends in Tanzania



Source: BOT statistics

In 1986, the government lifted controls in the economy in Tanzania, which was supported by the IMF and the World Bank, and a series of devaluations were then undertaken. The highest annual

devaluation ever in Tanzania was between 1986 and 1987, when the nominal exchange rate rose by 96.5 percent, from an average of TZS 32.70 per USD in 1986 to TZS 64.26 per USD in 1987. The substantial devaluation of the Shilling and the liberalization of trade contributed to the sharp depreciation of the RER between 1986 and 1990 (Figure 2.5). The aim of the reforms was to eliminate the multiplicity of exchange rates (black-market and official) that existed at the time, so as to develop a market-based exchange rate and remove the inefficiencies associated with the administrative allocation of foreign exchange. Since 1986, the exchange rate has been floating (determined by the market). The Shilling continued to depreciate substantially over this period, which suggests that the exchange rate was not at the appropriate market rate during the fixed exchange rate regime. That is, the Shilling had been overvalued for a long period of time. As a consequence, the external competitiveness of the country was reduced and export growth was undermined (Ndulu and Mutalemwa, 2002).

Between 1986 and 1992 the Tanzanian exchange rate was discretionarily adjusted. This led to a rapid depreciation of the nominal exchange rate. The parallel market premium declined from a peak of 800% in 1985 to 30% in early 1992. Reform of the exchange system and further devaluation continued during the Enhanced Structural Adjustment Program (ESAP) period. Over this period of time, the Shilling depreciated further, in nominal terms, reaching TZS 297.71 per US Dollar in 1992, more than twice the rate in 1989. The government continued to introduce more reforms and introduced the Bureau de Change in April 1993, where the parallel market was integrated into the formal market, as it was authorized to buy and sell foreign exchange freely. The foreign exchange auction system was then introduced in June 1993 to prepare the ground for the inter-bank foreign exchange market that was introduced in June 1994, replacing the previous foreign exchange auction system. This allowed banks and other authorized dealers to participate in the foreign exchange market. In addition, it also created a market determined exchange rate. Where the foreign exchange auction was replaced by the Interbank Foreign Exchange Market (IFEM) in 1994 (Wangwe et al., 1998). This wholesale market has determined the exchange rate of the Tanzanian Shilling up until the present day. Participants in this market are largely comprised of commercial banks, while the BOT participates mainly for liquidity management and to smooth fluctuations in the exchange rate.

As pointed out earlier, the RER has been relatively volatile since the 1980s (Figure 2.5), and the nominal exchange rate has generally depreciated, with fewer periods of appreciations. It is also worth noting that the RER appreciated even though the NER depreciated from 1994 to 2000, as this appreciation is due to the inflation rate differential. The central bank intervened in the exchange market during the period 1995 - 2002 with average net purchases of about USD 55.0 million, reflecting BOT efforts to reduce the real appreciation of the exchange rate and restore export competitiveness. Subsequently, the RER depreciated to 1143 TZS per USD. The explanations behind this movement of the TZS against USD are related to the reforms and various liberalization policies instituted throughout the period, as well as a decline in inflation.

2.4 Monetary Policy Stance in Tanzania

2.4.1 Monetary Policy Objectives

The Bank of Tanzania (BOT) is responsible for the formulation and implementation of monetary policy in Tanzania. It was established after independence in 1961, replacing the East African Currency Board (EACB) of 1919. It opened for business on June 14, 1966, by an Act of Parliament, to perform all the traditional functions of a central bank, such as inspecting and supervising banks and other financial institutions. All private banks were nationalized in 1967, as per the Arusha Declaration, at which time the economy was characterized by administered prices and credit controls. The monetary instruments used at that time were direct controls. Examples are the Annual Finance and Credit Plan, which coordinated economic growth and the interest rate, as well as the Foreign Exchange Plan, which coordinated the demand and supply of foreign currency. These controls contributed to the macroeconomic imbalances that began in the early 1970s, which contributed to high money growth, rising inflation and deteriorating economic growth (Figure 2.2 and Figure 2.7). A number of amendments to the BOT Act were enacted to ensure independence of central bank activities. The BOT Amendment Act of 1978 added additional developmental functions to the Bank, which included four special Funds: (i) the Rural Finance Fund, (ii) the Industrial Finance Fund, (iii) the Export Credit Guarantee Fund, and (iv) the Capital and Interest Subsidy Fund.

Since the BOT Act of 1995, the Bank has focused on the single objective of price stability. This price stability objective has been successful, as has been demonstrated by a notable decrease in inflation from above 30 percent in the early 1990s to single digit inflation since 1999. More recently, in 2006, a BOT Act which was passed which states, "the primary objective of the Bank shall be to formulate, define and implement monetary policy, directed to the economic objective of maintaining domestic price stability, conducive to a balanced and sustainable growth of the national economy of Tanzania (BOT Act, 2006)". In addition, this Act has facilitated conditions for where the BOT has remained relatively independent from the government. Monetary policy in Tanzania is set within the context of the macro-economic policy objectives of reaching desired targets of economic growth and maintaining macro-economic stability. This is done primarily by keeping annual inflation rates at the single digit level through targeting money supply (BOT report, 2010). Consistent with this framework, monetary policy is designed to provide adequate liquidity, including the provision of adequate private sector credit. It is designed to maintain an adequate level of gross foreign reserves to cover imports of goods, non-factor services and ensure a realistic and stable exchange rate.

2.4.2 Monetary Policy Implementation

Monetary policy implemented in Tanzania before the mid-1990s was focused on financing large fiscal deficits, which rose from about 4.2 percent of GDP during 1970 - 1979, to 8.2 percent during 1980 - 1994 (Figure 2.3). On average, about 30 to 50 percent of the deficit was financed by external grants, with the remaining balance funded from domestic sources, particularly the banking system. This is evidenced by the share of domestic credit extended to the government, which is higher than the share of credit extended to the private sector in total. Bank financing of the deficit increased money supply from 21.0 percent in 1970 - 1979 to about 27.0 percent during 1980 - 1994. This contributed to the general inflationary pressures experienced in the economy. In Table 2.1 we note that the rate of inflation, which averaged 11.6 percent in 1970 - 1979, rose to about 30.0 percent during 1980 - 1994.

The conduct of monetary policy during the fixed exchange rate regime (prior to 1986) was supposed to support the fixed exchange rate. However, the expansionary monetary policy

contributed to the appreciation and overvaluation of the RER observed during that time, which in turn, adversely affected export performance. The growth in money supply prior to the 1980s was largely driven by the changes in credit to the private sector (Table 2.1). The political transition which led to a multi-party system, was then introduced in 1985, which significantly increased the amounts of money in the economy. This was also facilitated by policies which encouraged private enterprise and the relaxation of import restrictions. As a result, credits to government rose faster than all other sectors in 1980 – 1984 (70.46 percent of money supply). The growth of money supply, on average, reached its highest point in 1990 and fell afterwards. Net foreign assets have been above 50 percent of money supply since 2000 (Table 2.1).

Table 2.1: Composition of Money Supply (%)

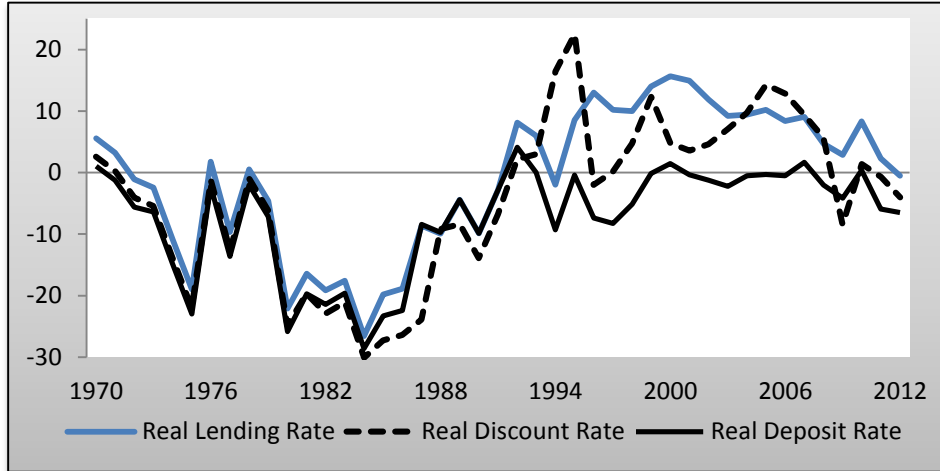
Year	Net Foreign Asset (% of M2)	Claims Government (% of M2)	Claims Private (% of M2)	Other Items (% of M2)	Total	Money Supply ($\Delta\%$)
1970 – 74	35.59	19.54	56.52	-11.66	100	18.89
1975 – 79	14.95	45.50	55.79	-16.24	100	25.84
1980 – 84	-0.92	70.46	40.16	-9.69	100	17.21
1985 – 89	-25.24	61.01	69.49	-5.26	100	32.64
1990 – 94	9.49	26.39	62.18	1.94	100	42.95
1995 – 99	38.51	29.98	22.83	8.68	100	11.37
2000 – 04	78.65	35.23	34.79	-48.67	100	20.42
2005 – 09	60.40	34.59	50.38	-45.37	100	23.76
2010	55.62	32.06	54.4	-42.09	100	24.70

Source: BOT statistics and World Development Indicators

The government, with assistance from the donor community, embarked on an ambitious stabilization and reform agenda in the mid-1990s. During this period, real interest rates rose as a result of the strict contractionary policy adopted during President Mkapa's time in 1995 (Figure 2.6). President Mkapa focused on achieving macroeconomic stability and monetary policy changed from having multiple policy objectives to the single policy objective of 'price stability' (Masawe, 2001). At the same time, increased transparency and co-ordination with donors on

macroeconomic policies and structural reforms helped mobilize financial support. This resulted in a fall of an overall deficit position to about 4.7 percent between 1996 and 2004 (Figure 2.3).

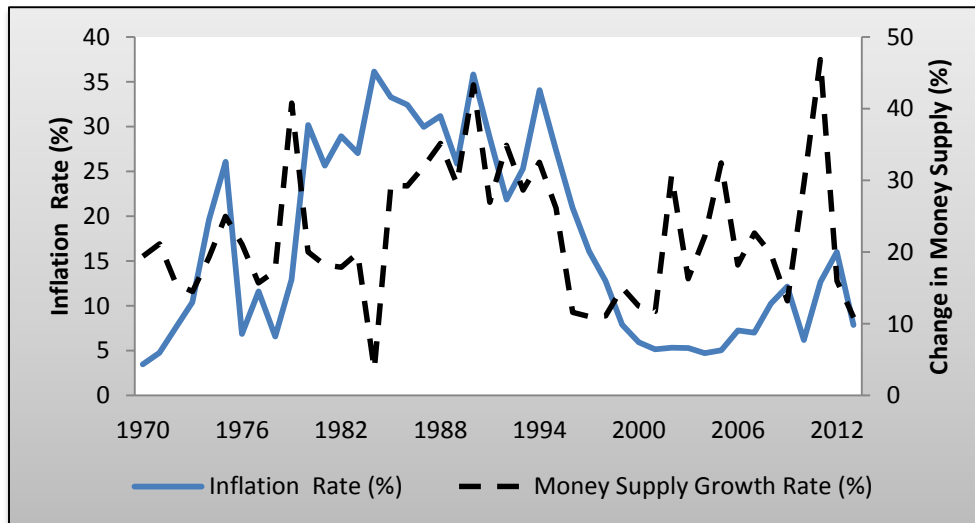
Figure 2.6: Interest Rates (Percent per Annum)



Source: BOT statistics

In line with these developments, monetary policy was promulgated with the intention of reducing the government’s domestic credit financing needs. This resulted in a fall in the growth rate of money supply and a decline in the rate of inflation (Figure 2.7).

Figure 2.7: Inflation Rate and Growth of Money Supply in Tanzania



Source: BOT statistics

As discussed earlier, the liberalization of trade and exchange controls introduced by the Interbank Foreign Exchange Market (IFEM) in the mid-1990s allowed the exchange rate to be determined freely. Monetary policy was then instituted merely to smooth fluctuations in the exchange rate to ensure stable economic growth while pursuing the BOT primary objective of price stability. These policies were implemented using foreign exchange market operations as an instrument whereby the BOT intervenes in the IFEM by selling, or purchasing foreign currencies. Foreign exchange market operations also have an impact on money supply growth, as purchases of foreign currency by the BOT resulted in an increase in money supply and a decrease in the interest rates. Sale of foreign exchange on the market by the BOT (restrictive policy) would result in a reduction of money supply and an increase in domestic interest rates. The BOT interventions in the IFEM during the period of 1995 - 2002 resulted in average net purchases of about USD 55.0 million, reflecting the BOT efforts to reduce exchange rate overvaluation and restore export competitiveness.

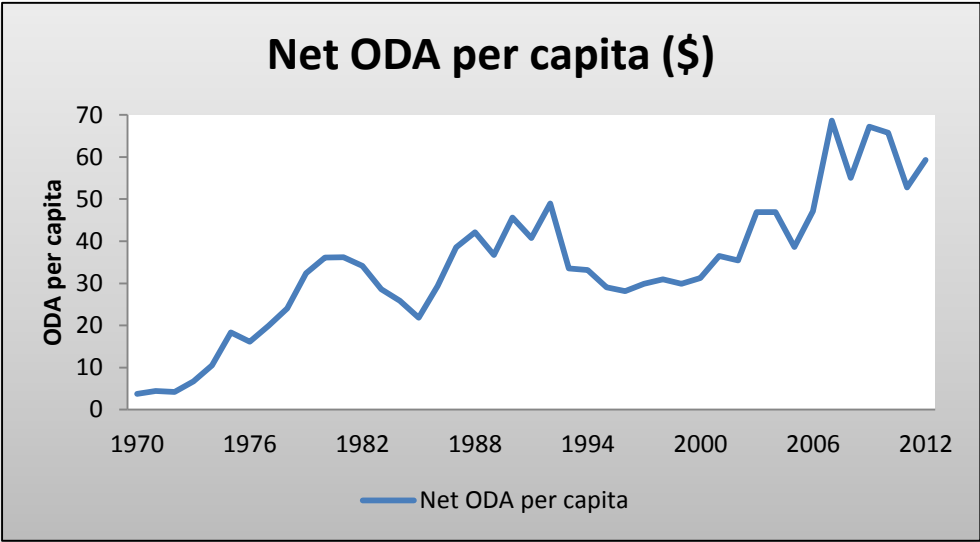
Monetary growth in Tanzania has been primarily driven by bank credit growth. This implies that the stability of the Tanzania Shilling (and therefore the confidence in it) depends on the quality of bank assets. In addition, the inflation pressure in Tanzania has been derived from both fiscal and monetary pressure. Prior to 1997 the relationship between the growth of money supply and inflation was positive, but after that period of time, the relationship has been significantly negative (Figure 2.7). Over the period of 1970 - 2010, the growth of money supply was only negative in one year, 1996 and the highest growth, was in 1994 at around 55 percent. Similarly, the highest inflation rates were in 1984 and 1990, reflecting rates of around 36 percent and 35.6 percent respectively. The rate of inflation reached its lowest level in 2005 (around 4.3 percent), but this was not accompanied by a decrease in money supply. The graph suggests that monetary expansion partly contributed to the inflation movements in Tanzania.

2.4.3 Aid Inflows and Monetary Policy Responses

In the early 1970s the aid received was targeted for development purposes. By the end of 1970s, however, this had changed because of agriculture and oil shocks. During that time foreign assistance was needed to deal with the balance of payment crisis, which affected consumption

and investment (Kiondo, 1991). This made room for the IMF to compel Tanzania to change their economic policies to encourage a free market economy and reduce government spending, in exchange for aid. Tanzania, in 1980 under President Nyerere, rejected those conditions on the grounds that the IMF was interfering in internal matters (Kiondo, 1991). By 1983, bilateral donors were the largest contributors of aid to Tanzania. West Germany, the UK and the United States sided with the IMF and stopped financial aid to Tanzania. Foreign aid declined from USD 697.78 million in 1981 to USD 477.18 million in 1985. This increased the pressure relating to the need to reform.

Figure 2.8: Trend of Foreign Aid per capita



Source: World Development Indicators

The move towards a market-based economy was followed by substantial aid inflows into Tanzania. The annual disbursements of official development assistance (ODA) per capita, which were about USD 8.8 per annum on average from 1971 to 1975, surged to USD 37.8 per annum from 1991 to 1995 (Table 2.2). This surge in aid inflows was accompanied by a rise in the growth rate of money supply from an average of 20 percent to about 43 percent; and a consequent rise in the rate of inflation from about 9 percent to about 30 percent during the same period (Figure 2.2). Concerns about inflation forced the BOT to sterilize the aid money by tightening its monetary policy through increasing the discount rate and reserve requirement (Figure 2.6). In addition, since the BOT is responsible for managing external resource inflows to

ensure that such inflows do not disrupt the macroeconomic stability of the country. It is responsible for reducing the inflationary impact of the aid money. This was achieved by sterilization of part of the aid money, so as to reduce excess money supply. However, sterilization of aid money involves difficult trade-offs. First, sterilization of the aid money through foreign exchange sales can result in RER appreciation and a loss in the country's export competitiveness. Second, sterilization of the aid money through domestic debt sales can lead to an increase in interest rates, since domestic debt markets are thin and financial assets are imperfectly substitutable.

However, during the mid-1990s, however, there was weaker commitment to economic reforms, which in turn resulted in major economic policy disagreements with most of the donors, particularly the IMF and the World Bank. During that time, the government failed to collect counterparty funds under the Commodity Import Support (CIS) programme, and the collection of tax revenue was inefficient or lacking (Kweka et al., 2005). Reacting to this, the IMF, World Bank and most bilateral donors reduced their support to Tanzania. As a consequence ODA decreased to about 13 percent of GDP between 1995 and 2000. This was turned around, however, after the successful stabilization of the economy with economic policy reforms and qualifications for highly indebted poor countries (HIPC) initiatives in the late 1990s. As a result, the aid inflows were increased, with ODA rising to about 15 percent of GDP between 2001 and 2004.

Table 2.2: Tanzania Foreign Aid Received

Year	Net ODA per capita (USD)	Net ODA (Δ in %)	Net ODA per GDP (%)	Real GDP Growth (%)	Inflation Rate (%)
1971-1975	8.83	45.37	7.29	4.47	14.02
1976-1980	25.72	19.35	12.41	2.87	14.78
1981-1985	29.33	-6.51	10.77	1.14	30.22
1986-1990	38.47	20.95	27.94	4.01	31.96
1991-1995	37.10	-4.04	30.44	2.02	27.48
1996-2000	30.03	4.16	13.71	4.25	12.76
2001-2005	40.89	8.52	12.65	7.50	4.82
2006-2010	60.76	16.95	13.58	6.88	8.78

Source: BOT statistics and World Development Indicators

The economic reforms enabled Tanzania to maintain macroeconomic stability, with real GDP growing by 6.1 percent on average during 2001 - 2004, and the inflation rate stabilizing at less than 5 percent. Given the priorities embedded in the country's Poverty Reduction Strategy Paper (PRSP), the public expenditure that was financed was biased towards non-tradable goods and was mainly focused on production for domestic consumption. This expanded money supply rapidly and created pressure for the RER to appreciate. Concerns about export competitiveness forced the BOT to react to this surge in aid, whereby they sought to sterilize the aid money by tightening monetary policy through domestic debt sales. This resulted in an increase in the Treasury bill rate, from 3.5 percent in 2002 to about 8.3 percent in 2004. However, in response to concerns about the rising interest rate in the mid-2000s (Figure 2.6), the BOT scaled back its intervention in the domestic debt market by reducing sterilization of the aid money.

In Sub-Saharan Africa (SSA), the nature of foreign aid received can be categorized into three phases. First, the development planning phase, during the 1960s and 1970s. Second, the Structural Adjustment phase during the 1980s and 1990s. Third, the post-reforms phase or "selectivity phase", during the 2000s. During the first phase, foreign aid was channelled to social services, infrastructure and technical support of the institutions. This type of aid was given regardless of economic performance. It was based only on an indicative development plan from a

recipient country (Lancaster and Wangwe, 2000). The plan was to use foreign aid to support the existing capital deficiencies that were required for the growth needed in these countries. Once economic growth rose, the foreign capital was to be abandoned. There were overflows of foreign aid and governments used these inflows to increase their spending (consumption) rather than foster growth (investment). The second phase of foreign aid sought to condition recipient governments to be accountable for how they use foreign aid, focusing on economic reforms. The emphasis on economic reforms was realised through structural adjustments, but this failed to produce the economic development intended. This was because the majority of these countries were characterized by poor institutions (bad governance and corruption). The third phase, or “selectivity phase,” emphasized the distribution of aid to those with track records of good governance. Aid was given to countries in need, who demonstrated good governance.

Prudent coordination of monetary and fiscal policies have greatly enhanced price stability since 1995, with the inflation rate declining substantially, from 28.4 percent in 1995 to 4.2 percent in 2004. At the same time real GDP grew from a rate of 4.2 percent in 1995 to 7 percent in 2004. The share of domestic credit to the private sector in total domestic credit has increased. Developments in the foreign exchange market show greater stability, both in the market and the exchange rate. This is a clear indication that the economic environment has been generally conducive for both local and foreign investors to invest in Tanzania.

2.5 Trade Policy Stance in Tanzania

Trade policies in Tanzania have been guided, in large, by socio-economic developments and political philosophy (Wangwe and Wanga, 2007). In the years immediately after independence Tanzania’s maintained fairly liberal trade policies with a mixed market economy controlled by the private sector. At that time the trade system reflected what the country received from the colonial system, whereby trade flows and relations rested on continued increased production of agricultural commodities and raw materials for export, largely in an unprocessed form. Domestic trade relations reflected the predominance of a subsistence economy in which policies and laws encouraged commercial activity based on the exportation of commodities, while discouraging the commercialization of the production of food crops. However, as the export-import trade was

dominated by foreigners and Tanzanians of Asian origin, government needed to address the political implications of these policies. As a result, co-operatives were formed to handle crop marketing in selected areas and the nationalization of various industries was instituted in 1967.

In 1967, the Arusha Declaration was introduced with a policy focusing on promoting public ownership of “commanding heights of the economy” covering production and distribution. Import trade was controlled, following the logic of inward looking state-led import substitution industrialization (ISI). Foreign trade was controlled by placing key products under the monopoly control of state trading companies. This was fairly typical of most small open African economies where large state trading companies controlled the exports and imports of key products. As the economic crisis deepened in the early 1980s with declining production, the shortage of goods became more acute. The government responded by intensifying these controls, which led to the emergence of parallel markets in the financial and goods markets, with the larger proportion of transactions taking place through unofficial channels. The policy of confinement continued up to the mid-1980s, when domestic and foreign trade were placed under public sector control and management. Direct government intervention in all operational aspects was enacted through the use of instruments such as administrative allocation of foreign exchange, price controls and rationing, import quotas, import licenses, and permits to control the internal movement of goods and services. At the same time, private exporters had to surrender most of their foreign exchange earnings to the central bank and faced a cumbersome and non-transparent system of export permits, which required exporters to obtain a license for their goods. This resulted in the worsening of the balance of payments and widening fiscal deficits. By the mid-1980s, the prevalence of controls, in a situation of increasing shortages, made it clear that there was a need to make a major policy shift.

2.5.1 Trade Policy Reforms

As a way of addressing the constraints to trade in the early-1980s, the government embarked on a number of trade policy reforms. The change in policy started with partial trade liberalization in 1984. It first targeted a few selected products, but later was extended to cover more product categories. With the adoption of the Economic Recovery Programme of 1986 - 1989, under the

Structural Adjustment Programme (SAP), the policy of trade liberalization was generalized and formalized. This new policy was characterized by the extension of the liberalization of internal, as well as foreign trade. The objective of the liberalization policy was to increase the profitability of export crops, by allowing exporters to receive a higher share of the proceeds from export sales and imported inputs.

Restrictions on exports were slowly relaxed, beginning with the introduction of the Export Retention Scheme (ERS) in 1986, which allowed traditional and non-traditional exporters to retain a certain percentage of the export earnings for purposes of importation of key inputs necessary to sustain their operations. The government also introduced the Duty Drawback Scheme (DDS) in 1988, which aimed at providing duty refunds for imported inputs used in the production of exportable goods. However, administrative bottlenecks and underfunding in the government budget limited the effectiveness of this scheme. More reforms in the exports sector were introduced in 1993/94, which included the abolition of the system of export licensing, the elimination of the requirement of registration for exporting companies, reducing the number of export items subject to permits and allowing private participation in traditional exports. To further bolster the export sector, the Export Credit Guarantee Scheme (ECGS) was established in 2002 to provide credit to notably non-traditional exports. These reforms aimed mainly at changing the "rules of the game" in the economy so as to increase the availability of foreign exchange, provide export incentives and direct more resources to productive sectors. The reforms succeeded in arresting the declining export trends of the early 1980s and improved the performance of exports. As a result, the share of exports of goods and services in GDP increased from 12.6 percent in 1990 to about 31 percent in 2011 and about 28 percent in 2013.

Because imports of capital and intermediate goods are critical inputs in the production of exports, reforms were also introduced on the import side. The Own Funds facility was introduced in 1984, under which import licenses were provided freely to importers who used their own foreign exchange holdings to pay for specific imports. The Open-General License (OGL) facility was introduced in February 1988, replacing the quantitative import restrictions. Under the OGL facility a number of goods could be imported without administrative allocation of foreign

exchange. The list of goods to be imported, using this facility, was later expanded to incorporate a large variety of items. At the beginning of July 1993 further import liberalization measures were undertaken towards a regime free of quantitative restrictions. The OGL list of excluded items was shortened to the goods that the government wished to control for health, security and preservation purposes. In 1996, Tanzania continued with liberalization measures by adopting Article VIII of the IMF, which requires liberalization of all current account transactions. This was followed by a partial liberalization of capital/financial accounts which allowed foreigners to participate in direct investment activities within the country.

The reforms also encompassed the tariff system, effectively simplifying the tariff schedules. Prior to the implementation of these reforms in June 1988, the tariff system contained 20 different rates with a maximum tariff of 200 percent. The reforms trimmed Tanzania's tariff structure to one with a narrow tariff range from 0 to 60 percent in 1991, with the tariff rates for intermediate and capital goods set at 0 percent. These reforms were reversed somewhat in 1993, when tariffs were raised to counter the shortfall in revenues (arising from excessive tariff exemptions and the setting of all goods to zero tariff rates, except for consumer goods). Thereafter, more concerted efforts were made to simplify the tariff system. The tariffs were reduced from seven tariff bands to four tariff bands (0, 10, 15 and 25 percent) and the maximum tariff rate reduced to 25 percent. Capital goods and unprocessed material imports enjoyed zero import duty, semi-processed inputs enjoyed 10 percent duty, and fully processed inputs were subjected to 15 percent duty, while most finished goods were subjected to the maximum duty of 25 percent.

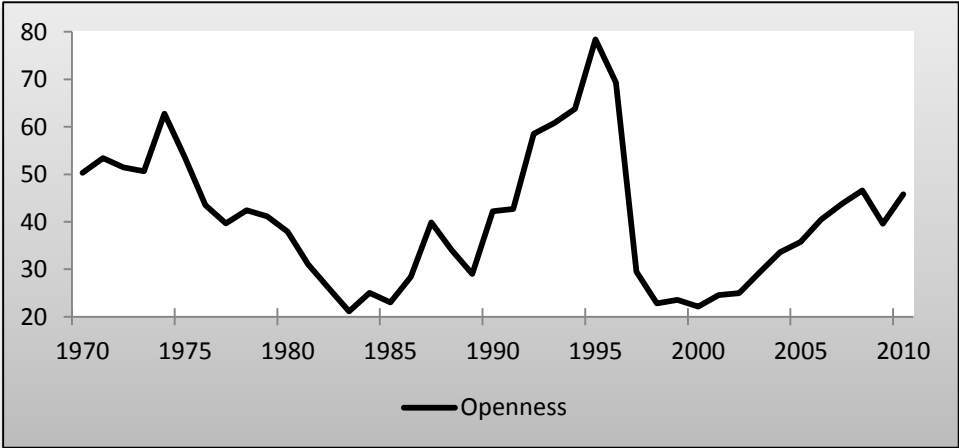
The tariff system was changed again in January 2005 when Tanzania, together with Kenya and Uganda, joined the customs union of the East African Community (EAC) that led to the adoption of the Common External Tariff (CET). The previous 4-band escalatory tariff structure of 0, 10, 15 and 25 percent was replaced by a 3-band escalatory tariff structure of 0, 10 and 25 percent (on raw materials, capital goods, meritorious goods such as medical, pharmaceutical and educational supplies, intermediate goods and finished goods).

The data indicate a clear relationship between the shift in the trade and exchange rate policies that have been adopted and the degree of Tanzania’s economic openness. The measure of trade openness the study employs is also referred to as trade intensity. The study uses this measure because it is commonly used, it allows easy country comparisons and the data needed is readily available. Critiques of this measure focus on the fact that the measure does not take into account the actual trade policy. This measure of trade openness is presented as (Edwards, 1993 and 1998; Frankel and Romer, 1999):-

$$\text{Trade openness} = \frac{\text{Exports} + \text{Imports}}{\text{GDP}} \times 100$$

As shown in Figure 2.9, the trade openness index was largely declining during the 1970s and early 1980s, which correlates directly with the restrictive trade and exchange control policies implemented during that time. The exchange rate and trade liberalization measures pursued since the mid-1980s exposed Tanzania to the international arena by opening up the economy to external trade. This is reflected by the rise in the trade openness index between 1985 and 1995 (see Figure 2.9).

Figure 2.9: Tanzania Trade Openness Index



Source: BOT statistics

2.5.2 Structure and Composition of Exports and Imports

Most Sub-Saharan African countries export primary goods and import capital and processed goods and services. Therefore, the share of imports in GDP is always higher than that of exports. For example, in Eritrea, Ethiopia, Mozambique, Tanzania and Uganda, the share of imports in GDP was double that of exports from 1990 to 1994 (Table 2.3). For the period of 1990 to 2010, all the countries that have been listed above imported more than they exported (Table 2.3). This implies that they have generated trade deficits over this period.

Table 2.3: Exports and Imports of goods and services (% of GDP)

Year	Congo (DRC)		Eritrea		Ethiopia		Kenya	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
1990-1994	20.7	21.0	23.1	70.6	5.2	10.9	31.0	30.9
1995-1999	25.9	26.4	18.6	79.6	11.3	19.5	24.3	31.7
2000-2004	17.3	18.0	8.2	61.7	13.1	26.9	24.0	31.6
2005-2010	28.3	34.2	6.8	27.2	13.1	33.3	26.9	38.4
Year	Malawi		Mozambique		Tanzania		Uganda	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
1990-1994	23.2	39.8	11.7	42.0	14.8	40.4	7.9	21.2
1995-1999	27.1	39.0	13.8	30.7	17.0	29.4	11.8	21.8
2000-2004	25.2	38.5	25.4	42.7	17.2	22.0	11.5	23.8
2005-2010	26.2	45.4	32.8	46.1	24.0	36.5	19.2	30.5

Source: World Development Indicators

Tanzania's exports are predominantly traditional commodities, including coffee, cotton, tea, sisal, cashew nuts, tobacco and cloves. This makes the export sector more vulnerable to fluctuations in world prices. The non-traditional commodities are mainly minerals, petroleum products and manufactured goods. The share of traditional exports in total exports has been declining while that of non-traditional exports has been rising since 1980s. Traditional exports accounted for 65.2 percent of total exports in 1980, but by 2004 these had declined to 41 percent. Over the same period there was a rise in non-traditional exports from an average of 35.0 percent in 1980 - 1985 to 59.0 percent between 1996 and 2004. The divergence in performance between these two categories of exports in the last few years has resulted in a significant shift in the composition of Tanzanian exports (Masenya, 2008).

The progress made in diversifying Tanzania's exports and reducing vulnerability to external shocks contributed to the fall in the share of traditional exports in total exports, particularly coffee and cotton, which were the two leading traditional commodities in the 1980s and 1990s. The impressive rise in non-traditional exports has largely been due to one export commodity, which is gold. Tanzania currently is Africa's fourth largest producer of gold and it is suggested that 70 percent of the recovery in non-traditional exports since 1998 was due to gold exports. This rose from nil in the first half of the 1990s to being the single largest export in 2004, making up nearly 47 percent of all exports. Aside from gold, fish products have also emerged as significant export items that have contributed to the recovery of non-traditional exports, their share of total exports rising from about 7.5 percent of total exports in 1997 to 12.9 percent in 2002.

Tanzania's trading partners have slightly shifted over time (Table 2.4), with the European Union as the major destination of Tanzania's exports, followed by Africa. Exports to the European Union (EU) were above 35 percent of its total exports from 1970 to 2004. The African continent has accounted for over 13 percent of total exports since 1990, with Kenya and South Africa as the largest recipients of Tanzanian exports. Since 1990, India and Japan have been the primary recipients of exports from Asia, averaging just above 8 percent and 5 percent of the export share, respectively.

Table 2.4: Tanzania's Exports (%) by Area of Destination

Exports to	1980-84	1985 - 89	1990-94	1995 - 99	2000 - 04	2005 -09
Japan	4.36	4.75	6.26	7.47	7.85	5.39
United Arab Emirates	0.05	0.02	1.39	1.35	2.11	4.74
Singapore	2.30	5.11	2.60	2.22	0.78	0.44
South Africa	0.00	0.00	0.60	1.27	1.91	2.66
Kenya	0.34	0.67	2.31	3.71	3.50	2.13
India	3.62	3.71	9.92	13.96	10.03	8.47
China	0.81	0.19	0.40	0.94	1.63	9.02
Hong Kong	3.92	2.42	2.07	1.63	1.37	1.09
European Union	52.31	64.08	41.66	36.80	45.03	24.69
Africa	11.88	4.05	13.35	15.38	15.55	19.40

Source: Direction of Trade Statistics

Tanzania's exports to the EU consist mainly of raw materials from agriculture and mining. In 2007, 90.6 percent of its exports to EU were primary products, consisting of 87.3 percent agricultural and 3.3 percent mining products. However by 2011 this figure had increased to 93.1 percent, consisting of 69.8 percent agricultural and 23.3 percent mining products. Traditionally, a number of factors, relating to the nature of exports and policy changes, have promoted Tanzania's exports to the EU. Firstly, Tanzania took advantage of the EU's invitation to sign the ACP-EU development co-operation, based on the need to promote economic development in Africa, the Caribbean and the Pacific. Secondly, Tanzania's exports to the EU do not compete directly with goods that are produced by the EU; and thirdly, the EU represents the primary market for Tanzania's natural wealth, particularly of the country's minerals.

Despite Europe's dominance as an importer of Tanzania's goods, Tanzania has made progress in diversifying its export markets. Since the 1990s there has been a substantial increase in the share of exports to African and other developing countries. The regional economic integration groups, which include the East African Community (EAC) and Southern African Development Community (SADC), have contributed to this increase in integration and trade. Tanzania, together with, Kenya and Uganda, joined the customs union of the EAC and adopted the Common External Tariff (CET). The country also participates in the SADC Free Trade Area agreement of 2008.

Table 2.5: Tanzania's Imports (%) by Area of Destination

Imports from	1980-84	1985-89	1990- 94	1995- 99	2000-04	2005- 09
Japan	10.00	11.37	7.70	7.38	6.39	3.38
United Arab Emirates	1.81	0.51	3.47	4.25	5.04	5.59
Singapore	0.82	1.63	2.02	1.78	0.44	1.03
South Africa	0.00	0.00	1.15	8.82	11.35	9.11
Kenya	1.02	2.83	5.46	9.24	6.71	7.44
India	2.30	1.19	4.20	6.41	6.01	10.91
China	1.46	0.66	3.85	3.36	5.83	11.97
Hong Kong	0.53	1.26	1.88	0.90	0.45	0.55
European Union	49.41	54.51	40.45	26.64	21.20	19.26
Africa	4.56	4.15	9.42	21.37	22.68	19.69

Source: Direction of Trade Statistics

Import data from various destinations to Tanzania are listed in Table 2.5. Initially, Tanzania imported more Japanese made products until these imports were overtaken by Kenyan and South African products in 1995. Since 2005, however, China and India have increased their share of Tanzanian import trade. European Union's imports were the bulk of all foreign imports until the turn of the 21st century, at which time imports from the whole of Africa began to make up an equal number. The most distinctive changes in Tanzania's trading partners have been the decline in the importance of EU in the second half of 2000s and the rising importance of China, India, the United Arab Emirates, and other African states. Given these changes that have taken place over time, it would be of interest to investigate the role of the exchange rate in the changes to the foreign trade patterns in Tanzania.

2.5.3 Export Competitiveness

The global economy has been transformed in recent years following the fall of international barriers to the flow of goods, services, capital and labour, as well as a marked acceleration in the pace of technological and scientific progress. In this new globalized economic climate, export attractiveness is becoming increasingly important. For a developing country like Tanzania, exports are vital, as they to secure much needed foreign exchange to meet international payments, which simultaneously promotes economic growth and development. However, the long run survival of exports is dependent upon its ability to compete with exports of similar products from other countries in the international market. Thus, improving export performance requires an enhanced external competitiveness.

Export competitiveness can be defined as the ability of an exporter to sell its products in external markets, essentially measuring the country's competitive position in the export market. According to Wangwe (1995), export or external competitiveness is influenced by three factors which are the macroeconomic environment, the ability to use and develop technology (which can reduce costs, improve product quality and generate new products) and the ability to market products successfully. The macroeconomic environment and the ability of the country to use and develop technology can affect the cost of production, the product quality and the reliability in the consistent supply. The ability to market products depends on the cost of production and quality

of the goods that are produced. Progress in these aspects is not measured in terms of a onetime success, but its sustainability over time.

Export competitiveness can also be influenced by such factors as international costs or price competitiveness, determined by the relationship between the cost and price of goods in various institutions (Golub, 2000). Factors specific to individual countries (e.g. infrastructure, institutions, taxes, financing,) also have an influence on export performance since they can affect production costs. This implies that the country's export competitiveness increases if it can consistently supply low cost and high quality exports to the international market.

2.5.3.1 Price Competitiveness and Export Performance

The real exchange rate (RER) index is an indicator of price competitiveness. This is the bilateral nominal exchange rate adjusted for the relative price levels of foreign and domestic economy. It is an important factor that will also influence export performance. There are also other indicators such as relative export prices, expectations of future market and real effective exchange rates that could be used to gauge price competitiveness. The bilateral real exchange rate has been widely used because of its availability, and as a result it has been used extensively in the remainder of this investigation.

2.5.3.2 Non-Price Competitiveness

Export flows are increasingly affected by the globalization of production and rapid technological advances. At the same time, on the demand side, consumers are becoming increasingly more discerning with regard to quality. In this regard, non-price aspects of competitiveness such as infrastructure, institutions, macro-economic stability, education and health, among others, can have very important effects, which may undermine the ground gained by maintaining a competitive RER.

When analysing the non-price competitiveness in Tanzania, use is made of the Global Competitive Index (GCI) developed by the World Economic Forum. This index is based on many factors of competitiveness such as: institutions, infrastructure, macroeconomic indicators,

health and primary education, higher education and training, market efficiency, technological readiness, business sophistication and innovation. In this case, there is a need to cover these factors, highlighting comparisons with Kenya, Uganda, Burundi and Rwanda, four of Tanzania's partner members of the EAC. The rationale for choosing these countries is that they have similar types of exports, mostly composed of primary commodities with coffee, tea, cotton and fish comprising of the bulk of these exports. In addition, it would be worthwhile to see how competitive Tanzania is among the EAC countries before making any comparisons with countries that have different economic structures.

According to the Global Competitiveness Report of 2014 - 2015 released by the World Economic Forum, Tanzania climbed four (4) places in the global competitiveness ranking in 2014. The rest of the EAC countries have also improved in their rankings. Tanzania currently ranks 121 among 144 countries included in this report. Neighbouring Rwanda, Kenya, Uganda, and Burundi were ranked 62, 90, 122, and 139, respectively. In 2013, Tanzania was ranked 125, while Kenya was ranked 96 and Uganda 129. Scores varied for individual competitiveness indicators. Tanzania performed better than Kenya, Uganda and Burundi in the area of health and primary education. Tanzania's rankings in terms of infrastructure, goods market efficiency, financial market efficiency, technological readiness, business sophistication and innovations, were poorer than all these countries, except Burundi (Table 2.6).

Table 2.6: Competitiveness Index Rankings of EAC Countries

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Global Competitiveness Index	139	90	62	121	122
Institutions	132	78	18	93	115
Infrastructure	140	96	105	130	129
Macro economy	112	126	79	109	96
Health and Primary Education	114	120	86	108	122
Higher Education and Training	142	95	122	134	129
Goods Market Efficiency	135	62	42	122	119
Financial Market Efficiency	142	24	55	96	81
Technological readiness	142	87	98	131	119
Business Sophistication	139	44	84	112	109
Innovation	133	38	53	98	96

Source: The Global Competitiveness Report 2014 - 2015

2.6 Fiscal Policy Stance in Tanzania

Since 1970, the budget balance of Tanzania has been in deficit (Figure 2.3). Financing of this deficit was done mainly by borrowing from the domestic banking system, which contributed to the growth of money supply and, ultimately, to inflation. The large deficit recorded over the period of 1979 - 1984 was mainly due to the overvaluation of the currency and restrictive economic measures. To combat this, the government, with assistance from the donor community, embarked on an ambitious stabilization and reform plan in the mid-1980s. In the fiscal area, efforts were focused on strengthening fiscal management via broad-based policy and administrative reforms. This led to an improvement in the fiscal performance by the end of the 1980s, but this did not last long.

Most of the deficits in developing countries are financed through the expansionary monetary policy. Despite its inflationary impact, it appreciates the RER via the effect on interest rates. This is because expansionary policies increase consumption and lower saving rates. As the saving rate is decreased, the exchange rate appreciates, and as a result the current account deficit increases.

In the literature, this is referred to as the “Twin - Deficit problem”, where we observe a large government budget deficit along with a similar current account deficit (Chinn, 2005).

2.7 Concluding Remarks

This chapter contains a discussion relating to the exchange rate and trade policies that were implemented in Tanzania. It started by indicating that the exchange rate and trade policies implemented prior to the mid-1980s were restrictive and supported by exchange controls and trade restrictions. These restrictive trade and exchange rate policies were primarily responsible for the RER overvaluations and the rise in the black market premium observed during that period. The adoption of economic reforms under the structural adjustment programmes, which started in the second half of the 1980s, emphasized the lifting of exchange controls and the removal of trade restrictions, which introduced flexibility in the exchange rate and opened up the economy to the external world. These reforms resulted in the reduction of the overvaluation in the RER, as the availability of foreign exchange increased. In addition, export incentives increased over this period, as more resources were directed to productive sectors. The reforms also attracted large amounts of aid inflows. This rise in monetary aid placed upward pressure on domestic inflation and eroded external competitiveness as a result of an increase in the external value of the currency. The Bank of Tanzania responded to this by sterilizing the aid money with the aid of tight monetary policy measures. The non-price competitiveness factors, such as infrastructure, institutions and technological readiness, indicate that many more improvements are required if Tanzania wants to make its business sector more competitive, since poor performance in these indicators may undermine the ground gained by maintaining a competitive RER. The next chapter discusses the use of foreign currency, that is, dollarization, in relation to the rate of inflation and the exchange rate movements.

Chapter Three

3 Dollarization in Low Income Countries: Tanzania

3.1 Background

Dollarization refers to the frequent use of foreign currency by domestic residents to store wealth or to utilize as a means of payment. It can be official dollarization which is the total substitution of the domestic currency, official semi-dollarization which is the use of both domestic and foreign currencies interchangeably as legal tender, and unofficial dollarization which is the use of foreign currency when local currency is the only legal tender (Meyer, 2000). The latter is practised in Tanzania and many other African countries, also known as de-facto dollarization. The Tanzanian Shilling is the only legal tender in Tanzania. However, the United States Dollar is widely used as a medium of exchange and store of value in metropolitan areas.

This increasing use of foreign currency in Tanzania can be traced back a few decades to an influx of international offices to the country, for example the United Nation offices, and the arrival of international schools. Additionally, it could also have resulted from a loss of confidence in the Tanzanian Shilling (TZS) or unbridled growth of the underground economic sector (Honig, 2009; Feige, 2003). Unsustainable monetary and fiscal policies led to the continued erosion of the value of the local currency and, as a result, people shifted into other assets, notably foreign currency (dollarization). Baliño et al. (1999) categorize two types of de-facto dollarized economies: Highly dollarized economies, where foreign currency deposits are above 30 percent, and moderately dollarized economies, where foreign currency deposits are less than 30 percent of the broad money supply (M2). Tanzania is in the highly dollarized economy category, as, since 2000 the ratio of foreign currency deposits to broad money is above 30 percent. Dollarization in Tanzania has two main features. Firstly, the degree of dollarization moves opposite to the inflation rate but parallel to the exchange rate. Secondly, there is a parallel movement in the degree of dollarization and the exchange rate. The former suggests the possibility of dollarization hysteresis. This is the increasing use of foreign currency after a period of high inflation even after inflation is reduced (Tellería, 2006). High use of foreign currencies

lower the demand for domestic currency and this leads to exchange rate depreciation. The depreciation reduces the purchasing power of the domestic currency, and therefore encourages further dollarization.

Dollarization is also viewed as the outcome of competition among currencies such as local legal tender where foreign currencies compete in the absence of restrictions (Schaub, 2009). In an inflationary environment foreign currency is often used as a protection mechanism against loss of purchasing power when transacting. This increases the availability of loans from commercial banks because foreign currency deposits are recognized, though there is a possibility of creating a currency mismatch if exchange rate risk is not properly accounted for by commercial banks and foreign account owners in their balance sheets (De Nicoló et al., 2005). The balance sheet of a bank describes the bank's financial position. This includes fixed assets, loans to customers, securities for sale, and loans to other banks on the assets side. It also includes customer deposits, and other trade liabilities on the liabilities side. As noted by various scholars (Meyer, 2000; Arteta, 2002; De Nicoló et al., 2005), dollarization creates a currency mismatch in the balance sheets of banks, if they are receiving dollar deposits but not issuing dollar loans. This currency mismatch is due to the immediate impact of exchange rate depreciation on foreign-currency denominated liabilities (Alvarez-Plata and García-Herrero, 2008). For example, a sudden real devaluation when bank liabilities are sometimes in Dollars and at other times in Shillings encourages depositors to immediately transform their Shilling deposits into dollars, and this leads to a currency mismatch between assets and liabilities. Banks are left with the only option of selling assets and buying the foreign reserves of the central bank, to hedge this risk, thus undermining the currency board (Roubini, 2001). The real devaluation shocks and sudden shift of depositors' currency preferences in dollarized economies creates financial distress in the banking system (Roubini, 2001).

Currency mismatch has happened in several economies, including Argentina (2002), Brazil (1999), Turkey (2000) and Uruguay (2002). (Cowan et al., 2005; Levy-Yeyati, 2006). In Tanzania customers can have foreign currencies account for their deposits but cannot get loans in foreign currencies. If deposits and loans are not expressed in a particular currency they may

perhaps not balance if there is a real exchange shock. This can happen even when banks are formally foreign currency hedged. That is, when they have equal foreign currency assets and foreign currency liabilities, for example, in Argentina (Roubini, 2001). An imbalance of assets and liabilities can cause financial instability, which may give rise to a banking crisis (García-Herrero, 1997). A banking crisis refers to a situation where banks have lent out most of their cash deposits and customers therefore cannot retrieve their deposits.

3.1.1 An overview of De jure and De Facto Dollarization

Different types of dollarization, such as payment dollarization, financial dollarization and real dollarization have been identified, based on the three functions of money in the economy (De Nicoló et al., 2005). Payment dollarization, also known as currency substitution, refers to residents' use of foreign currency as a medium of exchange (Ize and Levy-Yeyati, 2003; Levy-Yeyati, 2006; De Nicoló et al., 2005). Financial dollarization, also known as asset substitution, is when residents hold their financial assets or liabilities in foreign currency. This is determined by the risks of and returns on assets held in domestic and foreign currency, where foreign currency is used as a store of value (Feige and Dean, 2002). Real dollarization refers to a situation when local prices and wages are indexed in foreign currencies (De Nicoló et al., 2005). In Tanzania all three types of dollarization are practised.

De jure dollarization refers to a case in which the foreign currency is used as legal tender and the country abandons domestic currency. This is also known as official dollarization. In some cases, de jure dollarization is the parallel use of foreign currency and domestic currency. The central bank of a country that has abandoned domestic currency loses its monetary power and sovereignty in formulating monetary policy (Salvatore, 2001). Panama dollarized their economy in 1904 while Ecuador and El Salvador officially adopted full dollarization in 2001, and Guatemala did so in May 2001 (Dean, 2001). In Zimbabwe, by the mid-2000s, most goods and services were valued in either the South African rand or the US dollar because the Zimbabwean dollar lost almost 99.9% of its value between 2007 and 2008 (Makochekanwa, 2009). Domestic residents decided to hold foreign currency in cash without depositing it into their domestic banks, as it was hard for residents to withdraw foreign currency. In January 2009, Zimbabwe

adopted full dollarization and abandoned its currency. The current situation in Zimbabwe is that it has adopted multiple currency systems, with nine foreign currencies accepted as legal tender. Individuals and corporations can open bank accounts in any of these currencies. These currencies are the Botswana Pula, British Pound Sterling, Euro, South African Rand, United States Dollar, Australian Dollar, Chinese Yuan, Indian Rupee and Japanese Yen (Nkomazana and Niyimbanira, 2014).

Unofficial (de facto) dollarization is defined as the use of a foreign currency alongside the domestic currency. In this situation, foreign currency is not an official tender according to the country's financial or monetary regulation (Mengesha and Holmes, 2011). De facto dollarization can be categorized into two main types, as explained previously, which are currency substitution and asset substitution. Most people in Tanzania use foreign currency for transaction purposes, that is, there is currency substitution (Kessy, 2011 and Ngowi, 2011). There is extensive use of the US dollar in metropolitan areas like Arusha and Dar es Salaam. The use of the US dollar is for both major and minor transactions. The most common dollar payments are for electronic equipment such as computers, televisions, and mobile phones. Airline tickets and school fees are also paid in dollars. It is also common for social events to be planned and budgeted for in US dollars. In addition, people pledge in US dollars and landlords demand rent in US dollars. Hotel rooms are also charged in US dollars and most retail outlets accept US dollars.

Domestic residents prefer holding interest rate bearing financial assets for the purpose of protecting themselves against domestic inflation (Kessy, 2011; Levy-Yeyati, 2006). However, holding foreign currency as part of their asset portfolio enables them to earn an equivalent return as holding an interest bearing asset. In addition, a foreign currency-denominated asset gives the opportunity of insuring against macroeconomic risks such as high inflation rates, prolonged depressions and currency depreciation and fluctuations. The bureau de change and commercial banks are allowed to trade in currency exchange. However, many bureaus de change do not keep records of their transactions. This put the country in a situation of speculating the amount of foreign currency in the economy as the only accurate data they have is from commercial banks while many people trade with bureau de change. Bureaus de Change in Tanzania attracts many

customers as some of them do not require customers to provide their identification cards to transact. Schaub (2009) draws attention to poor institutions as contributing factors in the process of dollarization. In Tanzania, for example, many complaints have been registered regarding how individuals are forced to do domestic transactions in foreign currencies. There is no evidence that anything has been done about this. ²

3.2 Practices Concerning Dollarization

As mentioned previously, the first practise of dollarization is “currency substitution,” in which residents replace the local currency with foreign currency to function as a medium of exchange. This practise is based on the two economic principles. The first is that uncovered interest rate parity holds, meaning that the difference in interest rates between two countries is equal to the expected change in exchange rates between the countries’ currencies. Secondly, the practise assumes the Fisher hypothesis that the real rate of interest is constant, while the nominal interest rate moves with inflation. Using the uncovered interest rate parity and Fisher equation we have the following equations of i :

$$i - i^* = \Delta S_t^e \quad \text{and} \quad i = r + \pi^e$$

Where i is the domestic nominal interest rate, i^* is the foreign nominal interest rate, ΔS_t^e is the expected change in bilateral exchange rate (calculated as the change in the exchange rate) and r is the domestic real interest rate, and π^e is the expected domestic inflation. A change in the exchange rate causes interest rates (foreign or domestic) to change for the uncovered interest parity condition to hold. Furthermore, change in inflation causes the nominal interest rate to change for the Fisher equation to hold. The change in interest rates determines the decision to shift between domestic currency and foreign currency. These two principles show that the decision to use foreign currency is affected by the nominal exchange rate and the expected rate of inflation. The relationship is negative, thus, the higher the expected inflation rate the lower the

²<http://www.theeastafrikan.co.ke/business/Tanzania-business-people-protest-increasing-dollarization/-/2560/2490714/-/dljfdp/-/index.html>

demand for domestic currency. In addition, the more the exchange rate depreciates the lower the demand will be for domestic currency. The expected inflation and depreciation rates of exchange are causes of currency substitution (Ozsoz et al., 2008; Thomas, 1985).

The study below examines the two principles using data from Tanzania and the United States in an empirical exercise. This is because, the US dollar is the foreign currency mainly used in Tanzania. We note here that the relationship between inflation and foreign currency deposits is negative, while the exchange rate and foreign currency deposits are positively related. The coefficient of correlation between inflation and foreign currency deposits is - 0.21, while the coefficient for the relationship between the exchange rate and foreign currency deposits is 0.95. The results suggest that, the decision to use foreign currency is mainly driven by the depreciation of the Tanzania Shilling.

We then test whether the uncovered interest rate parity and Fisher equation hold in Tanzania. In this case the following OLS regression is used to test for the uncovered interest rate parity condition,

$$\Delta s_{t+k} = \beta_0 + \beta_1(i_t - i_t^*) + \varepsilon_{t+k}$$

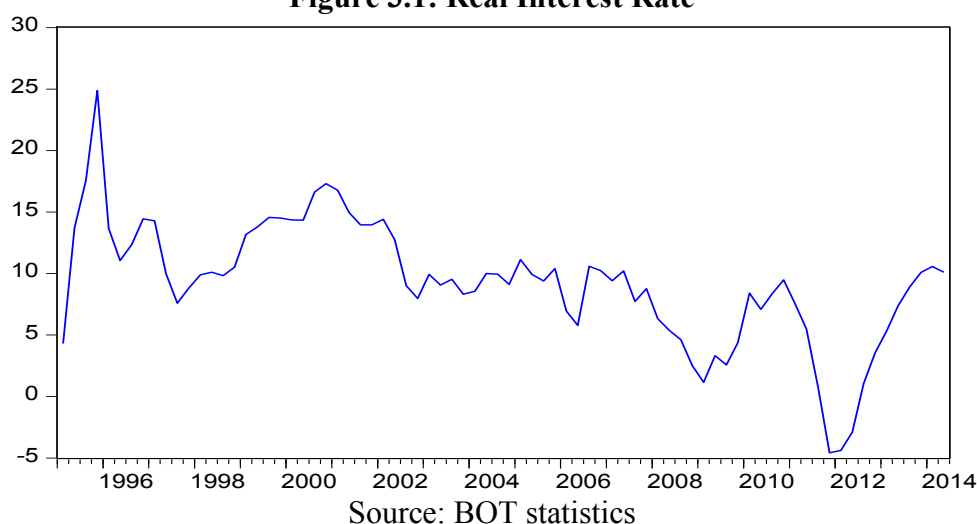
The results $\Delta s_{t+k} = 0.015 - (i_t - i_t^*)$. The β_0 and β_1 in this regression model are not significant, (full results are presented in appendix A). We then proceed to test that the uncovered interest rate parity condition holds, where we measure the difference in interest rates between the two countries, which should be equal to the change in exchange rates between the two countries' currencies. The Wald test results of the joint hypothesis are that $\beta_0 = 0, \beta_1 = 1$ when $P(> Chi^2) = 0.00$. In this case the joint null hypothesis of uncovered interest parity condition is rejected. The uncovered interest parity does not hold in Tanzania. This is possibly a result of not using the rational expectations assumption about exchange rate depreciation (Aggarwal, 2013).

The Fisher hypothesis is tested using the following OLS regression,

$$i_t = \beta_0 + \beta_1\pi_{t-1} + \varepsilon_t, \text{ for the hypothesis to hold it must be that } \beta_1 = 1$$

We use lag on past inflation rates to proxy for inflationary expectations like many other studies (Cooray, 2002). The results are $i_t = 10.44 + 0.86^{***}\pi_{t-1}$ (full results are presented in appendix A). For the Fisher hypothesis to hold, the real interest rate would need to be constant, and the nominal interest rate should move with the inflation rate. The real interest rate is not constant (Figure 3.1). The coefficient of inflation in the OLS regression is positive but less than one, the Wald test results for $\beta_1 = 1$ is $P(> Chi^2) = 0.0837$. Therefore we fail to reject the null hypothesis at the 1% significance level, and this suggests that the Fisher hypothesis partially holds.

Figure 3.1: Real Interest Rate



The uncovered interest parity condition does not hold in the case of Tanzania and the United States. The Fisher hypothesis partially holds, and this indicates that monetary policy has an effect on real interest rates. The study uses the inflation rate and not the expected inflation rate. The aim is to investigate the relationship between inflation and interest rate, and the relationship between the interest rate differential and the exchange rate.

The second practise of dollarization is “asset substitution”. This practice uses the minimum variance portfolio (MVP) approach to estimate the scope for dollarization of assets and liabilities (financial dollarization) as a function of macroeconomic uncertainty, like the volatility of inflation and the exchange rate (Ize and Levy-Yeyati, 2003). This practise emphasizes expected

real returns of interest-bearing assets, considering dollarization as a problem of portfolio choice, that is, between interest bearing bank deposits in foreign currency and local currency. A rational investor would invest in a portfolio with the least amount of risk, which would take the form of an efficient portfolio with minimum variance (Ize and Levy-Yeyati, 2003).

The utility function used to describe this investor behaviour is the quadratic utility function, twice differentiable with positive first derivative and negative second derivative (Collins and Gbur, 1991). The study uses mean variance analysis to explain the practise of asset substitution in line with Ize and Levy-Yeyati (2003). In this case, the mean-variance analysis is optimal under the assumption of quadratic utility. Domestic depositors (also referred to as investors) have a domestic portfolio of two assets, home currency deposits and foreign currency deposits. Ize and Levy-Yeyati (2003) assume that investors are risk averse and maximize their asset portfolio according to the following mean-variance utility function:

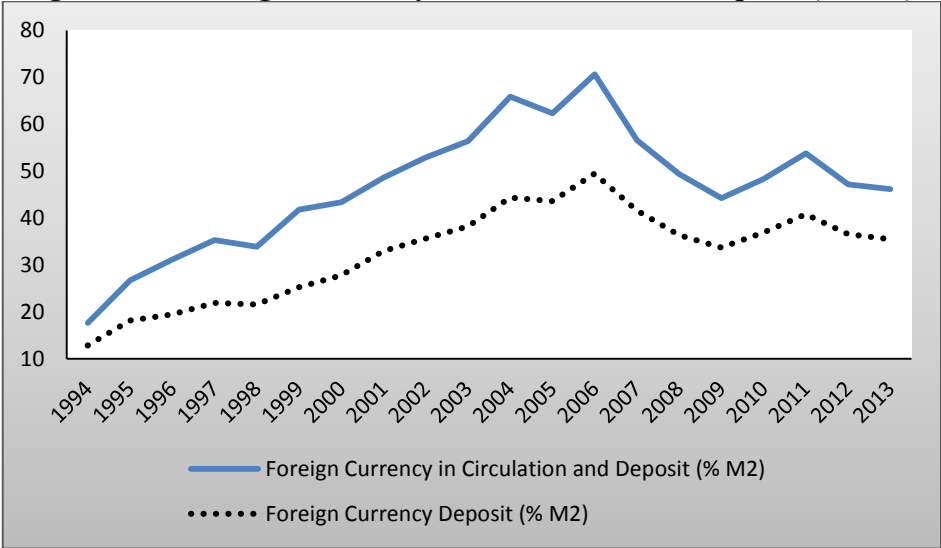
$$U = E(r) - Var(r)/2$$

where r is the average real return of the portfolio of assets in domestic and foreign currency. The function is increasing in $E(r)$ and strictly concave, which would describe risk aversion. To maximize utility U one would either maximize $E(r)$ for a given $Var(r)$, or minimize $Var(r)$ for a given $E(r)$. Variance is a measure of volatility. From the above equation investors' utility is minimized by low variance (volatility) and maximized by high returns. The mean-variance criterion is merged with the expected utility approach through quadratic utility function. Domestic inflation rates affect the real return on local currency-denominated assets while unexpected changes in the exchange rate affect the real rate of return on foreign denominated assets. High volatility of inflation would then increase the risk associated with local currency-denominated assets, whereas high exchange rate volatility increases the risk associated with foreign currency-denominated assets. The investor would weigh up the volatility before choosing the assets with the least amount of associated risk (for a given level of return). Even in a situation of a low inflation rate, it is possible to see high use of foreign currencies, if the volatility of inflation is higher than that of the exchange rate (Ize and Levy-Yeyati, 2003). The higher the

volatility of inflation, the higher the risk of holding domestic currencies. Therefore, the volatility of inflation and exchange rates determines which currency composition the investor will choose.

The practise of currency substitution attributes dollarization to inflation and the depreciation of the exchange rate. The practise of asset substitution attributes dollarization to the high volatility of domestic inflation. It is possible for asset substitution to continue, or even increase, while currency substitution is on the decline. Asset substitution in a developing country like Tanzania is simply foreign currency deposits while currency substitution results in foreign currency in circulation. Note that Tanzania is a cash based economy, where there is more money in circulation than in banks.

Figure 3.2 : Foreign Currency in Circulation and Deposit (% M2)



Source: BOT statistics

Whether dollarization takes the form of payment or financial dollarization, the use of foreign money makes the demand for domestic money more volatile (Baliño et al., 1999). As explained above, the shift between domestic money and foreign money depends on interest rates, inflation and exchange rates. As these three determinants vary, the demand for domestic money varies too. This makes the demand for money more sensitive to the variation in exchange rate as well as monetary policy when the economy is de-facto dollarized (Levy-Yeyati, 2006). Dollarization

can weaken the effectiveness of monetary policy transmission, as the fluctuation of interest rates might change the type of currency individuals hold, instead of changing money supply.

3.2.1 Dollarization, Exchange Rate and Monetary Policy

In a flexible exchange rate regime, currency substitution should increase exchange rate volatility (Alvarez-Plata and García-Herrero, 2008). This is because currency substitution makes the exchange rate more responsive to expected changes in domestic money supply, as well as other factors that affect the money market. The study by Calvo and Vegh (1992 and 1996) finds strong positive correlation between currency substitution and exchange rate volatility in developing countries. The extent of currency substitution is not known in Tanzania as there is no data for foreign currency in circulation. Therefore, this study has also sought to estimate foreign currency in circulation. The ratio of foreign currency in circulation to foreign currency deposits is taken as equivalent to the ratio of domestic currency in circulation to domestic currency deposits (Figure 3.2). The total foreign currency such as deposits plus currency in circulation (ratio to M2) is then used to calculate its correlation with exchange rate volatility. There is a positive correlation of 0.92 between dollarization and exchange rate volatility. The volatility of the exchange rate together with the instability of the money demand (shift between foreign and domestic currency) makes banks, firms and households vulnerable to currency risk or exchange rate risk in times of expansionary monetary policy (Havrylyshyn and Beddies, 2003). This risk is unpredictable gains and losses as an investor is exposed to the full extent of fluctuations in the exchange rate. When an investor is involved in a business across borders, a change in the exchange rate could change the value of the investment. This is known as currency risk or exchange rate risk.

Alvarez-Plata and García-Herrero (2008) also draw conclusions on the relationship between dollarization and monetary policy. Most notably, they have recognised that partial dollarization makes monetary policy more complicated and less effective. For example, when foreign currency is being used for transactions (currency substitution), the volatility of money demand increases. Tanzanian data shows that the degree of correlation between dollarization and change in money demand for M2 is positive at 0.98. This is because it costs less to switch between domestic and foreign currency holdings to escape the effect of inflation. In this situation, the

efforts of monetary authorities to control money supply are limited by the element of money supply that is denominated in foreign currency which follows individual “agents” behaviours. Regarding dollarization in the form of asset substitution, the demand for foreign currency as a store of value responds to monetary expansion or to a change in the exchange rate (Alvarez-Plata and García-Herrero, 2008). This makes inflation responses to monetary shocks stronger in countries which use foreign currencies. For this reason, there is room for monetary policy to work, because as prices are more responsive to monetary shocks, the decline in growth of money has more severe consequences (Levy-Yeyati, 2004 and 2006).

One might argue that these outcomes are only a concern in times of expansionary monetary policy. To determine whether dollarization will impede the effectiveness of a contractionary monetary policy, consider the case where contractionary monetary policy encourages liability dollarization. In this case the monetary policy may be less effective. Since liability dollarization occurs when bank deposits and lending are mainly denominated by foreign currency (Barajas and Morales, 2002; Catão and Terrones, 2000; Ize and Levy-Yeyati, 1998). There are two ways whereby contractionary monetary policy leads to liability dollarization. First, if domestic interest rates are higher than the interest rate on foreign currency then individuals tend to shift to dollar loans. Second, since domestic currency appreciates with a rise in domestic interest rates, the debt payment on dollar loans becomes cheaper. This reduces domestic credit and may weaken the credit channel.

The discussion of how dollarization affects the transmission mechanisms reported above, answers the question of why some channels are more effective than others. Generally, dollarization reduces the effectiveness of credit, balance sheet, and interest rate channels, while the exchange rate channel becomes more effective. Openness, remittance and availability of external funds for loans give individuals more opportunity to finance their consumption, as well as their investment. As a result, even if there is a change in domestic monetary policy, the response might be slow, which makes the interest rate and lending channels less effective. The presence of currency mismatch in dollarized economies challenges banks to cope with their debt

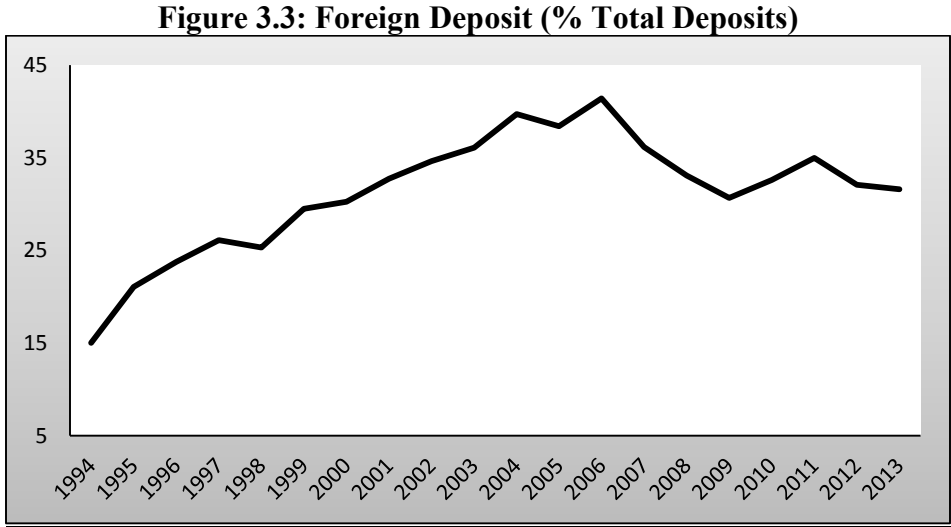
payment, and this affects the availability of credit and therefore the lending channel. The balance sheet channel is also affected if there are defaults.

Dollarization is likely to impact on the effectiveness of monetary policy and the exchange rate pass-through (Baliño et al., 1999). In fact, it could hamper the conduct of monetary policy in as far as it increases the pass through of the exchange rate to prices and requires larger monetary aggregates to be monitored. Monetary aggregates include foreign currency, and the central bank has no control over this currency. For instance, the interest rate channel takes into account domestic interest rates, which have fewer effects on loans issued in foreign currency (Ize and Levy-Yeyati, 2003). On the other hand, exchange rate pass-through increases with the spread of real dollarization (Schaub, 2009; Reinhart et al., 2003). This implies that a higher degree of price responsiveness will result, following a change in the exchange rate, as the price of properties and services are indexed in foreign currency. As has been explained by asset substitution practises, the use of foreign currency is characterized by higher volatility of the domestic inflation rate. The characteristics of interest and exchange rate channels in a de facto dollarized economy weaken and challenge the implementation of monetary policy. The volatility of the exchange rate and the instability of money demand make individual's finances less sensitive to changes in the domestic interest rate. The interest rate, therefore, becomes less effective in the presence of dollarization.

3.3 Evidence of Dollarization in Tanzania

In Tanzania, commercial banks were authorised to open foreign currency deposit accounts for both residents and non-residents in 1992. Foreign currency deposits as a percentage of total deposits have increased over time, and reached a peak in 2006 (Figure 2.1). Bureau de Change markets were introduced in 1993 to liberalize the foreign exchange regime. However, the Tanzanian Shilling remained the country's only legal tender. Nevertheless, individuals and companies were allowed to quote their prices in dollars and receive payments in either TZS or USD, based on customer preferences. These have been costly to customers, owing to the exchange rate set by sellers, which is normally above the market rate. The consequence of this has been an increase in foreign currency accounts among individuals. It is common for parents

with children in private schools, to have to pay fees directly into their schools' account in dollars (Kessy, 2011). Other industries accepting dollars in Tanzania include the real estate and tourism sectors.

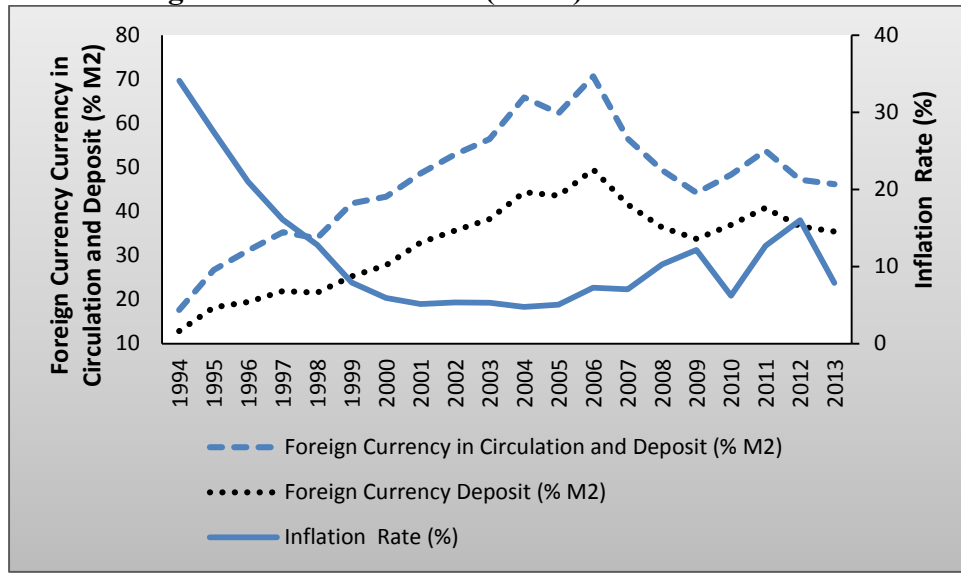


Source: BOT statistics

Because of the unavailability of data on foreign currency in circulation, analysts have used foreign currency deposits as an indicator of the extent of dollarization in the country. Foreign currency deposits, according to the Central Bank of Tanzania, are the difference of extended broad money supply (M3) and broad money supply (M2). Foreign currency deposits in Tanzania are supposed to facilitate transactions and are not meant to act as a store of value (Kessy, 2011). From 2000 to 2009 around 60 percent of foreign currency deposits were demand deposits (Kessy, 2011).

The standard measure of dollarization is the ratio of foreign currency deposits to broad money supply. Although this is the most widely accepted measure, it may underestimate the problem in this case, since Tanzania is a cash-based economy. The ratio of foreign currency deposits to broad money supply was above 30 percent during the 2000s. The highest recorded ratio occurred in 2006 and was above 49 percent. This happened after inflation had fallen to its lowest rate in 2005 of 4.4 percent.

Figure 3.4: Dollarization (%M2) and Inflation Rate



Source: BOT statistics

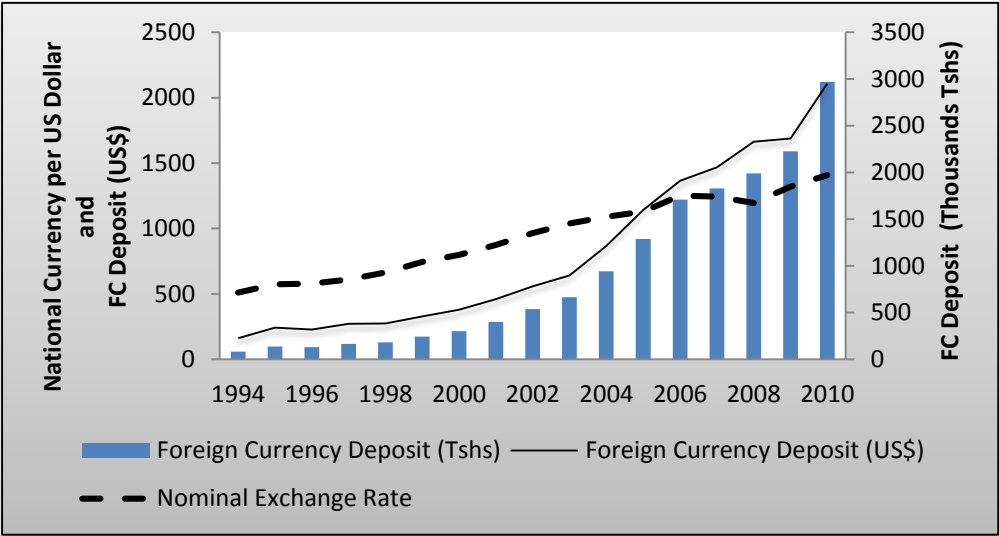
Dollarization in Tanzania is moving in the opposite direction as the inflation rate, and the degree of correlation is negative at 0.8. The relationship between dollarization and exchange rate is positive, and the degree of correlation is 0.6. The study checked for Granger causality as correlation does not imply that the relationship is one of causation. There is one way causality, showing inflation granger causes dollarization (Table 3.1). This means that inflation rate does forecast the future degree of dollarization. However, the degree of dollarization does not forecast the rate of inflation.

Table 3.1: Pairwise Granger Causality Test, 1994 - 2013

Null Hypothesis:	Obs	F-Statistic	Prob.
INFLATION does not Granger Cause DOL	19	3.91863	0.0652
DOL does not Granger Cause INFLATION		0.53518	0.4750
XRATE does not Granger Cause DOL	19	0.56900	0.4616
DOL does not Granger Cause XRATE		0.14981	0.7038
XRATE does not Granger Cause INFLATION	19	0.69248	0.4176
INFLATION does not Granger Cause XRATE		1.13445	0.3026

Exchange rate does not cause the degree of dollarization, and vice versa holds. This is similar to the empirical results of currency substitution practise, which indicate that the use of foreign country in Tanzania is driven by the change in inflation and not change in exchange rates. The movements of foreign currency deposits can be explained either by the direct effects on exchange rate movements, or by the expectations of indirect agents about the future exchange rate. Furthermore, because deposits can either be local or foreign denominated, if there is a decrease in the domestic real interest rate, local deposits will decrease and foreign currency deposits will increase.

Figure 3.5: Foreign Currency Deposits (TZS and USD) and Nominal Exchange Rate



Source: BOT statistics

As noted above, dollarization in Tanzania is moving in the opposite direction to inflation. This indicates the possibility that efforts to lower inflation are not hindered by the use of foreign currency, or that the use of foreign currency was not driven by high inflation. A study on the effectiveness of monetary policy (control of inflation), given dollarization, in a number of developing countries, found the same results (Reinhart et al., 2003). Researchers concluded that using foreign currency does not harm domestic monetary policy and its efforts to combat inflation. Others have arrived at the same conclusion (Havrylyshyn and Beddies, 2003; Mongardini and Mueller, 2000; Savastano, 1996; Mueller, 1994). Similarly the Tanzanian Government, does not seem to see the current level of dollarization as a threat to the economy.

Adam Malima, the Minister of Finance, recently stated that “...the use of foreign currency in the economy enables banks to provide loans to foreign investors, hence improves the growth of the economy” (2014). In a similar vein, the Governor of the Bank of Tanzania, Professor Benno Ndulu, explains that “...the reason for using the foreign currency is to simplify business transactions with foreigners” (2014).

3.4 The Effect of De Facto Dollarization in Developing Economies

A 2003 study on 85 developing countries shows that even when there are long periods of low inflation rates the degree of dollarization is persistent, and did not seem to impede monetary policies, (Reinhart et al., 2003). Therefore, dollarization neither altered the monetary transmission mechanism, nor did it hinder efforts to lower inflation. The periods of high dollarization are associated with high exchange rate pass-through. The high pass-through makes prices erratic, and this limits the effectiveness of exchange rate policies, and countries will manage their exchange rates through “fear of floating” (Reinhart et al., 2003). Another observation is dollarization makes exchange rates more volatile (Havrylyshyn and Beedies, 2003). That is, there is a strong positive correlation between currency substitution and exchange rate volatility (Calvo and Vegh, 1992 and 1996). This correlation makes exchange rates more responsive to expected changes in domestic money supply and other factors that affect the money market. This creates a currency mismatch if the exchange rate risk is not properly accounted for by commercial banks and foreign account owners (De Nicoló et al., 2005). Tanzanian banks issue loans in foreign currency. Therefore, it is reasonable to expect that there will be little or no problems regarding currency mismatch. Dollarization eliminates exchange rate risks and provides greater economic and financial integration. This comes with the loss of seignuriage, and the loss of the ability of the central bank to act as ‘lender of last resort’. This implies that the central bank will be inadequate in its attempt to support commercial banks with financial help. As the country makes more use foreign currency the central bank will have diminishing control over the cash in circulation and deposit.

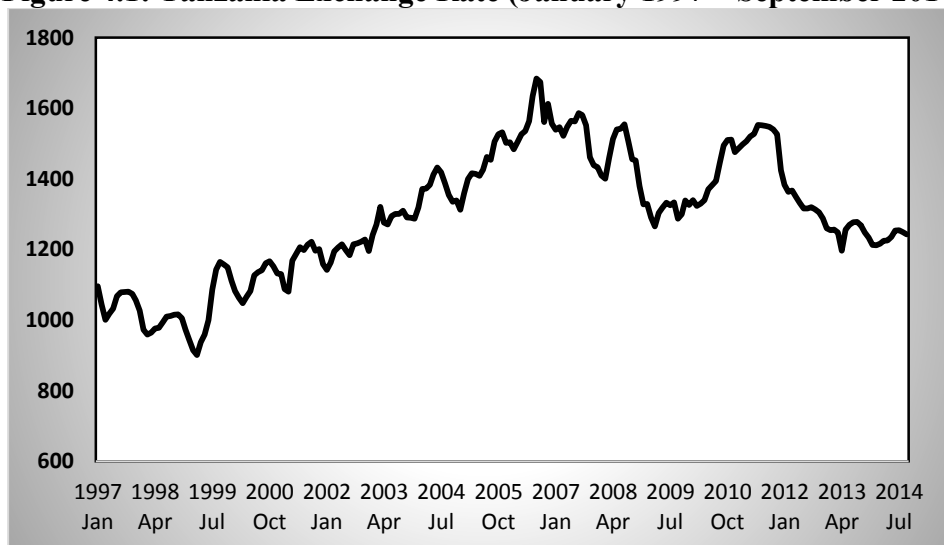
Chapter Four

4 The Probability of Exchange Rate Overshooting

4.1 Introduction

The mandate for monetary policy in Tanzania was amended in 1995 from one that sought to achieve multiple policies to one that focused on the single policy objective of price stability. This is to be achieved within a flexible exchange rate system after the fixed regime was abandoned in 1986. When considering the rate of Tanzanian inflation, we note that the problem of high inflation was evident in both fixed and flexible regimes (Rutasitara, 2004). This high rate of inflation and the volatility in the exchange rate has endangered the stability of Tanzania's domestic financial sector (Tanzania Investment Report, 2012). As noted in Figure 4.1, the exchange rate between Tanzanian Shillings (TZS) and the United States Dollar (USD) has been relatively volatile.

Figure 4.1: Tanzania Exchange Rate (January 1997 – September 2014)



Source: BOT statistics

One way of seeking to describe this volatility in the exchange rate is with the aid of overshooting model, which seeks to explain the volatility of the exchange rate as the outcome of the sluggish

behaviour of prices. This occurs when the exchange rate temporarily overreacts to the monetary policy shock and thus deviates from its equilibrium value (Dornbusch, 1976). This short-run process causes the exchange rate to be volatile as it overshoots on successive periods (Pierdzioch, 2004). In addition, the consequences of the volatility in the exchange rate is that it hinders economic growth, through its negative impact on current accounts and various economic decision-making processes. It also has a negative effect on real wages, savings, and investment patterns of economic agents. As has been noted in central bank publications, the volatility of the exchange rate in Tanzania year 2011/12, contributed to a decline in savings, investments and the increase in the deficit in the current account (BOT, 2011). Furthermore, the volatility of the exchange rate encourages individuals to store their wealth in foreign currencies (Mizen and Pentecost, 1996). For example, Tanzanian data shows a high degree of correlation between foreign currency deposits and the volatility of the exchange rate. The degree of correlation is 0.97.

It is the aim of this chapter to investigate the exchange rate behaviour in the partially dollarized economy of Tanzania, with the aid of an empirical model that examines the overshooting hypothesis, using the Tanzanian Shilling - United States Dollar exchange rate. The study also seeks to identify the determinants of the exchange rate.

4.2 Literature Review

4.2.1 Empirical Studies on the Determinants of Exchange Rate

Empirical studies on the determinants of RER include those involving cross-sectional and panel data analysis and country-by-country analysis, and have included both developed and developing countries. This section gives a brief review of some of these studies with a view to unveiling the available evidence on RER determinants. The main determinants are terms of trade, productivity differentials (Balassa-Samuelson hypothesis), macroeconomic policy, parallel market premium, the degree of openness, foreign aid and net foreign assets.

Some studies find that an improvement in the terms of trade appreciate the real exchange rate in the long run for groups of developing countries (Edwards, 1989; Elbadawi, 1998; Elbadawi and

Soto, 2005), Cote d'Ivoire and Burkina Faso (Baffes et al., 1997), Kenya (Mwega and Ndung'u, 1997). Others find that a worsening of the terms of trade depreciate the real exchange rate, for example in Tanzania (Muganyizi, 2004) and Zambia (Mkenda, 2001). The impact of the terms of trade on RER is larger in African economies than in other regions. Some find that productivity differentials, also referred as technological progress, appreciate the real exchange rate (Elbadawi, 1998; Baffes et al., 1997; Mkenda, 2001; Elbadawi and Soto, 2005). Others find that technological progress depreciates the RER, contradicting the Balassa-Samuelson hypothesis (Edwards, 1989). Technological progress is the main fundamental of RER in the long run and their impact is more pronounced in developing economies, particularly in Sub-Saharan Africa. Increases in the parallel market premium, an expansionary macroeconomic policy and tighter import restrictions have been shown to appreciate the real exchange rate in Tanzania (Rutasitara, 1996 and Nyoni, 1998). An increase in the degree of openness depreciates the real exchange rate (Elbadawi, 1998; Baffes et al., 1997; Mkenda, 2001; Muganyizi, 2004; Elbadawi and Soto, 2005). The degree of openness has no significant impact on the Kenyan real exchange rate, implying that the country has been a reluctant reformer (Mwega and Ndung'u, 1997). In the short run, an inconsistent expansive monetary policy goes together with exchange rate appreciation.

The findings for Zambia indicate that an improvement in the terms of trade and an increase in government consumption expenditure depreciates the RER for imports. They show, however, that an increase in investment share of GDP appreciates the RER for imports. The findings also indicate that an improvement in the terms of trade depreciates the RER for exports, while an increase in central bank reserves and trade taxes appreciates the RER for exports in the long run. The internal RER depreciates if there is an improvement in trade, but appreciates if there is an increase in investment share of GDP and an increase in the real GDP growth rate. In the short run, however, aid and openness depreciate the RER indices. These results tally with Tanzanian studies on the determinants of the exchange rate (Rutasitara, 1996; Nyoni, 1998; Muganyizi, 2004). Zambia shares a border with Tanzania and uses a Tanzania harbor, as it is landlocked, and therefore we expect border similarities between the two countries.

The fundamentals that determine the exchange rate are categorized as long run determinants when all variables are flexible and short run determinants when prices are sticky. The long run determinants are terms of trade, capital flows, tariff barriers on imports, public expenditure, productivity differentials and ratio of investment to GDP (Edwards, 1989). Excess supply of domestic credit and nominal exchange rate changes are the nominal, or monetary, factors affecting RER in the short run. Elbadawi (1998) extends the developing countries' model of RER developed by Edwards (1989) and applied by Elbadawi (1994) and Elbadawi and Soto (1997a, b). He does this by incorporating in addition to the traditional current account fundamentals of RER (terms of trade, ratio of government consumption to GDP, trade policy and productivity), official development assistance (ODA) which he considers to be a very important current account fundamental of RER determination in low-income developing countries. Apart from the current account fundamentals, he includes three stock variables relevant for determination of capital account equilibrium. These are ratio of change in international reserves to GNP, ratio of net foreign capital inflows to GNP, and ratio of net foreign income to GNP.

Elbadawi (1998) also incorporates two short run determinants of RER, which are the nominal exchange rate devaluation and an indicator of macroeconomic (monetary) policy, defined as the ratio of change in domestic credit to initial stock of broad money supply. The model emphasizes the interplay of long run fundamentals of current account balance and determinants of longer term propensity for accumulation (or de-accumulation) of net foreign assets. When a country achieves a higher sustainable level of net foreign income in the long run, the RER of that country will converge to a more appreciated level. However, in the medium to long run (when the stock of net foreign assets is less than the desired level), that country may have to depreciate its RER (run a current account surplus, which is the counterpart to accumulating reserves) in order to raise the value of its assets to the desired level. The required size of RER depreciation may be improved by the extent of sustainable levels of private capital flows or foreign aid, both of which support a more appreciated path of long run RER if they can be sustained.

4.2.2 Empirical Studies on Tanzania

There is a dearth of studies on exchange rate overshooting on the Tanzanian foreign exchange market. However, there are studies that have analyzed the determinants of the exchange rate in Tanzania.

Rutasitara (1996) examines the relationship between export performance and real exchange rate behaviour in Tanzania. First, the study analyzes real exchange rate behaviour in Tanzania with the view to identify the impact of determinants of the real exchange rate. Using the ordinary least square (OLS) technique the study finds that an increase in the parallel market premium and an expansionary macroeconomic policy tend to appreciate the real exchange rate. The findings also indicate that a less restrictive trade regime tends to depreciate the real exchange rate. Second, the study investigates the direct impact of real exchange rate uncertainty and the indirect influence of real exchange rate determinants on the performance of exports (agricultural and manufactured exports). The study uses the model-based approach and the real exchange rate uncertainty was measured as squared deviations of the actual real exchange rate around the entire period mean. Using a bivariate cointegration technique, Rutasitara (1996) also finds that depreciation of the real exchange rate positively affects all categories of exports. The findings also show that an increase in real exchange rate uncertainty has a negative impact on exports. The findings also indicate that agricultural exports are less responsive to real exchange rate changes and real exchange rate uncertainty than manufactured exports. With regard to real exchange rate determinants, the findings reveal that expansionary macroeconomic policy, tighter import restriction policies and the parallel market premium negatively affect exports performance.

Nyoni (1998) investigates the impact of foreign aid inflows on real exchange rate in Tanzania. The findings indicate that in the long-run, an increase in government consumption tends to appreciate the real exchange rate. An increase in the openness of the economy was found to be associated with depreciation of the real exchange rate, consistent with the theory of real exchange rate determination. However, contrary to the theory of real exchange rate, the findings

indicate that an increase in foreign aid inflows tends to be associated with real exchange rate depreciation in the long-run.

Muganyizi (2004) analyzes real exchange rate behaviour in Tanzania with the aim of identifying the determinants of the real exchange rate. The study finds that in the long-run, an improvement in terms of trade, an increase in the degree of openness of the economy, reforms, and a rise in debt serving depreciate the RER. The study also shows that the most important determinants of RER in the short-run are reserves, devaluation of the nominal exchange rate, terms of trade, openness, debt serving, and macroeconomic policy.

These studies investigate the determinants of exchange rate in Tanzania but not the overshooting hypothesis. This chapter focuses on the short-run analysis with the intention of examining empirically the Dornbusch overshooting analysis, using Tanzanian data.

4.3 Theoretical Framework

Monetary policy shocks play a major role in the volatility behaviour of exchange rates (Faust and Rogers, 2003). The monetarist's explanations for the determinants of the exchange rate focus on price index behaviour. For example, purchasing power parity (PPP) assumes prices are flexible and the overshooting hypothesis assumes sticky prices. MacDonald (1995) and Rogoff (1996) provide evidence which indicates that purchasing power parity (PPP) is not an appropriate model for the determination of exchange rates because of the slow mean reversion of RER to a constant. These characteristics, the speed of exchange rate convergence to purchasing power parity and the large fluctuation of exchange rates, are difficult to bring together (Rogoff, 1996). This calls for departure from purchasing power parities as there are large fluctuations (volatility) in the real exchange rate (Frenkel, 1981).

The overshooting model explains the volatility of exchange rates, and the model assumes the fixed domestic nominal prices, and the short-run situation (Dornbusch, 1976 and Mussa, 1976). The overshooting occurs because while price is sticky in goods and labour market, in the foreign exchange market prices adjust instantaneously (Nieh and Wang, 2005). The different speeds of

adjustment across markets create excessive movements in exchange rates. Monetary policy shocks, such as a decrease in the money supply, increase interest rates and cause capital inflows and as a result exchange rates appreciate.

The following observations are made to construct the model: The economy is small, open, and with a flexible exchange rate regime such that it takes world prices and interest rate as given. This characterizes our case study, Tanzania, which is open but still small compared to its trading partners. The exchange rate overshooting research used data from the three types of markets, which are asset market, money market, and goods market (Dornbusch, 1976). The asset market assumes uncovered interest parity which implies equivalent returns on similar assets. The overshooting model assumes that the uncovered interest parity holds at all times. There is perfect capital mobility, such as funds or portfolio flows from one currency to another whenever the domestic interest rates i is different from the sum of foreign interest rates i^* and the expected exchange rate x :

$$i = i^* + x \quad 4.1$$

To attract foreign capital, interest rates in Tanzania must be equal to foreign interest rates plus the future expected change in the exchange rate. This is uncovered interest rate parity which implies that domestic interest rates positively correlate with the expected exchange rate. Exchange rate (x) is the domestic currency per foreign currency, and expected sign is positive. If the exchange rate is expected to depreciate, domestic interest rates must be higher than foreign rates to compensate foreigners for the capital loss which they will incur as a result. The opposite is true. In the money market domestic interest rate is the one that equates the demand for real money balances and real money supply. The demand for real money is a function of domestic interest rate and real income. In the goods market, the demand for domestic output is a function of relative price of domestic goods, interest rate and real income. A decrease in prices, reduction in interest rates, and increase in real income raises the demand for domestic output. All markets do not clear as the prices in the goods markets are sticky. Then, a rise in the money supply overshoots the exchange rate, as the exchange rate depreciates above its equilibrium value. The

exchange rate moves a lot to compensate for the fact that prices do not change. Gradually the price increase and exchange rate appreciate. If prices were not sticky the economy would move immediately to its long run position, with higher prices.

The following model explains how exchange rates can overshoot or undershoot. We assume a situation in which the domestic money supply increases unexpectedly. The immediate effect is the fall of domestic interest rates (i). Since foreign investors anticipate that prices will eventually rise, they also know that the currency will depreciate. Because of the expected depreciation, investors will demand a higher interest rate than before in order to continue holding the domestic currency. However domestic interest rates are falling, not rising. What will now happen is something of a speculative run on the currency as investors start selling. As a result the currency will depreciate to below its long-term equilibrium from where it may well be expected to appreciate again. Now investors will be prepared to hold the currency as the expected appreciation will offset their lower interest returns. What has happened is that the currency is said to undershoot its equilibrium level. In a reverse situation, for example, after a tightening of monetary policy, the currency can overshoot its long-term equilibrium level.

The relationship between these three (interest rates, inflation and exchange rates) is derived from the relationship between domestic real interest rates (r) and foreign real interest rates (r^*), which we assume are equal

$$r = r^*$$

The only difference between the nominal interest rates (i) is the expected inflation (π^e), the asterisk stands for foreign, $i - \pi^e = i^* - \pi^{e*}$, $i - i^* = \pi^e - \pi^{e*}$. From the interest parity equation $i - i^* = x$, we have:

$$i - i^* = \pi^e - \pi^{e*} = x \tag{4.2}$$

From (4.2), real interest rates are equalized between countries when nominal interest rates incorporate differences in inflationary expectations. Inflationary expectations determine the

expected future exchange rate. This means that inflationary expectations and the expected future exchange rate are determined simultaneously. A monetary policy that affects inflationary expectations and interest rates also affects exchange rates. This model suggests two things: The volatility of the exchange rate is the outcome of its overshooting, and the exchange rate will appreciate at the same time as prices are rising. The latter relationship is supported by uncovered interest parity, while the relationship between exchange rate and prices is not supported by monetary policy. Exchange rate overshooting focuses on the short-run response of the exchange rate to a shock which exceeds its long-run response. We build our empirical analysis base on this relationship.

4.4 Empirical Estimation Model

The study uses the Structural Vector Autoregression (SVAR) to test if the overshooting hypothesis holds for the TZS-USD exchange rate. This chapter adopts SVAR methodology as used by Bjørnland (2009) in re-examining Dornbusch's overshooting hypothesis. The overshooting model assumes perfect capital mobility; this does not apply in Tanzania's case. With perfect capital mobility, an increase in money supply push the domestic interest rate down, which lead to capital outflows, then a sharp depreciation of the nominal exchange rate. Without perfect capital mobility, the movement of exchange rate is expected to be weak in response to change in interest rates.

We define the moving average $Z_t = B(L)v_t$ where Z_t is a (5×1) vector macroeconomic variables and v_t is a (5×1) vector of reduced form residuals assumed to be identically and independently distributed. The underlying orthogonal structural disturbances (ε_t) are assumed to be $v_t = S\varepsilon_t$, linear combinations of the innovations. The VAR is then a substitution of the orthogonal structural disturbances into the moving average function written in terms of the structural shocks as $Z_t = C(L)\varepsilon_t$ where $B(L)S = C(L)$.

The order of structural shocks is $\varepsilon_t = [\varepsilon_t^{i^*}, \varepsilon_t^y, \varepsilon_t^\pi, \varepsilon_t^i, \varepsilon_t^e]$ where $\varepsilon_t^{i^*}$ the foreign interest rate shocks, ε_t^y is the output shocks, ε_t^π is the inflation shocks, ε_t^i is the Tanzanian interest rate shock (monetary policy shock) and ε_t^e is the exchange rate shock. To derive the structural interpretation of this VAR we apply the following restrictions. Tanzania is a small open economy therefore foreign interest rates will only be affected by exogenous foreign monetary policies. Macroeconomic variables adjust with a lag to monetary policy shocks. Monetary policy reacts immediately to the shock on the macroeconomic variables. The exchange rate reacts immediately to all shocks. This is because price is rigid in the short run which is a core message of the overshooting hypothesis. The model is presented as:

$$\begin{bmatrix} i^* \\ y \\ \pi \\ i \\ e \end{bmatrix}_t = B(L) \begin{bmatrix} S_{11} & 0 & 0 & 0 & 0 \\ S_{21} & S_{22} & 0 & 0 & 0 \\ S_{31} & S_{32} & S_{33} & 0 & 0 \\ S_{41} & S_{42} & S_{43} & S_{44} & S_{45} \\ S_{51} & S_{52} & S_{53} & S_{54} & S_{55} \end{bmatrix} \begin{bmatrix} \varepsilon^{i^*} \\ \varepsilon^y \\ \varepsilon^\pi \\ \varepsilon^i \\ \varepsilon^e \end{bmatrix}_t$$

For the robustness of this structural model we compare this result with those of the standard Cholesky model (Bjørnland, 2009).

The empirical estimation of the determinants of the exchange rate is derived from the surveyed literature on the factors that have been found to affect exchange rates. These include: degree of openness; government consumption expenditure; productivity differentials; real interest rate differentials; net foreign assets; monetary policy, and exchange rate policy. The impact of these fundamentals on the exchange rate is explained below:-

- Commercial policy (degree of openness) affects the exchange rate. A more restricted trade regime is likely to be associated with an appreciated RER. Trade restrictions (for instance, an increase in import tariffs or import quota) increase the domestic price of imports, which are part of tradable goods. This leads to a fall in demand for importable goods and shifts demand towards non-tradable goods, assuming perfect substitutability.

Therefore, the price of non-tradable goods will rise beyond that of tradable goods, leading to an appreciation of the RER (Edwards, 1989; Edwards and Ostry, 1990).

- The effect of government consumption expenditure on RER is theoretically ambiguous because it depends on whether such expenditure is predominantly on tradable or non-tradable goods. An increase in government spending on non-tradable goods will increase demand for non-tradable goods. To restore equilibrium in the non-tradable goods market, the price of non-tradable goods must rise. The increase in price of non-tradable goods will appreciate the exchange rate (Edwards, 1989; Montiel, 1999; De Gregorio et al., 1994). In contrast, an increase in government spending on tradable goods creates a trade deficit, which requires the exchange rate to depreciate in order to maintain external balance.
- Productivity differentials between tradable and non-tradable goods sectors is another important determinant of the exchange rate. This is known as the Balassa-Samuelson effect, introduced by Balassa (1964) and Samuelson (1964). According to this effect, labour productivity in the tradable sector grows faster than in the non-tradable sector. These differences in labour productivity may arise as countries develop, open up to international trade or catch up with technology used in more advanced countries. An increase in labour productivity growth in the tradable goods sector relative to the non-tradable sector within a country, for instance, on account of technological change, will lead to a rise in wages in that sector that is not accompanied by an increase in the prices of tradable goods, since tradable good prices are fixed by international prices. Due to the ‘law of one wage’ that is assumed, wages in the non-tradable goods sector will also rise. This will increase costs and, hence, prices in the latter sector, which will in turn cause the prices of tradable (relative to those of non-tradable goods) to fall, leading to an appreciation of the exchange rate. The Balassa-Samuelson effect is also explained by the relative labour productivity differential across countries. Higher labour productivity growth in a country relative to its main trading partners will lead to an increase in demand for labour in the tradable sector in that country, since wages are higher in that sector. This will cause the non-tradable goods sector to release labour to the tradable

goods sector. At a given RER, the tradable goods sector will expand while the non-tradable goods sector will contract. The supply of non-tradable goods accordingly will decrease and result in excess demand for non-tradable goods. With the consequent rise in the relative price of non-tradable goods, exchange rates will appreciate.

- A decrease in the country's real interest rate relative to those of its main trading partners, causes capital outflows which depreciate the country's exchange rate.
- An increase in net foreign assets appreciates the exchange rate in the long run. Higher net foreign assets induce an increase in expenditure on domestic goods, which in turn raises the price of non-tradable goods (MacDonald and Ricci, 2004).
- Monetary policy also affects the exchange rate, but only in the short run. The expansionary monetary policy under a flexible exchange rate lowers interest rates, boosts domestic demand for non-tradable goods, and increases prices. It thus appreciates the exchange rate (Edwards, 1989; Elbadawi, 1998). Under a fixed exchange rate, excessive monetary expansion would immediately be reversed by capital outflows, leaving the exchange rate unchanged.

The Autoregressive Distributed Lag (ARDL) model was chosen to examine determinants of the real exchange rate. This is based on its robustness when sample sizes are small and its ability to accommodate both stationary and non-stationary variables. ARDL is used to estimate the real exchange rate and the probability of exchange rate overshooting in a de-facto dollarized economy.

The study estimates the determinants of the real exchange rate as:

$$lreer_t = (nfa_t, lopen_t, rrepo_t, lrgdp_t, lgov_t) \quad (4-1)$$

Our dependent variable in (4-1) is the natural log of real exchange rate (*lrer*). The fundamentals used are the net foreign asset ratio to real GDP (*nfa*), natural log of degree of openness (*lopen*), real interest rate differentials (*rrepo*), natural log of relative gross domestic product per capita (*lrgdp*) and natural log of government expenditures ratio to real GDP (*lgov*).

Net foreign assets capture the effect of external resource balances on exchange rates (Edwards, 1988; Clark and MacDonald, 1998). An increase in net foreign assets will appreciate the RER, indicating that the expected sign of its coefficient is negative. The study defines the degree of openness as the ratio of the sum of values of exports and imports to GDP. Openness will cause RER to depreciate, and a positive sign is therefore expected for the coefficient of openness. Labour productivity growth, which captures the Balassa-Samuelson effect, will be proxied by real GDP per capita of Tanzania, relative to the trading partners, an expected sign for the coefficient of labour productivity growth is negative. The study also uses real interest rate differential as per Keynesian expectations on price of assets. The sign for real interest rate differential is expected to be negative. The anticipated sign for the coefficient of government expenditures is theoretically ambiguous since it can be positive or negative, depending on whether expenditures are in the tradable or non-tradable goods sector.

4.4.1 Data and Variable Description

The SVAR order of variables follows the approach of Bjørnland (2009) for a small open economy such as (i^*, y, π, i, e) . The foreign interest rate does not react to all variables but all other variables react immediately to the change in foreign interest rate. The data is from the International Monetary Fund (IMF) - International Financial Statistics (IFS) for the period of January 1997 to September 2014. Real GDP (y) data is annual and was converted to monthly rates by assuming that it is averagely spreading (Kodongo and Ojah, 2012). The nominal exchange rate (e) is the period average exchange rate, and the increase denotes depreciation. The interest rate used for both the United States (i^*) and Tanzania (i) is the discount rate. The inflation rate (π) is calculated from Tanzania's monthly Consumer Price Index deviation from the previous year.

The determinants of the exchange rate, net foreign asset and government expenditure, are taken as the ratio to GDP. The degree of openness is the ratio of the sum of values of exports and imports to GDP. The real interest rate differential is calculated as the difference between Tanzania's real interest rate and the weighted trading partners' real interest rate. The relative

GDP per capita is the GDP per capita of Tanzania relative to the weighted GDP per capita of trading partners. The fundamentals and RER are not stationary and are integrated of order one. The way forward requires the stochastic term to be stationary, and that the RER and its fundamentals are cointegrated. In the case of non-stationary data, estimation of the long run relationship may produce spurious results if the variables are not cointegrated. The cointegration test was conducted to examine the long run relationship between the exchange rate and its fundamentals. There are several techniques available for conducting a cointegration test, but the most widely used techniques are the residual-based two-step procedure developed by Engle and Granger (1987) and the maximum likelihood-based technique of Johansen (1988, 1991) and Johansen and Juselius (1990).

The Engle-Granger (residual-based) procedure is a static cointegration test, beginning with an estimation of a static cointegrating regression for the series involved. The second step involves testing whether the residuals from the cointegrating regression are stationary. The regression on the first step requires the use of one variable as dependent and other variables as explanatory, and the process is iterative (Enders, 2004). This test also assumes that there is a unique cointegrating vector and that the explanatory variables therein are assumed to be “weakly exogenous.” Therefore, long run estimates do not suffer from “endogeneity” bias. However, there are problems associated with the Engle-Granger cointegration test. This test can lead to contradictory results in small samples where one regression indicates the variables are cointegrated while interchanging the role of variables indicates that they are not cointegrated. To address this when given small samples, it is suggested that two variables are used, which should minimize this problem. With large samples, however, the analysis of residuals is not affected by the choice of dependent variables (Enders, 2004). Banerjee et al. (1993) show that the use of the Engle-Granger cointegration technique in small samples may cause test statistics and estimates of static Engle-Granger cointegrating regression to be biased upwards. For this reason no judgments can be made using standard critical values on the statistical significance of the parameters.

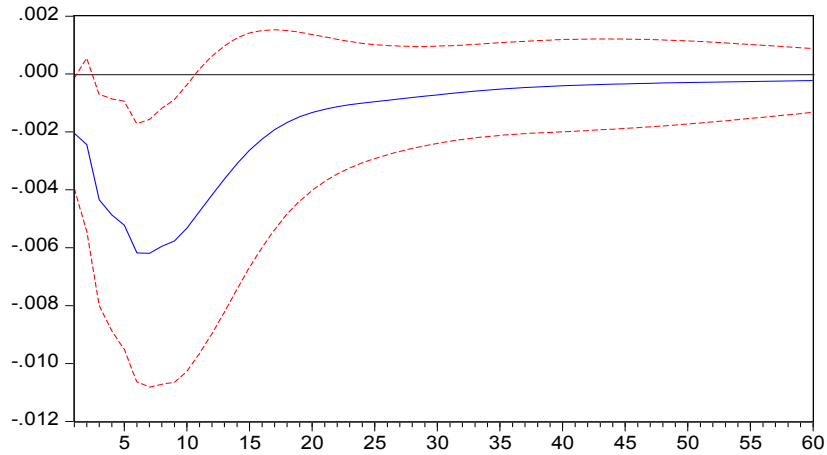
Johansen (1988), along with Johansen and Juselius (1990), have presented tests that provide a system-based Vector Autoregressive (VAR) approach to overcome these difficulties. The main advantage of the Johansen Maximum Likelihood (ML) VAR approach is that it enables one to determine the number of existing cointegrating relationships among the variables on a single attempt. It is commonly acknowledged that the statistical properties of the Johansen procedure are generally better and the cointegration test is more powerful than that of the static Engle-Granger (Charemza and Deadman, 1997). Johansen's procedure provides different options for hypothesis testing on a set on the cointegrating vector, that is, exogenous restrictions on the cointegrating vector or speed of adjustment coefficients. Despite its theoretical advantages, however, the Johansen cointegration test is, in practice, not without its shortcomings. Given the small sample size, the method is inappropriate for most cases because the point estimates obtained for cointegrating vector may not be particularly meaningful. The problems in overcoming small sample sizes led to the popularity of Autoregressive-distributive lag (ARDL) by Pesaran et al. (2001) and Pesaran and Shin (1995), which was unencumbered by these limitations as a technique for cointegration test. Of course, though the ARDL is not limited by sample size, it is nonetheless limited for hypothesis testing, like exogenous restriction. Given the limitations of Engle-Granger (constrained with iterative processes) and ARDL (constrained with hypotheses testing), this study opts for the Johansen procedure to conduct the cointegration test.

We conclude, based on the Max-Eigenvalue test type, that there is one cointegrating equation. This implies that the null hypothesis of no cointegration is rejected at all levels of significance in favour of the alternative that there is one cointegration. This allows the vector error estimation of the long run relationship between the RER and the economic fundamentals.

4.5 Empirical Results

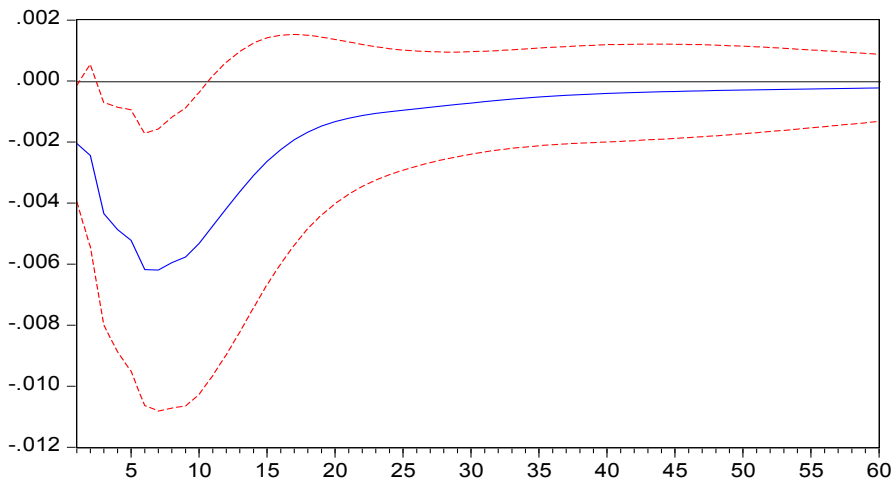
There is evidence of delayed overshooting following a contractionary monetary policy in which the exchange rate appreciates for more than a year before returning to equilibrium. Bjørnland (2009) defines delayed overshooting to be a prolonged period of appreciation of up to 3 years.

Figure 4.2 : Monetary Policy Shock- SVAR
 Response of LXRATE to Structural
 One S.D. Shock4



Using the Structural VAR, the initial effect of monetary policy on the exchange rate is the appreciation (Figure 4.2). The results are not significantly different from those of Cholesky, and also suggest delayed overshooting (Figure 4.3). These delays in small economies' setups are structurally based rather than a response of the exchange rate. The study therefore concludes that there is exchange rate overshooting. This explains the increasing use of foreign currencies the country has experienced.

Figure 4.3 : Monetary Policy Shock- Cholesky
 Response of LXRATE to Cholesky
 One S.D. TZREPO Innovation



The findings of the determinants of exchange rates shows the following, net foreign assets ratio to GDP is significant and has the expected sign, though of the small effect of 0.03 per cent (equation (4-2)).

$$\begin{aligned} \text{LRER}(-1) = & -\frac{0.0003^{***}}{(7.30)} * \text{NFA}(-1) + \frac{0.126^{***}}{(2.47)} * \text{LOPEN}(-1) - \frac{0.006^{**}}{(1.63)} \\ & * \text{RREPO}(-1) - \frac{0.507^{***}}{(27.46)} * \text{LRGDP}(-1) + \frac{0.492^{***}}{(6.14)} * \text{LGOV}(-1) \end{aligned} \quad (4-2)$$

The long run findings also indicate that the coefficient of the degree of openness is statistically significant and has the expected positive sign. This finding is in line with the theory of RER determination and is consistent with the works of Nyoni (1998), Opoku-Afari et al. (2004), Muganyizi (2004) and Atingi-Ego and Sebudde (2004). It implies that an increase in the degree of openness depreciates the RER in the long run. An increase in the degree of openness is associated with a depreciation of about 0.13 per cent. Openness does not depreciate the currency as much has been suggested. This may be due to other features that emerge over time, like dollarization. The real repo rate has a significant negative sign as expected, indicating that exchange rate and interest rate move in opposite directions.

The coefficient of central government expenditure as a share of GDP is statistically significant in the long run, and is associated with a depreciation of the RER. The coefficient of relative real GDP per capita is statistically significant at 1 per cent level and has a negative sign, consistent with the Balassa-Samuelson effect. This implies that in the long run, a one per cent increase in real GDP per capita (a proxy for labour productivity growth) is associated with an appreciation of the RER of about 0.5 per cent.

4.6 Concluding Remarks

This chapter investigates the movement of the exchange rate in Tanzania for the period of 1997 to 2014 using monthly data. Specifically, the study investigates whether the overshooting hypothesis holds for the TZS - USD exchange rate. In addition, the study also tests if there is a relationship between the TZS - USD exchange rate and other macroeconomic fundamentals. The

study make use of a SVAR model to test the overshooting hypothesis, while an ARDL model is used to examine the determinants of the exchange rate. The SVAR methodology has the advantage of accommodating necessary restrictions required for model identification. These restrictions can be used to test whether such shocks affect the economic variables, as economic theory would predict. Hence, one is able to use this methodology to interrogate the theory.

The findings show delayed overshooting, where the exchange rate gradually depreciates (for almost two years) while responding to expansionary monetary policy. It is worth noting that in this case, the Tanzanian foreign exchange market is underdeveloped, which could limit the exchange rate performance. The other explanation for this delayed overshooting is imperfect information on the exact type of monetary policy shock. The Tanzanian economy, like that of many African countries, is subject to government intervention. This limits the information the individual has about market operations. The most important fundamentals that are found to determine the RER are trade openness, real interest rate differentials, labour productivity and government expenditure.

Chapter Five

5 The Role of the Exchange Rate and Dollarization in the Monetary

Transmission Mechanism in Tanzania's Economy

5.1 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 chapter 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 (Figure 2.6). 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).

5.2 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.

- The interest rate channel takes into account the impact of monetary policy on saving and consumption behaviour of households and firms (Dabla-Norris and Floerkemeier, 2006). This channel emphasizes the impact of policy on interest rates, concerning deposit and lending rates. This allows for investigation of how a contractionary or expansionary policy impacts credits via the credit channel.
- In an open economy there is a possibility of arbitrage due to the differences between domestic and foreign interest rates. The change in interest rate can also cause exchange rates to fluctuate, which has an impact on foreign trade, and therefore affects output through the exchange rate channel.
- The other channel, bank lending, refers to the amount of loans rather than the cost of loans. A change in monetary policy, for instance, changes the banks' reserves, and this

changes the amount of loans available for firms and households (Bernanke and Blinder (1988, 1992)). For example, expansionary monetary policy increases total reservable bank deposits, and this makes it possible for the banks to increase their loan portfolio (Bernanke and Gertler, 1995).

- The balance sheet channel refers to the impact of monetary policy on the net worth of firms and households (Mishkin, 2001). This channel is established on the asymmetric information and moral hazard in credit markets (Dabla-Norris and Floerkemeier, 2006). For instance, contractionary monetary policy can trigger a fall in financial asset prices and this reduces the net worth of firms. As a result, the level of lending is reduced, which in turn reduces consumption and investment, and thereby changes the aggregate output and inflation.
- The asset price channel is about the distribution effects of monetary policy decisions (Mishkin, 1995). This channel operates through two sub-channels. The first is Tobin's q theory of investment, and the second is the wealth effects on consumption based on the life cycle model of Modigliani (Mishkin, 1995). Tobin's q refers to the ratio between the market value of a given company and its replacement cost of capital, (Tobin, 1969). A contractionary monetary policy reduces the price of equity, which also reduces Tobin's q and wealth. The reduction in Tobin's q effectively reduces investment, and the reduction in wealth reduces consumption, which in turn reduces aggregate output.
- The last channel is the expectation channel (Mishkin, 1995). This channel works through the impact that monetary policy has on the confidence and expectation of firms, banks, households and the public sector about future economic conditions. More detailed discussions on all the channels can be found in the studies of (Dabla-Norris and Floerkemeier, 2006).

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. This study specifically focuses on the exchange rate channel.

5.2.1 Exchange Rate Channel of Monetary Transmission

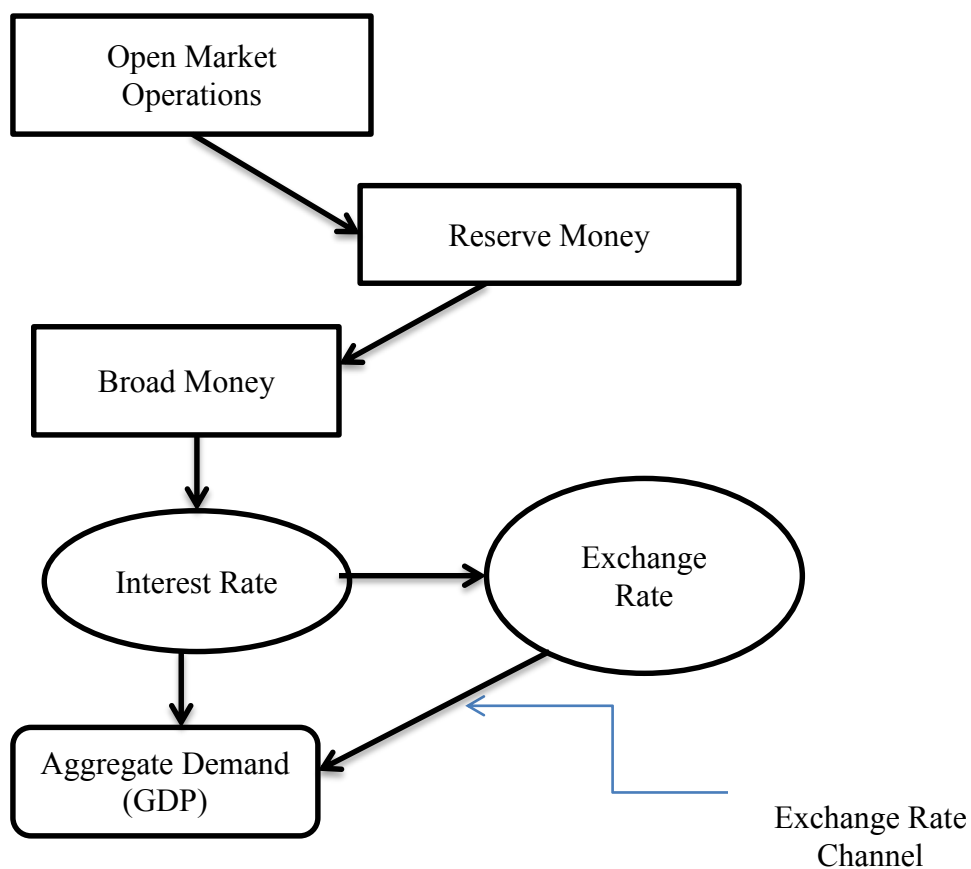
Since 1995, the Bank of Tanzania has moved to indirect instruments of monetary policy. These include open market operations; repurchase agreements; discount windows; foreign exchange market operations; statutory minimum reserve requirements; and moral suasion. Open Market Operation (OMO) is the leading 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 main objectives of monetary policy in Tanzania are to maintain and to ensure price stability. Which is conducive to balanced and sustainable growth of the national economy and to ensure a stable exchange rate (BOT Act 1995). The Bank of Tanzania handles monetary policy by managing base money (M0) as the operational target, with a view to attaining a level of broad money (M2) that is consistent with its macroeconomic objectives of increasing output growth and the level of international reserves, and reducing the level of inflation. 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 5.1 describes the Exchange Rate Channel of monetary policy transmission for Tanzania.

Figure 5.1: 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. This chapter 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?

5.3 Empirical Literature

Most of the work on the transmission mechanisms of monetary policy emanates from the seminal work of Taylor (1995) and Obstfeld and Rogoff (1995). These studies emphasize the importance of the international aspects of monetary policy. Taylor (1995) agrees that monetary expansion leads to a depreciation of the domestic currency. It is clear that exchange rates should not be ignored when setting monetary policy because of its importance as an economic indicator. However, with its importance, the reform of monetary institutions for example, the 1995 BOT Act which increased the autonomy of the Central Bank, is more likely to be realized when the focus is on the control of domestic inflation. Smets and Wouters (2002) find the exchange rate channel to be less effective as a result of imperfect exchange rate pass-through, where sticky prices contribute to market imperfections. This leads to increased effectiveness of the domestic interest rate channel. Mwase (2006) assesses the exchange rate pass-through in Tanzania, finding that the pass-through declined in the late 1990s despite the depreciation of the currency. The study articulates this decline to be a result of changes in monetary policy in 1995. These results support existing findings that the degree of pass-through is higher in economies with a higher rate of inflation. In addition, Buigut (2009) analyzed the interest rate channel using a recursive VAR approach for Tanzania, Kenya and Uganda. In his study he assumes that the policy instrument affects output and inflation, but with a lag. He concludes that the interest rate channel of monetary transmission in these three countries is weak and interest rate policy has

insignificant effects on output and inflation. The weak monetary transmission mechanism can be attributed to the channel used by Buigut (2009) and should not to be generalized. For example the channel used, “interest rate” operates through deposit and lending rates which had little impact in 1990s, as the money market was underdeveloped in East Africa.

We also review other low income countries in Africa. Many of these countries share similar historical patterns to those of Tanzania and reformed their economies during the mid-1980s. Monetary policy, as measured by bank rates, had more of an impact on bank credit in Malawi than reserve money, changes in bank credit subsequently affected both real output and inflation, (Ngalawa and Viegi, 2011). This runs contrary to results of Cheng (2006) for the Kenyan economy, which could be due to differences in exchange rate systems, as the Malawian Kwacha was almost pegged during that period. They suggest that non-monetary policy shocks may have contributed to price instability in Malawi and also find a significant contribution by the exchange rate regime to the monetary transmission process. Studies in Kenya by Ndung’u (1999) analyze the effects of expansionary monetary policy on the real and nominal exchange rate. The findings indicate that excess domestic credit or excess money supply feed into the cyclical movements of the real exchange rate. On the other hand, Cheng (2006) estimates a structural VAR in levels (no differences), imposing contemporaneous restrictions to analyze the monetary transmission mechanism in Kenya between 1997 and 2005. He finds a temporary monetary policy shock to be followed by a decline in prices and an appreciation in the nominal exchange rate, while the impact on output is insignificant. Cheng finds that variations in the repo rate account for around one-third of the fluctuations in prices and half of the fluctuations in the nominal exchange rate, but only 10 per cent of the output variation. The study concludes that exchange rate appreciation follows an increase in the interest rate, and that output variance is due to non-monetary policy shocks. This would imply that the impact of repo on output is not significant but is significant on prices.

As the use of foreign currency increases in a given country, monetary policy should use the exchange rate channel to achieve its targets. It has been suggested that the exchange rate channel has a greater impact on inflation in countries with de facto dollarization (Acosta-Ormaechea and

Coble, 2011; Dabla-Norris and Floerkemeier, 2006; Égert and MacDonald, 2006; Juks, 2004). Moreover, the more the country is dollarized, the more foreign currency deposits expand, and if credits are also in foreign currency then the effectiveness of monetary policy is limited (Levy-Yeyati, 2006). Under this scenario, the exchange rate response to a change in monetary policy mitigates the impact of the change in policy on inflation and output. This is known as the balance sheet effect and has been explained as one of the reasons that monetary policy is ineffective in dollarized economies, signifying that the exchange rate may outweigh interest rate effects (Acosta-Ormaechea and Coble, 2011).

The present study goes beyond the existing literature in two ways. First, it investigates the exchange rate pass-through in Tanzania. Second, it examines the monetary policy transmission channel in a de-facto dollarized economy. The findings may help policymakers in achieving sustainable growth of the national economy, and also may be applied to other economies with the similar features to Tanzania.

5.4 Empirical Methodology

5.4.1 Pass-through in a Dollarized Economy

Exchange Rate Pass-Through (ERPT) refers to the effects that a change in the external value of the currency has on the domestic prices of imported goods and services (and on domestic price indices in general). The ERPT is broadly defined as the percentage change in local currency import prices resulting from a one per cent change in the exchange rate between the exporting and importing countries (Goldberg and Knetter, 1997). It is simply the marginal change in domestic prices resulting from a change in the exchange rate.

The study undertaken in this paper defines ERPT simply as the change in domestic prices resulting from a change in the exchange rate. Equation (5.1) is adapted to the data available, which is import prices. Data for Tanzania's inflow trade are not available. We follow the approach of Takhtamanova (2010) by including supply shock in our model. The following equation captures the pass-through effect, and the pass-through is from the exchange rate to inflation:

$$\pi_t = \delta_0 + \delta_1 \sum_{j=1}^n \pi_{t-j} + \delta_2 \sum_{j=1}^n \Delta e_{t-j} + \delta' X_{t-1} + u_{it} \quad (5.1)$$

Where: π_t is the domestic inflation of Tanzania at time t , Δe_{t-1} is the lagged nominal exchange rate expressed in *TZS/USD*, and X_t is the control variable represented by the output gap, controlling for the impact of the economy's excess capacity on domestic inflation. Domestic inflation rate is calculated as the change in consumer price index and the change in the nominal exchange is also calculated from nominal exchange rate. The output gap is calculated as the difference between the actual real GDP and potential output. The study employs the Hodrick and Prescott (1997) technique to derive a measure of potential output. The short-term pass through is δ_2 ; it is the direct response of inflation to a change in the nominal exchange rate. The long-term pass through is defined as $\frac{\delta_2}{1-\delta_1}$; that is, the overall reaction of inflation to exchange rate shock. The autoregressive distributed lag (ARDL) approach to cointegration by Pesaran, Shin and Smith (2001) is employed to estimate equation (5.1). To determine the autoregressive lag length, (n), Akaike Information Criterion (AIC) for lag selection criterion, has been applied.

The exchange rate pass-through is complete, if $\delta_2 \geq 1$, this would imply that inflation changes by the same proportion or more than the change in the exchange rate. The exchange rate pass-through is incomplete if $\delta_2 < 1$, which implies that if inflation changes by a proportion smaller than the exchange rate change, then exchange rate pass-through is said to be partial or incomplete. Similarly, there is no exchange rate pass-through if $\delta_2 < 0$. Although high exchange rate pass-through is beneficial when the policy is to boost foreign trade, however a low pass-through helps to contain inflation and promote competitiveness (Obstfeld, 2002).

5.4.2 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, $\beta = 0$.³ The matrix for Σ takes an appropriate inverse-Wishart distribution to allow for the derivation of the posterior from:

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

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

³ This is later confirmed by the impulse response functions, which suggest the effects of shocks are temporary.

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 to their 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 way as an endogenous dummy variable, so that the effects of the structural breaks are contained.⁴

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 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:

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

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

⁴ 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).

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,

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

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:

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

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,

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

5.5 Data

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.⁵ 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 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.

⁵ See, Beveridge and Nelson (1981), Christiano and Fitzgerald (2003), Baxter and King (1999), Hodrick and Prescott (1997), and King and Rebelo (1993).

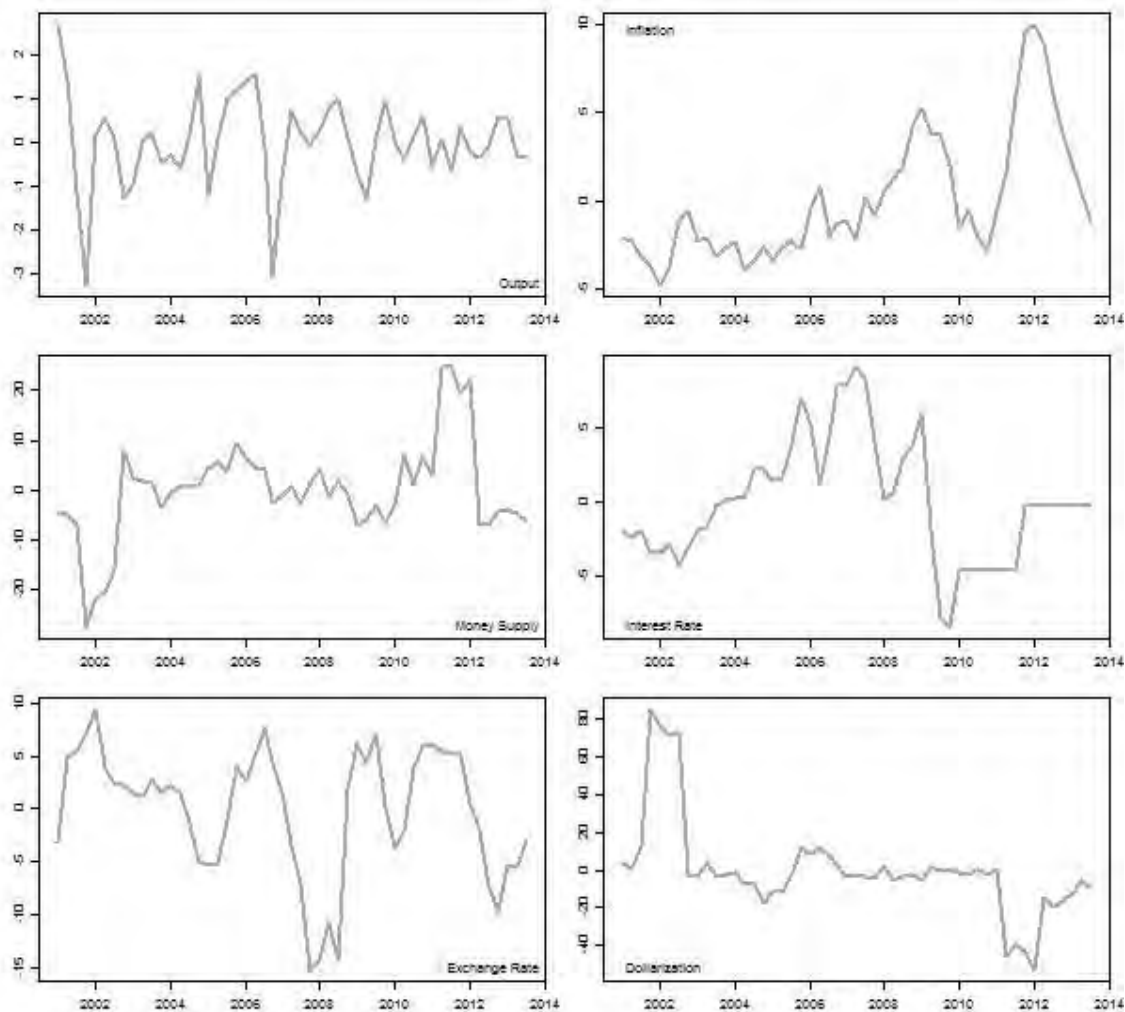
The measure of the exchange rate (x_t) is the nominal exchange rate between the United States Dollar and the Tanzanian Shilling. To ensure that it is consistent with the other variables, we make use of the quarter-on-quarter logarithmic change for this series.

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 indicator. 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).⁶ Figure 5.2 presents these variables after transformation.

Figure 5.2: Variables after Transformation

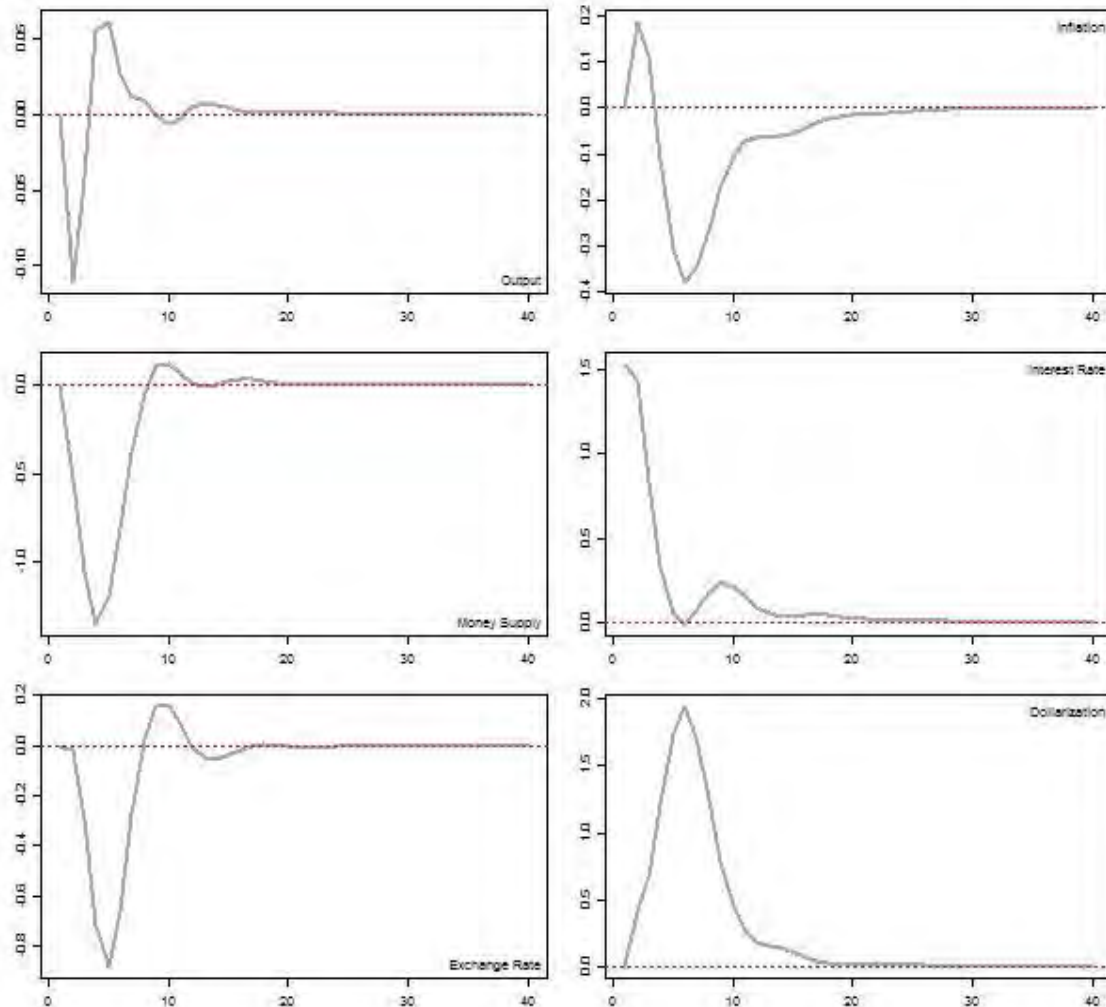


⁶ Unfortunately, as there is no data that distinguishes foreign currency reserves from foreign currency in circulation, we do not have any other option than to use the growth rate in broad foreign currency holdings as a measure of dollarization.

5.6 Empirical Results

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 5.3.

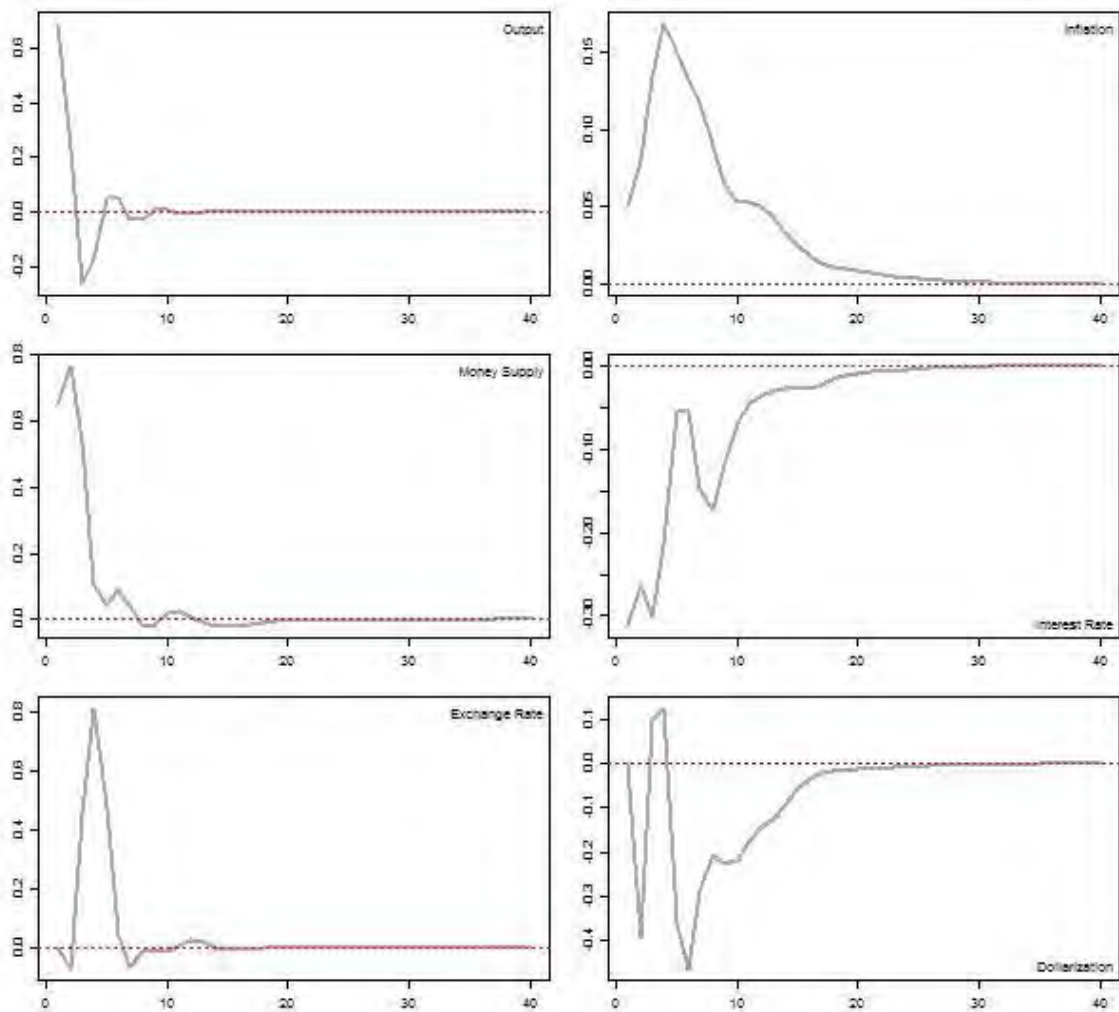
Figure 5.3 : Bayesian VAR - Monetary Policy Shock



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. This results in an increase in the measure of foreign capital in the economy, as is shown in Figure 5.3.

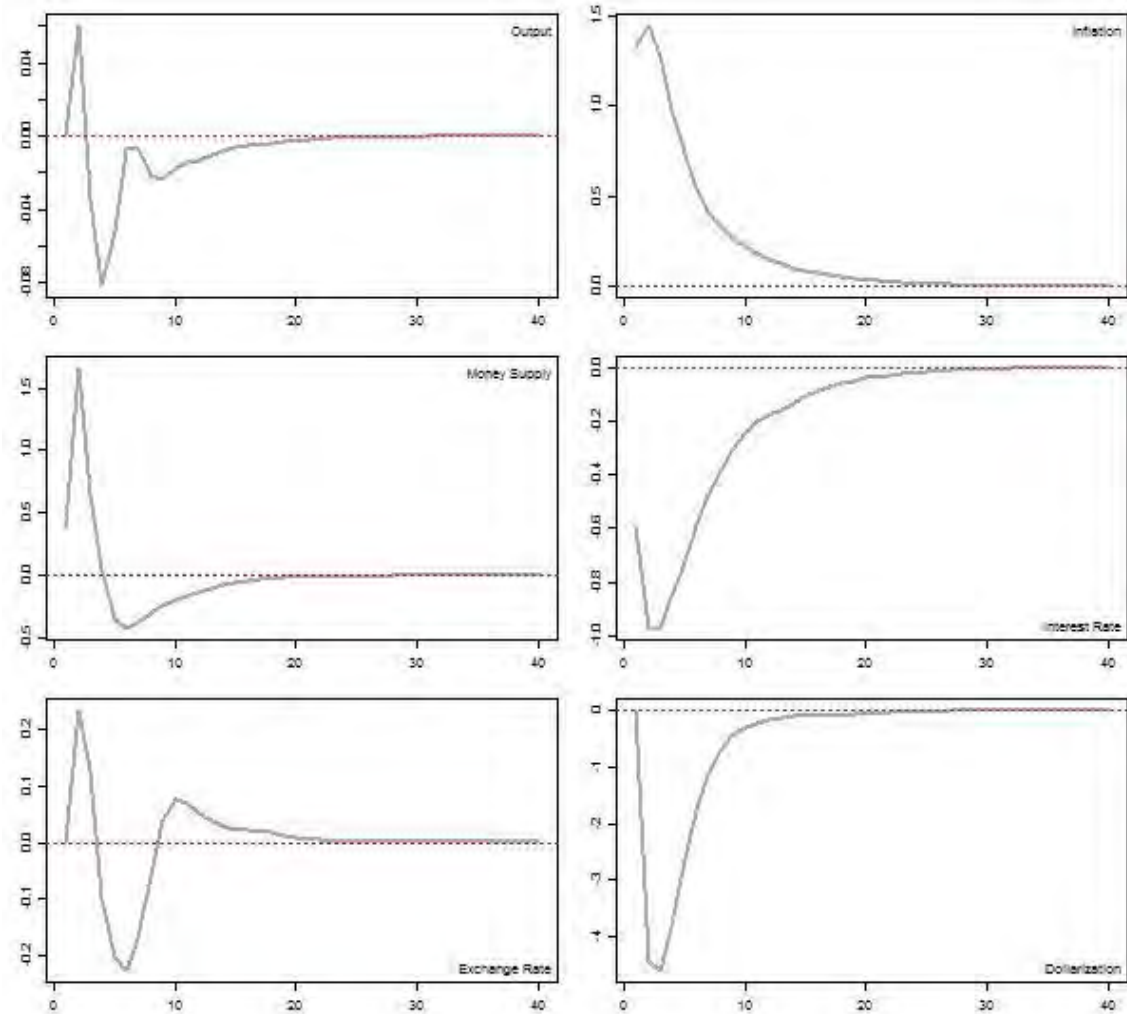
Figure 5.4 : Bayesian VAR - Aggregate Demand Shock



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

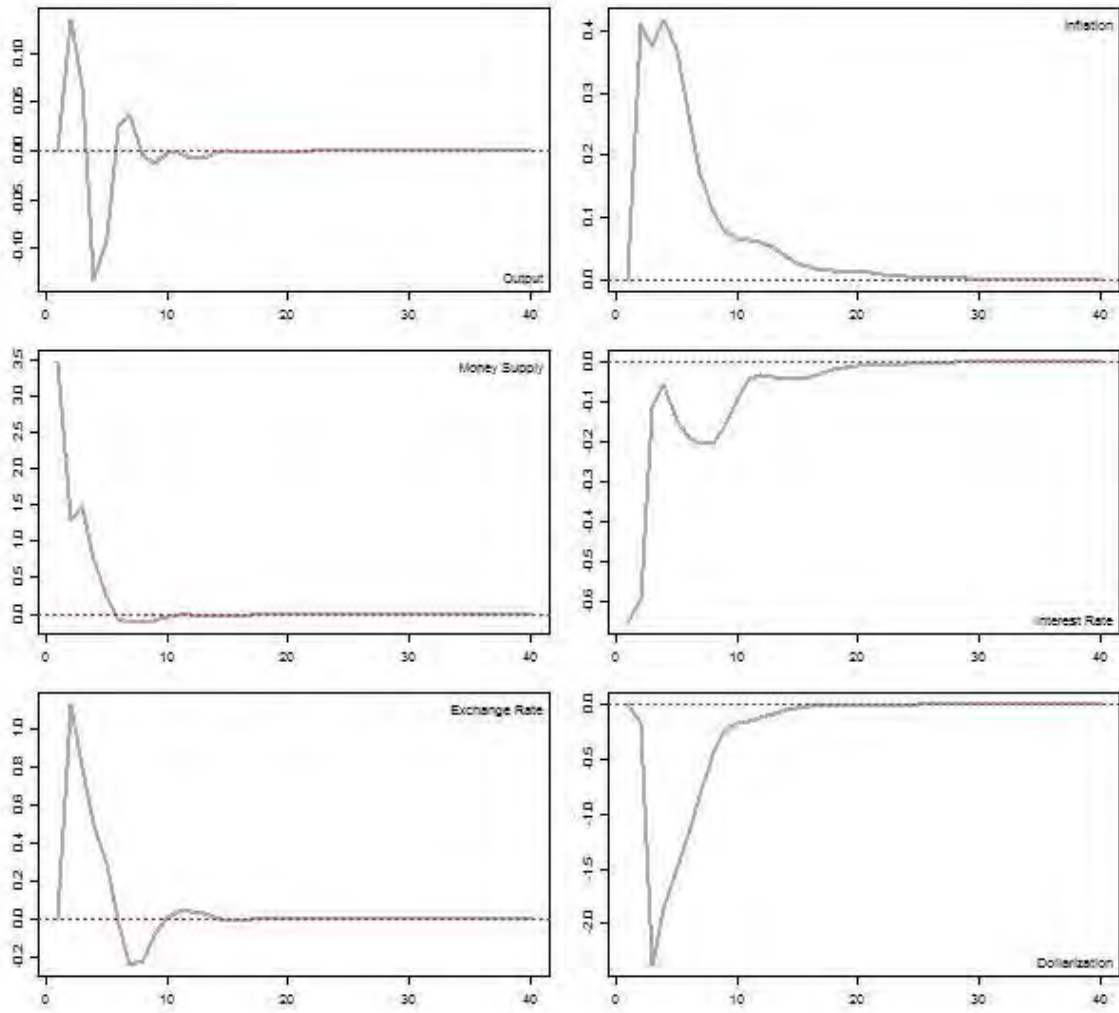
demand for real monetary balance. In addition, the nominal exchange rate depreciates, as the amount of foreign currency holdings declines. These results are shown in Figure 5.4.

Figure 5.5 : Bayesian VAR - Cost Push Shock



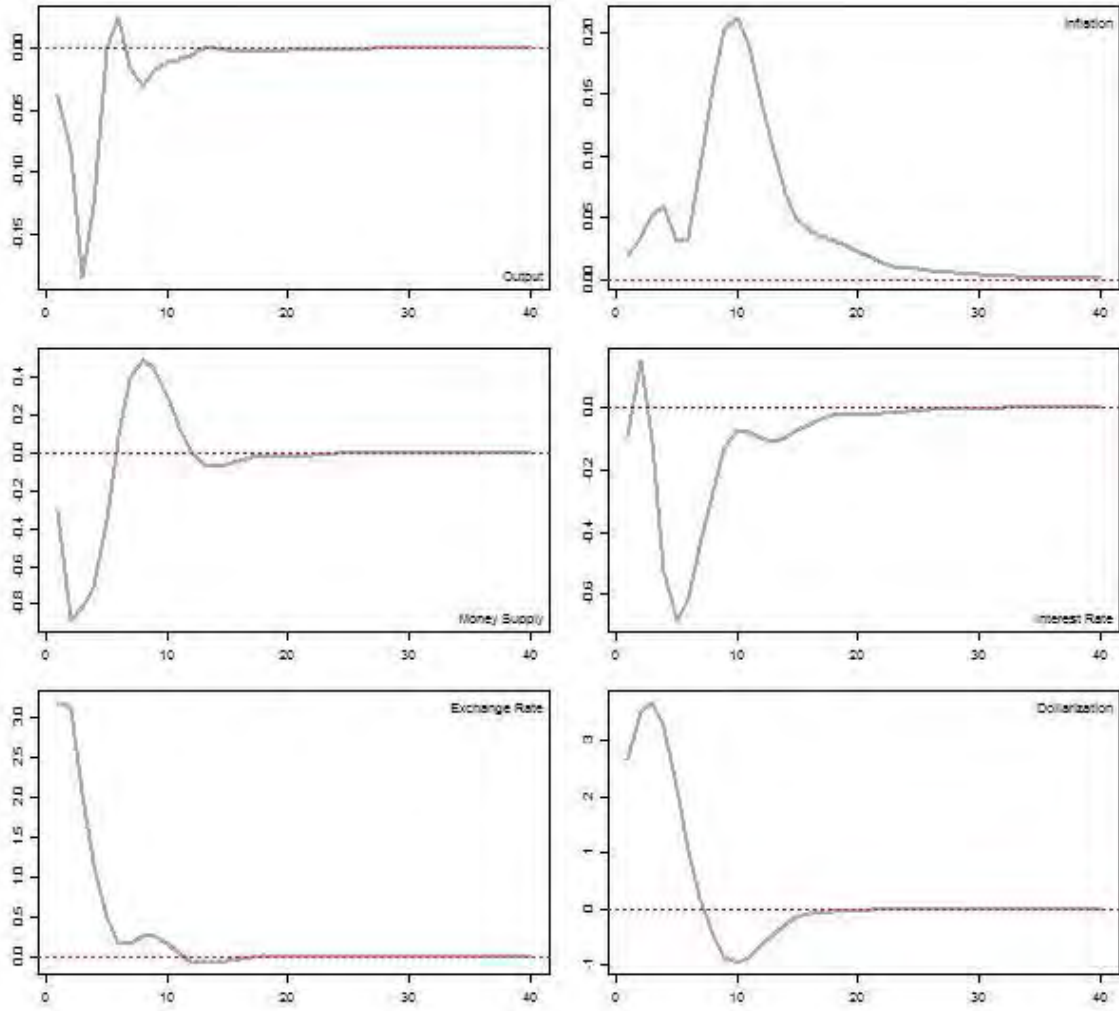
The effect of an unexpected increase in inflation is captured by the cost push shock that follows an innovation to the rate of inflation. The effect of such a shock on other endogenous variables is characterised in Figure 5.5. The relatively high environment would appear to be associated with low interest rates, although one would expect that the central bank would react to the increase in inflation by raising the nominal interest rate.

Figure 5.6 : Bayesian VAR - Monetary Supply Shock



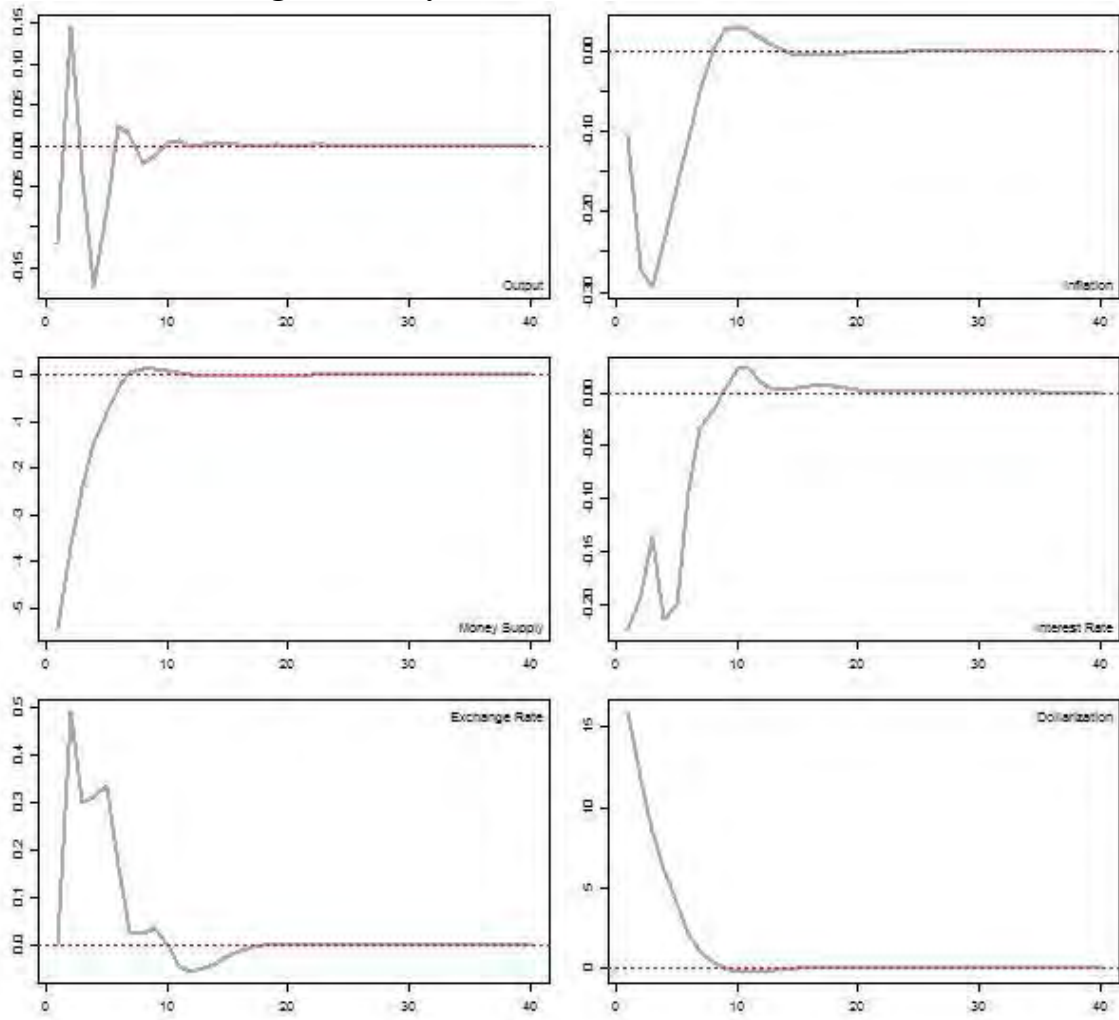
The positive innovation to monetary supply is associated with a significant reduction in the interest rate. This gives rise to an initial increase in output and a significant increase in inflationary pressure. The exchange rate also experiences a significant deterioration with the result that the foreign 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 5.6.

Figure 5.7: Bayesian VAR - Exchange Rate Shock



A positive exchange rate shock would result in a depreciation of the external value of the domestic currency, as shown in Figure 5.7. 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.

Figure 5.8 Bayesian VAR - Dollarization Shock



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 5.8.

5.7 Concluding Remarks

This chapter has considered the various channels of the monetary transmission in a de-facto partially dollarized economy. A Bayesian VAR model was used to investigate this phenomenon, where the study covered the period of the floating exchange rate regime of 2001 - 2013.

The results suggest that the exchange rate pass-through is not significant (full results are presented in appendix C). 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 (Chapter Three). 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.

Chapter Six

6 Monetary Policy in a Small Open Partially Dollarized African Economy

6.1 Introduction

The central banks of most developed and many developing economies make use of structural macroeconometric models to assist with policy analysis and forecasting (Tovar, 2009). Some of the variants of these models follow Laxton et al. (2006), which describes the framework that is currently used by several central banks on the African continent.⁷ The central features of this model incorporate various nominal and real rigidities, as well as a large number of shocks. Within this framework, the rational expectations of economic agents are accounted for and each of the equations in the model has a structural economic interpretation.

In the case of Tanzania, which may be classified as a small open economy, the analysis of monetary policy is largely conducted with the aid of reduced-form models, which do not take into account the expectations of agents or potentially important structural relationships that could exist between the variables. Another interesting feature of the Tanzanian economy is that most transactions may be conducted in either Tanzanian Shillings or United States Dollars. In addition, the agents in the Tanzanian economy may choose to hold dollars to store value during periods of abnormally high inflation. This behaviour gives rise to a partially dollarized economy, as discussed in Reinhart et al. (2014).

Various authors have made use of different structural models to investigate the conduct of monetary policy in an economy that encounters partial dollarization. These include dynamic stochastic general equilibrium (DSGE) models which have been applied to several South

⁷ The model is usually termed the Quarterly Projection Model (QPM) and is the basis of comparison for many country economists of the International Monetary Fund. Over time, a large number of IMF Working Papers have extended the work of Laxton et al. (2006). See for example, Carabenciov et al. (2013), Blagrove et al. (2013), Freedman et al. (2009a), Freedman et al. (2009b), Carabenciov et al. (2008b), Carabenciov et al. (2008a), and Laxton et al. (2008).

American economies. Important recent contributions include the work of Castillo et al. (2013) who suggest that two forms of partial dollarization are present in the Peruvian economy (currency substitution and dollar-price indexation).⁸ In addition, Salas (2010) makes use of a structural macroeconometric model to suggest that the expectations channel has become more prominent in the transmission of monetary policy shocks.

The model in this paper follows that of Salas (2010), in which the foreign currency holdings affect the domestic aggregate demand equation. In addition, we also assume that the central bank may choose to intervene in the foreign exchange market, as rapid exchange rate depreciation could reduce the ability of the agents to repay foreign currency denominated debt.⁹ When we allow for financial dollarization (where dollars are preferred as a store of value) and currency mismatches, the balance sheet effects associated with large exchange rate swings are likely to emerge, which could be detrimental if the central bank does not intervene in the foreign exchange markets.

After the model has been log-linearized it is applied to quarterly Tanzanian data for the period, 2001q1 to 2013q3. The starting date of this sample represents the earliest available quarterly data point for Tanzanian output. The model includes measures for domestic output, inflation, real effective exchange rate, nominal currency depreciation and the nominal interest rate, as well as foreign output, inflation and the corresponding interest rate.

The parameters that pertain to the critical behavioural equations in the model are then estimated with Bayesian techniques. These parameter estimates suggest that transaction dollarization and dollar-price indexation are quite important, while financial dollarization is highly prevalent. When we then turn our attention to the impulse response functions, we note that although one could suggest that the existence of partial dollarization in the Tanzanian economy may result in

⁸ See also the references noted in Castillo et al. (2013) for a discussion of earlier applications of DSGE models with partial dollarization in South American economies.

⁹ See, Calvo and Reinhart (2002), Reinhart and Reinhart (2008) and Reinhart and Rogoff (2009) for a discussion on the interventions by central banks in the foreign currency markets in emerging market economies.

ineffective monetary policy, the effect of a shock to the short-term domestic interest rate continues to result in important changes in the real variables.

In terms of the contribution of this paper, to the best of our knowledge this is the first application of a structural macroeconometric model for a partially dollarized African economy that has been used to investigate the effectiveness of monetary policy. The rest of the paper is organized as follows. Section 6.2 describes the methodology, section 6.3 provides details of the data and section 6.4 includes details of the parameter estimation techniques. The results are discussed in section 6.5 and the conclusion is contained in section 6.6.

6.2 Methodology

6.2.1 Theoretical DSGE Model

The structure describes the cyclical behaviour of a small open and partially dollarized economy, in a setting that is consistent with several DSGE models. It is a short-run model in the sense that the variables are expressed in terms of deviations from their equilibrium, or steady-state values. A number of new Keynesian features have also been included, in the form of nominal and real rigidities. We also include features that are consistent with agents that display rational expectations and backward-looking indexation.

In the tradition of Botman et al. (2007), while the model is consistent with many micro-founded models, it has not been derived from explicit microfoundations. It is argued that this practice is consistent with those followed by most central banks that are “*engaged* but not *married* to economic theory” Laxton, et al. (2006). In what follows, we show how the linear conditions in the model are related to purely microfounded model representations.¹⁰

¹⁰ Of course it would be possible to derive microfoundations for most of the final model equations. However, such a time-consuming procedure would be of little use in this instance.

The household and the aggregate demand expression:

The microfoundations for the household of most small open economy models, which follow that of Galí and Monacelli (2005) and Justiniano and Preston (2010) suggest that the representative household seeks to maximize utility in the function,¹¹

$$E_t \sum_{t=0}^{\infty} \beta^t \left[\varepsilon \left\{ \frac{(C_t - \zeta C_{t-1})^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\gamma}}{1+\gamma} \right\} \right] \quad (1)$$

where the variable C_t refers to consumption and N_t to labour, both in period t . The parameter β is the time-discount factor, $1/\sigma$ is the intertemporal-elasticity of substitution, $1/\gamma$ is the Frisch-elasticity of labour supply, and ζ is a consumption-habit parameter. The exogenous demand shock is then represented by \hat{a}_t^y .

The budget constraint of the household may then be expressed as,

$$\frac{P_{c,t}}{P_t} C_t + \frac{B_t}{P_t} + \frac{\varepsilon_t B_t^*}{P_t} \leq \frac{W_t}{P_t} N_t + R_{t-1} \frac{B_{t-1}}{P_t} + R_t^* \phi_{t-1} \frac{\varepsilon_t B_{t-1}^*}{B_t} + \frac{\pi_t}{B_t} \quad (2)$$

where $P_{c,t}$ is the price of the consumption good, B_t is the domestic bond, E_t is the nominal exchange rate, B^* is the foreign bonds that are held by domestic residents, W_t is the nominal wage rate, R_t is the nominal domestic interest rate, R_t^* is the nominal foreign interest rate, Π_t is profits received from the domestic intermediate goods producers, and P_t is the aggregate price index that is used to deflate the above measures.

¹¹ Similar models have been used to describe monetary policy in other African countries. See for example, Steinbach et al. (2009) and Alpanda et al. (2010a; 2010a; and 2011). For a more elaborate discussion of the microfoundations that have been employed in this exposition, see Alpanda et al. (2010a).

In an open-economy setting the consumption and price indices refer to a combination of goods that are produced by domestic and foreign manufacturers, such that

$$C_t = \left[(1-\alpha)^{\frac{1}{\eta}} C_{h,t}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{f,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \quad (3)$$

and

$$P_{c,t} = \left[(1-\alpha)P_t^{1-\eta} + \alpha P_{f,t}^{1-\eta} \right]^{\frac{1}{1-\eta}} \quad (4)$$

where $C_{h,t}$ and P_t refer to the domestic consumption and price indices, while $C_{f,t}$ and $P_{f,t}$ refer to the foreign counterparts. The importance of foreign goods in overall consumption is represented by α and $\eta > 0$ is the elasticity of substitution between domestic and foreign goods.

After imposing the constraint for no Ponzi schemes and where we assume that the goods market clears, when consumption is equal to output (i.e. $C_t = Y_t$), one is able to derive the following microfounded equilibrium expression for aggregate demand,

$$y_t = \frac{1}{1+\zeta} E_t [y_{t+1}] + \frac{\zeta}{1+\zeta} y_{t-1} - \frac{1-\zeta}{\sigma(1+\zeta)} (r_t - E_t [\pi_{t+1}^c]) - \varepsilon_t^y \quad (5)$$

where the use of small letters denotes that the variable is expressed in terms of the logarithmic deviation from steady-state values. This expression may be termed the new Keynesian *IS*-curve for a small open-economy.

In the model for the small open-economy with partial dollarization, we make use of the following expression that describes the aggregate demand dynamics,

$$y_t = a^{re} E_t [y_{t+1}] + a^y y_{t-1} - a^{rmc} (A^r r_t + A^{rs} r_t^*) \dots \quad (6)$$

$$+ a^{tot} (A^u tot_t + (1 - A^u) tot_{t-1}) + a^q q_t + a^{fis} fis_t + a^{y*} y_{t-1}^* + \varepsilon_t^y$$

where after making a comparison with equation (5), we note that $a^{re} \approx 1/(1+\zeta)$, $a^y \approx \zeta/1+\zeta$, and $a^{mc} A^r \approx (1-\zeta)/\sigma(1+\zeta)$. In the final expression, the A^r parameter refers to the proportion of monetary holdings that are denominated in the domestic currency. In addition to the variables from the microfounded aggregate demand expression, we have augmented this equation in (6) with information relating to foreign interest rates, r_t^* , the change in the terms of trade, tot_t , the real effective exchange rate q_t , the fiscal impulse, $\hat{f}is_t$, and the measure for foreign aggregate demand, y_t^* .

The motivation for including these additional terms should be self-evident, where in a partially dollarized economy the interest rate on holdings of dollars would be of importance. Note that in this case, the A^{rs} parameter refers to the proportion of domestic monetary holdings that is denominated in dollars. Furthermore, an improvement in the terms of trade (the price of exports relative to the price of imports) should improve aggregate demand in the domestic economy. In addition, depreciation in the real effective exchange rate (which is represented by an increase in q_t) would also improve conditions for exporting additional goods, while a positive fiscal impulse (as represented by an increase in government expenditure that is over and above the trend) would stimulate domestic demand. Similarly, an increase in the global (foreign) economic output would also contribute towards more positive trading conditions, which would provide an impetus for an increase in domestic output.

The firm and the aggregate supply expression:

In the new Keynesian model we assume that the differentiated goods of the monopolistic competitive intermediate producers are indexed by the continuum $j \in [0,1]$, such that the final good may be expressed with the aid of the following aggregation function,

$$Y_t = \left[\int_0^1 Y_{j,t}^{\frac{\theta_t-1}{\theta_t}} dj \right]^{\frac{\theta_t}{\theta_t-1}} \quad (7)$$

where θ_t is the elasticity of substitution between the intermediate goods and $\epsilon_t^\pi = \theta_t / (\theta_t - 1)$ may be used to describe the gross markup over marginal costs. The representative intermediate firm would then set prices to maximize the present value of profits. Since future earnings are discounted at the same rate as the household, their objective function may be expressed as

$$\max E_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \frac{\lambda_\tau}{\lambda_t} \left[\frac{P_{j,\tau}}{P_\tau} Y_{j,\tau} - \frac{W_\tau}{P_\tau} N_{j,\tau} - \frac{\kappa}{2} \left(\frac{P_{j,\tau} / P_{j,\tau-1}}{\pi_{\tau-1}^\varphi} \right)^2 Y_\tau \right] \quad (8)$$

where the last term is the quadratic cost of price adjustment as described in Rotemberg (1982). The parameter κ regulates the magnitude of the price adjustment costs, which are also scaled by aggregate domestic output. The price-adjustment cost is incurred when the increase in the firm's own price deviates from the past inflation rate, where the parameter φ regulates the extent to which current price changes are indexed to past inflation.

These expressions may be used to drive the familiar new Keynesian Phillips curve with indexation,

$$\pi_t = \frac{\beta}{1 + \beta\varphi} E_t[\pi_{t+1}] + \frac{\varphi}{1 + \beta\varphi} \pi_{t-1} + \frac{\theta-1}{\kappa(1 + \beta\varphi)} mc_t + \frac{\theta_t}{\theta_t-1} \quad (9)$$

where the use of small letters denotes that the variables are expressed in terms of logarithmic deviations from their steady-state values. In addition, a complete expression for marginal costs, mc_t , in a microfounded small open-economy may take the form of,

$$mc_t = \gamma y_t + \alpha (tot_t) + \frac{\sigma}{1-\zeta} (c_t - \zeta c_{t-1}) \quad (10)$$

The aggregate supply condition in the model that we use for the partially dollarized economy may be expressed as,

$$\pi_t^c = (1-b^{p*})\left(b^p \pi_{t-1}^c + (1-b^p) \pi_{t+1}^c\right) + b^y y_{t-1} + b^{p*} \left(\pi_t^m - \Delta \bar{q}_t\right) + \varepsilon_t^\pi \quad (11)$$

where π_t^c refers to core inflation (that part of the inflationary process that is not subject to transitory shocks) and π_t^m refers to imported inflation. The term $\Delta \bar{q}_t$ refers to the steady-state of the real effective exchange rate in first difference. When comparing the above expression with that of the microfounded model, we note that $\beta/(1+\beta\varphi) \approx (1-b^{p*})(1-b^p)$ and $\varphi/(1+\beta\varphi) \approx (1-b^{p*})(1-b^p)$. In addition, it is also worth noting that the marginal costs in the microfounded model are largely influenced by the deviations of output from its steady-state values, and as a result a measure of the output gap has been included in the model for the partially dollarized economy.

The remaining term in the microfounded marginal cost expression relates to the effects of changes in the terms of trade, which is a measure for the price of exports in terms of the price of imports. This is the source for which we may incorporate imported inflation into the microfounded model. In the model for the partially dollarized economy we make use of a more elaborate expression for imported inflation, which takes the form of,

$$\pi_t^m = c^p \pi_{t-1}^m + c^{pf} \left(\pi_t^* + 4.\Delta S_t\right) + (1-c^p - c^{pf}) \left(\pi_{t-1}^m + 4.\Delta S_{t-1}\right) + \varepsilon_t^m \quad (12)$$

where π_t^* is a measure of foreign inflation, which is expressed in terms of domestic currency units after accounting for the annual change in the nominal exchange rate, ΔS_t . Imported inflation is also influenced by past changes in the price of imported raw materials and other intermediate goods, π_{t-1}^m , which is expressed in terms of domestic currency after including a term for the annual depreciation of the domestic currency. The shock to imported inflation is

given by ε_t^m and the contemporaneous quarterly exchange rate pass-through would be represented by the product of the coefficients b^{p*} and c^{pf} .

Modified uncovered interest rate parity:

As in the microfounded model that makes use of the interest rate parity condition to close the open economy features in a model, we make use of the following uncovered interest rate parity condition

$$4(s_t^e - s_t) = i_t - i_t^* - rp_t + \varepsilon_t^s \quad (13)$$

Where rp_t refers to the risk-premium. As an alternative, one could make use of complete risk-sharing conditions to close off the open economy features of the model, however, Alpanda et al. (2010b) suggest that the use of the modified interest rate parity condition that incorporates a risk-premium may result in more consistent explanation of the data, when applied to an African economy. The stochastic term ε_t^s represents the disturbance to the modified uncovered interest rate parity condition.

In the model for the partially dollarized economy, exchange rate expectations, s_t^e , are described by the weighted average of backward-looking and forward-looking components, such that $s_{t+1}^e = (1-\theta)s_{t+1} + \theta(s_{t-1} + 0.5(\Delta\bar{q}_t + \bar{\pi}_t - \bar{\pi}_t^*)) + \varepsilon_t^e$ where ε_t^e is the stochastic error term.

The monetary policy rule:

Various expressions for the monetary policy rule have been used to describe the way in which the central bank sets short-term nominal interest rates.¹² The ease with which one is able to accomplish this objective is facilitated by the fact that the majority of monetary policy rules that

¹² Galí (2008) considers the implications of a few of these in small open economy setting.

have been considered are linear by definition; and most are based on those that are described in Taylor (1993). The rule that is in our model for the partially dollarized economy takes the form

$$i_t = f^i i_{t-1} + (1 - f^i) \left(\tau_t + f^p \left(E_t \left[\pi_{t+4}^{A,c} \right] - \bar{\pi}_t \right) + f^y \frac{y_t + y_{t-1}}{2} + f^s \Delta s_t \right) + \varepsilon_t^i \quad (14)$$

where i_t refers to the nominal domestic interest rate, \bar{i}_t refers to the steady-state or natural interest rate, $E_t \left[\pi_{t+4}^{A,c} \right]$ refers to the expected value of the one-year-ahead value for annual core inflation, and $\bar{\pi}_t$ is the central bank annual inflation target. Contractionary monetary policy innovations would then be effected through a positive shock to the ε_t^i stochastic term.

In terms of the coefficients, f^i would refer to the extent of interest rate smoothing, f^p refers to the central bank reaction function to deviations in expected inflation from the target rate, f^y refers to the central bank reaction function to deviations in the average of the past two quarters output gap and f^s refers to the central bank response to changes in the nominal depreciation rate of the domestic currency.

Additional model equations that define the equilibrium conditions:

In addition to the six essential behavioural equations (5, 6, 11, 12, 13 and 14) that have been described above, the model includes an additional forty-three equations that are used to define the equilibrium conditions. These include those that are used to convert quarterly to annual measures, definitions for steady-state values, and those that define the persistence in variables and innovations. A complete list of the model equations is contained in the appendix D.

6.3 Data

The dataset makes use of quarterly data that extends over the period 2001q1 to 2013q3. The start date of the sample is the earliest date for which a measure of quarterly output is available. A total of eight observed variables are used to reflect measures of: Domestic output growth, y_t , consumer inflation, π_t , nominal interest rate, i_t , real effective exchange rate, q_t , nominal

currency depreciation, s_t , foreign output growth, y_t^* , foreign inflation, π_t^* , and foreign nominal interest rate, i_t^* . Most of the data for the Tanzanian economy was obtained from the IMF's International Financial Statistics (IFS) database, with the exception of the nominal interest rate data, which were obtained from the Bank of Tanzania. The data for the United States economy was obtained from the Federal Reserve System.

A seasonal filter was applied to the unseasonally adjusted measure of domestic output, which is used to derive a measure of the domestic output gap. The filter used is described in (Hodrick and Prescott, 1997). The seasonally adjusted measure of output was used for the foreign output gap, which was also derived from a Hodrick-Prescott filter. Domestic consumer inflation rates are expressed as the year-on-year logarithmic difference in the average quarterly consumer price index, while foreign inflation is derived from the deflator. The official interest rate in Tanzania is transformed to an annualised rate to reflect the nominal domestic interest rate, while the annualised Federal Funds rate is used for the foreign interest rate. The logarithmic difference of the nominal exchange rate between the Tanzania Shilling and US dollar has been used to measure nominal exchange rate depreciation, while similar transformations have been applied to the real effective exchange rate.

6.4 Estimation Techniques

The dataset includes eight variables that span only a 12-year period. To alleviate potential problems relating to insufficient degrees of freedom, Bayesian techniques are used to estimate the parameter values. The use of these methods to estimate the parameter estimates is recommended by several researchers, including Fernández-Villaverde (2010), Fernández-Villaverde et al. (2010) and Del Negro and Schorfheide (2011).

Given the size of the model, we have elected to calibrate all of the parameters that do not relate to the essential behavioural equations. The values that we have used for this exercise follow those that are contained in Laxton et al. (2006) and Salas (2010), and may be found in the

appendix D. For the parameters in the behavioural equations we have provided details of priors in Tables 6.1 to 6.5, which also include the posterior values of these parameters.

6.5 Results

6.5.1 Posterior Estimates

All of the parameters in the aggregate demand equation were estimated, with the exception of the coefficient that is attached to the previous observed measure of the output gap, which was calibrated to the value its persistence in a first order autoregressive model (appendix D). The results that are contained in Table 6.1 suggest that the forward-looking aspect in aggregate demand is slightly smaller than the backward-looking element, which was calibrated at 0.55. In addition, given the weights of A^r and A^{rs} the posterior estimate for a^{rmc} would suggest that the weight on the real interest rate gap in domestic currency is almost 11%, while the foreign currency equivalent is approximately 5%. It is also worth noting that the coefficient value for the influence of the fiscal impulse is relatively large, while the posterior values for the other coefficients are relatively small.

Table 6.1 : Parameters - Aggregate Demand Equation

	Prior			Posterior		
	Distrib.	Mean	Std. Dev.	Mode	[10%	90%]
a^{re}	beta	0.4	0.15	0.291	0.135	0.429
a^{rmc}	beta	0.4	0.15	0.377	0.207	0.552
a^{tot}	beta	0.1	0.05	0.08	0.018	0.141
a^q	gamma	0.06	0.025	0.081	0.034	0.126
a^{fis}	beta	0.3	0.15	0.36	0.148	0.529
a^{y^*}	gamma	0.1	0.05	0.073	0.027	0.118

When we consider the results from the aggregate supply equation in Table 6.2, we note that the agents in the model are largely backward-looking, as the current value of inflation is largely influenced by past values of this variable. After multiplying out the respective parameters the backward-looking coefficient is associated with a value of 0.74, while the forward-looking component is associated with a value of 0.22. In addition, we note that the posterior value for the

parameter that is related to the measure of output is 0.11, which is slightly higher than the prior value. In terms of the effect of the sources of imported inflation, only a small proportion (7%) may be attributed to the effect of raw materials, while the largest component is due to inflation in the foreign country.

Table 6.2 : Parameters - Aggregate Supply Equation

	Distrib.	Prior		Posterior		
		Mean	Std. Dev.	Mode	[10%	90%]
b^{p*}	beta	0.11	0.05	0.058	0.018	0.102
b^p	beta	0.5	0.2	0.744	0.589	0.882
b^y	beta	0.1	0.05	0.148	0.072	0.229
c^p	beta	0.3	0.1	0.318	0.155	0.468
c^{pf}	beta	0.65	0.15	0.607	0.449	0.8

When considering the factors that influence exchange rate expectations, we note that the agents in the model are more likely to make use of forward-looking expectations, as oppose to backward-looking adaptive expectations. Evidence of this is provided by the decline in the value of the posterior estimate for θ , from 0.5 to 0.4 .

Table 6.3 : Parameters - Exchange Rate Expectations

	Distrib.	Prior		Posterior		
		Mean	Std. Dev.	Mode	[10%	90%]
θ	beta	0.5	0.05	0.411	0.358	0.478

The parameters for the monetary policy rule are contained in Table 6.3, where we note that all the posterior values are relatively closely associated with their priors, which could be used to infer that they are consistent with international evidence. In this case the response of the central bank to inflation is considerably stronger than the response to any movement in the output gap.

Table 6.4 : Parameters - Monetary Policy Equation

	Distrib.	Prior		Posterior		
		Mean	Std. Dev.	Mode	[10%	90%]
f^i	gamma	0.7	0.01	0.702	0.69	0.716
f^p	gamma	1.5	0.05	1.532	1.455	1.62
f^y	gamma	0.5	0.05	0.498	0.429	0.562

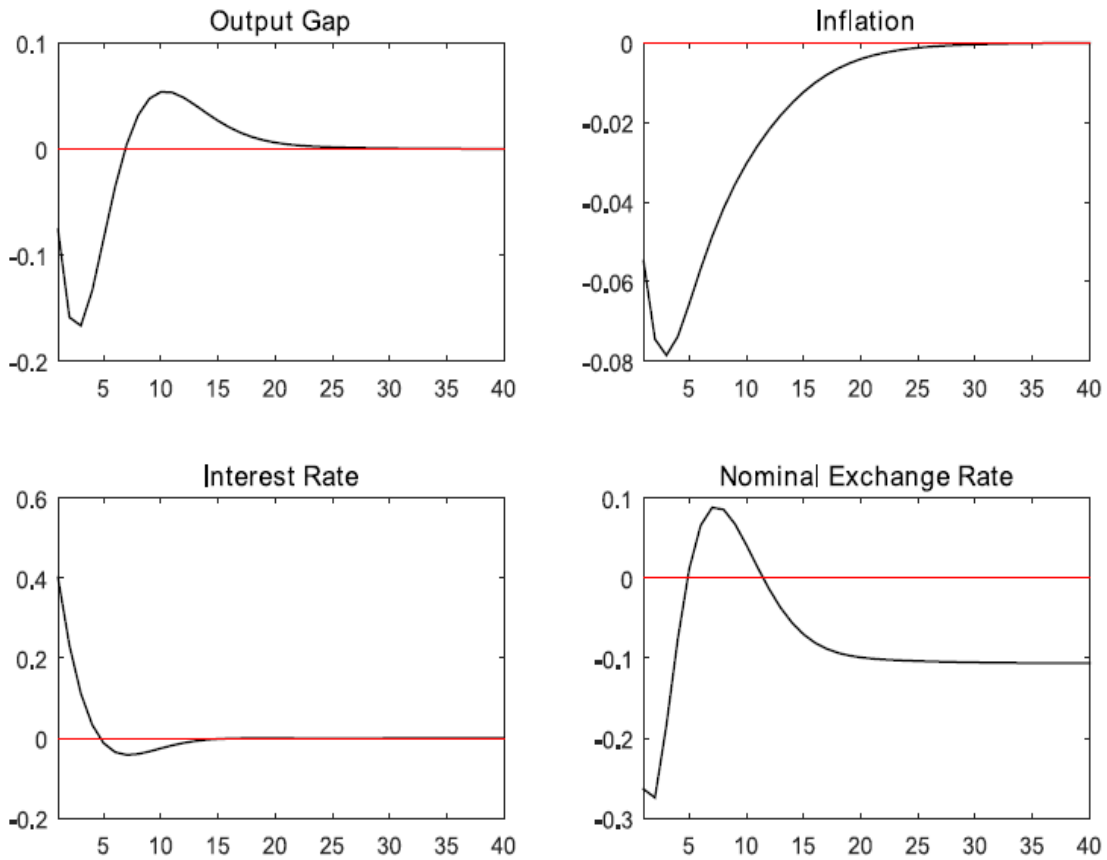
The posterior values for the parameters that pertain to the shocks and the respective persistence in these shocks are contained in the appendix.

6.5.2 Impulse Response Functions

The results of the Bayesian impulse response functions are displayed in Figures 6.1 through 6.4. The confidence interval for each of these functions is set to 90%, which ensures that they are relatively broad and consistent with the intervals that are reported for the posterior estimates.

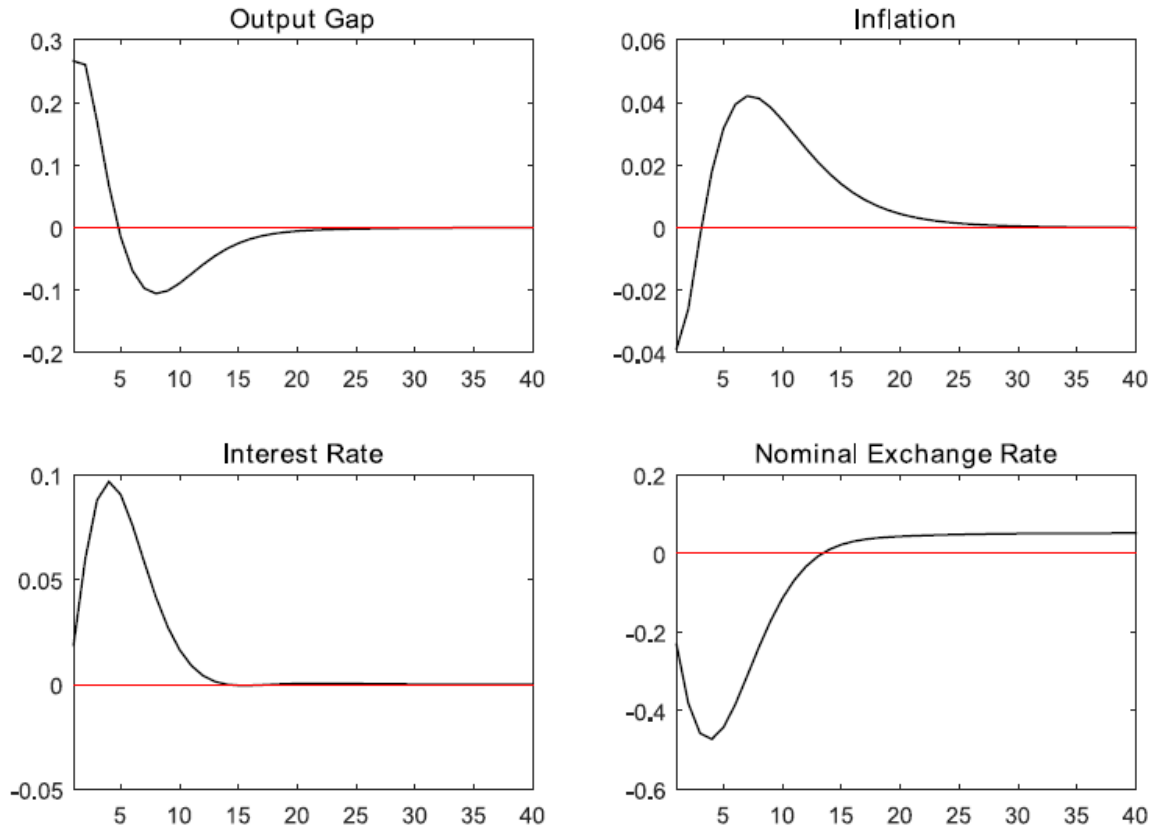
Figure 6.1 provides details of the simulated effects of a monetary policy shock that results from a 1% increase in the standard deviation in ε_t^i . We note that output and inflation decline, where the effect on output is greater than the effect on inflation, which is largely consistent with economic theory. We also note that the nominal exchange rate strengthens following the initial impact period, which is consistent with the results of a number of other studies (a decline in rate of currency depreciation is equivalent to appreciation in the exchange rate).

Figure 6.1: The Impulse Response Function - Monetary Policy Shock



The impulse response function that describes the effects of a shock to domestic aggregate demand are displayed in Figure 6.2, where positive innovation to aggregate demand results in an increase in output, which fuels inflation and causes the interest rate to rise. The rise in the interest rate causes output to stabilize and also provides some impetus for renewed currency strength.

Figure 6.2: The Impulse Response Function - Aggregate Demand Shock



The effects of a cost-push shock, which affects the aggregate supply relationship, are displayed in Figure 6.3. In this case, a positive innovation to the cost-push shock causes an increase in inflation and a decline in output. From a theoretical perspective, such a shock would shift the Phillips curve and presents a less favourable trade-off between inflation and output. The rising in the rate of inflation also results in an increase in interest rates, since the monetary policy rule places more emphasis on rising inflation than declining output. The short-term rise in interest rates is associated with a certain degree of currency strength. However, after the effects of the spike in inflation are realised, the external value of the currency depreciates.

Figure 6.3: The Impulse Response Function - Cost-Push Shock

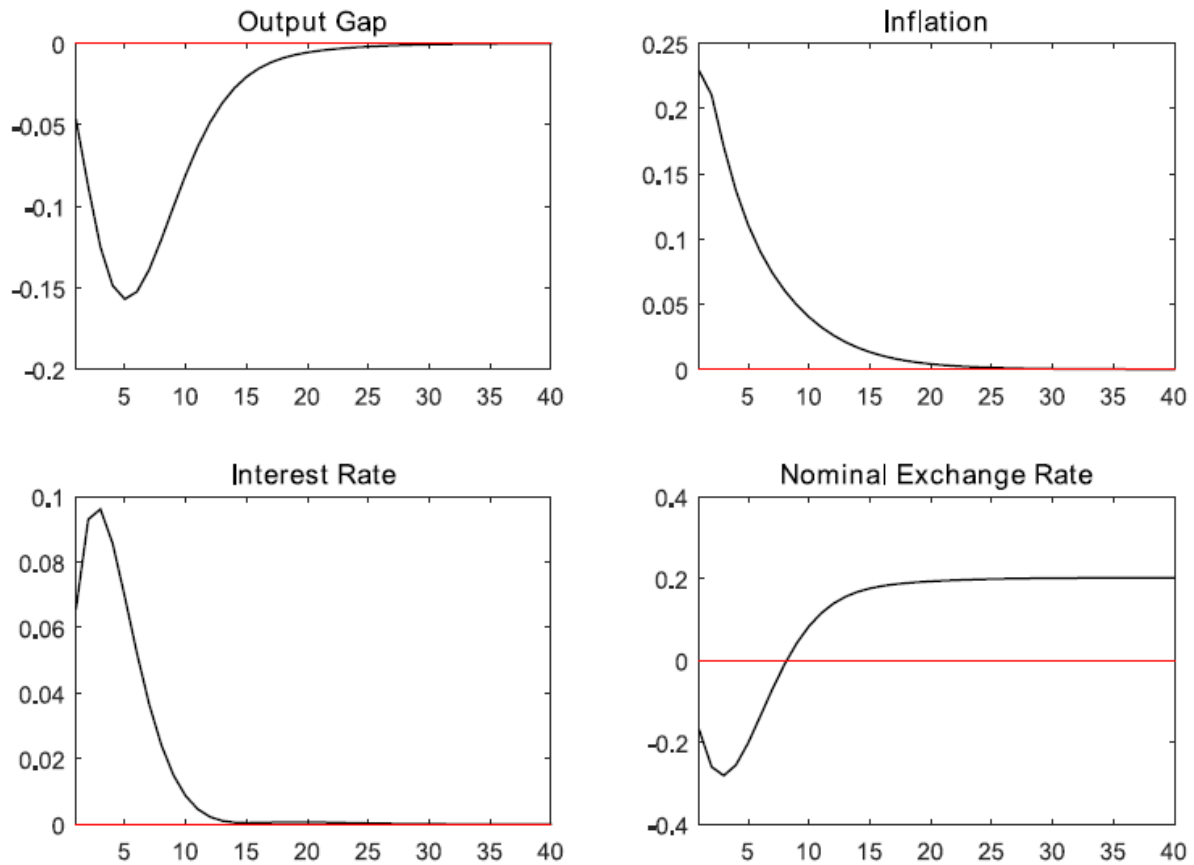
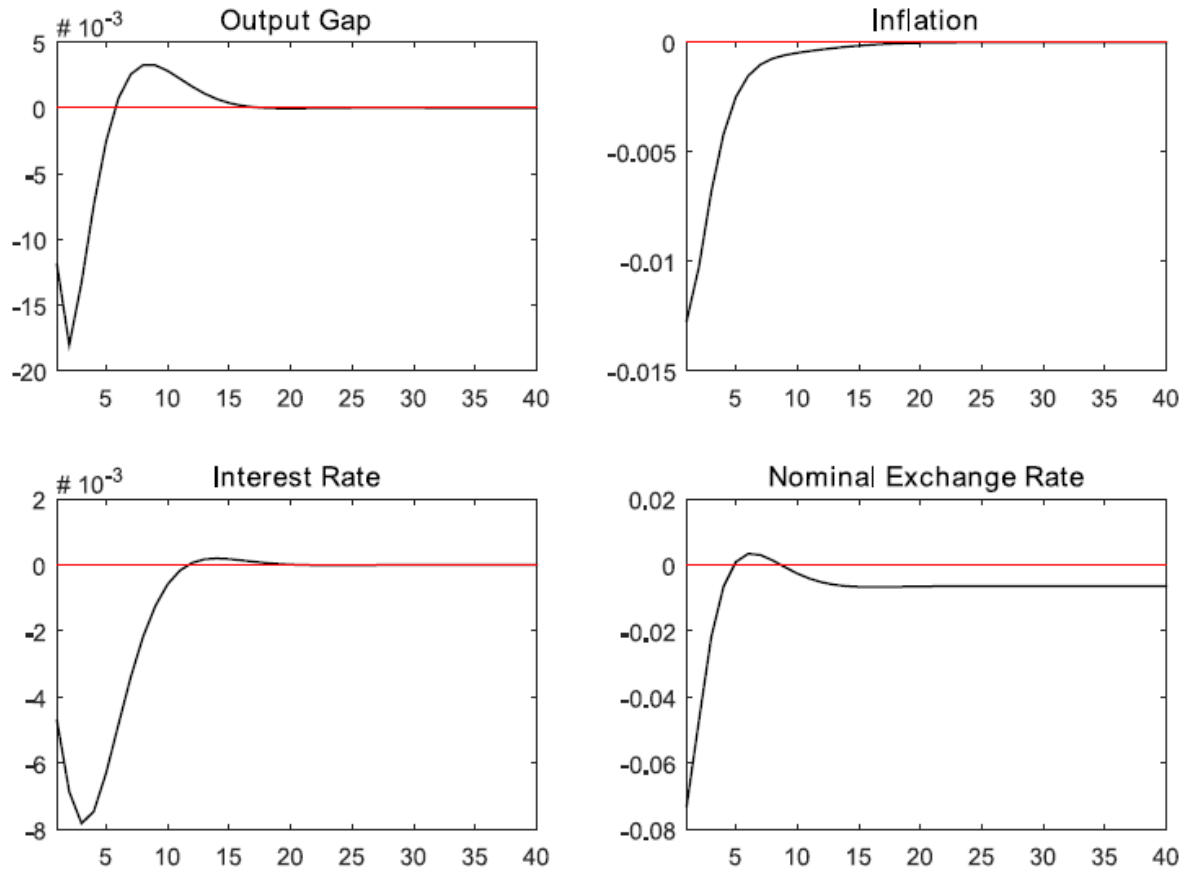


Figure 6.4 displays the effects of a shock to the exchange rate, where we note that a negative shock, which results in an appreciation of the nominal exchange rate, is accompanied by a decline in output, as the terms of trade will deteriorate. The decline in aggregate demand would result in a decline in the rate of inflation, which would allow for the central bank to ease monetary policy conditions.

Figure 6.4: The Impulse Response Function - Nominal Exchange Rate Shock



6.6 Conclusion

This paper considers the use of a small macroeconomic model for the Tanzanian economy. While all of the relationships in this model have not been derived from explicit microfoundations, it shares a number of features that are consistent with purely theoretical models. In addition, the model incorporates several conditions that are consistent with most modern new Keynesian models in that it allows for a number of nominal and real rigidities. The setting is also consistent with that of other models for a small, open-economy that employs an interest rate sharing condition with a risk premium, which is used to close off the open-economy features in the model. The agents in the model are also able to engage in the type of behaviour that is frequently observed in partially dollarized economies, where households and firms may choose to hold and transact with a foreign currency.

The results suggest that after including a role for partial dollarization in the model, monetary policy continues to have short-run effects on the real variables through the traditional interest rate channel of the transmission mechanism. In addition, we also observe that the effects of aggregate demand, cost-push, and exchange rate shocks are consistent with economic theory, where the response of interest rates would appear to be pragmatic.

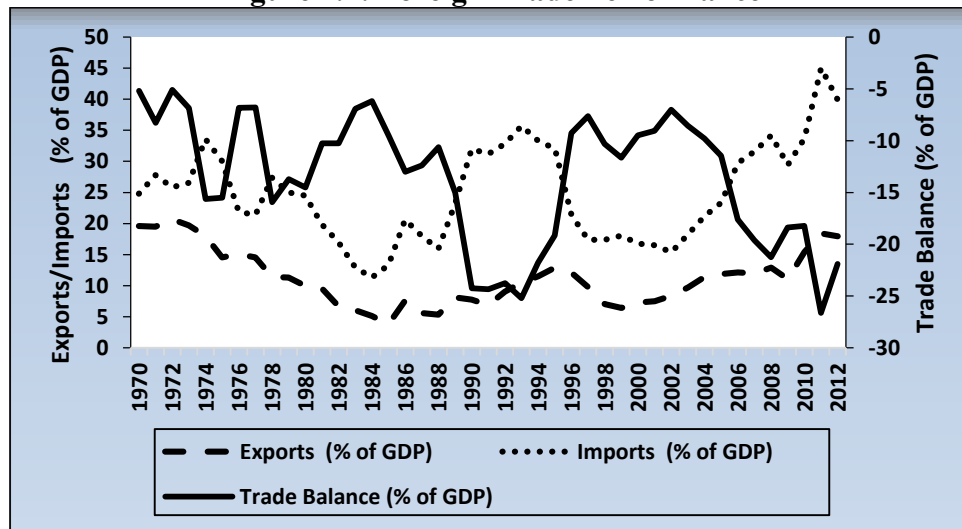
Chapter Seven

7 Exchange Rate Sensitivity of Tanzania's Foreign Trade Flows

7.1 Introduction

From the mid-1980s the Tanzanian economy began to experience positive signs of low inflation rate and positive GDP growth. This improvement in the growth of the economy is not surprising given that the export sector had become more diversified, with the main driver being the mining sector (gold). Tanzania has also become more export-oriented since the late 1990s (Ndulu et al., 2008) and the performance of Tanzania's external sector has improved (i.e. the trade account), with a recorded decrease in the deficit during early 2000s. Looking at the performance of trade flows relative to GDP, the trade balance as a percent of GDP since 2006 is worse than it was in the 1970s and early 1980s (Figure 7.1). Imports of goods and services as a percent of GDP have also been higher than exports of goods and services, as a percent of GDP, throughout the period 1970 to 2013 (Figure 7.1).

Figure 7.1: Foreign Trade Performance



Source: BOT statistics

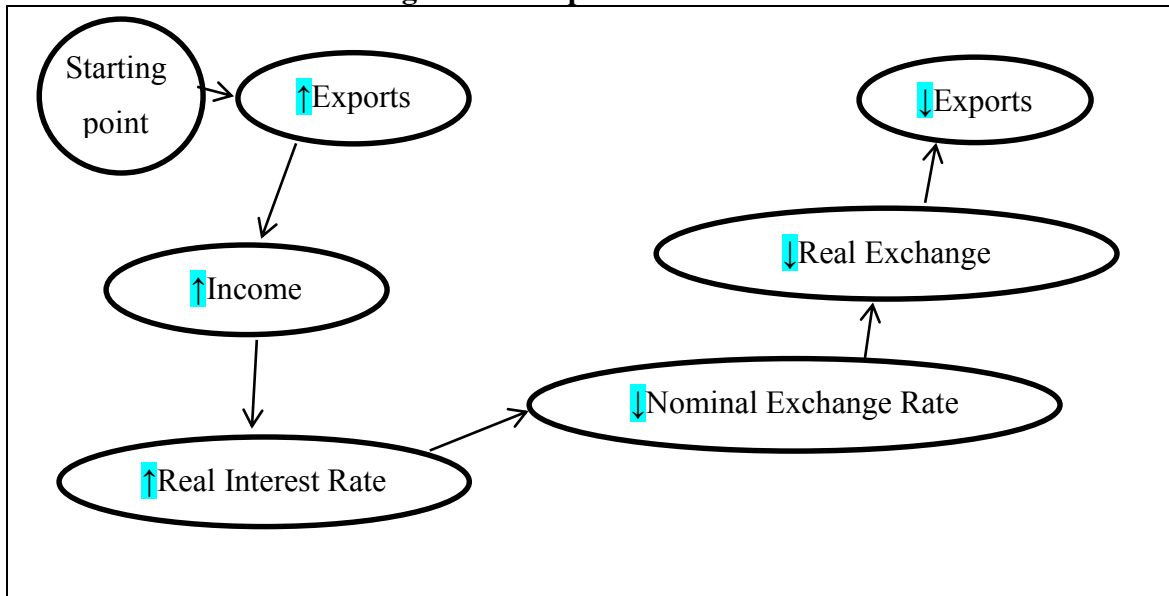
Trade balance as a percent of GDP was negative in the early 1970s, and has remained negative since that point in time. The worst deterioration of the trade balance occurred in the early 1990s, which was around negative 25 percent. By the end of the 1990s the trade balance as a percentage of GDP started to improve and remained hovering around negative 10 percent throughout the early 2000s. This improvement in foreign trade goes along with the improved growth in GDP. The growth of exports have contributed to renewed economic growth following the increase in trade openness and job creation. However developing countries like Tanzania experience many uncertainties in the form price volatility and unpredictable weather, which have severe consequences for a country that exports primary products. This chapter seeks to investigate the price effects of the exchange rate.

Hence, the objective of this chapter is to investigate the effects of the exchange rate on foreign trade flows (i.e. exports and imports), while incorporating both long run and short run dynamics. This focus is then expanded to investigate the export-led growth hypothesis, which considers the causality between exports and economic growth.

7.1.1 Export-Led Growth

Tanzania has embarked on a five-year program of National Export Strategy (NES, 2010 - 2014) with the vision to “sustain development and wealth creation through export led growth in line with the National Strategy for Growth and Reduction of Poverty (MKUKUTA) goals and cluster strategies (Tanzania National Export Strategy Report , 2010-2014, page 2)”. However, the United Nations Conference on Trade and Development (UNCTAD) stated in 2013 that “export-led development is no longer viable, economies will perform better with more balanced strategies” (Trade and Development Report, 2013). This implies that the National Export Strategy to increase export competitiveness and performance are necessary, but should be combined with other measures. Accordingly, this chapter estimates the export effects on growth, whilst allowing two-way causality to determine if income growth in Tanzania implies more exports.

Figure 7.2: Export- Led Growth



Sources: Author's own

The starting point of this graph is the understanding that a rise in exports generates income growth, *ceteris paribus*. The growing income thereby creates a rise in the real interest rate. This is because increase in the demand for capital caters for the increase in demand for goods and services due to high income. Assuming other factors remain constant (central bank decisions are not to increase money supply, inflation is stable). The rising real interest rate attracts more foreign capital, effectively appreciating the nominal exchange rate, causing the RER to appreciate as well. The resulting stronger domestic currency will then curb exports. The aforementioned rise in exports is now engrossed by an appreciation of RER. This is influenced by the assumption that central bank decisions were held constant, that is, money supply was not adjusted in reaction to interest rates' negative effect on exports. The implication of this is that export-led growth is unsustainable and short-lived in the short run, meaning when some variables like prices are constant. The strength and sustainability of export-led growth means the larger the share of exports on GDP, the less the interest rate reacts to income, the less the exchange rate reacts to the interest rate and the less exports are responsive to the exchange rate. The Tanzania National Export Strategy is mainly focused on the internal basis for export-led growth. This is because more internal development and adjustments were needed to accelerate export growth. However, external reasons for export-led growth include the GDP of Tanzania's trading partners.

Countries with high incomes will have more need for Tanzanian exports. The UNCTAD report raises concerns, however, because of the recently slowed growth in developed countries, suggesting less demand for exports from developing countries like Tanzania, and rendering export-led growth unsustainable.

7.2 Theoretical Literature Review

This section reviews literature on the short run effect “time lag” of devaluation (J-curve), the literature on the long run effect only and the literature which combines both short run and long run effects of exchange rate devaluation on trade. The J-curve refers to the case where elasticity condition is not satisfied in the short run, but is satisfied in the long run. This flows from the fact that there is time lag, that is, trade volumes take time to adjust due to trade contracts. Thus, an increase in the nominal exchange rate may initially worsen the trade balance and later improve it. There are various channels through which the exchange rate can affect the trade balance. These are: the elasticity approach, income multiplier approach, absorption approach, and monetary approach. The next section provides a more detailed analysis of the theoretical literature around the mentioned approaches.

The elasticity approach (also referred to as the relative-price approach) is the earliest amongst the channels investigated to explain the effect of exchange rate on the balance of trade (Bickerdike, 1920; and Metzler, 1948). The approach posits that devaluation of the domestic currency reduces the price of domestic goods (which includes exports) relative to foreign goods. This increases export demand and consequently the export volume increases. The depreciation of the exchange rate increases import prices in domestic currency terms (the price of imports relative to the price of domestic goods increases). Since export demand expands and import demand contracts, the resultant effect is an improvement in the trade balance. The elasticity approach simply implies that nominal exchange rate depreciation will improve the trade balance only if the sum of the export (ϵ_x) and import (ϵ_m) elasticities with respect to prices is greater than one. This is referred to as the Marshall-Lerner condition (Marshall, 1923 and Lerner, 1944) and the following equation is achieved:

$$\varepsilon_x + \varepsilon_m > 1$$

The income multiplier approach resolves the inability of the elasticity approach to capture the income effect of an improvement in the trade balance. The income approach postulates that the exchange rate depreciation improves trade balance if the marginal propensity to spend on domestic output (which is the marginal propensity to consume plus the marginal propensity to invest minus the marginal propensity to import) is less than one. This is because the depreciation of nominal exchange rate increases income. The increase in income takes place through the increase in aggregate domestic demand, which comes from the increase in demand for exports and the substitution of import demand for domestic goods. This increase in income increases imports which reduces the trade balance. This is the second round effect of the increase in exchange rate on imports. This implies that even if the Marshall–Lerner condition is satisfied, devaluation does not necessarily improve the trade balance once the income effect is taken into consideration.

The absorption approach (Alexander, 1952) considers the effects of exchange rate depreciation on income and absorption. The approach maintains that depreciation of domestic currency improves the trade balance if it increases income more than it increases absorption, if it reduces absorption more than it reduces income, or if it increases income and reduces absorption. B (*Trade Balance*) $\equiv Y(\text{Income}) - A(\text{Absorption})$; $\Delta B = \Delta Y - \Delta A$. The depreciation of exchange rates increases income if there are unemployed resources in the economy or if it improves the terms of trade. The impact of exchange rate depreciation on absorption can be direct or indirect (when exchange rate impacts absorption through change in income). This approach, maintains that the effect of devaluation in the trade balance is ambiguous.

The monetary approach considers the money market to examine the effect of exchange rate depreciation on the trade balance. This approach considers balance of payments as a monetary phenomenon, such as any imbalances that emerges from the mismatch between money supply and demand (Frenkel, 1981; Dornbusch, 1980). It concludes that, in the short run, prices are sticky, the depreciation of exchange rate improves the balance of trade, but in the long run the

monetary consequences of the balance of trade ensures that the improvement is neutralized by a deterioration in the balance of trade. The depreciation of the exchange rate increases the domestic price of exported goods, which implies a reduction in real money balances, requiring a decrease in spending to maintain the desired level of the real trade balance. The decrease in spending has a negative impact on output and exports; where exports are a function of output. This a change in the exchange rate has no effect on the balance of trade in the long run.

This chapter incorporates two approaches, the elasticity and J-curve approaches, to investigate the effects of exchange rate depreciation on Tanzania's trade balance. It combines short run and long-run effects of exchange rate devaluation. The elasticity approach assumes the economy is small, that is, it cannot affect the prices of its exports and imports. The J-curve approach addresses the short run dynamics emerging from a continuation of a deteriorating trade balance, even when the Marshall–Lerner condition is satisfied. Short run elasticities are usually smaller than long run elasticities. That is, elasticity increases as time passes after a devaluation of the exchange rate. The idea behind this phenomenon is that there is a time lag for other necessary components of trade to adjust to changes in the exchange rate (Krueger, 1983). It is anticipated that the necessary features for devaluation is short run deterioration and long run improvement (Bahmani-Oskooee and Ratha, 2004).

Figure 7.3: Devaluation on the Trade balance J-Curve

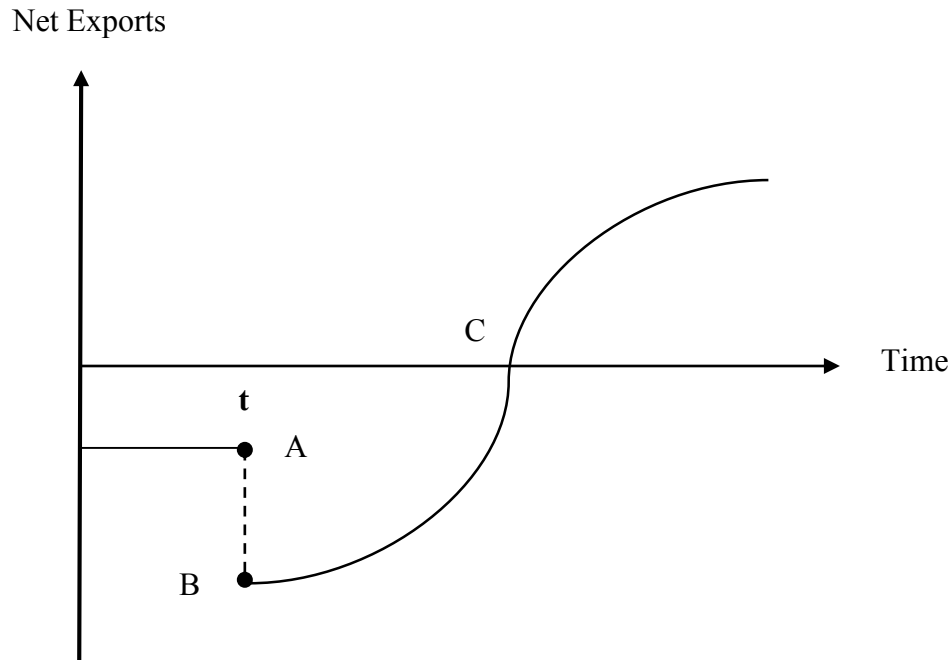


Figure 7.3 depicts the impact of domestic currency depreciation on net exports (trade balance). At time ' t ' there is a depreciation in the currency. However, due to lags and price stickiness, the impact of the depreciation on the trade balance is not initially positive, dropping from point A to point B after the depreciation. Initially the trade balance weakens because that the price of imports has risen. However, agents have either not had enough time to change supplies or information regarding the depreciation has not disseminated quickly enough, resulting in no change in the quantity of imports. Simultaneously, initial exports have not increased in order to offset the loss of income by the higher cost of imports. Over time, the information regarding the depreciation is disseminated. Individuals may also adjust import and export quantities according to the price change, which, of course, improves the existing trade balance. Over time, the increased exports and decreased imports cause the currency to strengthen, reversing the effects of the depreciation.

7.3 Empirical Literature

Magee (1973) was among the first to address the short run effect of devaluation. The study argues that devaluation improves the trade balance in the long run, and the post-devaluation time-path of the trade balance is ambiguous in the short run. The study, along with that of Junz and Rhomberg (1973), identifies five types of lags which delay the trade response after devaluation of the exchange rate. Lags may be due to recognition, decision, delivery, replacement, and production. The recognition lag is the time needed for the markets to know that the exchange rate has changed. The decision lag is the time needed to establish new orders (contracts). The delivery lag is the time needed to deliver the orders. The replacement lag is the time needed for the replacement of inventories, outdated equipment and other items. The production lag is the time needed to undertake modifications in supply (Stucka, 2004).

Extensive empirical research was undertaken in the 1980s and 1990s on the effect of the exchange rate on the balance of trade. Most of these studies were undertaken on developed countries, and the evidence is inconclusive. Some studies find that devaluation does not improve the trade balance in the United States in the long run and short run (Rose and Yellen, 1989). Other studies in the US, and other developed countries, have found that devaluation improves the trade balance, at least in the long run (Demirden and Pastine, 1995; Marwah and Klein, 1996; Gupta-Kapoor and Ramakrishnan, 1999). These studies include those that apply Vector Autoregression, disaggregated data, instrumental variables, Ordinary Least Squares, vector error correction models, and impulse response analysis. Macro-simulation frameworks have also been used to examine the effect of the exchange rate on the balance of payments and some found that currency devaluation does not improve the trade balance (Musila and Newark, 2003; Taye, 1999).

Bahmani-Oskooee and Goswami (2004) estimate error-correction models for Japan and nine of Japan's key trading partners, applying other ways of assessing the impact of currency depreciation on bilateral trade flows for the period 1973 - 1998. Using the Autoregressive Distributed Lag (ARDL) approach, they find that Japan's exports are not sensitive to RER in most cases, but Japanese imports are very sensitive to RER. Bahmani-Oskooee and Ratha (2004)

review the J-Curve related empirical literature. This research posits that currency devaluation initially worsens the trade balance, but later improves it through “time path-effects”. The research finds that the short run response of the trade balance is ambiguous. The long run response, however, yields more outcomes on bilateral trade data and supports the positive long run relation among exchange rate and trade balance. Bahmani-Oskooee (1985) uses the Almon lag structure on the exchange rate variable as a different way of detecting the existence of the J-Curve for a sample of developing countries with different exchange rate regimes for the period 1973 - 1980. The study finds empirical evidence regarding the existence of the J-curve in the four countries studied. Nadenichek’s (2000) study on Japanese-US trade for the period 1974 - 1996 finds no evidence for the J-curve pattern, other than that the persistent depreciation of the US RER has led to a deficit in the US trade with Japan. The study uses a Structural Vector Autoregression model to examine the interaction between output, the RER and trade. It concludes that an appreciation of the RER triggers an improvement in the trade balance and growth in output.

Gupta-Kapoor and Ramakrishnan (1999) verify the J-curve phenomenon for Japan for the period 1975-1996. The study uses an error correction model and the impulse response function, and finds that there is a long run equilibrium relationship between the ratio of imports to exports and the exchange rate. The impulse response function shows that the J-curve holds in a flexible exchange rate regime. Koch and Rosensweig (1990) investigate the J-curve explanation for US data during the era of floating exchange rate only (1973 - 1987). They find delays of US import response to dollar movement (trade-balance response), contrary to J-curve theory. They suggest their results could explain the 1985 delay of US trade balance responses to the decline of the dollar. Petrović and Gligorić’s (2010) study on Serbia uses Johansen’s autoregressive distributed lag approach to examine whether and how exchange rate affects trade balance in the long and short runs. The two approaches give the same result, that exchange rate depreciation improves trade balance in the long run, while giving rise to a J-curve effect in the short run. The error correction models also indicate the same, that the J-curve pattern follows an episode of currency depreciation. This implies trade balance first deteriorates before it improves. The study also estimates the J-curve using the impulse response of the trade balance upon the exchange rate

shock. They find that the trade balance, hit by exchange rate depreciation, deteriorates in the first five months and subsequently improves, reaching a new equilibrium value in a little over a year. They provided warnings against relying solely on the impulse response results.

There is, however, research which does not find evidence of a J-curve. Halicioglu (2007) employs cointegration, generalized impulse response analysis, and stability tests to examine the dynamics of bilateral and aggregate trade for Turkey. The empirical results for Turkish bilateral trade and trade with nine trading partners suggest the non-existence of the J-curve effect at disaggregate and aggregate levels. However, the Marshall-Lerner condition holds for the aggregate data, for trade with some of the trading partners. With regard to the stability of trade balance equations, the findings are mixed.

Bahmani-Oskooee and Wang (2006) disaggregate the data by country to estimate a trade balance model for China and the country's 13 major trading partners. They find little support for the J-curve hypothesis, as real depreciation of the Chinese currency has a favourable impact on trade balance with a few partners only, especially the USA. They use Johansen's co-integration technique and the bound testing approach. Their results revealed that a real depreciation has significant short run effects, but does not follow the path outlined by the J-curve phenomenon. These short run effects, however, disappeared in the long run except in cases of trade with four partners, including the US, China's largest trading partner. An important policy implication of this finding is that a real devaluation against the US Dollar will have long run favourable effects on the trade balance between China and the United States. The impulse response functions show similar results.

Narayan (2006) investigates China's trade balance and the bilateral RER with the USA. The study uses the bounds testing approach to check for cointegration, the autoregressive distributed lag to estimate the long and short runs and the impulse response functions to estimate the impact of shocks to exchange rate on the trade balance. They find evidence that there is a long run relationship between trade balance and RER, and that in both the short and long run a real devaluation of the Chinese RMB improves the trade balance. As a result, there is no evidence of a J-curve type adjustment. The results of the impulse response show that a standard deviation

shock to RER creates a lot of instability in China's trade balance for the first three years, but the impact of this shock dies out thereafter.

Gomes and Senne (2005), use a VECM model to check if the Marshall-Lerner condition and J-curve phenomenon hold in the case of Brazil after the country's adoption of a crawling-peg exchange rate regime. The results indicate that the Marshall-Lerner condition holds in the long run and in the short run, and the J-curve pattern is present.

A number of studies have empirically investigated the effects of the exchange rate on external trade performance. However, research on Tanzania has not been based on current data. For instance, Rawlins and Praveen (1993) investigate the impact of real exchange-rate devaluation on the trade balance for Tanzania and 18 other African countries. They specified and estimated an Almon Distributed Lag process of trade balance using annual data that consists of monetary and fiscal policy variables. Their findings suggest that RER depreciation improves the trade balance of Tanzania. However, their study does not distinguish between the effects of depreciation of the nominal exchange rate and inflation on the trade balance. Furthermore, their study does not capture the various macroeconomic interactions that follow a change in the exchange rate. Finally, their study focuses on the long run impact on the trade balance, with little attention to the short run impacts.

7.4 Theoretical Framework and Methodology

7.4.1 Exchange Rate Sensitivity of Trade: Methodology

The theoretical framework for the empirical model of this chapter is the absorption approach. This approach takes into consideration the many channels through which a change in exchange rate can affect trade flows by the incorporation of income and price variables. This study adopts a two-country model, building on Rose and Yellen (1989). In this model the home country is Tanzania and the foreign country is the rest of the world. Trade flows are assumed not to be perfect substitutes for domestic goods, in order to allow for the calculation of finite elasticities of demand and supply. This follows the literature, including Rose and Yellen (1989).

In summation, the value of the domestic trade balance (TB) is the value of net exports in domestic currency divided by P :

The trade balance can then be expressed in real terms as follows:

$$TB = B(q, Y, Y^*) \quad (7.1)$$

Using the above equations (7.1), the study estimates the trade balance as a function of q (the RER), Y is the real domestic income and Y^* is the real foreign income. By looking at the sign on the partial derivative of TB with respect to q , it will be able to determine the depreciating effects of the RER on the trade balance. The J-Curve assumptions are negative short run derivative and positive long run derivative. Consequently, after devaluation the balance of trade in real terms deteriorates in the short run and improves in the long run.

7.4.2 Export-Led Growth – Methodology

Export-led growth studies mainly use Granger causality methodology to examine the causality between export and the income level (Alimi and Muse, 2013).

The general framework is provided by a VAR (p) model (Petrović and Gligorić, 2010):

$$Z_t = a_0 d_t + \sum_{i=1}^p \Pi_i Z_{t-i} + u_t$$

Where: Z_t is a $K \times 1$ vector of endogenous variables; d_t is a vector of deterministic elements, u_t is a vector of errors with expected value zero and covariance matrix. Endogenous variables are the growth rate of exports and growth rate of real gross domestic product. This simple framework provides a systematic way to capture rich dynamics in multiple time series, and the statistical toolkit that comes with VARs is easy to use and interpret (Stock and Watson, 2001). As Sims (1980) and others argue, in a series of influential early papers, VARs held out the promise of providing a coherent and credible approach to data description, forecasting, structural inference,

and policy analysis. For illustration purposes x_t, y_t are presented as a second order VAR with deterministic trend “t”:-

$$y_t = a_{10} + a_{11}t + a_{12}y_{t-1} + a_{13}x_{t-1} + a_{14}y_{t-2} + a_{15}x_{t-2} + u_{1t}$$

$$x_t = a_{20} + a_{21}t + a_{22}y_{t-1} + a_{23}x_{t-1} + a_{24}y_{t-2} + a_{25}x_{t-2} + u_{2t}$$

The elements of the variance/covariance matrix Σ are:

$$E(u_{1t}) = \sigma_1^2; E(u_{2t}) = \sigma_2^2; E(u_{1t}u_{2t}) = \sigma_{12}$$

The interest is in the relationship between a measure of output, e.g. the logarithm of real domestic product (y_t), and export variables, say the logarithm of exports (x_t). Given $t=1, 2, \dots, T$. The variable, (y_t), is said to be Granger-causal for another variable, (x_t), if knowing past (y_{t-1}), in addition to other available information, including past (x_{t-1}). This explains the current (x_t) or, equivalently, current (y_t) to predict future (x_{t+i}).

The null hypothesis is:

- Export (x_t) does not Granger cause output (y_t) i.e. $a_{13} = a_{15} = 0$ and output (y_t) does not Granger cause export (x_t) i.e. $a_{22} = a_{24} = 0$.

To test the hypothesis the VAR-granger causality analysis will be conducted and the existence of causality will help answer our hypothesis.

7.5 Empirical Methodology

The Autoregressive Distributed Lag (ARDL) approach to cointegration as proposed by Pesaran and Shin (1995) and Pesaran et al. (2001) is employed here.

The trade balance (export ratio to import value) functions in log linear form,

$$\ln TB_{it} = \alpha + \gamma \ln Y_t + \tau \ln Y_{it}^* + \phi \ln RER_{it} + \varepsilon_t \quad (7.2)$$

Where: TB_{it} is Tanzania's trade balance with trading partner i at time t , Y_t is Tanzania's gross domestic product at time t , Y_{it}^* is the gross domestic product of trading partner i at time t , RER_{it} is the Tanzanian RER with trading partner i at time t , and ε_t is a white noise error term. The study examines only major trading partners which are: China, European Union, Germany, India, Japan, Kenya, South Africa, United Arab Emirates, and United States of America. The white noise error assumption allows us to estimate consistently by ordinary least squares (OLS). The estimated empirical equations are essentially log-linear approximations to equation 6.2, supplemented by a trend factor and disturbance term to represent 'unimportant', omitted factors. The ARDL approach to cointegration by Pesaran et al. (2001) allows investigation of the short run dynamics of the model, which refers to the J-curve test. (6.2) is transformed to the error correction version of the ARDL model which is:

$$\begin{aligned} \Delta \ln TB_{it} = & \alpha + \sum_{j=1}^n \beta_j \Delta \ln TB_{it-j} + \sum_{j=0}^n \gamma_j \Delta \ln Y_{t-j} + \sum_{j=0}^n \tau_j \Delta \ln Y_{it-j}^* \\ & + \sum_{j=0}^n \phi_j \Delta \ln RER_{it-j} + \delta_1 \ln TB_{t-1} + \delta_2 \ln Y_{t-1} + \delta_3 \ln Y_{it-1}^* + \delta_4 \ln RER_{it-1} + \mu_t \end{aligned}$$

This chapter describes the two steps followed, as proposed by Pesaran et al. (2001). The first step is to perform the F-test (variable addition test) to justify the addition of the level of variables. This chapter investigates if a long run relationship exists between trade balance and exchange rate, that is, whether the trade balance and exchange rate are cointegrated. There is no need for pre-testing unit roots with the approach of Pesaran et al. (2001), since this takes into consideration the stationarity properties of variables and provides a way to escape the still questionable route of testing for unit root. However, to ensure nonexistence of the $I(2)$ variable, unit root test was performed.

The null hypothesis is

- $H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ – This means there is no cointegration among level variables and the alternative hypothesis is $H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$.

Under the null, the F-statistic has an asymptotic, non-standard distribution, regardless if all variables are I(0), I(1) or mutually cointegrated. The critical values form a lower and an upper bound for the opposite cases where all variables are I(0) or I(1). Using variables of different I(d) is not a problem since the bounds cover all situations. The existence of cointegration will help to identify the existence of a long-run relationship.

The advantage of the bounds test is that if the F-statistic falls outside the bounds no knowledge is needed about the characteristics of the integration or the cointegration. The disadvantage is that if the F-statistic falls within the bounds, the test is inconclusive, which means that more knowledge about the series is needed (Pesaran et al., 2001). This thesis opts for the critical values provided by Narayan (2004), rather than the original values reported in Pesaran et al., (2001). The reason behind this is the fact that the values of Narayan are suitable for small sample sizes of between 30 and 80 observations, whereas Pesaran et al., values are based on much larger samples of between 500 and 1000 observations. The null can be rejected if the calculated F-stat lies above the upper bound, whereas the null cannot be rejected if the F-statistic falls below the lower bound. The second step is to estimate the whole equation (error-correction). To determine the autoregressive lag length, Akaike Information Criterion (AIC) for lag selection criterion has been applied.

Apart from time lags that are caused by contracts, we expect time lag effects due to distance, as the majority of the trading partners in our estimation are far from Tanzania which prolongs shipping time and ordering time (Marwah and Klein, 1996). As a result of these delays, short run and long run elasticities will not necessarily be the same, and foreign trade reactions to exchange rate movements will be time dependant. It is also expected that the respective elasticities differ from other studies in that strong business relationships might overlook the movements of the exchange rate.

7.5.1 Data Descriptions

This study focuses on time series analysis of quarterly data for 1986Q1 to 2013Q4, sourced from International Financial Statistics (IFS). The trading partners are China, India, Japan, Kenya, South Africa, European Union, United Arab Emirates and United States. The trade balance is calculated as nominal value of exports to value of imports. The study also estimates exports and imports separately for each trading partner. Y^* is the real GDP of trading partner i . Y is the real GDP of Tanzania and RER is the RER of the Tanzanian Shilling per the trading partner currency. Since quarterly frequency data of the GDP is not available for some countries, the study assumes the ratio of exports in a quarter to exports in a year equal the ratio of GDP in a quarter to GDP in a year. The following formula was used to interpolate GDP for those countries:

$$Y_{tTi} = \frac{X_{tTi}}{X_{Ti}} Y_{Ti}$$

Where: Y_{tTi} and X_{tTi} are the GDP and export values in quarter t of year T for country i , while Y_{Ti} and X_{Ti} are the GDP export values for country i in year T . All variables are transformed to natural logarithms. This helps to fit the variables into a normal distribution as macro variables sometimes have a positive skew distribution.

The principal components analysis is also used to reduce the dimension of the dataset. The indices are constructed for exchange rates, exports, imports, trade balance and foreign GDP. The indices created by Principal component analysis (PCA) are a linear combination of the respective original attributes weighed by their variances. The application of PCA requires the variables to be correlated. We calculated principles of the estimated correlation. The pairwise correlation coefficient is greater than 50 percent for exports (Table 7.1), imports (Table 7.2) and trade balances (Table 7.3). The application of PCA on these variables is appropriate as they are strongly correlated. South Africa's real GDP (Table 7.4) is weakly correlated with other countries' real GDP.

Table 7.1: Correlation Matrix of Tanzania Exports to Major Trading Partners

	LUAEXP	LCHNEXP	LEUEXP	LINDEXP	LJPNEXP	LKNYEXP	LZAEEXP	LUSAEXP
LUAEXP	1.000000							
LCHNEXP	0.889573	1.000000						
LEUEXP	0.729344	0.700670	1.000000					
LINDEXP	0.680846	0.677961	0.670989	1.000000				
LJPNEXP	0.812256	0.795135	0.711043	0.639260	1.000000			
LKNYEXP	0.825497	0.780371	0.797878	0.741922	0.785865	1.000000		
LZAEEXP	0.821149	0.789949	0.753114	0.666659	0.730305	0.788853	1.000000	
LUSAEXP	0.855888	0.827121	0.705868	0.724741	0.745749	0.794013	0.769759	1.000000

Table 7.2: Correlation Matrix of Tanzania Imports from Major Trading Partners

	LUAIMP	LCHNIMP	LEUIMP	LINDIMP	LJPNIMP	LKNYIMP	LZAIMP	LUSAIMP
LUAIMP	1.000000							
LCHNIMP	0.903480	1.000000						
LEUIMP	0.879607	0.917065	1.000000					
LINDIMP	0.943925	0.932785	0.893203	1.000000				
LJPNIMP	0.714082	0.770295	0.732883	0.810416	1.000000			
LKNYIMP	0.849581	0.875514	0.822364	0.829676	0.587616	1.000000		
LZAIMP	0.811445	0.694919	0.601095	0.718125	0.541092	0.799202	1.000000	
LUSAIMP	0.843072	0.825988	0.770727	0.857286	0.712373	0.760183	0.753399	1.000000

Table 7.3: Correlation Matrix of Tanzania Trade Balances-Major Trading Partners

	LUAETB	LCHNTB	LEUTB	LINDTB	LJPNTB	LKNYTB	LZATB	LUSATB
LUAETB	1.000000							
LCHNTB	0.929416	1.000000						
LEUTB	0.936775	0.925405	1.000000					
LINDTB	0.926612	0.911943	0.905172	1.000000				
LJPNTB	0.813171	0.836872	0.831962	0.870067	1.000000			
LKNYTB	0.904863	0.902057	0.852451	0.857542	0.762359	1.000000		
LZATB	0.839682	0.737167	0.734991	0.758666	0.687473	0.847460	1.000000	
LUSATB	0.879674	0.863168	0.846398	0.876157	0.823927	0.840296	0.799706	1.000000

Table 7.4: Correlation Matrix of Tanzania's Trading Partners' Real GDP

	LUAERGDP	LCHNRGDP	LEURGDP	LINDRGDP	LJPNRGDP	LKNYRGDP	LZARGDP	LUSARGDP
LUAERGDP	1.000000							
LCHNRGDP	0.976408	1.000000						
LEURGDP	0.858584	0.784780	1.000000					
LINDRGDP	0.927174	0.938992	0.789811	1.000000				
LJPNRGDP	0.954184	0.922088	0.899210	0.859465	1.000000			
LKNYRGDP	0.389632	0.429701	0.346672	0.583273	0.344215	1.000000		
LZARGDP	-0.323908	-0.285206	-0.249567	-0.011463	-0.389541	0.416344	1.000000	
LUSARGDP	0.959052	0.925064	0.886347	0.832130	0.959582	0.207348	-0.501537	1.000000

The Kenya's Shilling exchange rate (Table 7.5) has a weak correlation with other countries' exchange rate but greater than 50 percent with India. The correlation coefficients support the application of PCA to calculate the indices.

Table 7.5: Correlation Matrix of Tanzania's exchange rate - major Trading Partners

	LUAEXRATE	LCHNXRATE	LEUXRATE	LINDXRATE	LJPNXRATE	LKNYXRATE	LZAXRATE	LUSAXRATE
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LUAEXRATE	1.000000							
LCHNXRATE	0.748913	1.000000						
LEUXRATE	0.842408	0.505601	1.000000					
LINDXRATE	0.822107	0.624225	0.793517	1.000000				
LJPNXRATE	0.890595	0.694030	0.616780	0.679521	1.000000			
LKNYXRATE	0.067273	0.106748	0.161567	0.573754	-0.054431	1.000000		
LZAXRATE	0.827166	0.681890	0.768759	0.878775	0.800456	0.304292	1.000000	
LUSAXRATE	0.836698	0.619052	0.805851	0.958191	0.647337	0.545814	0.799995	1.000000

The motivation for using principle component analysis is to reduce the dimensionality of interrelated variables while keeping the variation in the data as much as possible. The study retains the first principal component for each variable, since the next components offers little increase in the total variance explained (Holland, 2008).

7.6 Results and Interpretations

This chapter has been constructed to estimate bilateral exchange rate effects for Tanzanian trade with major partners in order to determine the magnitudes and relevant time delays in trade accounts. The F-statistics are obtained for four lags. The decision is constrained by the short time span of the dataset. The results are reported in **Table 7.6**. We deleted insignificant variables.

Table 7.6: Cointegration F-Test for Tanzania's variables in relation to Her Major Trading Partners

Trading Partner	Calculated F-statistics	
	The Whole Equation	The Reduced Equation
China	6.18247***	8.837284***
India	9.484692***	13.96238***
Japan	2.957524	3.860258**
Kenya	4.575058**	7.835101***
South Africa	2.306252	3.376044
European Union	3.619960	4.345671**
United States of America	4.747565**	17.30611***

***, ** and * denote statistical significance at 1, 5 and 10 percent respectively

The F-test reveals that only Tanzania's trade with China and India is significant at both levels. With Kenya and the United States the null hypothesis that there is no cointegration is rejected at 10 percent. There is no evidence of a long run relationship between variables of Tanzanian trade with Japan, South Africa and the European Union. However, when all insignificant first

difference variables are eliminated, the long run relationship is evidenced with all trading partners, including South Africa.

Table 7.7: Short Run Estimates of Exchange Rate and Error Correction Term

Trading Partner	$\Delta \ln RER_{it-j}$	EC_{it-j}
China	0.028596 (0.40594)	-.33030 (4.6092)
India	2.3685*** (3.2918)	-.50424 (5.7459)
Japan	.35391** (1.9348)	-.21258 (2.2246)
Kenya	.035370 (.21783)	-.19847 (3.4801)
South Africa	-1.320** (1.7338)	-.37749 (3.5965)
European Union	-.83259*** (2.5793)	-.12986 (1.7465)
United States of America	.78335** (1.7957)	-.79938 (8.5398)

***, ** and * denote statistical significance at 1, 5 and 10 percent respectively

In the short run, exchange rate devaluation affects positively and significantly only Tanzanian trade with India, Japan and the United States. It negatively affects the trade with South Africa and the European Union. Exchange rate devaluation does not affect trade with China and Kenya. This is to say that the J-curve evidence is indicated by negative effects due to expected time lags, and is supported in the cases of Tanzanian trade with the European Union and South Africa only. The error correction is significant with all trading partners, signified in the long run relationships among variables. These results suggest that Tanzanian bilateral trade does not follow the J-curve pattern, and it can also imply that there are factors other than the exchange rate that impact the bilateral trade balance. Not to include these has possibly changed the significance and the sign.

Table 7.8: ARDL Approach to Marshall- Lerner Condition

Trading Partner	Export	Import	Marshall- Lerner Condition
China	.76507*** (3.5271)	.95032*** (4.1156)	Doesn't hold
India	.58102** (2.1836)	3.7699* (1.8779)	Doesn't hold
Japan	3.0477 (1.3140)	-.40810 (.41556)	Doesn't hold
Kenya	2.5933*** (3.5629)	4.4158*** (2.2637)	Doesn't hold
South Africa	.16979 (.50896)	.95409* (1.6756)	Doesn't hold
European Union	.53015*** (2.9292)	1.2355*** (15.6319)	Doesn't hold
United State of America	1.6229 (1.5499)	.88592*** (14.2130)	Doesn't hold

***, ** and * denote statistical significance at 1, 5 and 10 percent respectively

The Marshall-Lerner condition that imports have to decrease and exports increase with exchange rate depreciation is not satisfied. The results suggest that imports to all trading partners respond to the exchange rate positively in the long run. Exchange rate depreciation does not harm imports as expected, but rather it significantly encourages imports. This could be due to the existence of foreign currency in the economy in about 50 percent of broad money supply. Therefore importers are not directly affected by the depreciation of the exchange rate.

The ARDL results from the indices (in the Appendix E) show that Tanzania's trade balance does not follow a J-curve trend, and there is short-run gain from depreciation of the exchange rate. In the long-run depreciation also increases the trade balance. There is a J-curve trend to exports level but it is not significant, and in the long-run exchange rate depreciation increases exports. Tanzanian imports follow a J-curve trend, and exchange rate depreciation in the short-run does not harm imports, and there is positive significant impact of exchange rate on imports. In the long-run imports do not show a significant response to the exchange rate.

7.6.1 Export-led Growth and Growth-led Exports

This part of analysis used annual on real gross domestic product and exports from 1966 to 2012 to investigate the export-led growth hypothesis.

**Table 7.9: Export-Led Growth
Granger Causality Wald Tests**

Equation	Excluded	Chi2(df)	p-value
Δ realGDP	Δ exports	9.713 (2)	0.0078***
Δ exports	Δ realGDP	0.604(2)	0.7394

***, ** and * denote statistical significance at 1, 5 and 10 percent respectively

We reject the hypothesis that the growth of exports does not Granger cause growth of real GDP, cannot reject the hypothesis that growth of real gross domestic product does not granger cause growth of exports. We conclude that there is one-way causality from exports to real GDP growth.

The export-led growth hypothesis does not hold for Tanzania, and, to increase exports supply, other measures apart from GDP growth have to be considered. There remain a variety of actions that can support exports, including further trade liberalization, further tariff revisions, non- tariff barriers, the building up of efficient and reliable infrastructure, and modern agricultural farming.

7.7 Conclusion

It is argued in the international economics literature that the relationship between the exchange rate and the trade balance differs in the short-run and long-run. In particular, it is widely believed that the immediate effect of currency depreciation or devaluation is to lower the trade balance, but this is reversed in the long-run, thus, producing the J-curve phenomenon. This phenomenon is used to describe the short-run and long run response of the trade balance to currency depreciation.

This chapter empirically examined the exchange rate sensitivity of Tanzanian foreign trade. It investigates if short and long-run relationships exist between the exchange rate and foreign trade.

The results suggest that the Marshall-Lerner condition does not hold for trade with all of Tanzania's trading partners. The results suggest that the evidence of a J-curve in Tanzanian bilateral trade is seen in the trade with a few trading partners and no evidence of it is visible at the aggregate level of trade. This is to say, after a period of exchange rate depreciation, aggregate trade does not decline before it improves. However the indices from the principal components analysis show evidence of the J-curve, with regards to imports, level but not with the trade balance. The trade balance indices show a positive response to the depreciation of the exchange rate even in the short-run.

Tanzania's economy is small, open, and depends on exports to promote economic growth. Our findings suggests that the exchange rate depreciation has long-run positive effects on the trade balance and exports. This supports the proposal that one may be able to make use of the exchange rate to increase exports and promote economic growth. Moreover, Tanzania needs to consider other policy channels (such as trade, fiscal and monetary policies) to achieve economic growth.

Chapter Eight

8 Conclusion and Policy Implications

8.1 Summary of the Study

This thesis investigates the role of the exchange rate in Tanzania and reviews macroeconomic policies of Tanzania and other Sub-Saharan African countries over the period 1970 to 2013. The empirical analyses presented in chapters four, five, and six are for the period of the floating exchange regime (1986 - 2013). The analyses take into account the de-facto dollarized features of the economy to examine the probability of exchange rate overshooting, the effect on the monetary policy transmission mechanisms and foreign trade sensitivity to the exchange rate. The models used have several Keynesian features that take into account the rigidity of price levels in response to shocks.

Different techniques were employed to complete these analyses, including cointegration, error correction, principle components, dynamic stochastic general equilibrium (DSGE), Bayesian vector autoregressive modelling and impulse response analysis. The Autoregressive distributed lag model (ARDL) was employed for both long run and short run analysis. The advantage of this model is its ability to perform where there are relatively few observations. It is also able to incorporate variables that are stationary and non-stationary. For the analysis of the monetary policy transmission mechanism, the study opted for a Bayesian model with Markov switching, which has admirable small sample properties. In addition, a DSGE model was also used to investigate the dynamic effects of a monetary policy shock in a partially dollarized economy.

8.2 Principal Findings

8.2.1 Dollarization in Tanzania and other Sub-Saharan African Countries

Chapter three assesses the practice of dollarization in Tanzania and Sub-Saharan Africa. The main discoveries are:

- The strength of the relationship between dollarization and inflation rate is strongly negative; the correlation coefficient is -0.7. The Granger causality reveals that inflation does Granger-cause dollarization, but the opposite does not hold true.
- There is a moderate positive relationship between exchange rate and dollarization; the correlation coefficient is 0.54. The Granger causality reveals that the two variables do not cause each other.

8.2.2 The Probability of Exchange Rate Overshooting

Chapter four aims to achieve the following objectives, to examine the overshooting hypothesis in a dollarized economy using the Tanzania Shilling-US Dollar exchange rate. Then to estimates the macroeconomic determinants of the exchange rate. The main conclusions drawn from this analysis are summarized below:

- The findings indicate delayed overshooting, in which the exchange rate gradually depreciates for almost two years while responding to an expansionary monetary policy. This is explained as a result of an underdeveloped foreign exchange market, imperfect information on the exact type of the monetary shock, and government intervention.
- The most important fundamentals that are found to determine the RER are trade openness, real interest differentials, labour productivity, and government expenditures.

8.2.3 Monetary Transmission Mechanism

Chapter five objectives are to examine the channel of monetary transmission mechanisms and examine the exchange rate pass-through to prices. This chapter explores whether shocks are transmitted to other monetary and real variables in the presence of dollarization. The shocks investigated are: a monetary policy shock; an aggregate demand shock; a cost push shock; an exchange rate shock; and a dollarization shock.

The main findings are:

- Monetary policy shocks (interest rate) lead to a lower monetary supply, a reduction in output, lower rates of inflation, exchange rate appreciation and increased foreign currency deposits.
- Aggregate demand shocks (output) fuel inflation, increase monetary supply, depreciate the exchange rate, and reduce foreign currency holdings.
- Cost push shocks (inflation) decrease interest rates. This is contrary to our expectation that the central bank raises the nominal interest rate to lower the inflation rate.
- Exchange rate shocks lower the interest rate, cause an initial increase in output and dollarization, and increase inflation. Depreciation in the 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.
- Dollarization shocks reduce the monetary supply of the local currency (M2).

8.2.4 Monetary Policy in a Small Open Partially Dollarized African Economy

Chapter six considers a small macroeconomic model and incorporates the Dynamic Stochastic General Equilibrium (DSGE) features to examine the effects of monetary policy. The aim of this section is to include the expectations of agents in a dynamic model.

The main findings are:

- The model incorporates several conditions that are consistent with most modern new Keynesian models in that it allows for a number of nominal and real rigidities.
- The agents in the model are also able to engage in behaviour that is frequently observed in partially dollarized economies, where households and firms may choose to hold and transact with a foreign currency.
- The results are more robust compared to those discussed in chapter five, in that they are consistent with macroeconomic theory.

- The results suggest that in a de facto dollarized economy, monetary policy is limited, and has short-run effects on the real variables. In addition, the effects of aggregate demand, cost-push, and exchange rate shocks are consistent with economic theory, where the response of interest rates would appear to be pragmatic.

8.2.5 Exchange Rate Sensitivity of the Tanzania's Foreign Trade Flows

Chapter seven aims to achieve the following objective, to identify the effects of the exchange rate movements on foreign trade flows. The chapter covers both the long and short run exchange rate sensitivity of the bilateral foreign trade flows. The main conclusions drawn from this analysis are summarized below:

- Tanzanian bilateral trade does not follow the J-curve pattern with export levels and the trade balance. There may be other factors that impact on the bilateral trade, and not including them has possibly changed the significance of the suggested relationship and the sign. The error correction behaviour is significant for the trade balance, as well as the export and import equations, and signifies a long-run relationship among the variables.
- There is a one-way causality relationship from exports to real GDP growth. We reject the hypothesis that the growth of exports does not Granger cause growth of real GDP, but we cannot reject the hypothesis that growth of real GDP does not granger cause growth in exports.

8.3 Policy Implications and Recommendations

The findings of this study inform the following policy recommendations that practitioners, policymakers and other stakeholders can take into consideration. Departures of the actual RER from its equilibrium value should provide an early warning signal. Policymakers should avoid large jumps in the exchange rate if they want to reduce distortions in consumption allocations and investment decisions, so as to promote export competitiveness.

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.

The study suggests that policies that are aimed at eliminating trade restrictions, have contributed to a depreciation in the RER. One policy implication that can be drawn from this finding is that the government should continue to implement trade liberalization policies. Fiscal and trade policies can be used by policymakers to impact the exchange rate in the short run. For example, limiting government consumption, nominal exchange rate depreciation and increasing openness to trade, can be used to depreciate the RER in the short run. The findings suggest that an excessive amount of positive money supply shocks would appreciate the RER in the short run. This calls for prudent monetary policy to ensure that money supply growth does not exceed the growth of other economic activities. 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.

There is weak evidence of J-curve phenomenon for Tanzania's bilateral trade. Other types of measures such as control of foreign currency holdings and sustainable economic growth can be used to promote higher import response. This can be achieved by supporting other non-price incentives such as developing institutional infrastructure. Easy access to affordable credit and the availability of suitable but cheap storage and transport facilities are necessary for exporters to take full advantage of the maintenance of a competitive RER. There is one-way causality from

exports to real GDP growth. This implies that for a small open economy like Tanzania to grow, emphasis should be placed on the countries' export performance and its determinants.

8.4 Limitations of the Study and Areas for Further Research

Insufficient data has been the most limiting factor in this study. It was not possible to obtain all the data in their required forms. For example, data were not available on the fundamentals of the RER such as terms of trade, government consumption expenditure on tradable and non-tradable goods, and labour productivity growth. Therefore proxies had to be used for this data. The data on foreign currency in circulation was estimated but was used only for trend analysis. A more useful measure of this variable would be highly desirable. Furthermore, it was not possible to obtain high frequency data, such as quarterly data on real GDP, for an extended period. The findings of this study should therefore be interpreted in light of this data deficiency. This study can also be extended by including the non-price aspects of competitiveness, such as quality of infrastructure, cost of doing business, institutions, and tax structures in the empirical analysis so as to get a comprehensive set of factors which affect potentially Tanzania's export competitiveness. An analysis of the impact of dollarization on income inequality would also be most interesting.

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A. Appendix A

Appendix for Chapter Three

A 1: Correlation Matrix

	FCD	XRATE	INFLATION
FCD	1.000000	0.943840	-0.205191
XRATE	0.943840	1.000000	-0.339784
INFLATION	-0.205191	-0.339784	1.000000

A 2: The Uncovered Interest Rate Parity

Dependent Variable: CXRATE

Method: Least Squares

Sample: 1995Q1 2014Q1

Included observations: 77

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014685	0.008452	1.737509	0.0864
INTERESTTZ-INTERESTUS	-1.15E-05	0.000566	-0.020384	0.9838
R-squared	0.000006	Mean dependent var		0.014529
Adjusted R-squared	-0.013328	S.D. dependent var		0.030922
S.E. of regression	0.031127	Akaike info criterion		-4.075842
Sum squared resid	0.072667	Schwarz criterion		-4.014963
Log likelihood	158.9199	Hannan-Quinn criter.		-4.051491
F-statistic	0.000416	Durbin-Watson stat		1.897665
Prob(F-statistic)	0.983791			

A 3: Wald Test - The Uncovered Interest Rate Parity

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	8847680.	(2, 75)	0.0000
Chi-square	17695360	2	0.0000

Null Hypothesis: C(1)=0, C(2)=1

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.014685	0.008452
-1 + C(2)	-1.000012	0.000566

Restrictions are linear in coefficients.

A 4 : Fisher Hypothesis

Dependent Variable: LENDING

Method: Least Squares

Sample (adjusted): 1995Q2 2014Q1

Included observations: 76 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	10.44429	1.018794	10.25163	0.0000
INFLATION(-1)	0.855446	0.083589	10.23397	0.0000
R-squared	0.585977	Mean dependent var		19.30164
Adjusted R-squared	0.580382	S.D. dependent var		7.233289
S.E. of regression	4.685574	Akaike info criterion		5.952817
Sum squared resid	1624.641	Schwarz criterion		6.014152
Log likelihood	-224.2071	Hannan-Quinn criter.		5.977330
Durbin-Watson stat	0.257587			

A 5: Wald Test - Fisher Hypothesis

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
t-statistic	-1.729348	74	0.0879
F-statistic	2.990645	(1, 74)	0.0879
Chi-square	2.990645	1	0.0837

Null Hypothesis: C(2)=1

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	-0.144554	0.083589

Restrictions are linear in coefficients.

A 6: Cointegrating Relations- The Uncovered Interest Rate Parity

Sample: 1995Q1 2014Q2

Series: CXRATE INTERESTTZ-INTERESTUS

Lags interval: 1 to 4

Selected

(0.05 level*)

Number of
Cointegrating
Relations by
Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	2	2	2	2
Max-Eig	1	2	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information
Criteria by
Rank and
Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend

	Log Likelihood by Rank (rows) and Model (columns)				
0	72.23837	72.23837	72.32670	72.32670	74.01680
1	81.92278	82.58103	82.58105	84.35038	85.45615
2	82.91949	92.25999	92.25999	94.40175	94.40175

	Akaike Information Criteria by Rank (rows) and Model (columns)				
0	-1.562177	-1.562177	-1.509075	-1.509075	-1.500467
1	-1.720077	-1.710584	-1.682807	-1.704177	-1.707115
2	-1.636653	-1.840555	-1.840555	-1.844493*	-1.844493*

	Schwarz Criteria by Rank (rows) and Model (columns)				
0	-1.056251	-1.056251	-0.939908	-0.939908	-0.868059
1	-1.087670*	-1.046557	-0.987159	-0.976909	-0.948227
2	-0.877764	-1.018426	-1.018426	-0.959123	-0.959123

B. Appendix B

Appendix for Chapter Four

B 1 : The Unit Root Test

Variable	Level	First Difference
LRER	0.1044	0.0000
NFA	0.1779	0.0000
LOPEN	0.1641	0.0000
LRGDP	0.6623	0.0005
RREPO	0.0385	0.0000
FISC	0.7001	0.0000

B 2 : Johansen Cointegration Test Summary

Sample: 1986Q1 2013Q4

Included observations: 112

Series: LRER LNFA LOPEN REPO LRGDP FISC

Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	3	2	3	2
Max-Eigenvalue	1	2	1	1	1

B 3 : Exogeneity Tests for Exchange Rate Equation

VEC Granger Causality/Block Exogeneity Wald Tests

Date: 06/02/14 Time: 02:17

Sample: 1986Q1 2013Q4

Included observations: 104

Dependent variable: D(LRER)

Excluded	Chi-sq	df	Prob.
D(NFA)	0.301263	1	0.5831
D(LOPEN)	0.000326	1	0.9856
D(RREPO)	4.724231	1	0.0297
D(LRGDP)	0.336607	1	0.5618
D(FISC)	2.726216	1	0.0987
All	12.67312	5	0.0266

B 4 : Lag Exclusion Wald Tests

VEC Lag Exclusion Wald Tests

Sample: 1986Q1 2013Q4

Included observations: 104

Chi-squared test statistics for lag exclusion:

Numbers in [] are p-values

	D(LRER)	D(NFA)	D(LOPEN)	D(RREPO)	D(LRGDP)	D(FISC)	Joint
DLag 1	15.41461 [0.017266]	62.07699 [1.70e-11]	18.23154 [0.005679]	12.91446 [0.044415]	50.91907 [3.07e-09]	57.83822 [1.24e-10]	246.8465 [0.000000]
df	6	6	6	6	6	6	36

C. Appendix C

Appendix for Chapter Five

C 1 : Exchange Rate Pass-Through

Dependent Variable: LCPITZ

Variable	Coefficient	Prob.
LCPITZ(-1)	1.314034	0.0000
LCPITZ(-2)	-0.166463	0.2258
LCPITZ(-3)	-0.449286	0.0010
LCPITZ(-4)	0.233098	0.0974
LCPITZ(-5)	0.052746	0.7082
LCPITZ(-6)	-0.249525	0.0694
LCPITZ(-7)	0.324329	0.0159
LCPITZ(-8)	-0.118820	0.3680
LCPITZ(-9)	-0.227835	0.0835
LCPITZ(-10)	0.411201	0.0012
LCPITZ(-11)	0.028197	0.8249
LCPITZ(-12)	-0.158012	0.0277
LEXRATE	0.051194	0.3299
LEXRATE(-1)	-0.156783	0.0800
LEXRATE(-2)	0.030224	0.7490
LEXRATE(-3)	0.160708	0.0837
LEXRATE(-4)	-0.151897	0.1080
LEXRATE(-5)	0.093160	0.3272
LEXRATE(-6)	-0.050256	0.5944
LEXRATE(-7)	0.029387	0.7523
LEXRATE(-8)	0.085986	0.3604
LEXRATE(-9)	-0.040260	0.6694
LEXRATE(-10)	-0.133812	0.1405
LEXRATE(-11)	0.109292	0.1978
LEXRATE(-12)	-0.021686	0.6769
OUTPUTGAP	1.882049	0.2069
OUTPUTGAP(-1)	-2.633227	0.2161
OUTPUTGAP(-2)	-1.121511	0.5969
OUTPUTGAP(-3)	5.824814	0.0064
OUTPUTGAP(-4)	-4.102946	0.0585
OUTPUTGAP(-5)	0.755774	0.7274
OUTPUTGAP(-6)	2.278243	0.2862
OUTPUTGAP(-7)	-3.517276	0.0998
OUTPUTGAP(-8)	1.763113	0.4107
OUTPUTGAP(-9)	0.102500	0.9610
OUTPUTGAP(-10)	0.036015	0.9863
OUTPUTGAP(-11)	-1.469403	0.4695
OUTPUTGAP(-12)	1.751772	0.1987
R-squared	0.999053	4.509395
Adjusted R-squared	0.998808	0.298750

C 2 : Statistics for Unit Root Test

Level			First Difference		
Variable	Lag (SIC)	ADF p-value	Variable	Lag (SIC)	ADF p-value
LCPI TZ	12	0.3497	D(LCPITZ)	11	0.0215*
LMI	1	0.0000**			
REPO	13	0.2665	D(REPO)	12	0.0002**
LEXRATE	2	0.9885	D(LEXRATE)	0	0.0000**
OUTPUTGAP	14	0.0004**			
LCPIUS	2	0.0368	D(LCPIUS)	1	0.0000**
LDOL	1	0.6652	D(LDOL)	0	0.0000**

** and * indicate rejection of a unit root in 1% and 5% respectively.

D. Appendix D

Appendix for Chapter Six

Model Equations

$$y_t = a^y y_{t-1} + a^{re} y_{t+1} + a^{rmc} Q_{t-1} + a^{tot} \left(A^{tot} tot_t + (1 - A^{tot}) tot_{t-1} \right) + \dots$$

$$a^q q_t + a^{fis} fis_t + a^{y^*} y_{t-1}^* + \varepsilon_t^y$$

$$\pi_t^c = b^{p^*} \left(\pi_t^m - \Delta q_{ss} \right) + (1 - b^{p^*}) \left(b^p \pi_{t-1}^c + (1 - b^p) \pi_{t+1}^c \right) + y_{t-1}^{b^y} + \varepsilon_t^\pi$$

$$4(s_t^e - s_t) = i_t - i_t^* - rp_t + \varepsilon_t^\pi$$

$$i_t = f^i i_{t-1} + (1 - f^i) \left(\bar{i}_t + f^p \bar{\pi}_t + \frac{f^y (y_t + y_{t-1})}{2} + f^s \Delta s_t \right) + \varepsilon_t^i$$

$$\pi_t^m = c^p \pi_{t-1}^m + c^{pf} (4\Delta s_t + \pi_t^*) + (1 - c^p - c^{pf}) (4\Delta s_{t-1} + \pi_{t-1}^m) + \varepsilon_t^m$$

$$i_t^* = (1 - \mathcal{G}^{i^*}) (\bar{r} r_{ss}^* + \pi_t^*) + \mathcal{G}^{i^*} i_{t-1}^* + \varepsilon_t^{i^*}$$

$$Q_t = -(A^r r_t + A^{rs} r_t^*)$$

$$r_t = rr_t - \bar{r} r_t$$

$$rr_t = i_t^4 - \pi_{t+4}^{4,c}$$

$$i_t^4 = \varepsilon_t^{4p} + 0.25(i_t + i_{t+1} + i_{t+2} + i_{t+3})$$

$$r_t^* = rr_t^* - \bar{r} r_t^*$$

$$rr_t^* = s_t^{4,e} - s_t + i_t^{4,*} - \pi_{t+4}^{4,c}$$

$$i_t^{4,*} = \varepsilon_t^{lp*} + 0.25(i_t^* + i_{t+1}^* + i_{t+2}^* + i_{t+3}^*)$$

$$s_{t+4}^e = (1-\theta)s_{t+1} + \theta(s_{t-1} + 0.5(\Delta q_{ss} + \bar{\pi}_s s - \pi_{ss}^*)) + \varepsilon_t^e$$

$$s_{t+4}^{4,e} = \varepsilon_t^{4,e} + \omega(s_{t-1} + (\Delta q_{ss} + \bar{\pi}_s s - \pi_{ss}^*)1.25) + (1-\omega)s_{t+4}$$

$$\Delta s_t = s_t - s_{t-1}$$

$$rp_t = \mathcal{G}^{rp} rp_{t-1} + (1 - \mathcal{G}^{rp}) rp_{ss}$$

$$\pi_t^{4,c} = 0.25(\pi_t^c + \pi_{t-1}^c + \pi_{t-2}^c + \pi_{t-3}^c)$$

$$q_t = \Delta s_t + q_{t-1} + 0.25(\pi_t^* - \pi_t - \Delta \bar{q}_t)$$

$$\pi_t^{rm} = \pi_{t-1}^{rm} \mathcal{G}^{rm} + \pi_{ss}^* (1 - \mathcal{G}^{rm}) + \varepsilon_t^{rm}$$

$$\pi_t^* = \pi_{ss}^* (1 - \mathcal{G}^{\pi*}) + \mathcal{G}^{\pi*} \pi_{t-1}^* + \varepsilon_t^{\pi*}$$

$$\pi_t = \pi_t^c \chi + (1 - \chi) \pi_t^{nc}$$

$$\pi_t^{nc} = \bar{\pi}_s s (1 - \mathcal{G}^{nc}) + \mathcal{G}^{nc} \pi_{t-1}^{nc} + \varepsilon_t^{nc}$$

$$\bar{\pi}_t = \pi_{t+4}^{4,c} - \bar{\pi}_s s$$

$$\bar{i}_t = (1 - \mathcal{G}^i)(\bar{\pi}_s s + \bar{r}_{ss}) + \mathcal{G}^i \bar{i}_{t-1}$$

$$tot_t = tot_{t-1} \mathcal{G}^{tot} + \varepsilon_t^{tot}$$

$$fis_t = \mathcal{G}^{fis} fis_{t-1} + \varepsilon_t^{fis}$$

$$y_t^* = y_{t-1}^* \mathcal{G}^{y^*} + \varepsilon_t^{y^*}$$

$$\Delta \bar{q}_t = \Delta q_{ss} (1 - \mathcal{G}^q) + \mathcal{G}^q \Delta \bar{q}_{t-1}$$

$$\bar{r}r_t = (1 - \mathcal{G}^{\bar{r}r})(\bar{r}r_{ss} + phi_{ss}^4) + \mathcal{G}^{\bar{r}r} \bar{r}r_{t-1}$$

$$\bar{r}r_t^* = (1 - \mathcal{G}^{\bar{r}r^*})(\bar{r}r_{ss}^* + phi_{ss}^{4,*}) + \mathcal{G}^{\bar{r}r^*} \bar{r}r_{t-1}^*$$

$$\varepsilon_t^y = \rho^y \varepsilon_{t-1}^y + \zeta_t^y$$

$$\varepsilon_t^\pi = \rho^\pi \varepsilon_{t-1}^\pi + \zeta_t^\pi$$

$$\varepsilon_t^s = \rho^s \varepsilon_{t-1}^s + \zeta_t^s$$

$$\varepsilon_t^i = \rho^i \varepsilon_{t-1}^i + \zeta_t^i$$

$$\varepsilon_t^m = \rho^m \varepsilon_{t-1}^m + \zeta_t^m$$

$$\varepsilon_t^{i^*} = \rho^{i^*} \varepsilon_{t-1}^{i^*} + \zeta_t^{i^*}$$

$$\varepsilon_t^{lp} = \phi_{ss}^4 (1 - \rho^{lp}) + \rho^{lp} \varepsilon_{t-1}^{lp} + \zeta_t^{lp}$$

$$\varepsilon_t^{lp^*} = \phi_{ss}^{4,*} (1 - \rho^{lpf}) + \rho^{lpf} \varepsilon_{t-1}^{lp^*} + \zeta_t^{lp^*}$$

$$\varepsilon_t^e = \rho^e \varepsilon_{t-1}^e + \zeta_t^e$$

$$\varepsilon_t^{4,e} = \rho^{4,e} \varepsilon_{t-1}^{4,e} + \zeta_t^{4,e}$$

$$\varepsilon_t^{rm} = \rho^{rm} \varepsilon_{t-1}^{rm} + \xi_t^{rm}$$

$$\varepsilon_t^{\pi^*} = \rho^{\pi^s} \varepsilon_{t-1}^{\pi^*} + \xi_t^{\pi^*}$$

$$\varepsilon_t^{nc} = \rho^{nc} \varepsilon_{t-1}^{nc} + \xi_t^{nc}$$

$$\varepsilon_t^{tot} = \rho^{tot} \varepsilon_{t-1}^{tot} + \xi_t^{tot}$$

$$\varepsilon_t^{fis} = \rho^{fis} \varepsilon_{t-1}^{fis} + \xi_t^{fis}$$

$$\varepsilon_t^{y^*} = \rho^{ys} \varepsilon_{t-1}^{y^*} + \xi_t^{y^*}$$

$$y_t^{data} = y_t + \mu_t^y$$

$$\pi_t^{c,data} = \pi_t^c + \mu_t^\pi$$

Calibrated Parameters

D 1 : Parameters - Calibrated Values

Parameter	Value	Parameter	Value
g^{i*}	0.9	$\bar{r}r_{ss}^*$	2.5
A^r	0.3	$\bar{\pi}_{ss}$	2
A^{rs}	0.15	π_{ss}^*	2
W	0.8	$\bar{r}p_{ss}$	1
g^{π^*}	0.25	$\bar{r}r_{ss}$	$\bar{r}r_{ss}^* + \bar{r}p_{ss}$
g^{rp}	0.7	ϕ_{ss}^4	8
g^{rm}	0.7	$\phi_{ss}^{4,*}$	4.5
χ	0.6	ρ^i	0
g^{nc}	0.4	ρ^m	0
g^i	0.5	ρ^{is}	0.6
g^{tot}	0.8	ρ^{lp}	0.95
g^{fis}	0.5	ρ^{lpf}	0.95
g^{y^*}	0.9	ρ^{rm}	0
g^q	0.9	$\rho^{\pi s}$	0
$g^{\bar{r}}$	0.95	ρ^{nc}	0
$g^{r\bar{r}^*}$	0.95	ρ^{fis}	0
\bar{q}	0	ρ^{ys}	0

Parameter Estimates for Shocks

D 2 : Parameters - Persistence in Shocks

	Distrib.	Prior		Mode	Posterior	
		Mean	Std. Dev.		[10%	90%]
ρ^y	beta	0.5	0.1	0.483	0.314	0.645
ρ^π	beta	0.15	0.05	0.165	0.088	0.252
ρ^s	beta	0.15	0.05	0.147	0.066	0.206
ρ^e	beta	0.3	0.1	0.29	0.125	0.404
$\rho^{4,e}$	beta	0.6	0.1	0.612	0.471	0.756
ρ^{tot}	beta	0.4	0.1	0.407	0.259	0.557

D 3 : Parameters - Standard Deviation of Shocks

	Distrib.	Prior		Mode	Posterior	
		Mean	Std. Dev.		[10%	90%]
ξ_t^y	invg	0.4	4	0.321	0.13	0.512
ξ_t^π	invg	0.4	4	0.55	0.117	1.076
ξ_t^i	invg	0.4	4	0.373	0.191	0.527
$\xi_t^{4,e}$	invg	0.4	4	0.278	0.143	0.447
ξ_t^s	invg	0.4	4	0.471	0.111	1.034
$\xi_t^{\pi^*}$	invg	0.4	4	1.189	0.86	1.471
$\xi_t^{i^*}$	invg	0.4	4	0.231	0.18	0.271
$\xi_t^{y^*}$	invg	0.4	4	0.548	0.465	0.623

E. Appendix E

Appendix for Chapter Seven

E 1 : Principal Components Analysis- Exports

Principal Components Analysis
 Sample: 1992Q1 2014Q3
 Included observations: 91
 Computed using: Ordinary correlations
 Extracting 8 of 8 possible components

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	6.313296	5.884494	0.7892	6.313296	0.7892
2	0.428801	0.072818	0.0536	6.742097	0.8428
3	0.355984	0.083620	0.0445	7.098081	0.8873
4	0.272363	0.067708	0.0340	7.370444	0.9213
5	0.204656	0.031320	0.0256	7.575100	0.9469
6	0.173336	0.020052	0.0217	7.748436	0.9686
7	0.153284	0.055005	0.0192	7.901720	0.9877
8	0.098280	---	0.0123	8.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
LUAEXP	0.371649	-0.318980	-0.130981	-0.092801	-0.095846	-0.013507	-0.223292	-0.821664
LCHNEXP	0.362856	-0.345254	-0.232334	-0.055243	-0.047338	0.446428	-0.511388	0.478588
LEUEXP	0.339329	0.327850	0.694472	-0.041785	-0.366277	0.393729	0.036127	-0.053344
LINDEXP	0.323358	0.740060	-0.481241	0.119605	0.241684	0.179931	-0.025331	-0.102102
LJPNEXP	0.348746	-0.287087	0.118637	0.753748	0.289594	0.050646	0.355189	0.034013
LKNYEXP	0.365203	0.158612	0.174715	0.134902	-0.088835	-0.758901	-0.413103	0.195624
LZAEXP	0.354422	-0.090187	0.212472	-0.585916	0.638957	-0.082000	0.233542	0.090974
LUSAEXP	0.360409	-0.090364	-0.353887	-0.206524	-0.544041	-0.167039	0.579069	0.186678

The first principle component has the highest eigenvalue, and accounts for 79% of the total variance while the second accounts for only 5%. This justifies our decision to use only the first principle component. The first component is roughly a linear combination of all eight of the export variables, other components have both positive and negative loadings.

E 2 : Principal Components Analysis- Imports

Principal Components Analysis

Sample: 1992Q1 2014Q3

Included observations: 91

Computed using: Ordinary correlations

Extracting 8 of 8 possible components

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	6.564660	5.994140	0.8206	6.564660	0.8206
2	0.570519	0.211860	0.0713	7.135179	0.8919
3	0.358659	0.154853	0.0448	7.493838	0.9367
4	0.203807	0.064084	0.0255	7.697645	0.9622
5	0.139723	0.058240	0.0175	7.837368	0.9797
6	0.081483	0.027418	0.0102	7.918851	0.9899
7	0.054065	0.026981	0.0068	7.972916	0.9966
8	0.027084	---	0.0034	8.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
LUAIMPORTS	0.375304	0.099226	-0.059343	-0.052258	-0.627198	-0.085864	0.116337	-0.654801
LCHNIMPORTS	0.374228	-0.131163	-0.255398	0.038704	0.160636	-0.330826	-0.799587	-0.037872
LEUEANIMPORTS	0.358233	-0.246477	-0.459721	-0.052223	-0.110026	0.730144	0.017479	0.226553
LINDIMPORTS	0.377538	-0.154939	-0.023804	-0.071582	-0.303883	-0.502081	0.323796	0.615219
LJPNIMPORTS	0.315261	-0.591433	0.538534	0.428413	0.182371	0.090323	0.100167	-0.160656
LKNYIMPORTS	0.352384	0.330768	-0.370932	0.290172	0.558850	-0.144573	0.423735	-0.178496
LZAIMPORTS	0.317762	0.652170	0.423664	0.294254	-0.135244	0.251406	-0.223597	0.275925
LUSAIMPORTS	0.351708	0.060562	0.335022	-0.795988	0.335418	0.075647	0.048942	-0.078577

The first principle component has the highest eigenvalue, accounting for 82% of the total variance while the second accounts for only 7%. This justifies our decision to use only the first principle component. The first component is roughly a linear combination of all eight import variables, other components have both positive and negative loadings.

E 3: Principal Components Analysis- Real GDP

Principal Components Analysis

Sample: 1992Q1 2014Q3

Included observations: 91

Computed using: Ordinary correlations

Extracting 8 of 8 possible components

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	5.767019	4.205345	0.7209	5.767019	0.7209
2	1.561674	1.228056	0.1952	7.328693	0.9161
3	0.333618	0.080860	0.0417	7.662311	0.9578
4	0.252758	0.208749	0.0316	7.915069	0.9894
5	0.044009	0.024424	0.0055	7.959077	0.9949
6	0.019584	0.006159	0.0024	7.978662	0.9973
7	0.013425	0.005512	0.0017	7.992087	0.9990
8	0.007913	---	0.0010	8.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
LUAERGDP	0.411562	-0.018305	0.020122	-0.204751	-0.083330	0.433869	-0.764994	-0.086900
LCHNRGDP	0.403242	0.024385	-0.086293	-0.443206	-0.029113	0.425457	0.609280	-0.282559
LEURGDP	0.376076	-0.013882	0.371311	0.725857	-0.297156	0.080563	0.128790	-0.286803
LINDRGDP	0.387507	0.233563	0.118233	-0.342839	-0.274682	-0.743102	-0.073883	-0.175102
LJPNRGDP	0.405946	-0.079575	0.027888	0.137902	0.878894	-0.185287	-0.011415	-0.046520
LKNYRGDP	0.179983	0.639700	-0.675713	0.292352	-0.035413	0.038349	-0.002140	0.116631
LZARGDP	-0.132468	0.701136	0.613475	-0.112913	0.173267	0.190380	0.026222	0.186566
LUSARGDP	0.402100	-0.192837	0.081125	-0.001728	-0.157245	0.002653	0.143853	0.865516

The first principle component has the highest eigenvalue, accounting for 72% of the total variance, while the second accounts for 20%. This justifies our decision to use only the first principle component. The first component is roughly a linear combination of all eight of the real GDP variables, which has a negative loading for South African Real GDP only.

E 4 : Principal Components Analysis- Exchange Rate

Principal Components Analysis

Sample: 1992Q1 2014Q3

Included observations: 91

Computed using: Ordinary correlations

Extracting 8 of 8 possible components

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	5.643656	4.339627	0.7055	5.643656	0.7055
2	1.304029	0.785894	0.1630	6.947684	0.8685
3	0.518135	0.236675	0.0648	7.465820	0.9332
4	0.281460	0.106308	0.0352	7.747279	0.9684
5	0.175152	0.134709	0.0219	7.922431	0.9903
6	0.040443	0.017718	0.0051	7.962874	0.9954
7	0.022725	0.008324	0.0028	7.985599	0.9982
8	0.014401	---	0.0018	8.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
LUAEXRATE	0.397419	-0.230702	-0.101010	-0.067813	0.360231	-0.065390	-0.251336	0.759487
LCHNXRATE	0.322223	-0.213444	0.720631	-0.537587	-0.143742	0.103122	0.013643	-0.104033
LEUXRATE	0.359625	-0.044767	-0.620772	-0.415150	-0.234161	0.478245	0.088619	-0.139843
LINDXRATE	0.398918	0.250035	-0.046023	0.087671	0.023355	-0.230541	-0.740961	-0.407217
LJPNXRATE	0.350844	-0.362042	0.136215	0.598558	0.290277	0.433006	0.152882	-0.271808
LKNYXRATE	0.142547	0.804887	0.233018	0.104795	0.043180	0.443038	0.071526	0.251584
LZAXRATE	0.390526	-0.012906	0.018880	0.370584	-0.738274	-0.282517	0.193779	0.217300
LUSAXRATE	0.392228	0.240025	-0.099012	-0.140641	0.403759	-0.489520	0.560115	-0.206353

The first principle component has the highest eigenvalue, accounting for 71% of the total variance, while the second accounts for 16%. This justifies our decision to use only the first principle component. The first component is roughly a linear combination of all eight exchange rate variables, other components have both positive and negative loadings.

E 5 : Principal Components Analysis- Trade Balance

Principal Components Analysis

Sample: 1992Q1 2014Q3

Included observations: 91

Computed using: Ordinary correlations

Extracting 8 of 8 possible components

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	6.935292	6.545362	0.8669	6.935292	0.8669
2	0.389930	0.155166	0.0487	7.325223	0.9157
3	0.234765	0.090626	0.0293	7.559987	0.9450
4	0.144139	0.021521	0.0180	7.704126	0.9630
5	0.122618	0.036148	0.0153	7.826744	0.9783
6	0.086470	0.035209	0.0108	7.913214	0.9892
7	0.051261	0.015735	0.0064	7.964475	0.9956
8	0.035525	---	0.0044	8.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
LUAETB	0.369088	0.064362	-0.244173	-0.016649	-0.347882	-0.053878	-0.175210	-0.803188
LCHNTB	0.363026	-0.196654	-0.349957	0.013849	0.306717	0.106639	-0.725004	0.275318
LEUEANTB	0.359285	-0.236681	-0.329618	0.014462	-0.450644	0.485576	0.405825	0.320127
LINDTB	0.362832	-0.218276	0.009965	-0.023280	-0.201347	-0.833455	0.127362	0.262028
LJPNTB	0.337721	-0.443625	0.646024	0.444572	0.132409	0.178434	0.008669	-0.157177
LKNYTB	0.355370	0.293425	-0.293237	0.230122	0.644123	-0.049587	0.468953	-0.106768
LZATB	0.325644	0.754673	0.308356	0.211373	-0.270822	0.062051	-0.190613	0.266712
LUSATB	0.353364	0.033003	0.332783	-0.838750	0.188445	0.130946	0.080192	-0.026653

The first principle component has the highest eigenvalue, accounting for 87% of the total variance, while the second accounts for only 5%. This justifies our decision to use only the first principle component. The first component is roughly a linear combination of all eight trade balance variables, other components have both positive and negative loadings.

E 6 : Estimated Long Run and Short Run of the Trade Balance Model

Estimated Long Run Coefficients using the ARDL Approach
 ARDL(3,0,2,3) selected based on Akaike Information Criterion

Dependent variable is TB1
 87 observations used for estimation from 1993Q1 to 2014Q3

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
RGDP1	1.0945	.15058	7.2688[.000]
XRATE1	.50444	.25603	1.9702[.052]
LTZARGDP	.080150	.043845	1.8280[.071]

Error Correction Representation for the Selected ARDL Model
 ARDL(3,0,2,3) selected based on Akaike Information Criterion

Dependent variable is dTB1
 87 observations used for estimation from 1993Q1 to 2014Q3

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dTB11	-.23041	.10086	-2.2845[.025]
dTB12	-.24616	.092097	-2.6728[.009]
dRGDP1	.10631	.049957	2.1281[.036]
dXRATE1	.077818	.042333	1.8382[.070]
dXRATE11	.090548	.041178	2.1989[.031]
dLTZARGDP	.014402	.93150	.015461[.988]
dLTZARGDP1	1.8277	.94016	1.9440[.055]
dLTZARGDP2	-1.9895	.76049	-2.6160[.011]
ecm(-1)	-.097133	.044311	-2.1921[.031]

List of additional temporary variables created:

dTB1 = TB1-TB1(-1)
 dTB11 = TB1(-1)-TB1(-2)
 dTB12 = TB1(-2)-TB1(-3)
 dRGDP1 = RGDP1-RGDP1(-1)
 dXRATE1 = XRATE1-XRATE1(-1)
 dXRATE11 = XRATE1(-1)-XRATE1(-2)
 dLTZARGDP = LTZARGDP-LTZARGDP(-1)
 dLTZARGDP1 = LTZARGDP(-1)-LTZARGDP(-2)
 dLTZARGDP2 = LTZARGDP(-2)-LTZARGDP(-3)
 ecm = TB1 -1.0945*RGDP1 -.50444*XRATE1 -.080150*LTZARGDP

R-Squared	.37148	R-Bar-Squared	.28878
S.E. of Regression	.27218	F-Stat.	F(8,78) 5.6149[.000]
Mean of Dependent Variable	.095909	S.D. of Dependent Variable	.32274
Residual Sum of Squares	5.6303	Equation Log-likelihood	-4.3556
Akaike Info. Criterion	-15.3556	Schwarz Bayesian Criterion	-28.9181
DW-statistic	1.9527		
F-statistic 95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.1062	2.4812	3.7227	2.0254 3.1493
W-statistic 95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
32.4248	9.9248	14.8906	8.1018 12.5971

E 7 : Estimated Long Run and Short Run of the Export Model

Estimated Long Run Coefficients using the ARDL Approach

ARDL(4,1,3) selected based on Akaike Information Criterion

Dependent variable is EXPORT1

87 observations used for estimation from 1993Q1 to 2014Q3

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
RGDP1	.92525	.092277	10.0269[.000]
XRATE1	.28297	.13537	2.0904[.040]

Error Correction Representation for the Selected ARDL Model

ARDL(4,1,3) selected based on Akaike Information Criterion

Dependent variable is dEXPORT1

87 observations used for estimation from 1993Q1 to 2014Q3

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dEXPORT11	-.35124	.10926	-3.2147[.002]
dEXPORT12	-.39434	.10849	-3.6348[.000]
dEXPORT13	-.22656	.10908	-2.0770[.041]
dRGDP1	.64555	.28579	2.2588[.027]
dXRATE1	-.025967	.064780	-.40084[.690]
dXRATE11	.022056	.060177	.36652[.715]
dXRATE12	.11399	.057394	1.9861[.050]
ecm(-1)	-.22481	.083703	-2.6858[.009]

List of additional temporary variables created:

dEXPORT1 = EXPORT1-EXPORT1(-1)

dEXPORT11 = EXPORT1(-1)-EXPORT1(-2)

dEXPORT12 = EXPORT1(-2)-EXPORT1(-3)

dEXPORT13 = EXPORT1(-3)-EXPORT1(-4)

dRGDP1 = RGDP1-RGDP1(-1)

dXRATE1 = XRATE1-XRATE1(-1)

dXRATE11 = XRATE1(-1)-XRATE1(-2)

dXRATE12 = XRATE1(-2)-XRATE1(-3)

ecm = EXPORT1 -.92525*RGDP1 -.28297*XRATE1

R-Squared .46459 R-Bar-Squared .40201

S.E. of Regression .43976 F-Stat. F(7,79) 9.5450[.000]

Mean of Dependent Variable .10131 S.D. of Dependent Variable .56868

Residual Sum of Squares 14.8906 Equation Log-likelihood -46.6625

Akaike Info. Criterion -56.6625 Schwarz Bayesian Criterion -68.9921

DW-statistic 1.6380

F-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound

4.4331 2.7887 3.9741 2.2016 3.2743

W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound

13.2992 8.3661 11.9224 6.6047 9.8230

E 8 : Estimated Long Run and Short Run of the Import Model

Estimated Long Run Coefficients using the ARDL Approach

ARDL(3,1,1) selected based on Akaike Information Criterion

Dependent variable is IMPORT1

87 observations used for estimation from 1993Q1 to 2014Q3

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LTZARGDP	.70606	.87187	.80983[.420]
XRATE1	4.6882	5.6253	.83341[.407]

Error Correction Representation for the Selected ARDL Model

ARDL(3,1,1) selected based on Akaike Information Criterion

Dependent variable is dIMPORT1

87 observations used for estimation from 1993Q1 to 2014Q3

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dIMPORT11	-.24438	.10008	-2.4420[.017]
dIMPORT12	-.34993	.093207	-3.7543[.000]
dLTZARGDP	2.4335	.95833	2.5393[.013]
dXRATE1	.17502	.044737	3.9122[.000]
ecm(-1)	-.012144	.014895	-.81527[.417]

List of additional temporary variables created:

dIMPORT1 = IMPORT1-IMPORT1(-1)

dIMPORT11 = IMPORT1(-1)-IMPORT1(-2)

dIMPORT12 = IMPORT1(-2)-IMPORT1(-3)

dLTZARGDP = LTZARGDP-LTZARGDP(-1)

dXRATE1 = XRATE1-XRATE1(-1)

ecm = IMPORT1 - .70606*LTZARGDP - 4.6882*XRATE1

R-Squared .30681 R-Bar-Squared .25482

S.E. of Regression .32469 F-Stat. F(4,82) 8.8521[.000]

Mean of Dependent Variable .088030 S.D. of Dependent Variable .37613

Residual Sum of Squares 8.4340 Equation Log-likelihood -21.9344

Akaike Info. Criterion -28.9344 Schwarz Bayesian Criterion -37.5651

DW-statistic 2.1506

F-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
 8.1065 2.7887 3.9741 2.2016 3.2743

W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
 24.3194 8.3661 11.9224 6.6047 9.8230