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Abstract

This paper examines the influence of global economic disturbances to Tanzania aggregate macroeconomic fluctuations, using a VAR model comprising foreign and domestic variables, with block exogeneity restrictions. Specified in the foreign block are, variables mostly considered in the literature to characterize world economic shocks and include world interest rate, economic growth, inflation, and oil prices. The domestic block capture output, inflation, money stock and the real exchange rate. The findings show that whilst foreign shocks exert notable impact on domestic macroeconomic fluctuations irrespective of the exchange rate regime, disturbances of domestic origin are also important.

The study underscores the need to build response capacity of Tanzania's economy to exogenous shocks, which includes enhancing the domestic resource base, developing sustainable export growth strategies that include export diversification, strengthening of technological and human capacity for production, as well as maintaining stable macroeconomic environment.

1.0   Introduction

Accounting for the impact of external shocks to a domestic economy's aggregate disturbances is a subject of considerable interest in the field of open economy macroeconomics. This interest has intensified over recent years due to the emergence of the age of world economic integration, coupled with important global events, such as a prolonged phase of large United States (US) productivity gains in the second half of the 1990s, which led to a major expansion of global demand, the bursting of the stock market bubble, which contributed to a global economic downturn in 2001, and the recurrence of global economic and financial crises.

While it is widely acknowledged that global economic integration is a crucial engine for growth around the world, the adverse implications resulting from spill overs of the negative shocks have created overwhelming challenges. Small open economies are particularly vulnerable, as they can neither influence the economic conditions where the disturbances originate nor can they mitigate the impact of major external disturbances.

In theory, there are a number of channels through which shocks can be transmitted across countries. Firstly, this may take place through product competitiveness (Gerlach and Smets, 1995; Corset et al., 1998). In principle, if one country devalues its currency, then that country's exports will be relatively cheaper in international markets. Consequently, similar products from firms in other countries that are sold in the same markets will be less competitive in comparison. Moreover, if exports from the initial country constitute a large share of global production in a given industry, then industry prices could fall worldwide.

The second mechanism is through the income effect (Stockman and Svensson, 1987). When a country is affected by a negative shock, economic growth will generally slow down and exports to that country will face a reduced demand. This negative effect will be transmitted to those countries whose exports are affected by the decline in the demand.

The third channel of international transmission of shocks is through a credit crunch. A financial shock to one country causes investors in that country to withdraw their deposits, reducing the liquidity of financial intermediaries and forcing them to liquidate loans to firms in other countries and/or be unable to renew their financing (Goldfajn and Valdés, 1997). Moreover, commercial banks with lending concentrated in a crisis-stricken country could be forced to withdraw lending in other countries in order to maintain solvency (Kaminsky and Reinhart, 1998).

The fourth mechanism is through a portfolio re-composition. This occurs when a shock to a particular country reduces the liquidity of market participants, and may force them to sell assets in other markets or countries in order to meet liquidity requirements (Frankel and Schmukler, 1998; Valdés, 1996).

Finally, international transmission of shocks can take place through a wake-up call effect. In this situation a shock to one country leads to the assessment of the economic conditions in another country by the economic agents (Tornell, 1999). For example, if a country with certain macroeconomic characteristics (such as a weak banking sector) appears to be susceptible to a currency crisis, then investors will reassess the risk of investing in other countries with similar macroeconomic behavior.

One of the main implications of these theories is that the impact of external shocks will generally depend on the particular model together with the underlying assumptions. For this reason, the extent to which international disturbances affect the domestic economy is, to a large degree, a matter of empirical assessment.

This study contributes to the existing literature by assessing the relative importance of foreign and domestic shocks to macroeconomic fluctuations in Tanzania. Following two decades of major economic reforms, coupled with an increasing pace of integration into the global economy, the Tanzanian economy is increasingly facing the challenges of coping with international economic instabilities. Despite this, little research, if any, has been undertaken to measure the importance of various international shocks on the domestic economy. For example, little is known about the main sources of external economic shocks, the extent to which they affect domestic economic variables, and whether they are more or less important when compared to shocks of domestic origin. This paper aims at filling the gap by addressing three questions:

- Are foreign shocks of a greater or lesser importance than domestic shocks for the Tanzanian economy?
- Has the introduction of the flexible exchange rate policy made the Tanzanian economy more or less sensitive to foreign shocks?
- To what extent has monetary policy been exogenous in the sense of influencing rather than responding to domestic and foreign shocks?

The rest of the paper is organized as follows: section 2 discusses the evolution of Tanzania's economy by highlighting various policies and their impact on the overall economic performance. Section 3 reviews the literature underpinning the role of external shocks in domestic macroeconomic fluctuations. Section 4 describes the methodology regarding the empirical framework, model specification, data and estimations. Section 5 presents the findings, while section 6 concludes.

2.0 Tanzania's Economy and External Environment

2.1 Evolution of the Economy

According to Wangwe (1983, 1995), the evolution of Tanzania's economic policy can be organized into three distinct periods, namely the period just after independence (1961-1967), the period of the development policy drive (1968-1985) and the reforms period (1986 onwards).

During 1961-1967, peasant agriculture was encouraged by conventional measures and industrial development, which relied on private investors, was promoted with a relatively mild import substitution policy. This was also a period of macroeconomic stability associated with low inflation, a favourable balance of payments and steady economic growth.

Between 1968 and 1985, the main tenet of economic policy was to achieve rapid economic development through the modernization of the economy and structural transformation, with the state playing a principal role. Accordingly, investment was directed at developing the economic infrastructure with the objective of strengthening the manufacturing sector for import substitution, and increasing the output from sectors producing primary commodities. One of the key elements of this policy was the Basic Industrial Strategy (BIS) which aimed at broadening import substitution in consumer, intermediate and capital goods. Macroeconomic and sectoral level incentive structures were geared towards supporting the strategy. Industrial expansion was favoured through low interest rates and the allocation of public investible resources. Furthermore, the industrial sector was protected through tariff structures, quantitative restrictions and exchange rate policy.

Table 1 in Appendix 1 shows that the volume of investment directed to this end rose tremendously, with the manufacturing sector's share rising to an average of 25.3 percent during the period 1976-1980 from 15.0 percent in 1968-1970. In comparison, the share of investment in agriculture remained relatively low and declined from an average of 9 percent in 1968-1970 to 7.2 percent during 1971-1980. The performance of the Tanzanian economy until the mid-1970s was characterized by relatively reasonable rates of real growth, a reasonable macroeconomic environment and a sustainable resource balance. During 1968-1975, the annual average real GDP growth was 3.9 percent. Among the sectors involved in this growth, agriculture grew at a modest average rate of 2.3 percent in real terms, while the manufacturing sector grew at an average of 6.5 percent thus raising its contribution to overall production quickly. Economic services also registered an average growth of 4.8 percent over the same period.

As shown in **Table 2**, between 1968 and 1975, inflation averaged 7.5 percent, with much of the rise being the consequence of the 1973/74 oil crisis. The external current account deficit averaged at 4.5 percent of GDP, with much of its widening again being attributed to the 1973/74 oil crisis. The parallel market exchange rate premium, a good measure of pressure on the foreign exchange market, averaged 26 percent during 1968-1970 and then rose sharply to 110 percent during 1971-1975. Domestic savings

financed 71 percent of investment during the 1968-1970 period, but subsequently fell significantly to 45 percent during the 1971-1975 period. On average, the overall fiscal deficit to GDP (excluding grants) increased from 5.5 percent during 1968-1970 to 8.8 percent during 1971-1975, while fiscal deficit to GDP (including grant) rose from 3.7 percent to 4.8 percent respectively. The rapid rise in development expenditure during 1971-1975 was the main reason for the widening of the budget deficit.

During the period 1976-1980, macroeconomic conditions started to indicate some weaknesses. Growth in output slackened despite the massive investment drive that was put into place. Growth in agriculture declined, averaging only 1.8 percent compared with 2.5 percent during 1971-1975. In manufacturing, growth declined markedly, despite the large amount of investment the sector had received.

Serious macroeconomic imbalances started to emerge in 1981-1985. During this period, real GDP growth fell sharply to an average of 0.7 percent from 2.8 percent during 1976-1980. Capital formation to GDP declined to 18.1 percent, down from 28.0 percent in the period 1976-1980 on account of a sharp decline in domestic savings as well as a contraction of inflows of external financing (**Table 1**). The current account deteriorated as well, partly due to decline in export volumes and world commodity prices. The overall fiscal deficit to GDP widened to an annual average of 11.5 percent (excluding grants) and 8.2 percent (including grants) during the period 1981-1985. On average, inflation increased to 30.2 percent in 1981-1985 from 13.8 percent in 1976-1980. Between 1981 and 1985, the parallel market exchange rate premium reached a peak of 257 percent.

Table 1: Investment and Growth in Tanzania

	1968-70	1971-75	1976-80	1981-85	1986-90	1991-2010
(a) Fixed capital formation to GDP (%)	24.2	26.8	28.0	18.1	24.6	38.6
(b) Sectoral shares of fixed capital formation						
(i) Agriculture	9.0	6.3	8.1	10.7	34.5	25.6
(ii) Manufacturing	15.4	14.0	25.3	24.0	13.0	28.5
(iii) Economic infrastructure[*]	43.1	43.1	54.6	34.9	27.7	29.4
(c) Share of fixed capital formation						
(i) Private sector	47.0	32.0	44.0	55.0	60.7	75.0
(ii) Public sector	53.0	68.0	56.0	45.0	39.3	25.0
(d) Real GDP growth (%)	3.9	3.8	2.8	0.7	4.1	6.6
(e) Sectoral real GDP growth rates (%)						
(i) Agriculture	2.1	2.5	1.8	3.0	4.9	4.3
(ii) Manufacturing	8.1	4.8	2.7	-4.9	3.8	7.9
(iii) Services	5.9	3.7	2.6	0.4	4.2	7.3
(f) Per capita income growth (%)	2.1	-0.7	3.0	0.8	0.6	1.2

Source: Calculated using data from the Economic Surveys and National Accounts (various years)

From 1986, Tanzania embarked on comprehensive economic reforms supported by the International Monetary Fund (IMF) and the World Bank. The reforms aimed at stimulating supply response, stabilizing macroeconomic environment and promoting institutional efficiency. Similarly, incentive structures were realigned towards export growth and preservation of scarce foreign exchange (Wangwe, 1995 and Treichel, 2005).

One of the key policy measures focused on the exchange rate, which was significantly devalued to ease the pressure in foreign exchange markets. Consequently, the parallel market premium declined from the peak of 257 percent in 1985 to just 30 percent in 1992. The unification of the parallel and the formal foreign exchange markets was achieved in 1993, following the introduction of foreign exchange bureaus and weekly foreign currency auctions. Measures to remove protective structures were implemented through price and tariff rates structures. Similarly, both domestic and foreign private actors were accorded freedom of entry into many sectors of the economy. Key institutional and sectoral reforms included financial sector reforms, reforms in the goods market, public sector reforms and the promotion of the private sector. The financial sector reforms included the restructuring of the state-owned banking sector to improve efficiency, and the introduction of private banks to strengthen competition in the banking system. The Bank of Tanzania's supervisory and regulatory role was enhanced and interest rates were also liberalized with real magnitudes turning positive as inflationary pressures slackened. Internal and external trade was liberalized in the early stages of the reforms, and the role of marketing agricultural products was taken away from parastatals and transferred to private sector entities or cooperatives. Macroeconomic adjustment entailed implementation of prudent monetary and fiscal policies consistent with low inflation and long-term economic growth.

These reform measures led to a significant restoration of macroeconomic stability, and a revival of economic growth (**Tables 1** and **2**). Specifically, in the period 1991-2010, investment rate doubled to 38.6 percent compared with the level in the pre-reform period (1981-1985), largely driven by external financing as reflected by a widened current account deficit. Over the same period, real GDP growth averaged at 6.6 percent from an average of 0.7 percent, while inflation declined significantly to an average of 7.4 percent, down from 30.2 percent. The decline in inflation was partly due to the availability of goods and services, and the tightening of money growth, which was largely made possible by non-monetization of budget deficits.

Table 2: Macroeconomic Balances and Key Incentive Instruments in Tanzania

	1968-70	1971-75	1976-80	1981-85	1986-90	1991-2010
(a) Investment-Savings gap (%)						
(i) Gross domestic saving/GDP	17.1	12.9	15.3	10.5	13.8	16.0
(ii) Domestic saving/capital formation	70.7	45.1	54.6	58.0	59.6	62.0
(b) Current account balance/GDP (%)	-1.3	-7.7	-6.4	-5.8	-7.5	-9.6
(c) Fiscal balances (%)						
(i) Recurrent budget balance/ GDP	0.3	0.8	-0.4	-4.1	-4.3	-5
(ii) Overall fiscal balance/GDP (excluding grants)	-5.3	-8.8	-12.6	-11.5	-9.2	-7.2
(iii) Overall fiscal balance/GDP (including grants)	-3.7	-4.8	-7.1	-8.2	-5.6	-2.4
(d) Inflation	2.8	13.7	13.8	30.22	12.8	7.4
(e) Key incentive instruments						
(i) Exchange rate premium	26.1	109.8	118.7	257.1	30.0	0.0
(i) Real exchange rate index (1966=100)[*]	76.2	72.4	69.0	45.0	69.4	86.4
(ii) Terms of trade	130.0	142.6	153.0	128.2	108.8	87.3

Note: * Increase in the index is depreciation and decrease is appreciation.
Source: Calculated using data from the Economic Surveys and National Accounts (various years)

2.2 The External Environment

The Tanzanian economic experience coincided with a number of global challenges, which include the volatility of commodity prices and capital flows (private and official including aid and debt relief). This situation has been heightened by the recurrence of global economic shocks such as changes in global demand, global financial crises, technological changes and world supply disruptions. For example, the sharp increase in oil prices during the 2000s and the spikes in the prices of other inputs affected domestic production. Similarly, the 2008 disruptions arising from the global rice market exerted more pressure on domestic prices. Private capital inflows are becoming an important source of financing for domestic investment as a result of the increasingly opening of capital account transactions over recent years (OECD, 2013). This development has been in response to enhanced macroeconomic stability and structural conditions resulting from a wide range of reform measures, including the commitment to the East African Community (EAC) common market, which envisages the free movement of capital among the EAC countries (EAC, 2009).

Official capital inflows have also played a critical role as a source of financing domestic investment. In addition to an increase in the absolute levels of aid inflows, two other macroeconomic aspects of aid

inflows are worth noting, namely, the change in the composition of aid and the scaling-up of debt relief. Aid has increasingly been channelled in the form of general budget support that is, as cash directly going into the budget instead of project support. Such a modality gives the government more control over the use of the resources. Significant aid has also been provided in the form of debt relief, which substantially reduced the country's debt burden[1].

3.0 Literature Review

A growing number of studies measuring the transmission of international economic shocks to domestic economies have focused on the vector autoregressive (VAR) model or its variants.

Ibrahim (2003) and Hsiao et al. (2003) analyzed the impact of the US economy on selected countries in East Asia using the structural VAR. Ibrahim (op. cit.) found that the fluctuations in US real GDP influenced Malaysia's real output. However, Hsiao et al. (op. cit.) found that, when compared to Japan, the US economy exerts a lesser influence on the fluctuations of Malaysia's real output. Maćkowiak (2007) estimated the structural VAR models with block exogeneity for 10 emerging markets in East Asia and Latin America. He found that in a typical emerging market, external shocks account for approximately 50 percent of the variation in the exchange rate and price level, and 40 percent and 33 percent for variations in real outputs and short-term interest rates respectively. He also showed that the US monetary policy shocks are less important for emerging markets compared to other external shocks, as they account for, on average, less than 10 percent of the macroeconomic fluctuations. A study by Moon and Jain (1995) delved on Korea and her three main trading partners. They focused on a co-integration VAR using the following variables industrial production, wholesale price indices, call market interest rates, and share prices. They found strong influences of external shocks on the Korean economy. In particular, Korean variables seem to adjust fairly rapidly to shocks in foreign interest rates and foreign output. Lastrapes and Koray (1990) estimated an eight variable-model of a structural VAR (SVAR) for the United Kingdom (UK), France, Germany and the US comprising of real output, inflation, money stock and interest rates. Their estimation covered periods of fixed and flexible exchange rate regimes. They found that a flexible exchange rate regime did not insulate Germany, France and UK from shocks originating from the US.

Selover and Round (1996) estimated a VAR model using quarterly data on real activity, price level, interest rates and money stock for Australia and Japan. They found that Japan's real output shock had a significant and persistent effect on Australian output and accounted for about 21 per cent of its error variance. Selover (1997) evaluated the business cycle transmission between Japan and the US, using a six-variable Vector Error Correction Model (VECM), comprising of industrial production, consumer price index, and interest rates for both countries. It was found that economic fluctuations in the US

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[1] Tanzania qualified for the Highly Indebted Poor Countries (HIPC) Initiative in 2001 (IMF, 2001).

exerted a significant effect on Japan in the short-term, but in the long-term, the effects became moderate. Ahmed and Tongzon's (1998) study on the direction of causation and transmissions of shocks among the Association of South East Asian Nations (ASEAN) and the effect of external shocks on these countries using a VAR model and quarterly real GDP data from 1975 to 1993. They found that shocks from Indonesia exerted a dominant influence to other ASEAN countries. In addition, they found that shocks from the US have a substantial impact on ASEAN economies.

Yean (2004) measured the transmission of shocks from the US, Japan and the European Union to ASEAN countries using a VAR model. In order to detect the differences between the shocks before and after the financial crisis in 1997/1998, the model was estimated over the pre-crisis and post-crisis sub-periods. The results revealed that the effect of foreign shocks on the domestic output variability in Indonesia, Malaysia and Singapore increased after the crisis. The results also indicated that the origin of the foreign shocks before and after the crisis were different for these three countries.

Chua et al. (1999) studied the impact of shocks from the US and Japanese economies on Korea and Malaysia. They found that macroeconomic variations in these two small open economies were influenced by the US and Japan. In a similar study, Lee et al. (2003) used a four-variable VAR model to study the relative impact of the US and Japanese business cycles on the Australian economy. Their study showed that foreign factors are responsible for approximately 50 percent of the economic fluctuations in Australia. Sosa (2008) examined the relative importance of external shocks as a source of business cycle fluctuations in Mexico and identified the dynamic responses of domestic output to foreign disturbances. Using a VAR model with block exogeneity restrictions, he found that US shocks explain a large share of Mexico's macroeconomic fluctuations following the North American Free Trade Agreement (NAFTA).

Generally, this literature review highlights the usefulness of VAR empirical approach in explaining the international transmission of shocks and how significant are the external shocks as sources of macroeconomic fluctuations. It also highlights that VAR may offer a convenient framework for explaining the mechanisms through which external shocks are propagated to the domestic economy.

4.0 Methodology

4.1 Empirical Framework

Following Cushman and Zha (1997), Selover and Round (1996), Giordani (2004a), Hsiao (2003), Kim (2003), Hoffmaister and Roldos (2001) among others, this study focuses on a standard vector autoregressive (VAR) model with block exogeneity restrictions. The model is divided into two blocks of equations: a foreign block (global economy) and a domestic block (domestic economy), with the assumption that the small economy (domestic block) does not affect the global economy (foreign block).

Accordingly, domestic variables are excluded from the equations of the foreign block. Let z denote a vector of relevant domestic variables and x a vector of relevant foreign variables that have an influence on the domestic economy. The structural model of this economy can be expressed as:

$$Cz_t = C(L)z_{t-1} + B(x_t) + B(L)x_{t-1} + \xi_t \qquad (1)$$

$$Kx_t = K(L)x_{t-1} + \omega_t \qquad (2)$$

where (1) and (2) are equations in a VAR model consisting of domestic and foreign blocks respectively where:

$$C(L) = \sum_{i=O}^{l} C_i L^i \;,\quad B(L) = \sum_{i=0}^{l} B_i(L^i) \quad \text{and} \quad K(L) = \sum_{i=0}^{l} K_i(L^i) \;.$$

In these specifications ξ_t and ω_t are random errors and correspond to domestic and foreign structural shocks respectively. They constitute the sources of macroeconomic fluctuations which are propagated through the matrices C(L), B(L) and K(L). Since the interest is to determine the relative importance of foreign and domestic shocks for the behavior of variables contained in vector z, (1) and (2) can be compactly combined to get:

$$\begin{pmatrix} C & -B \\ 0 & K \end{pmatrix} \begin{pmatrix} z_t \\ x_t \end{pmatrix} = \begin{pmatrix} C(L) & B(L) \\ 0 & K(L) \end{pmatrix} \begin{pmatrix} z_{t-1} \\ x_{t-1} \end{pmatrix} + \begin{pmatrix} \xi_t \\ \omega_t \end{pmatrix} \qquad (3)$$

Expression (3) can be represented as a reduced VAR model of the form:

$$\begin{pmatrix} z_t \\ x_t \end{pmatrix} = \begin{pmatrix} N_{11}(L) & N_{12} \\ 0 & N_{22} \end{pmatrix} \begin{pmatrix} z_{t-1} \\ x_{t-1} \end{pmatrix} + \begin{pmatrix} \upsilon_t \\ \psi_t \end{pmatrix} \qquad (4)$$

where:

$$N_{11}(L) = C^{-1}C[L]$$

$$N_{12} = C^{-1}BK^{-1}K(L) + C^{-1}B(L)$$

$$N_{22}(L) = K^{-1}K(L)$$

$$\upsilon_t = C^{-1}\xi_t + C^{-1}BK^{-1}\omega_t$$

$$\psi_t = K^{-1}\omega_t$$

The expression (4) can be transformed into a moving average VAR as in (5):

$$\begin{pmatrix} z_t \\ x_t \end{pmatrix} = \left[I - \begin{pmatrix} N_{11}(L) & N_{12}(L) \\ 0 & N_{22}(L) \end{pmatrix} \right]^{-1} \begin{pmatrix} \upsilon_t \\ \psi_t \end{pmatrix} \tag{5}$$

The assumption that foreign variables are exogenous implies that the VAR is a block triangular, implying that shocks to domestic variables can neither affect contemporaneously, nor with any lags, the external variables. On the other hand, shocks to foreign variables can affect domestic variables, either contemporaneously or with lags.

4.1.1 Relative Importance of Foreign and Domestic Shocks

From (5), the optimal forecast on (z_{t+h}) based on the current information set $(\aleph^t)$ is:

$$z_{t+h} - E(Z_{t+h} / \aleph^t) = \sum_{h=0}^{h} \sum_{k=1}^{k} N_{h,k} \upsilon_t + \sum_{h=o}^{h} \sum_{k=1}^{k} N_{h,k} \psi_t \tag{6}$$

Then, the h-step forecast error variance of $z_{i,t+h}$ is given by:

$$z_{t+h} - E(Z_{t+h} / \aleph^t) = \sum_{h=0}^{h} \sum_{k=1}^{k} \left(N_{h,k}^2 \right) \left(\sigma_{\upsilon_k}^2 \right) + \sum_{h=o}^{h} \sum_{k=1}^{k} \left(N_{h,k}^2 \right) \left(\sigma_{\psi_k}^2 \right) \tag{7}$$

Equation (7) expresses the variance of domestic variables as the sum of the variance stemming from the domestic variables (the first term on the right hand side) and the variance arising from foreign variables (the second term on the right hand side). The relative impact of foreign variables on domestic variables relates to a proportion of the total forecast error variance that can be attributed to innovations on foreign variables. From (7), this can be written as:

$$\Im = \frac{\left[\sum_{h=o}^{h} \sum_{k=1}^{k} \left(N_{h,k}^2 \right) \left(\sigma_{\psi_k}^2 \right) \right]}{\left[\sum_{h=0}^{h} \sum_{k=1}^{k} \left(N_{h,k}^2 \right) \left(\sigma_{\upsilon_k}^2 \right) + \sum_{h=o}^{h} \sum_{k=1}^{k} \left(N_{h,k}^2 \right) \left(\sigma_{\psi_k}^2 \right) \right]} \tag{8}$$

4.2 Model Specification

The empirical model used in this study is motivated by the open economy Keynesian theoretical models (Svensson, 2000; Giordani, 2004a; Gal and Gertler, 2007; and Gal and Monacelli, 2005). In this respect, specification in the empirical model is intended to capture the domestic and foreign variables that are responsible for the behaviour of domestic economy. In specifying the econometric model

however, a balance has to be made between the specification and parsimoniousness in order to minimize the over-parameterization problem.

4.2.1 Domestic Block

In line with Sims (1980b) four domestic variables were chosen to characterize the domestic economy. These are real output, money stock, inflation and real exchange rate. These variables are the focus of macroeconomic policy and therefore command important policy considerations in the event of a shock. In contrast to Sims (1980b) however, reserve money   is used instead of an interest rate as a measure of monetary policy.[2] In addition, the real exchange rate is included, in order to capture its key role of adjustment.

4.2.2 Foreign Block

Included in the foreign economy are variables that are mostly considered in the literature to characterize world economic shocks.[3] These include the interest rate to reflect external conditions for credit; foreign real economic activity to capture the external demand conditions; and the foreign price index to capture the external inflationary pressures. In addition, oil prices are included to account for the effect of important common shocks.

On the external side, only advanced and emerging economies are included. These economies are identified basing on the IMF approach, which classifies the world's economies basing on: (a) the per capita income level; (b) the export diversification; and (c) the degree of integration into the global financial system. According to 2010 economic data, there are 34 advanced countries and 40 emerging markets. The advanced countries are Australia, Austria, Belgium, Canada, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, the United Kingdom, and the United States.

Given the assumption of a small open economy for the domestic economy, the inclusion of all emerging markets in the foreign block may result in identification problems in the VAR analysis due to possible prevalence of small economies within the emerging economies. In this category therefore, only China and India are included, which are considered to be the largest emerging markets.[4]

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[2] The choice of base money as a measure of monetary policy (instead of interest rate) is based on the Bank of Tanzania monetary policy framework, which, during the sample period, focused on the reserve money target as the instrument of monetary policy rather than using the policy rate.

[3] See for example Cecchetti and Karras, (1992).

[4] See Chandra (2006)

4.3 Data Sources and Variables

Quarterly data spanning from 1980 through 2010 are used and all variables are measured on natural logarithms except for those in percentage changes.

4.3.1 Domestic variables

Domestic variables are taken from the International Financial Statistics (IFS), World Economic Outlook (WEO) and the Bank of Tanzania. Domestic inflation (π) is measured using the consumer price index (CPI). Real economic activity is measured by real domestic product (y). Domestic monetary policy is measured using domestic reserve money (m). The real exchange rate (rer) is measured as the real effective exchange rate.

4.3.2 Foreign Variables

Following Desroches (2004), the sum of the advanced countries, China, and India's real GDP are used as a proxy for external real activity (y^*). This variable is available in the WEO. The world interest rate (i^*) is from the IFS (Line 60c) and is measured as the average of the treasury bills rate over the advanced countries, China, and India. The average is weighted by each country's share of real GDP over the total GDP of these countries. Oil prices (p^{oil}) are taken from the WEO database, and the variable is measured as the simple average of the three crude oil spot prices (Dated Brent, West Texas Intermediate, and Dubai Fateh) in US dollars per barrel. Foreign inflation (π^*) is measured as the average inflation of the advanced countries, China, and India.

4.4 Diagnostic Checks

4.4.1 Stability Tests and VAR Lag Structure

The unit root is tested using the Philip and Perron (1988) test. This test is used because it has improved power properties compared to the Augmented Dickey Fuller (1979) unit root test. The results indicate that variables included in the model are integrated in the first order. Accordingly, the VAR analysis was based on the differences instead of on the levels. Finally, the appropriate lag structure of the VAR is determined using the Hannan and Quinn (1978) and the Schwarz (1979) criteria. The application of both criteria led to the choice of two lags for the domestic output, the domestic inflation, the real exchange rate, the foreign inflation, the foreign output and the world oil prices. Domestic money stock and foreign interest rate were selected with three lag times. However, on account of the limited sample size, misspecification and over-parameterization only two lags were focused on.

4.5 Identification and Ordering

In this analysis, the VAR identification was based on Cholesky factorization.[5] The choice of this approach followed the assessment of the correlation coefficients of the shocks which was found to be below 0.20.[6] Because Cholesky decomposition is limited to the contemporaneous relationship, a block triangular restriction was further imposed such that time lagged values of domestic variables do not enter the equations of foreign variables.

Following Lastrapes and Koray (1990), all relevant foreign variables were ordered first, followed by the domestic variables. On the other hand, the domestic variables were ordered such that money stock appeared first, followed by inflation, output and the real exchange rate. This ordering follows a standard channel of monetary transmission mechanism, where changes in money supply are transmitted to the goods market, through changes in the interest rate[7].

5.0 Estimation

5.1 Error Variance Decomposition

Since the error variance decomposition shows the proportion of forecast error variance attributable to each of the variables included in the model, one can derive the relative importance of foreign variables $\left(\Xi^{f} \right)$ and domestic variables $\left(\Xi^{d} \right)$ for a given forecast horizon using the expression (8) above. This measure is computed over 8 horizons (eight quarters) for each variable and the results are reported in **Tables 3** through **6** in the appendices.

The importance of both domestic and foreign variables in accounting for the forecast error variance of domestic output appears in **Table 3**. The proportion of domestic output error variance explained by the world interest rate is 10.77 percent after one quarter and declines to 7.38 percent after 8 quarters. The proportion of domestic output error variance explained by world inflation is 7.37 percent after one quarter and 8.71percent after eight quarters. The contribution of oil prices to domestic output error variance decomposition in the first quarter is approximately 12.92 percent and declines to 9.72 percent in the eighth quarter while, the contribution of world output is approximately 4.0 percent after one quarter and 4.50 percent after eight quarters. Overall, the proportion of output error variance decomposition attributed to foreign factors is 35.23 percent in the first quarter and 30.3 percent after eight quarters. Compared to foreign factors, domestic factors exert a relatively larger influence on the fluctuations in

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[5] Benoit (1924) and Sims (1980b)

[6] Enders (2004) suggests that when the contemporaneous correlation of errors is less than 0.20, then the ordering of the variables in the VAR does not affect the error variance decomposition.

[7] See Papadopoulos and Papanikos (2002) for various alternative orderings.

domestic output. For example, the proportion of domestic output error variance decomposition that originates from domestic output reaches 35.72 percent during the first quarter and 44.00 percent after eight quarters. This is followed by domestic inflation which, contributes about 17.04 percent of the fluctuations in the domestic output during the first quarter and 10.45 percent after eight quarters. The real exchange rate and the money supply contribute the least, each with 1.37 percent and 4.64 percent of error variance decomposition respectively during the first quarter, and 0.72 percent and 3.53 percent respectively, after eight quarters. Overall, domestic factors account for about 65 percent of the fluctuations in domestic output during the first quarter and increase to 70 percent in the eighth quarter.

Table 4 shows that variability in domestic inflation is driven by both domestic and foreign conditions. The proportion of domestic inflation error variance decomposition attributed to domestic factors reached 77.84 percent during the first quarter, and 66.03 percent after eight quarters. Domestic variables that dominate the volatility of the domestic inflation are domestic inflation itself reflecting persistency in domestic prices; money stock; domestic output; and the real exchange rate. Domestic inflation accounts for about 69 percent of its own fluctuations during the first quarter, and declines to about 30 percent after eight quarters. Money stock accounts for about 10.40 percent of fluctuations in domestic inflation during the first quarter, and increases to 30.30 percent after eight quarters. Domestic output and the real exchange rate contribute about 2.30 percent and about 1.70 percent respectively of domestic inflation error variance decomposition during the first quarter and about 4.0 percent and 2.0 percent respectively after eight quarters. Factors dominating the importance of foreign shocks on domestic prices are world interest rates, world inflation and oil prices.

Table 5 shows that the proportion of domestic money stock error variance decomposition attributed to domestic factors reaches 79.00 percent in the first quarter and 68.44 percent after eight quarters. Domestic variables that account for most of the volatility in the domestic money stock are a lag in domestic money stock, followed by domestic inflation and domestic output. The proportion of domestic money stock error variance decomposition attributed to foreign shocks reached 31.68 percent in the eighth quarter, up from 24.19 percent in the first quarter. Factors dominating the importance of foreign shocks to fluctuations in domestic money stocks are world interest rates, world output and oil prices.

Table 6 indicates that variability in the real exchange rate is largely dominated by foreign factors. The proportion of error variance decomposition of the real exchange rate accounted for by foreign factors increased from about 47.00 percent in the first quarter to 77.20 percent after eight quarters. Factors driving the external influence on the real exchange rate are world interest rates, world inflation and the world GDP.

5.1.1 Impact of Exchange Rate Regimes

To investigate the importance of changes in the exchange rate regimes to these results, estimations are made over two sub-samples, one spanning from 1980:1 to 1995:4 and another spanning 1996:1 to

2010:4. The former coincides with the period of the fixed exchange rate system, during which the Tanzanian shillings was fixed to the US dollar; whilst the latter covers the period of floating exchange rates. Tables 3-6 also report the error variance decompositions under the systems of fixed and flexible exchange rate sub-samples.

The impact of foreign shocks on domestic macroeconomic fluctuations under the regime of a fixed exchange rate is large and persistent. The proportion of error variance decomposition of domestic output contributed by external factors reaches about 70 percent during the first quarter and 56 percent after eight quarters while domestic factors contribute about 30.0 percent in the first quarter and 44.0 percent after eight quarters. The proportion of domestic inflation error variance decomposition arising from the external sources reaches about 71.0 percent during the first quarter and 55.0 after eight quarters, with domestic sources contributing about 29.0 percent during the first quarter and 45.0 percent after eight quarters. The proportion of domestic money stock error variance decomposition due to external factors is about 73.0 percent during the first quarter and 63.0 percent after eight quarters, while the domestic sources contribute about 27.0 percent during the first quarter and 37.0 percent after eight quarters. The proportion of the real exchange rate error variance decomposition attributed to external factors is about 82.0 percent in the first quarter and 83.0 percent after eight quarters, while the contribution of domestic factors is about 18.0 percent during the first quarter and 17.0 after eight quarters.

During the flexible exchange rate period, domestic conditions dominate domestic macroeconomic fluctuations, although the influence of foreign factors is still notable. The proportion of domestic output error variance decomposition originating from external sources is about 29 percent in the first quarter and 41 percent after eight quarters, while that originating from domestic sources contributes about 71.0 percent during the first quarter and 59.0 percent after eight quarters. The proportion of domestic inflation error variance decomposition attributed to external shocks is about 18.0 percent during the first quarter and 47.0 percent after eight quarters, with domestic conditions contributing about 82.0 percent in the first quarter and 53.0 percent after eight quarters. The proportion of domestic money stock error variance decomposition accounted for by the external factors is about 25.0 percent in the first quarter and 42.0 percent after eight quarters; while domestic sources contribute about 75.0 percent during the first quarter and 58.0 percent after eight quarters. The proportion of real exchange rate error variance decomposition originating from external shocks is about 82.0 percent during the first quarter and 90.0 percent after eight quarters, with domestic shocks contributing about 18.0 percent during the first quarter and 10.0 percent after eight quarters. Although the results indicate that the influence of domestic economic conditions on domestic macroeconomic fluctuations has increased substantially following a shift from the fixed to flexible exchange rate policy, the sizeable error variance decompositions of domestic variables attributed to external factors shows that overall, the flexible exchange rate regime has not led to the insulation of the Tanzanian economy from external disturbances to the extent anticipated.

The nature of the transmission of the shocks under the two exchange rate regimes shows an interesting trend. Whereas under the fixed exchange rate regime, large error variance decompositions of domestic variables originating from external sources are accounted for at short horizons (one to four quarters), under the flexible exchange rate, they are largely accounted for after longer horizons. This reflects changes in the nature of transmission mechanisms as the country shifted from a fixed to a flexible exchange rate policy. In the former, the external shocks are transmitted directly through policy induced world interest rates (which are directly linked to the domestic economy) while in the latter, the transmission takes place indirectly through international trade.

5.1.2 Implications to Monetary Policy

In general practice, the role of monetary policy is to maintain price stability in addition to supporting the stability of the real economy. The degree of commitment of monetary policy to price stability particularly in the short-term therefore depends on the extent it is being used to stabilize the real part of the economy. The importance of variation in other variables for explaining variability in the domestic money supply is illustrated in **Figures 1** and **2**.

Under the fixed exchange rate (**Figure 1**), the world output and world interest rates account for most of the error variance decomposition of money stock, with money increasingly becoming endogenous in large part to foreign variables.

Figure 1: Error Variance Decomposition of Money Stock—Fixed Exchange Rate
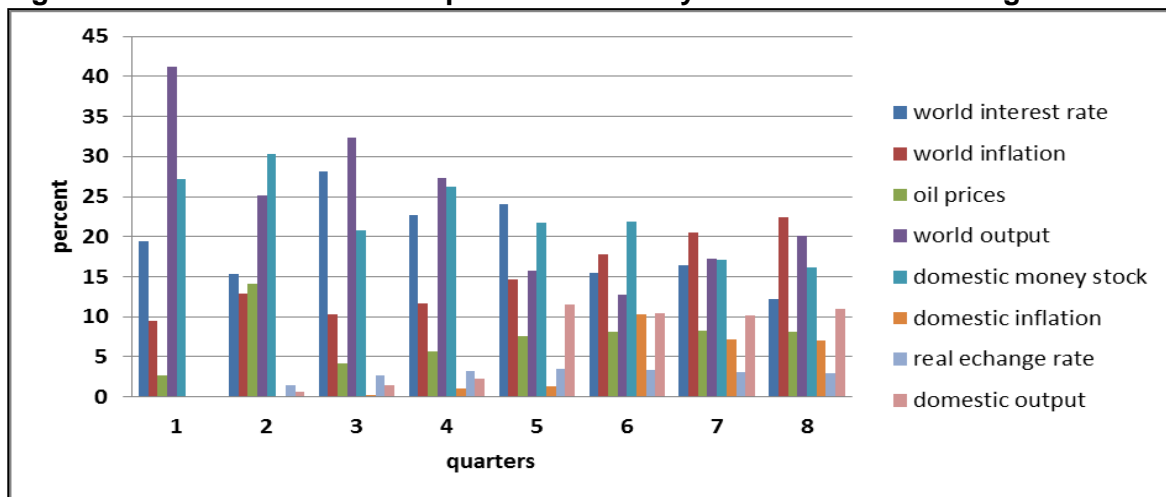
Under the flexible exchange rate (**Figure 2**), money stock mostly accounts for its own variability as the contribution of other variables to money stock error variance decomposition remains relatively small, compared to that observed under the fixed exchange rate. While endogeneity of monetary policy under a fixed exchange rate regime may not be surprising due to the implied adjustment process, endogeneity

under a flexible exchange rate could have resulted from a discretionary response to domestic and foreign shocks.

Figure 2: Error Variance Decomposition of Money Stock—Flexible Exchange Rate
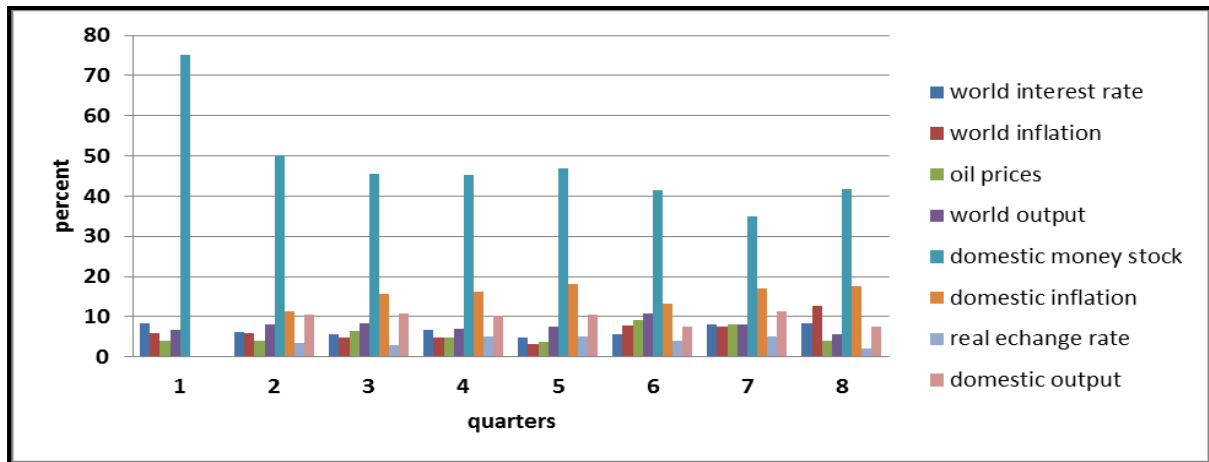
6.0 Conclusion

6.1 Summary of the Findings

This paper examines the influence of global economic disturbances to Tanzania aggregate macroeconomic fluctuations, using a VAR model comprising foreign and domestic variables, with block exogeneity restrictions. Specified in the foreign block are variables mostly considered in the literature to characterize world economic shocks and include world; interest rate, economic growth, inflation, and oil prices. In the domestic block, the variables included are output, inflation, money stock and the real exchange rate. The findings indicate that although domestic shocks still account for a larger part of domestic macroeconomic fluctuations, there remains a strong influence from external sources. In particular, the results suggest that development in international real activity, international prices, international interest rates, and world oil prices exert a significant influence on Tanzanian real output, inflation and money stock. This influence has remained important despite the introduction of a flexible exchange rate system in the early 1990's.

It is also found that domestic monetary policy reacts to various shocks, though at varying degrees. Variability in money stock is dominated by past realization of money stock, domestic inflation, domestic output, world output and world interest rates, signalling that in addition to fighting inflation, monetary policy also plays the role of stabilizing the economy.

One of the striking aspects of these results is that variations in domestic variables explained by their own inertial components (own persistence) are large. While persistence in money stock may reflect a

non-endogenous component of monetary policy, the sluggishness in domestic prices signals the importance of the role of supply side, which tends to trigger the influence of past inflation on current price setting.

6.2 Policy Implications

One of the key policy implications arising from the above results is that building the response capacity of the Tanzania's economy to exogenous shocks is critical for macroeconomic stability. In this regard, enhancing the domestic resource base with a view to reducing the import-dependent nature of investment and production is critical. This will reduce the extent to which the domestic economy is susceptible to the variability in import capacity that may arise from fluctuations such as those in commodity prices, terms of trade and changes in world demand.

While external resource inflows, such as grants, have contributed a significant proportion to financing imports, these resources are exogenously determined and subject to changing conditions in donor countries. Exports earnings, although subject to variations in external demand conditions, should be considered the backbone of economic growth. Consequently, developing sustainable export growth strategies that include export diversification remains important. Another structural area that needs to be given attention is the strengthening of technological and human capacity for production in order to enhance the flexibility of the economy to respond to changing external and domestic conditions.

Finally, a stable macroeconomic environment is necessary in order to mobilize domestic resources and attract foreign resources, especially foreign direct investment. This underscores the need for prudent monetary and fiscal policies as well as the recognition of the critical role that may be played by the exchange rate policy with respect to macroeconomic adjustment, and the effectiveness of monetary policy.

Lastly, it might be useful to address several limitations of the analysis in future work. First, as the sample size increases, additional data can be used in the estimation in order to capture more information to enrich the analysis. Secondly, it may be useful to increase the number of shocks in the model to broaden the number of factors influencing the behaviour of the economy in the short-term, and this may help shed more light on the posed research questions.

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Appendices

Table 1: Investment and Growth in Tanzania

	1968-70	1971-75	1976-80	1981-85	1986-90	1901-2010
(a) Fixed capital formation to GDP (%)	24.2	26.8	28.0	18.1	24.6	38.6
(b) Sectoral shares of fixed capital formation						
(iv) Agriculture	9.0	6.3	8.1	10.7	34.5	25.6
(v) Manufacturing	15.4	14.0	25.3	24.0	13.0	28.5
(vi) Economic infrastructure[*]	43.1	43.1	54.6	34.9	27.7	29.4
(c) Share of fixed capital formation						
(i) Private sector	47.0	32.0	44.0	55.0	60.7	75.0
(ii) Public sector	53.0	68.0	56.0	45.0	39.3	25.0
(d) Real GDP growth (%)	3.9	3.8	2.8	0.7	4.1	6.6
(e) Sectoral real GDP growth rates (%)						
(iv) Agriculture	2.1	2.5	1.8	3.0	4.9	4.3
(v) Manufacturing	8.1	4.8	2.7	-4.9	3.8	7.9
(vi) Services	5.9	3.7	2.6	0.4	4.2	7.3
(g) Per capita income growth (%)	2.1	-0.7	3.0	0.8	0.6	1.2

Source: Calculated using data from the Economic Surveys and National Accounts (various years)

Table 2: Macroeconomic Balances and Key Incentive Instruments Tanzania

		1968-70	1971-75	1976-80	1981-85	1986-90	1991-2010
(f)	Investment-Savings gap (%)						
(iii)	Gross domestic saving/GDP	17.1	12.9	15.3	10.5	13.8	16.0
(iv)	Domestic saving/capital formation	70.7	45.1	54.6	58.0	59.6	62.0
(g)	Current account balance/GDP (%)	-1.3	-7.7	-6.4	-5.8	-7.5	-9.6
(h)	Fiscal balances (%)						
(iv)	Recurrent budget balance/ GDP	0.3	0.8	-0.4	-4.1	-4.3	-5
(v)	Overall fiscal balance/GDP (excluding grants)	-5.3	-8.8	-12.6	-11.5	-9.2	-7.2
(vi)	Overall fiscal balance/GDP (including grants)	-3.7	-4.8	-7.1	-8.2	-5.6	-2.4
(i)	Inflation	2.8	13.7	13.8	30.22	12.8	7.4
(j)	Key incentive instruments						
(ii)	Exchange rate premium	26.1	109.8	118.7	257.1	30.0	0.0
(iii)	Real exchange rate index (1966=100)[*]	76.2	72.4	69.0	45.0	69.4	86.4
(iv)	Terms of trade	130.0	142.6	153.0	128.2	108.8	87.3

Note: [*] Increase in the index is depreciation and decrease is appreciation.
Source: Calculated using data from the Economic Surveys and National Accounts (various years)

Table 3: Proportion of Forecast Error Variance Accounted for by Foreign and Domestic Shocks by Real GDP (y)

Horizon	(i^*)	(Π^*)	(p^{oil})	(y^*)	Ξ^f	(m)	(Π)	(rer)	(y)	Ξ^d	$\Xi^f + \Xi^d$
						Full sample: 1980-2010					
1	10.77	7.37	12.92	4.17	35.23	4.64	13.04	1.37	45.72	64.77	100
2	12.42	8.50	13.73	5.09	39.74	5.62	15.96	1.27	37.41	60.26	100
3	13.55	7.17	13.10	5.10	38.92	7.57	13.26	0.97	39.28	61.08	100
4	13.60	6.59	12.36	4.69	37.24	8.31	13.80	0.90	39.75	62.76	100
5	13.15	4.50	11.89	4.25	33.79	7.85	14.19	0.75	43.42	66.21	100
6	8.73	5.13	11.69	4.05	29.60	5.22	15.80	0.70	48.68	70.40	100
7	10.72	8.54	6.66	4.07	29.99	3.44	13.50	0.73	52.34	70.01	100
8	7.38	8.71	9.72	4.49	30.30	3.53	11.45	0.72	54.00	69.70	100
						Fixed exchange rate period 1980-1995					
1	23.61	30.32	6.14	10.07	70.14	2.87	14.99	5.55	6.45	29.86	100
2	30.39	22.55	6.63	10.91	70.48	12.15	10.70	3.39	3.28	29.52	100
3	21.01	22.44	14.19	16.09	73.73	9.99	6.97	2.70	6.61	26.27	100
4	17.58	23.50	16.44	14.89	72.41	9.27	9.58	2.49	6.25	27.59	100
5	18.75	22.84	14.05	14.60	70.24	11.62	9.39	2.47	6.28	29.76	100
6	16.25	22.46	11.96	9.68	60.35	16.49	9.30	3.47	10.39	39.65	100
7	16.00	15.02	16.01	10.65	57.68	16.90	9.53	3.43	12.46	42.32	100
8	16.00	13.47	15.95	10.82	56.24	16.50	9.39	5.39	12.48	43.76	100
						Flexible exchange rate period: 1996-2010					
1	5.02	10.09	4.69	9.12	28.92	15.02	9.09	3.90	43.07	71.08	100
2	7.66	9.32	3.91	4.92	25.81	15.64	9.06	3.79	45.70	74.19	100
3	6.43	9.22	5.16	4.12	24.93	12.26	13.30	3.10	46.41	75.07	100
4	6.42	7.43	3.20	3.33	20.38	16.22	12.81	5.39	45.20	79.62	100
5	9.02	8.09	5.69	7.12	29.92	17.05	15.60	4.46	32.97	70.08	100
6	7.66	6.32	9.91	11.92	35.81	11.63	16.06	5.80	30.70	64.19	100
7	10.43	7.22	7.16	13.12	37.93	10.26	13.59	9.82	28.40	62.07	100
8	10.42	9.43	13.20	8.33	41.38	15.22	12.81	7.39	23.20	58.62	100

Table 4: Proportion of Forecast Error Variance Accounted for by Foreign and Domestic Shocks by Domestic Inflation (Π)

Horizon	(i^*)	(Π^*)	(p^{oil})	(y^*)	Ξ^f	(m)	(Π)	(rer)	(y)	Ξ^d	$\Xi^f + \Xi^d$
Full sample: 1980-2010											
1	3.78	11.26	5.38	0.74	21.16	10.39	68.45	0.00	0.00	78.84	100
2	6.61	9.75	5.37	0.85	22.58	10.28	63.15	1.66	2.33	77.42	100
3	9.46	8.70	10.01	0.75	28.92	13.50	52.02	2.04	3.52	71.08	100
4	9.69	8.32	13.06	0.76	31.83	20.59	42.08	2.02	3.48	68.17	100
5	9.33	8.17	14.45	0.80	32.75	25.91	36.03	1.96	3.35	67.25	100
6	9.33	8.07	14.81	0.78	32.99	25.91	35.71	1.92	3.47	67.01	100
7	9.85	7.97	14.71	0.81	33.34	27.43	33.65	1.89	3.69	66.66	100
8	10.66	7.85	14.46	1.00	33.97	30.58	29.70	1.86	3.89	66.03	100
Fixed exchange rate period: 1980-1995											
1	21.39	8.73	31.82	9.08	71.02	6.54	22.44	0.00	0.00	28.98	100
2	23.33	10.17	25.28	14.24	73.02	5.62	18.07	2.25	1.04	26.98	100
3	23.88	10.33	20.02	14.79	69.02	5.67	18.54	5.44	1.33	30.98	100
4	19.32	7.37	20.73	13.51	60.93	5.98	26.41	5.37	1.31	39.07	100
5	18.96	8.06	18.26	13.80	59.08	6.23	28.24	5.19	1.26	40.92	100
6	19.59	8.21	15.97	13.66	57.43	9.15	24.04	5.13	4.25	42.57	100
7	19.66	8.67	15.72	11.64	55.69	9.12	26.81	5.13	3.25	44.31	100
8	19.80	8.86	12.53	13.69	54.88	8.13	27.65	5.09	4.25	45.12	100
Flexible exchange rate period: 1996-2010											
1	9.23	7.49	1.20	0.24	18.16	20.30	61.54	0.00	0.00	81.84	100
2	12.13	5.52	4.37	1.13	23.15	21.13	53.47	1.50	0.75	76.85	100
3	12.01	5.36	7.79	1.08	26.24	19.92	50.44	2.69	0.71	73.76	100
4	12.51	5.21	12.29	1.21	31.22	18.44	46.53	3.00	0.81	68.78	100
5	13.68	4.93	17.72	2.04	38.37	16.57	41.35	2.75	0.96	61.63	100
6	14.60	4.81	21.55	3.03	43.99	15.26	37.26	2.46	1.03	56.01	100
7	14.65	4.81	23.31	3.51	46.28	14.90	35.40	2.35	1.07	53.72	100
8	14.43	4.83	23.76	3.63	46.65	15.03	34.86	2.35	1.11	53.35	100

Table 5: Proportion of Forecast Error Variance Accounted for by Foreign and Domestic Shocks by Domestic Money Stock (M)

Horizon	(i^*)	(Π^*)	(p^{oil})	(y^*)	Ξ^f	(m)	(Π)	(rer)	(y)	Ξ^d	$\Xi^f + \Xi^d$
				Full sample: 1980-2010							
1	5.00	7.06	4.74	7.39	24.19	75.81	0.00	0.00	0.00	75.81	100
2	8.50	1.28	2.46	6.91	19.14	49.16	20.26	3.43	8.01	80.86	100
3	12.37	3.72	2.38	9.48	27.95	36.42	20.24	3.03	12.37	72.05	100
4	11.91	6.85	4.66	9.55	32.97	27.33	21.82	5.84	12.04	67.03	100
5	11.97	6.84	6.60	5.31	30.71	34.93	17.85	5.90	10.61	69.29	100
6	10.64	5.78	5.08	7.00	28.50	31.92	25.47	3.13	10.98	71.50	100
7	8.61	6.74	4.20	9.72	29.27	31.37	24.70	3.47	11.19	70.73	100
8	12.24	7.74	5.08	6.50	31.56	30.68	23.59	4.86	9.30	68.44	100
				Fixed exchange rate period: 1980-1995							
1	19.46	9.49	2.72	41.21	72.88	27.12	0.00	0.00	0.00	27.12	100
2	15.28	12.90	14.10	25.19	67.47	30.34	0.10	1.44	0.64	32.53	100
3	28.08	10.35	4.12	32.31	74.85	20.78	0.19	2.67	1.50	25.15	100
4	22.68	11.67	5.61	27.30	67.25	26.20	1.06	3.27	2.21	32.75	100
5	24.05	14.70	7.53	15.73	62.01	21.71	1.28	3.51	11.50	37.99	100
6	15.44	17.76	8.17	12.76	54.13	21.89	10.25	3.32	10.41	45.87	100
7	16.46	20.51	8.21	17.21	62.39	17.16	7.14	3.09	10.22	37.61	100
8	12.18	22.44	8.08	20.16	62.86	16.18	7.01	2.92	11.03	37.14	100
				Flexible exchange rate period: 1996-2010							
1	8.32	5.92	4.04	6.64	24.93	75.07	0.00	0.00	0.00	75.07	100
2	6.16	5.89	4.06	8.10	24.21	50.30	8.41	3.41	13.67	75.79	100
3	5.69	4.87	6.45	8.33	25.34	45.46	12.57	2.87	13.75	74.66	100
4	6.64	4.90	4.79	6.90	23.22	45.21	10.20	5.10	16.28	76.78	100
5	4.83	3.15	3.71	7.62	19.31	46.87	13.15	5.05	15.62	80.70	100
6	5.68	7.80	9.12	7.90	30.49	41.61	13.24	4.04	10.62	69.51	100
7	8.11	7.42	8.00	8.09	31.61	35.06	13.03	3.04	17.27	68.39	100
8	8.33	12.81	10.14	10.64	41.92	30.85	9.65	2.05	15.53	58.08	100

Table 6: Proportion of forecast error variance accounted for by foreign and domestic shocks by real exchange rate (rer)

Horizon	(i^*)	(Π^*)	(p^{oil})	(y^*)	Ξ^f	(m)	(Π)	(rer)	(y)	Ξ^d	$\Xi^f + \Xi^d$
					Full Sample: 1980-2010						
1	5.81	66.54	0.09	9.09	81.52	2.95	4.30	11.22	0.00	5.81	100
2	14.32	73.54	1.35	3.93	93.14	2.08	1.81	2.96	0.01	14.32	100
3	19.79	61.54	1.02	5.53	87.88	8.95	1.66	1.45	0.06	19.79	100
4	23.66	56.95	1.02	4.99	86.61	10.94	1.28	1.07	0.09	23.66	100
5	23.99	54.79	1.20	5.04	85.02	12.66	1.25	0.98	0.09	23.99	100
6	24.14	53.32	1.30	5.10	83.86	13.68	1.40	0.95	0.11	24.14	100
7	24.18	52.85	1.36	5.10	83.49	13.95	1.47	0.96	0.13	24.18	100
8	24.13	52.79	1.37	5.11	83.40	13.94	1.54	0.98	0.13	24.13	100
					Fixed exchange rate period 1980-1995						
1	5.81	66.54	0.09	9.09	81.52	2.95	4.30	11.22	0.00	18.48	100
2	14.32	73.54	1.35	3.93	93.14	2.08	1.81	2.96	0.01	6.86	100
3	19.79	61.54	1.02	5.53	87.88	8.95	1.66	1.45	0.06	12.12	100
4	23.66	56.95	1.02	4.99	86.61	10.94	1.28	1.07	0.09	13.39	100
5	23.99	54.79	1.20	5.04	85.02	12.66	1.25	0.98	0.09	14.98	100
6	24.14	53.32	1.30	5.10	83.86	13.68	1.40	0.95	0.11	16.14	100
7	24.18	52.85	1.36	5.10	83.49	13.95	1.47	0.96	0.13	16.51	100
8	24.13	52.79	1.37	5.11	83.40	13.94	1.54	0.98	0.13	16.60	100
					Flexible exchange rate period: 1996-2010						
1	39.36	0.90	11.70	30.25	82.20	0.11	0.12	17.56	0.00	17.80	100
2	24.47	0.63	26.83	24.70	76.63	0.09	2.97	17.32	2.99	23.37	100
3	22.84	0.77	48.50	12.92	85.03	0.10	2.31	9.07	3.49	14.97	100
4	24.43	1.50	54.65	9.94	90.52	0.06	1.61	5.00	2.82	9.48	100
5	23.31	2.05	57.50	8.80	91.67	0.16	1.69	3.82	2.66	8.33	100
6	21.80	2.30	59.10	8.02	91.23	0.34	2.18	3.50	2.76	8.77	100
7	20.78	2.36	59.85	7.58	90.56	0.41	2.69	3.41	2.92	9.44	100
8	20.18	2.34	60.20	7.41	90.13	0.40	3.01	3.40	3.06	9.87	100