The Effects of Monetary Policy on Prices in Malawi

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Abstract

Evidence on the transmission mechanism of monetary policy is quite non-uniform, particularly across countries with different economic structures. Complications to theoretical propositions tend to arise when economies are less market-oriented and less sensitive to policy interventions, when monetary authorities are not adequately independent, or when market-based and administrative policy instruments are used concurrently. It is important, therefore, to appreciate the unique dynamics of the transmission mechanism in any jurisdiction, in order to understand and possibly predict the macroeconomic effects of monetary policy. This study assessed the effects of monetary policy in Malawi by tracing the channels of its transmission mechanism, while recognizing several factors that characterize the economy: market imperfections, fiscal dominance and vulnerability to external shocks. Within the environment of vector autoregressive modelling, Granger-causality and block exogeneity tests as well as innovation accounting analyses were conducted to describe the dynamic interrelationships among monetary policy, financial variables and prices. The study established the lack of unequivocal evidence in support of a conventional channel of the monetary policy transmission mechanism, and found that the exchange rate was the most important variable in predicting prices. Therefore, the study recommends that authorities should be more concerned with imported cost-push inflation rather than demand-pull inflation. In the short term, pursuing a prudent exchange rate policy that recognizes the country's precarious foreign reserve position could be critical in deepening domestic price stability. Beyond the short term, price stability could be sustained through the implementation of policies directed towards building a strong foreign exchange reserve base, as well as developing a sustainable approach to the country's reliance on development assistance.

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1. Introduction

The theory of the transmission mechanism of monetary policy is well developed, but real life situations are usually more complicated than the theory would typically suggest. Such complications may arise when economies are less market-oriented and less sensitive to policy interventions, when monetary authorities are not adequately independent, or when market-based and administrative policy instruments are used concurrently. It is important, therefore, to appreciate the unique dynamics of the transmission mechanism in any jurisdiction, in order to understand and possibly predict the macroeconomic effects of monetary policy.

This research project set out to appraise the effects of the monetary policy interventions undertaken after financial sector reforms and exchange rate liberalization in Malawi. Specifically, the study investigated whether and how monetary policy affected prices, given the environment in which policy was conducted: one characterized by fiscal dominance, excessive dependence on development assistance, a non-competitive banking structure, exogenous shocks and limitations to Central Bank independence.

The paper is organized as follows. The rest of this section expounds on the research problem and presents the objectives and hypotheses of the study. Section 2 contextualizes the study by presenting an account of the key macroeconomic developments and the conduct of monetary policy in Malawi. This section also presents brief accounts of external sector and exchange rate developments. Section 3 discuses the theoretical framework and the literature. The methodologies adopted are discussed in Section 4, while Section 5 presents and discusses the research findings. Section 6 presents a summary and recommendations, and also suggests the direction of further work.

Statement of the research problem

Both theory and evidence show that debate on the nature and effectiveness of monetary policy, and the manner in which such policy achieves its objectives (hence the optimal strategy for intermediate targeting), remain inconclusive questions.

From a theoretical perspective, the age-old debate on which one is more appropriate between the Keynesian interest rate channel and the classical money supply channel has hatched other conflicting views that are supported by equally conflicting evidence. Thus, even in the early literature, the evidence that policy matters (for example, Sims, 1972; Stock and Watson, 1989; Romer and Romer, 1990) was clearly challenged by Sims (1980), Friedman and Kuttner (1992) and Cochrane (1998) among many others. Friedman (1992) notes that identical monetary policy measures adopted for the same purpose at different times and in different economies can yield different outcomes. As such, Sims (1992) asserts that "the profession as a whole has no clear answer to the question of the size and nature of the effects of monetary policy upon aggregate activity". Bernanke and Gertler (1995) provide important stylized facts, puzzles and further evidence. It is also commonly accepted that different transmission mechanisms apply in different scenarios (Mishkin, 2007), and that the size of the economy, the degree of its external orientation, and the features of its institutions are relevant factors in the policy-designing process. As such, the success of monetary policy requires an accurate assessment of its effects on each unique economy.

The Reserve Bank of Malawi (RBM) has characteristically displayed a concerted commitment to control the growth of money supply. This is premised on the monetarist argument that dominant impulses run from money to prices and real activity. But, if the neutrality of money holds, the effects of such contractionary monetary policy could fall entirely on nominal output rather than real output, at least in the long run. Moreover, in the short run, contractionary monetary policy has the potential to lead to an excessive slowing down of economic activity, through dominant monetary impulses running from interest rates to money (or vice versa) and to real output (Walsh, 2003). Yet, prices and output in Malawi have the potential to be radically influenced by factors outside the control of monetary authorities, such as rainfall patterns, fiscal policy, and donor relations. As argued by the Bank of England (undated), real gross domestic product (GDP) is influenced by supply-side factors in the long run, and monetary policy may not directly affect it. This means that the actual effects of monetary policy must be empirically determined. It is also clear that several variables are candidates for a measure of the stance of monetary policy in Malawi (for example, reserve money, the bank rate and the inter-bank market rate), and that policy could follow any one of several competing channels, as discussed in Section 3.

The nature, role and effectiveness of RBM engagement during Malawi's various inflation episodes pose additional questions. In periods of steadily rising prices, the authorities justify their contractionary policy interventions as being pre-emptive measures, arguing that inflation rates could be worse without their mitigating actions. The actions of the authorities are equally open to discussion when one observes that especially since around 2005, the data depict a mix of declining inflation and rapid growth in money supply within an environment of expansionary monetary policy.

Notwithstanding the enormous volume of empirical work on the subject, less has been done on sub-Saharan African countries, let alone Malawi. The closest literature on Malawi could be Ngalawa (2009) who established that bank lending, money supply and the exchange rate contained key information on the transmission mechanism of monetary policy. This unpublished work deserves to be buttressed, and its findings

may be tested using different methodologies. Kwalingana (2007) noted that: (a) the Reserve Bank reacted to inflation and, moderately, to the exchange rate in setting the monetary base; (b) the Reserve Bank did not react to the output gap in setting the monetary base; and (c) bank rate determination was largely influenced by the desire to correct disequilibria rather than economic developments. But even if the bank rate was determined in this narrow manner, it would still be a good real-time indicator of the stance of policy for a given monetary base. Chirwa and Mlachila (2004) established that interest rate spreads had widened after the financial sector was liberalized. Mwanamvekha (1994) reported that liberalization of interest rates had increased private saving in Malawi, in keeping with the portfolio approach to the monetary policy transmission process. Further work, focused on investigating the nature and effects of monetary policy in Malawi, remains wanting.

Study objectives and hypotheses

The purpose of this study was to validate the significance of monetary policy in Malawi by investigating the nature and strength of the relationships among monetary policy instruments, intermediate targets and prices. Guided by the conduct of monetary policy and the high degree of vulnerability of the economy to external shocks, the study pursued this objective by tracing several possible channels of the monetary policy transmission mechanism. The specific objectives of the study were:

1. To investigate the effects of changes in monetary policy instruments (that is, reserve money or the bank rate) on intermediate macroeconomic variables (that is, interest rates, exchange rates and money supply);
2. To investigate the effects of changes in interest rates, exchange rates and money supply on prices; and
3. To investigate the degree of exogeneity of monetary policy shocks.

The general hypothesis of the study may be summarized by the statement that monetary policy shocks induce changes in financial variables which, in turn, induce changes in aggregate demand and prices. Since monetary policy could be endogenous in the sense that authorities could react to the stance of the economy in formulating policy positions, it is theoretically feasible for the directions of causality in the foregoing general hypothesis to be reserved. The following specific hypotheses were therefore investigated in this study:

1. Contractionary monetary policy (that is, reduction in reserve money or increase in the bank rate) dampens monetary growth, or increases the cost of credit, or leads to domestic currency appreciation. Expansionary policy yields converse effects;
2. Inflation can be controlled through a reduction in money supply, or through an increase in the cost of credit, or through domestic currency appreciation. Converse changes in these three macroeconomic variables are inflationary; and

3. Reserve money and the bank rate are determined exogenously of money supply, interest rates, exchange rates and prices.

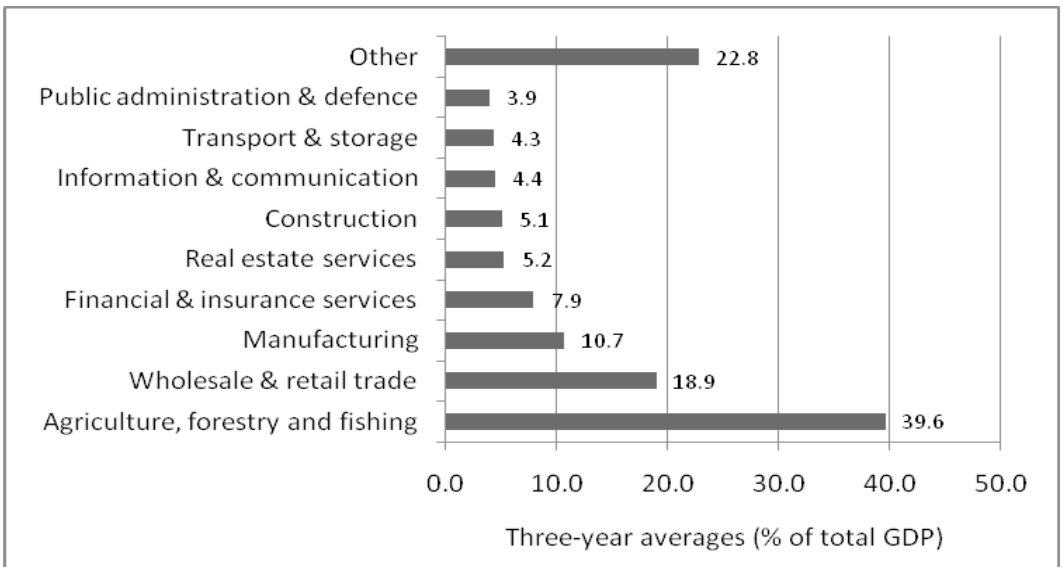
Through the variable choices and methodologies adopted in the study (see Section 4), addressing these hypotheses facilitates an investigation of several of the salient issues being debated in the contemporary monetary economics literature, such as identification of an appropriate measure of monetary policy stance, the exact channel of the transmission mechanism in Malawi, and the effects of policy on inflation.

2. The economy of Malawi and relevant policy developments

Malawi is a small, landlocked Southern African country with a population estimated at 13.1 million in 2008, and a population growth rate of 2.8% per annum (Government of Malawi, 2008a). According to the Reserve Bank of Malawi (RBM), the country's GDP was estimated at US$5.4 billion in 2010, equivalent to per capita income of only US$391.2 (Reserve Bank of Malawi, 2011). In 2008, it was estimated that 40% of the country's population was poor, with 15% categorized as ultra (Government of Malawi, 2009a). Other social indicators were equally low, and the country ranked 153 of the 169 countries surveyed in the 2010 Human Development Index (HDI) of the United Nations Development Programme.

Agriculture is the most important economic sector, employing about 85% of the labour force and generating over 80% of the country's foreign exchange. Tobacco alone normally generates over 60% of the country's foreign exchange. However, the agriculture sector contributes no more than 40% to total GDP, compared with 45%–50% for services and about 11% for manufacturing. In 2006 about 72% of the agricultural output was produced by the smallholder sector, while the balance was from estates. Output from the services sector is dominated by wholesaling and retailing, which contributes 15%–20%. Manufacturing output is mostly derived from agro-processing. Mineral exploration has been intensified since the turn of the century, and the production of uranium since 2009 is set to increase annual national output by an estimated 5%. Figure 1 shows the distribution of real GDP during the period 2007–2009.

Figure 1: Percentage distribution of real GDP by source (2007–2009 averages)



Source: Government of Malawi (2009a; 2010)

Although national development policies emphasize the significance of entrenching the private sector as the engine for development (Government of Malawi, 2006), Malawi has a weak private sector, which contributes only about 20% of annual total investment. Between 2002 and 2005, annual total investment averaged US$182.3 million. In 2006, this was at US$226.2 million (Benson and Mangani, 2008). Although updated statistics are unavailable, the role of the private sector in economic growth has not increased substantially as envisaged by the policy objectives. This is the result of many factors, notably the costs of importing raw materials, intermediate products and accessing export markets. These costs are high since Malawi is a landlocked economy. In addition, an Investment Climate Survey published in 2006 identified four top constraints to private sector development: macroeconomic instability, poor access to and high cost of finance, unreliable electricity supply and lack of skilled workers (Record and Davies, 2007).

Against this background, the country is relatively heavily aid-dependent. In 2007/08, a total of 20 development partners and the Global Fund disbursed about US$0.53 billion (or 13.5% of the country's GDP for that fiscal year) in aid.[1] Disbursement of official development assistance in the first half of 2008/09 alone totalled US$0.41 billion, about 85% of which was provided by only five of the donors (European Union, United Kingdom, Norway, the African Development Bank and the World Bank) as well as the Global Fund (Government of Malawi, 2009b). In 2008/09, up to 44.3% of the revised national budget, estimated at US$1.8 billion, was funded by foreign grants (35.2%) and loans (9.2%). Development assistance was generally above 40% of the government budget in the period 2004–2009. Crucially, an average of 80% of the government's annual development budget is donor-financed. There is also a long-standing tradition

of budget deficits, which locates the significance of fiscal dominance (that is, the extent to which government deficits condition the growth of money supply and inflation). Between 2004/05 and 2007/08, government budget deficits before grants ranged from 11% to 16% of GDP, but were usually much lower when grants were factored in.

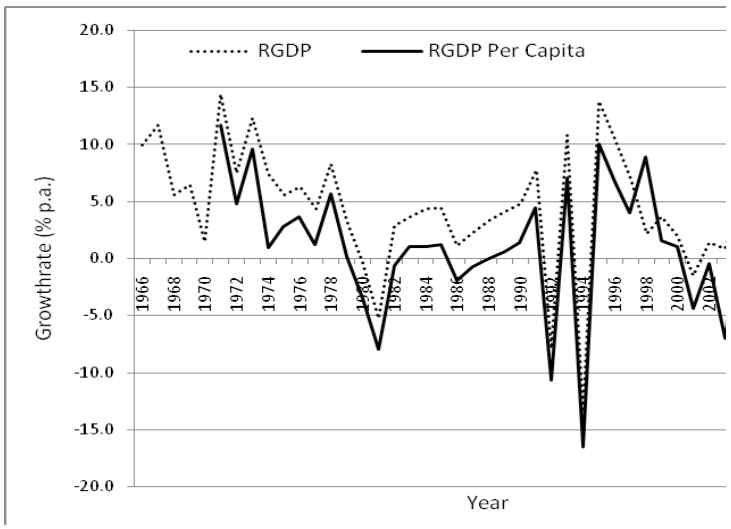
In addition to these challenges, high variability in real GDP growth has been the result of an unfavourable macroeconomic environment and high costs of production due to an admixture of supply-side constraints (Government of Malawi, 2006). Malawi also remains very vulnerable to external shocks, and the global increases in fuel and fertilizer prices witnessed in 2007–2008 contributed to worsening already depressing balance of payments (BOP) and foreign reserve positions.

Malawi reached a completion point under the Heavily Indebted Poor Countries (HIPC) Initiative of the IMF in 2006. This led to relief of US$646 million worth of debt in net present value terms under both HIPC and Multilateral Debt Relief Initiatives (MDRI). Assistance worth US$411 million in net present value terms was also topped up. This would reduce the country's annual debt service expenses to US$5 million between 2006 and 2025, and increase average annual debt service savings from US$39 million to US$110 million within the same period (Benson and Mangani, 2008). As a spillover effect of the IMF decision, some countries also cancelled Malawi's bilateral debt obligations. Reaching the HIPC completion point sent strong signals regarding macroeconomic management, and increased the country's sovereign credit rating and investor confidence. In addition, Malawi received a one-year US$77 million IMF Exogenous Shock Facility (ESF) in December 2008, in the wake of high world prices of fertilizer and oil (The CABS Group, 2009). However, only US$52 million of the total facility was actually paid out, and the programme was prematurely abandoned in 2009 because the government could not meet some programme targets. Fiscal overspending in the run-up to the May 2009 Presidential and Parliamentary Elections, and the failure to address foreign exchange shortages led to the poor performance of the IMF programme.[2] In February 2010 the IMF Board approved a new three-year Extended Credit Facility (ECF) worth US$79.4 million (IMF, 2010).

Malawi's business cycles

The foregoing overview of the structure of the economy reveals that trends in the economic performance of Malawi were typically influenced by many factors, notably its weak resource endowment, volatilities in agricultural production due to unreliable rainfall and the intake of farm inputs, international economic developments, international relations, and domestic policies. Figure 2 traces the evolution of Malawi's growth rates in real GDP and real per capita GDP. Average real GDP growth rates for five-year periods since the mid 1960s are shown in the accompanying side-table.

Figure 2: Economic growth, 1966–2010



Period	Growth (%)
1966–1970	7.0
1971–1975	9.4
1976–1980	4.4
1981–1985	2.0
1986–1990	3.1
1991–1995	2.2
1996–2000	5.0
2001–20 05	1.6
2006–2010	7.8

Source: Reserve Bank of Malawi Database

Malawi registered commendable rates of growth in real output during the first 15 years since independence in 1964, reaching a record high of 14.4% in 1971. However, the country did not sustain this trend from the early 1980s to the mid 1990s due to high costs of imports and exports occasioned by the Mozambican war that disrupted Malawi's traditional transport route to Nacala Port (Mwanamvekha, 1994). This was worsened by challenges arising from increasing oil prices, declining tobacco prices on the international market, and drought. At the bottom of this downturn, the economy shrank by 5.2% in 1981. It later picked somewhat, expanding by 7.8% in 1991 due to increased agricultural output. However, donors withdrew aid immediately thereafter — to force political change — creating a near-instantaneous contraction of 7.9% in 1992. This lacklustre performance was reversed by the resumption of aid after the adoption of multiparty democracy in 1994, coupled with better performance in agriculture. As a result, significant growth averaging 7.4% per annum was recorded in the last part of the 1990s, notwithstanding the shock arising from adopting a floating exchange rate regime in 1994. Economic growth was reported to be 13.8% in 1995. However, the turn of the new century coincided with a culture of laxity in fiscal discipline, resulting in high fiscal deficits (which, after grants, reached 11.6% of GDP in 2002), high domestic borrowing, excess liquidity, high interest rates and crowding out of private investment. This macroeconomic instability, coupled with failures in agriculture due to poor rains and low intakes of inputs, wiped away the gains recorded in the previous years pushing the economy into another slump.

Malawi's economic outlook since 2005 showed heartening signs of recovery from the sluggish performance registered at the turn of the century. Although the rate of annual real GDP growth never reached the 13.8% mark recorded in 1995, a growth

rate of 8.8% witnessed in 2008 represented a significant improvement, and was well above the average of 5.5% registered by sub-Saharan Africa. Annual economic growth averaged about 7.8% since 2006, significantly higher than the average of 3.3% over the 1996-2005 period. This translated into a reversal of the low growth rates in per capita real GDP recorded in prior years, to a growth rate of 4.7% in 2006 (Figure 2). The economy grew by 7.5% in 2009 and an estimated 6.5% in 2010 (Government of Malawi, 2010).

This positive trend was attributed to major policy shifts in economic management, improved donor relations and, more importantly, favourable conditions for rainfed agriculture. Since 2004 the Malawi Government had registered significant improvements in fiscal management, while enhancing smallholder agricultural output by providing subsidized farm inputs. Fiscal deficits after grants declined from 11.6% of GDP in 2002 to 2.9% in 2008 and 4.2% in 2009. This contributed to easing the inflationary pressure caused by fiscal dominance. At the same time, RBM signalled an expansionary monetary policy stance to stimulate private investment, and the donor community responded to the government's initiatives with greater support and aid. From 2006, government policy was guided by the Malawi Growth and Development Strategy (MGDS). The strategy stipulated initiatives to enhance growth and reduce poverty through economic diversification and wealth creation, among other goals. The strategy set an economic growth target of above 6.0% per annum, envisaged to emanate from growth in agriculture, manufacturing, mining and services sectors.

Monetary policy and prices

RBM was established by an Act of Parliament in 1964, and has been operational since 1965. Part III(1)(d) of the Reserve Bank of Malawi Act 1989 stipulates the bank's mandate in relation to monetary policy in broad terms:

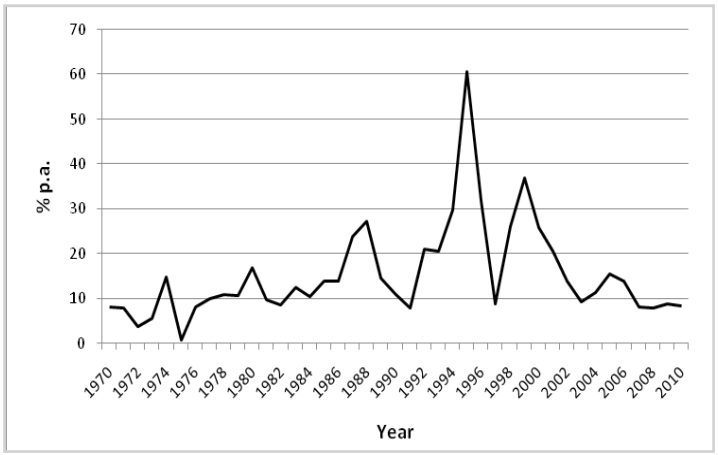
> "To implement measures designed to influence the money supply and the availability of credit, interest rates and exchange rates with the view to promoting economic growth, employment, stability in prices and sustainable balance of payments position".

Kwalingana (2007) correctly notes that implementing such a broad mandate could be practically challenging, since some of the policy objectives could be in conflict with each other. Standard Philips curve analysis, for example, suggests a trade-off between inflation and unemployment. Moreover, objectives such as economic growth and employment could be influenced by many other factors outside the domain of monetary policy, especially in an economy where rainfed agriculture is the mainstay. To operationalize these broad policy objectives in the short to medium term, MGDS proclaimed the monetary policy objective of achieving low inflation and low interest rates, setting an inflation target of 5.0% by 2011. Moreover, the Central Bank had set price stability as its measurable monetary policy objective in the short term, although the bank remained vague in terms of the uniqueness of its policy instrument, as is evident in the following pronouncement (see Reserve Bank of Malawi, 2006):

> "In Malawi the objective of monetary policy is to bring inflation down to a single digit by 2008. To achieve this, reserve money will remain the anchor of monetary policy. The Reserve Bank of Malawi uses a combination of instruments to achieve its objective on monetary policy. These include the bank rate, liquidity reserve requirements, open market operations, and sales and purchases of foreign exchange."

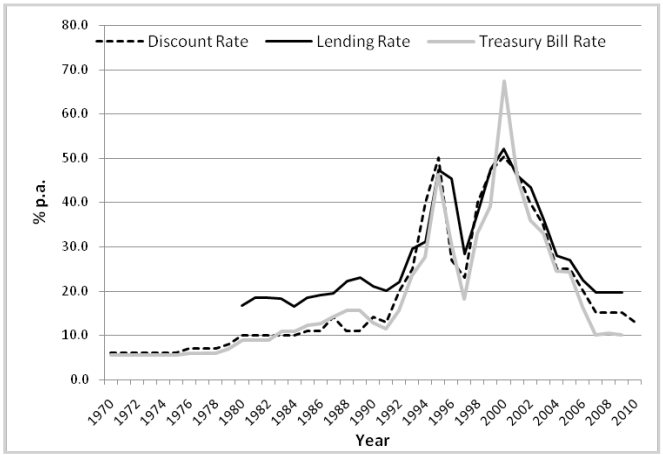
Figure 3 depicts trends in Malawi's inflation since 1970, while Figure 4 shows the evolution of interest rates over the same period. In the figures, annual inflation is defined as the percentage change in the all-items composite consumer price index. The bank (discount) rate is the rate at which commercial banks borrow from the Central Bank, and at which the Central Bank discounts illiquid commercial bank assets. The average base lending rate of the commercial banks is used.[3]

Figure 3: Inflation rate, 1970–2010



Source: Reserve Bank of Malawi Database

Figure 4: Interest rates, 1970–2010



Source: Reserve Bank of Malawi Database

In keeping with the global trend, monetary policy up to the late 1980s was principally guided by Keynesian theories of demand management, hence direct control of interest rates, credit, exchange rates and foreign exchange. The bank rate averaged 6.5% in the 1970s and 10.8% in the 1980s, while the average base lending rate was 19.1% between 1980 and 1989. This period was also associated with a mixed inflationary pattern, averaging 8.0% in the 1970s, rising to over 27% in 1988, and averaging 15.0% in the 1980s. The economy registered relatively high growth in the 1960s and 1970s, but low growth in the 1980s.

The aforesaid global trend in monetary policy eventually experienced a reversal in favour of monetarist arguments, which were largely occasioned by the collapse of the fixed exchange rate system of the Bretton Woods institutions in 1972. Therefore, within the framework of the IMF-induced structural adjustment programmes (SAPs), Malawi abandoned credit ceilings in 1989, and adopted the liquidity reserve requirement (LRR) ratio as the major monetary policy instrument. The importance of the LRR ratio was subsequently displaced by open market operations (OMO)[4] and the bank rate (Sato, 2000), due to the inherently limited flexibility of the LRR ratio. Decontrol of interest rates was adopted in 1990, while the exchange rate was floated in 1994. These developments induced upward pressure on both interest rates and exchange rates (to adjust to market conditions) and on prices (due to the high cost of borrowing and importation). As a result, the bank rate increased to 50% by 1995 (averaging around 30% in the 1990s), and annual inflation exceeded 60% in 1995.

From the late 1990s to 2005, deficit financing accounted for injections of massive liquidity in the Malawian economy, and exerted pressure on interest rates and prices. Inflation averaged 24.5% between 1995 and 2004, while the average bank rate was 38.4%. The bank rate reached its historical peak of 50.23% in 2000, pushing the base lending rate to 52%. From 2005, however, interest rates and inflation plummeted due improved fiscal discipline and real growth. This link between monetary and fiscal policy was accentuated by the lack of effective independence of RBM. Both the Central Bank's corporate governance and financing structures rendered it vulnerable to the executive arm of government, contrary to well-developed central bank structures such as at the Federal Reserve System of USA.

The Central Bank typically set an annual inflation target in collaboration with the Ministry of Finance, and monitored its attainment by controlling monetary aggregates. In 2008/09, for example, this target was set at 6.5% (Government of Malawi, 2008b). While the key intermediate target was to control growth in broad money (M2), the operating procedure focused on monitoring growth in reserve money (M0). The Central Bank's control over reserve money permitted it to influence movements in broad money (Sato, 2000). This monitoring process was achieved through reserve money programming within the Financial Programming Framework of IMF, which set monthly and quarterly reserve money targets based on broad money targets thought to be consistent with the desired levels of economic growth and inflation (Kwalingana, 2007). Therefore, once an estimate of the liquidity requirements of commercial banks was made, the procedure involved RBM intervention through changes in the level of reserve money, by manipulating commercial banks' access to credit from the Central Bank.

The foregoing exposition implies that RBM had adopted an operating target similar to that adopted by the US Federal Reserve System: reserve money (see Strongin, 1995). RBM sought to influence reserve money using three main instruments: the liquidity reserve requirement ratio, the bank rate and open market operations (see Sato, 2000). However, in USA, the federal funds rate was an unambiguous measure of monetary policy stance on which the Federal Reserve set its intermediate target (Bernanke and Blinder, 1992; Taylor, 2001). In contrast, Malawi did not emphasize the significance of the equivalent inter-bank market rate, and the Central Bank did not set a target on this variable. However, data suggested that the inter-bank market was probably more important as a source of commercial bank reserves and liquidity than recourse to the discount window. For example, calculations using data from RBM (see Reserve Bank of Malawi, 2009a) revealed that daily discount window accommodation averaged Malawi kwacha (MK) 1.57 billion between September 2008 and July 2009, compared with daily average inter-bank market trading of MK2.44 billion in that period. Changes in the RBM bank rate induced near-instantaneous changes in market interest rates (Mangani, 2008), and might be considered the most important indicator of the stance of monetary policy. Thus, no unique policy instrument could be pinpointed, although the operating and intermediate targets were clearly reserve money and broad money, respectively.

To facilitate the formulation and implementation of monetary policy, the Central Bank established the Monetary Policy Committee (MPC) in February 2000. The committee is chaired by the Governor of the Central Bank, and its membership comprises senior management of the bank, the Secretary to the Treasury, the Secretary for Development Planning and Cooperation, the Director for Economic Affairs in the Ministry of Finance, and one economist drawn from academia. MPC meets monthly to review economic and financial developments, and to determine the stance of monetary policy. Resolutions of MPC are informed by the technical work undertaken by the bank's Monetary Policy Implementation Committee (MPIC). In general, the resolutions focus on the level at which the bank rate and the liquidity reserve requirement ratio should be set, and the course of open market operations. These resolutions are publicized in the media.

Until after 2004, monetary policy was largely contractionary, since both the bank rate and the liquidity reserve requirement ratio were maintained at arguably high levels and the authorities typically intensified open market operations in order to mop up excess liquidity from the system. The LRR ratio was maintained at 35% throughout the 1990s, and accounted for wide spreads between lending and deposit rates. However, the reductions effected between 2000 and 2006 might have been a credible initiative to free funds for credit extension and growth.[5] In further pursuit of such expansionary monetary policy, the bank rate sequentially declined from 35% in January 2004 to 15% in April 2008 and 13% by August 2010. Saving interest rates were characteristically negative in real terms.

From a history of generally tight monetary policy and high inflation, therefore, the monetary authorities signalled an expansionary policy stance after 2004. These policy initiatives were pursued alongside evidence of a declining trend in domestic food prices, largely occasioned by increased production by smallholder farmers. Food

costs accounted for 58.1% of the national composite consumer price index upon which inflation was officially determined. Yet also, contrary to the quantity theory of money, this declining trend in inflation rates correlated with significant growth in money supply (Table 1). This questions the rationale for the post-2004 reductions in the bank rate and the liquidity reserve requirement ratio, and motivates the suspicion that the course of monetary policy was sternly influenced by the executive arm of government.

Table 1: Growth in money supply, output and prices (% p.a.)

Year	M2 growth	Real GDP growth	Inflation
2005	14.3	2.4	15.5
2006	17.4	8.2	13.9
2007	36.1	7.9	8.0
2008	46.2	8.8	7.9
2009	25.8	8.9	8.7
2010	21.3	6.7	7.4

Source: Government of Malawi (2007; 2009c; 2010; 2011)

To summarize, Malawi experienced episodes of high and low inflation rates since independence in 1964. While double-digit inflation rates characterized most of this period, inflation generally worsened after the financial reforms of the late 1980s, and never depicted a significant downturn until after 2004. Although the low inflation rates experienced in the 1970s still remain historical, the country was on course towards regaining price stability as single-digit inflation had persisted since 2007.

Exchange rate policy

In addition to the control of demand-pull inflation resulting from swelling aggregate demand and money supply, the Central Bank had to deal with cost-push inflation, largely arising from exogenous shocks. Malawi's foreign reserve position was hitherto precarious due to excessive dependence on two key but vulnerable sources: tobacco exports (which usually accounted for over 60% of foreign exchange earnings) and development assistance. Failures in rainfed agriculture and donor flows had a direct impact on domestic prices through currency depreciation/devaluation, and induced interventionist activities from the authorities. Moreover, the country's landlockedness and heavy reliance on costly imported oil for energy had the potential to induce imported inflation and to undermine monetary policy. As such, the discussion in this section clearly locates the exchange rate as the nominal anchor of stabilization in Malawi.

Various exchange rate regimes have been pursued in Malawi during its history, as discussed in Kayira (2006). The kwacha was pegged to the British pound sterling (GBP) at one-to-one from 1964 to 1967, and at MK2.00 per GBP between 1967 and 1973. Following the collapse of the fixed exchange rate system, the kwacha was pegged to a trade-weighted average of the pound sterling and the United States dollar

from November 1973 to June 1975, and to the Special Drawing Rights (SDR) at almost one-to-one between July 1975 and January 1984. In response to an expansion in Malawi's trade volume and trading partners, the kwacha was eventually pegged to a trade-weighted basket of seven currencies (US$, GBP, German Deutschmark, South African rand [ZAR], French franc, Japanese yen, and Dutch guilder). This period was characterized by frequent devaluations of the kwacha, implemented in the context of SAPs, in an attempt to improve the country's export competitiveness and BOP position. Devaluations of 10%, 20%, 7%, 15%, and 22% against the US$ were effected between February 1986 and August 1992. In February 1994 the kwacha was finally floated, and an inter-bank foreign exchange market was introduced to determine the exchange rate through market forces. Consequently, the current account was liberalized, although the capital account remained unliberalized and some exchange controls (for example, limitations on foreign exchange allowances for travel, remittances, repatriations and importation of consumer goods) were still in place. The immediate effect of the flotation was a 62.0% depreciation of the domestic currency between February and December 1994, from MK5.92 per US$ to MK15.58 per US$.

To operalitionalize the freely floating regime, an auctioning system was introduced at the time of flotation, allowing the highest bidder to purchase the available foreign exchange from the Central Bank. However, the authorities found this system inappropriate given the limited number of players on the market. Instead, the government adopted a managed floating system in 1995, under which the authorities intervened to artificially influence the exchange rate through sales and purchases of foreign currency, hence managing it within a limited band. But the band was removed in 1998 in favour of a free float, only to be reinstated in mid 2004.

Although maintaining stability of the exchange rate was a prime objective of the government, attaining this objective was a challenge. Due to a multiplicity of factors (for example, excessive dependence on imported raw materials, intermediate inputs and final consumer goods; currency overvaluation; and a narrow export base), Malawi's trade balance and BOP positions were almost perpetually negative and worsening over time (Tables 2 and 3). Thus, the authorities' attempts to prevent adverse fluctuations in the exchange rate exerted a lot of pressure on foreign reserves and on the external value of the kwacha.

Table 2: External trade position (US$ million)

	2002	2003	2004	2005	2006	2007*	2008*	2009	2010*
Total imports	699.6	787.0	932.2	1183.7	1268.5	1436.4	1654.5	1574.674	2325.807
Total Exports	409.6	530.5	483.1	503.7	709.1	920.4	1036.6	1118.117	1062.909
Trade balance	-290.0	-256.5	-449.1	-680.1	-559.4	-516.0	-617.9	-456.556	-1262.9

*Estimates
Source: Government of Malawi (2007; 2010).

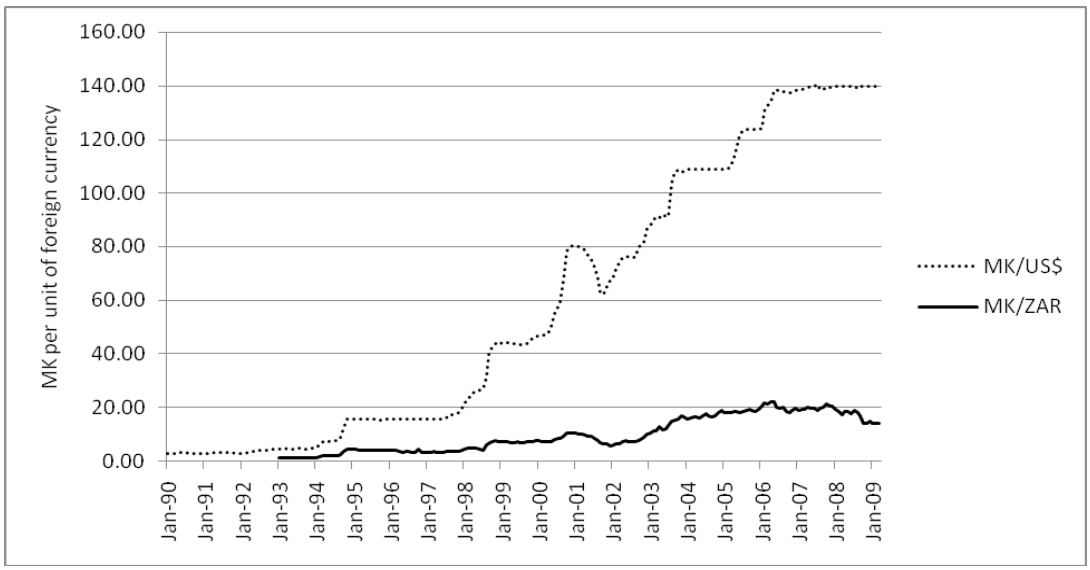
Table 3: Malawi's balance of payments summary (MK million)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Trade balance	-3226	-13895	-24400	-33889	-59369	-67499	-76298	-67316	-74514	-64959
Current account balance	-12831	-28678	-41581	-55232	-83136	-95348	-100592	-92614	-108177	-106105
Capital account balance	20241	15151	14012	29442	35677	28949	64020	68111	101808	141636
Balance before debt relief	559	-5904	-6224	-6774	-12483	-17100	-4535	9061	-7278	-14046
Debt relief	820	2244	4634	5125	7079	14925	155	-	-	-

Source: Reserve Bank of Malawi (2009a; 2011)

Figure 5 shows trends in the exchange rates between the kwacha and two currencies, the United States dollar (MK/US$) and the South African rand (MK/ZAR). Pressure on the kwacha remained steady since its flotation in February 1994, leading to a persistent downward trend in the value of the domestic currency. This trend continued until around mid 2006 when authorities opted to fix it in terms of the US dollar. Thus, the kwacha depreciated from about MK118 per US$ in 2005 to about MK139 per US$ by May 2006, although it remained pegged around this level (plus/minus MK2.00/US$) until around November 2009. This reflected a reversion to the managed floating regime, and was very costly on the limited foreign reserves available to the country. The fact that the rate on the parallel market was sometimes significantly higher than the official rate was a telling sign of domestic currency overvaluation. Thus, at US$209.5 million in July 2009 total gross official reserves were only equivalent to 1.6 months of imports (Reserve Bank of Malawi, 2009b). This represented a marginal improvement to the level of 1.1 months of imports experienced in January 2009, and 1.3 months in September 2008, all of which were significantly lower than the 2.5 months recorded in December 2005. Gross official reserves were estimated at US$302 million or 2.33 months of imports in November 2010. But these increased to the equivalent of 3.11 months in January 2011 due to increased donor inflows following a positive review of the Extended Credit Facility by IMF in December 2010 (Malawi Savings Bank, 2011).

Figure 5: Trends in Malawi kwacha exchange rates



Source: Reserve Bank of Malawi Database

Responding to this persistent pressure on foreign exchange reserves, the kwacha weakened and was selling at K147.4 per US$ at the close of December 2009. By end of January 2010, the kwacha was trading at around K151.5 per US$, and remained around that level throughout 2010. Given the country's narrow and vulnerable export base, it was difficult to imagine that in the short to medium term the government could operate a stable market-determined exchange rate regime without BOP support and other forms of assistance from donors. Moreover, fiscal policies in general and national infrastructure development projects in particular would not be effectively implemented without various forms of such donor support. Thus, relations with bilateral and multilateral donors were crucial in efforts aimed at achieving macroeconomic stability and growth.

3. Theoretical background and literature

Basic framework

The monetary policy transmission mechanism is the process by which monetary policy affects such macroeconomic variables as aggregate spending, prices, investment and output. Several extensions and variations of the conventional IS-LM-based interest rate (or cost-of-credit) channel of this transmission process proposed by Keynes (1936) and formalized by Tobin (1969) are presented in the literature, largely as classical or monetarist counter-arguments to the Keynesian view. These include the money supply channel, the credit channel, the exchange rate channel, and the domestic asset pricing channel. Here, representations of some selected channels purporting to characterize tight monetary policy are presented; the converses of these representations would reflect the case of expansionary policy. The discussion omits channels deemed less relevant to Malawi, such as the domestic asset pricing channel. Financial markets in general, and the stock market in particular, are underdeveloped in Malawi, and policy is envisaged to be transmitted through the banking system. A brief link between monetary and fiscal policies is also provided.

The interest rate channel

Under the conventional Keynesian interest rate channel, an increase in short-term interest rates occasioned by the manipulation of a policy instrument (for example, a rise in the bank rate) increases the cost of capital, lowers demand for credit and depresses spending on durable goods, albeit increasing saving. Bernanke and Gertler (1995) summarize two criticisms of this view. First, there is lack of compelling empirical evidence to suggest that supposedly interest-sensitive components of aggregate spending are indeed sensitive to the cost of capital. Second, contrary to this view, monetary policy tends to have large effects on purchases of long-lived assets

which should be more responsive to real long-term rates than real short-term rates. However, Taylor (1995) develops a model that shows how monetary policy affects real short-term and real long-term interest rates, hence real investment, real consumption and real output. Some evidence of an effective interest rate channel has been documented for Egypt (Al-Mashat and Billmeier, 2007) and for Kenya (Cheng, 2006).

The money supply channel

In contrast with the Keynesian interest rate view, Friedman and Schwartz (1963) argue that the price level reflects money market conditions. They argue that money supply is under the control of the authorities (hence exogenous). However, money demand can be expressed as a simple multiplicative relation between nominal income and social and instructional factors that can be proxied by a constant. Given money market equilibrium, a reduction in the stock of money reduces aggregate demand and prices. This reasoning challenges a suggestion by Keynes that money does not matter, and implies that monetary authorities could achieve price stability by controlling the growth in money supply. While the Keynesian view is that a shock to short-term real interest rates (for example, a bank rate change) could be more effective in achieving policy objectives, the standard monetarist (hence classical) view is that manipulations in the level of money supply (for example, through OMO) could be more ideal. Evidence in support of the money supply channel exists for both developed economies (Friedman and Schwartz, 1963) and less developed economies (for example, Chimobi and Igwe [2010] for Nigeria; Lozano [2008] for Columbia), but stern criticisms of the assumptions underlying the channel have been advanced by Ando and Modigliani (1965), Tobin (1970) and other neo-Keynesians. Monetarist arguments are central to the conduct of monetary policy by the European Central Bank as well as the policy prescriptions of IMF. These arguments also significantly influence the day-to-day conduct of monetary policy in Malawi.

Subsequent monetarist propositions of the transmission mechanism typically centre on the criticism that, by focusing on one asset price (that is, interest rates), the traditional interest rate channel ignores other asset prices through which monetary policy shocks can be transmitted in the economy, such as the exchange rate and equity prices.

The credit channel

The credit channel reflects efforts to explore whether credit market frictions could explain the effectiveness of the transmission mechanism. This channel may be perceived "as a set of factors that amplify and propagate conventional interest rate effects" (Bernanke and Gertler, 1995). The general argument is that the effect of monetary policy on interest rates is amplified by endogenous changes in the external finance premium (that is, the wedge between the costs of externally-raised and internally-raised investment funds). The size of this premium is a reflection of market imperfections, and a change in market interest rates due to monetary policy is positively related to a change in the premium, hence credit conditions, money supply,

prices and output. Bernanke and Gertler (1995) describe this in two possible ways: the balance sheet channel and the bank lending channel. The balance sheet channel argues that tight monetary policy directly weakens borrowers' balance sheets, lowers their collateral for loans and creditworthiness, and increases their external finance premium. Lower net worth for borrowers increases both adverse selection and moral hazard problems, leading to a decline in lending for investment spending. The bank lending channel posits that a disruption in the supply of bank loans resulting from tight monetary policy makes loan-dependent small and medium firms incur costs associated with finding new lenders (Ehrmann and Worms, 2001). This directly increases their external finance premium, lowers the levels of their borrowing, and reduces real economic activity.

Evidence in support of the credit channel exists (Gertler and Gilchrist, 1993, 1994), as does the lack of such evidence (Christiano et al., 1996). Explicit evidence in support of the bank lending channel is reported by Kim (1999) for Korea, but Favero et al. (1999) were unable to establish this result using cross-sectional data from Germany. De Bondt (2000) found evidence that the credit channel works alongside the interest rate channel in Germany. Evidence in general support of the credit channel in 13 European countries is documented by Bacchetta and Ballabriga (2000). Islam and Rajan (2009) established that the bank lending channel is quite effective even during a period of intense financial stress in India.

The exchange rate channel

The exchange rate channel captures the international effect of domestic monetary policy, especially after financial liberalization (Taylor, 1995). Assuming flexible exchange rates, a rise in domestic real interest rates reflective of tight monetary policy makes deposits denominated in domestic currency more attractive than those denominated in foreign currency. The increase in net capital inflows resulting from the high real interest rate differential leads to domestic currency appreciation, as well as a fall in exports, export-oriented investment and output. Additionally, the appreciation makes imports more competitive in the domestic economy. Changes in the exchange rate, therefore, have implications for individual spending (hence aggregate demand), and firms' investment behaviour, price stability and employment. In USA, Lewis (1995) and Eichenbaum and Evans (1995) found evidence that monetary policy effects on exchange rates increase persistently over periods of several months or years after the initial shock. Borker-Neal et al. (1998) found that monetary policy influences exchange rates immediately. Al-Mashat and Billmeier (2007) document evidence that the exchange rate channel plays the strongest role in propagating monetary shocks to prices and output in Egypt, and that most other channels are weak. An exchange rate effect on inflation is also documented for Kenya (Rotich et al., 2007), and for Ghana (Ocran, 2007).

Fiscal dominance

An area of related interest is the link between monetary and fiscal policies, particularly fiscal dominance. In simple terms, fiscal dominance describes a situation where a "fiscal deficit is financed in domestic capital markets in the local currency. Treasury and open market operations may be competing in similar segments of the yield curve, bidding interest rates up" (Coates and Rivera, 2004). To put this in context, Sims (2008) states:

> "A fiscal authority that controlled every component of the budget would control seigniorage and interest expenses, and in doing so would effectively determine monetary policy. A monetary authority that controls seigniorage and interest rates does not control taxes and expenditures, but imposes a long term relation between the two."

Thus, the nature of sources and uses of government revenue in deficit financing can have significant implications for monetary policy. Of relevance to Malawi is the treatment of foreign aid as a source of government revenue. Lipschitz (2005) shows that, when donor aid is spent on non-traded goods, an analysis of the determinants of inflation in the absence of an aid variable can depict a relation between inflation and the exchange rate arising from the monetization of aid flows.

Several studies have been carried out to analyse fiscal dominance. For example, Blanchard (2004) notes that fiscal policy, not monetary policy, becomes the appropriate instrument to control fiscal dominance-induced inflation if the increase in real interest rates arising from such dominance also increases default risk on public debt. Coates and Rivera (2004) explore the different manifestations of fiscal dominance in Latin America, while Kumhof et al. (2008) finds evidence suggesting that the welfare gain of employing monetary policy instruments to control inflation occasioned by fiscal dominance is minimal compared to the gain of eliminating fiscal dominance.

To summarize, two main strands of the transmission mechanism are apparent, namely the interest rate channel and its several asset price variants, and the money supply channel based on the quantity theory of money. In the interest rate channel, contractionary monetary policy would cause an increase in market interest rates and a decline in real money balances, thereby reducing the values of assets, wealth and consumption spending. Lower asset prices tend to reduce the value of collateral, hence the supply of credit. In economies with floating exchange rates, interest rate increases also result in domestic currency appreciation, and shift expenditures from domestic to foreign output. Hence, the "liquidity effect" of monetary policy occurs through a reduction in demand for and the supply of credit. In the money supply channel, contractionary monetary policy directly lowers the level of money balances and aggregate demand. The expected net effect of these dynamics is a dampening of inflation and a slowdown of economic activity, at least in the short run. Albeit a debatable issue, the literature establishes that the long-run effects of monetary policy fall almost entirely on prices, with little or no impact on the real sector (Sims, 1998; Walsh, 2003). This phenomenon is called the long-run "neutrality of money".

Moreover, the conduct of monetary policy is complicated by fiscal dominance in general and government expenditure of foreign aid on non-traded goods in particular. The monetization of aid flows, while masking fiscal indiscipline, could nevertheless have serious inflationary effects.

4. Methodology

It is argued in the literature that "most variations in monetary policy instruments are accounted for by responses of policy to the state of the economy, not by random disturbances to policy" (Sims, 1998). As such, policy interventions may be triggered by internal forces (such as fiscal deficit financing) or external shocks (such as exchange rate and oil price changes). Therefore, measured reactions of macroeconomic variables to policy intervention could reflect reactions to some other underlying condition to which the authorities could be responding. Put simply, policy variables are likely to be correlated with other macroeconomic variables in the policy reaction function, making the distinction between endogenous and exogenous policy shocks — which is necessary if the model is to be a useful tool for structural inference and policy analysis, rather than data analysis and forecasting only — rather difficult (Stock and Watson, 2001). Moreover, even if the policy instrument of the authorities were clear, the dissection of exogenous from endogenous policy interventions could imply that another variable related to the instrument could better capture the effects of policy, and that the directions of causality might not be as unilateral as implied by the theoretical policy transmission channels. To address these complications, which generally characterize the "identification problem", the approach pursued in the literature and in this study is to assess the multivariate and potentially multidirectional causal interrelationships within recursive vector autoregressive (VAR) frameworks (see Sims, 1980; Bernanke and Blinder, 1992; Rudebusch, 1998).

The simplest case of a VAR model, the reduced-form VAR model, expresses each variable as a linear function of its own past values and past values of all other variables. To illustrate using matrix notation, suppose that $x_t = (x_{1t}, x_{2t}, ..., x_{nt})'$ is an $(n \times 1)$ vector each of whose elements, say x_{jt} (for all $j = 1,2,...,n$) is a variable that can be included in the monetary policy transmission mechanism. A reduced-form VAR of order p in the levels of the variables is:

$$x_t = Ay_t + \Omega_1 x_{t-1} + ... + \Omega_i x_{t-i} + ... + \Omega_p x_{t-p} + \varepsilon_t \quad (1)$$

where y_t is a vector of deterministic variables such as constant, trend and seasonal terms; Ω_i and A are matrices of coefficients to be estimated; and ε_t is an $(n \times 1)$ vector of error terms, ε_{jt}. Unfortunately, the reduced-form VAR model does not resolve the identification problem because it typically yields error terms that exhibit cross-equation contemporaneous correlations. An alternative procedure for resolving the identification problem outside the VAR framework is the narrative approach proposed by Romer and Romer (1989), which incorporates a monetary policy dummy variable. However, Leeper (1997) showed that the Romer and Romer approach is not successful in resolving the identification problem either. As such, many researchers have tended to address the identification problem within the VAR framework itself.

Two main procedures are proposed to resolve the identification problem in a VAR framework. The first is to diagonalize the variance-covarince matrix of the VAR system using a triangular orthogonalization process. This is achieved by estimating the reduced-form VAR model, then computing the Cholesky factorization of the covariance matrix of the model (Lutkepohl, 1993). Although this recursive VAR modelling procedure can resolve the identification problem by ensuring that shocks to the VAR system can be identified as shocks to the endogenous variables in each equation (as in a reduced-form VAR), it has the general disadvantage of being sensitive to the ordering of variables in the computation of the shocks. The approach adopted in the literature is to place policy variables first in the ordering. The basis for this is the assumption that policy variables can influence non-policy variables contemporaneously as well as with a lag, while the non-policy variables themselves can only be influenced by the policy variables after a time-lag due, for example, to delays in the availability of economic data (Bernanke and Blinder, 1992; Stock and Watson, 2001). This approach is quite reliable when the off-diagonal elements of the variance-covariance matrix are small (that is, when the contemporaneous correlations among the relevant innovations are low; see Bacchetta and Ballabriga, 2000). However, Pesaran and Shin (1998) have provided a framework for applying the Cholesky decomposition procedure that is insensitive to the ordering of variables.

The second approach to the identification problem involves imposing restrictions (identifying assumptions) on the matrix that governs the contemporaneous relations among the variables in the VAR model, to reflect the structure of the economy. Based on the assumptions made regarding the causal links among the variables, instruments are produced to facilitate the estimation of the contemporaneous links using instrumental variables techniques (Stock and Watson, 2001; Ludvigson et al., 2002). A drawback of this structural VAR modelling framework is that the estimation results are sensitive to the identifying assumptions made. Stock and Watson (2001) admit that "even modest changes in the assumed rule resulted in substantial changes" in their work.

This study estimated recursive VAR models. The procedure of Pesaran and Shin (1998) was invoked, where possible, to yield "generalized" innovation accounting functions.

Variables and data

In keeping with the foregoing theoretical expositions and the discussion on the conduct of monetary policy in Malawi, this study used the variables presented in Table 4 (variable notation is in parentheses and italicized). To remain consistent with the discussion on the objectives of monetary policy in Malawi (see Section 2), this study did not trace the effects of policy on real output; it rather partially looked inside the "black box", to borrow from Angeloni and Ehrmann (2003).[6] Moreover, a world commodity price index was included to account for exogenous factors (those outside the domain of the authorities' control), a common practice in the literature.

Table 4: Variables in the study

Category	Variables
Policy instruments	Reserve money (M0) Bank rate (BRATE)
Intermediate variables	Lending rate (LRATE) MK/US$ exchange rate (EXRATE) Narrow money (M1) Broad money (M2)
Objective variables	All-items consumer price index (CPIA) Food price index (CPIF) Non-food price index (CPIN)
Other	World commodity price index (CPRICE)

Appendix 1 provides the variable definitions and data sources. Except for *CPRICE*, monthly data on the aforesaid variables were obtained from the National Statistical Office, RBM, and the International Financial Statistics of IMF. *CPRICE* data were downloaded at www.indexmundi.co/commodities/ on 15 November 2009. Monthly data from January 1994 to March 2009 were used to cover the implementation period for financial liberalization and the flexible exchange rate system. All the variables except the interest rates were transformed into natural logarithmic levels. The series are plotted in Appendix II.

VAR model specifications

To avoid unnecessary model over-parameterization, to minimize the problem of variable collinearity, and to assess the robustness of the study's findings, no two measures of policy, market interest rates, monetary aggregates or inflation were entered simultaneously in estimating the models. The baseline model was, therefore, a six-variable VAR process containing one policy variable, one market interest rate, the exchange rate, one monetary aggregate, one CPI variable and the world commodity price index. This yielded 12 different model permutations. However, it was strongly evident during experimentation with the data that substituting *M2* for *M1* was inconsequential to the study results. By substituting *M0* with *BRATE* and *CPIA* with

CPIF or *CPIN*, the analysis presented in this paper was based on six VAR permutations (Table 5). Notice that the choice to report results based on *M2* is consistent with the conduct of monetary policy in Malawi, which sets *M2* as the key intermediate target (Section 2). In the subsequent discussions, therefore, model p ($p = 1, 2, 3, 4, 5, 6$) reflects a specific variable permutation (Table 5).

Table 5: Variable permutations in the VAR models

VAR model	Variables
Model 1	*CPRICE M0 LRATE EXRATE M2 CPIA*
Model 2	*CPRICE M0 LRATE EXRATE M2 CPIF*
Model 3	*CPRICE M0 LRATE EXRATE M2 CPIN*
Model 4	*CPRICE BRATE LRATE EXRATE M2 CPIA*
Model 5	*CPRICE BRATE LRATE EXRATE M2 CPIF*
Model 6	*CPRICE BRATE LRATE EXRATE M2 CPIN*

Appendix II suggests that several of the variables could be trend stationary, but there appear to be no gulling signs of unit root non-stationarity. Notwithstanding that the VAR models described above could contain non-stationary or even cointegrated variables, the models were estimated in levels using the ordinary least squares (OLS) method. This follows Park and Phillips (1989) and Ahn and Reinsel (1990), who show that the OLS estimators are consistent and have the same asymptotic properties as the maximum likelihood estimator with the cointegration restrictions imposed. The merit in estimating the models in levels arises from the fact that the data would retain the desirable statistical properties and causal interrelationships that could be lost in the process of differencing (Sims et al., 1990). Bagliano and Favero (1997), Bacchetta and Ballabriga (2000), Braun and Shioji (2004) and others adopt the same procedure. All tests and estimations were conducted using the EView 7 package.

Only a few of the variables indicated in Table 5 were seasonally adjusted at source (see Appendix I). Furthermore, some of the variables displayed deterministic trends (see Appendix II). These effects were addressed by including 11 seasonal dummy variables, a trend term and an intercept in each of the VAR models. In addition, a dummy variable was introduced to capture the excessive deficit spending episode described in Section 2. This assumed a value of unity from January 2000 to December 2005, and a value of zero otherwise. Given the discussion of the structure of the economy in Section 2, this was considered to be adequate as a conditioning set for the VAR processes.

To select the appropriate orders of the VARs, the study relied on the application of likelihood ratio (LR) tests as described by Enders (2004), while paying due attention to serial correlation. Starting with a uniform lag length of 12, the study sequentially investigated whether the lag length in all equations for each VAR could be reduced. To implement these cross-equation restrictions, under the null hypothesis that the restrictions were not binding (that is, that the VAR order could be reduced), the sequential modified likelihood ratio test – a multivariate generalization of the test suggested by Sims (1980) – was applied. The test statistic is:

$$LR = (n - c)(\ln|\Sigma_{RR}| - \ln|\Sigma_{UR}|). \quad (2)$$

In Equation 2, n is the number of usable observations; c is the number of parameters estimated in each equation of the unrestricted VAR; while $\ln|\Sigma_{RR}|$ and $\ln|\Sigma_{UR}|$ are natural logarithms of the determinants of the variance/covariance matrices of the residuals in the restricted and unrestricted VARs, respectively. The statistic follows a χ^2_v distribution, where v (denoting the degrees of freedom) equals the number of restrictions in the system. Low values for the test statistics show that the restrictions are not binding and the test was evaluated at the 5% significance level.

In addition to reporting the results of this relatively reliable VAR order selection procedure, multivariate generalizations of the following standard model selection criteria that are commonly used in the literature were also examined: the forecast prediction error (FPE), the Akaike information criterion (AIC), the Schwarz information criterion (SIC), and the Hannan-Quinn information criterion (HQ). To ensure that the final lag length could account for serial correlation, high VAR orders were generally desired.

Charemza and Deadman (1997) advise that the lag length in a VAR model should be chosen so as to yield residuals without significant autocorrelation. This is because serial correlation can lead to inconsistent least squares estimates. Therefore, to bolster the above choice of lag length, tests for serial correlation of up to order 5 in each single equation of the suggested VAR models were conducted, using the Breusch-Godfrey test. The chosen VAR orders could account for at least such correlation.

Qureshi (2008) establishes that the presence of explosive roots in level VARs is common, contrary to the widespread consensus among macroeconomists that such roots are at most equal to unity. Accordingly, following Lütkepohl (1991), this study examined the inverse roots of the characteristic autoregressive (AR) polynomials derived from the models, to ensure that they had a modulus of less than unity. This property ensures the stability of the VAR model, hence the reliability of innovation accounting outcomes. Since the integration and cointegration properties of the data were ignored, ensuring the stability of the VAR was all the more necessary.

Granger-causality and block exogeneity tests

The interrelationships were initially accessed using Granger-causality and block exogeneity tests within the individual equations of each VAR model. Granger-causality tests seek to ascertain the joint statistical significance of the lagged values of a single variable in an equation where another variable is the regressand. Conversely, block exogeneity tests investigate the statistical significance of the lagged values of all other variables (but the dependent variable itself) included in each equation of the system. Thus, the block exogeneity test may only become relevant if causality cannot be established for each variable in a given equation under the Granger-causality test. Under the appropriate null hypotheses of no Granger-causality or no endogeneity,

the author sequentially computed chi-square statistics and their probability values using the standard procedure.

Innovation accounting

The dynamic interrelations were also investigated by examining impulse response and variance decomposition functions as described by Charemza and Deadman (1997) and Enders (2004). From the viewpoint of monetary policy, this investigation becomes necessary considering the distinction between endogenous and exogenous policy changes already described, as well as the inconclusive debate regarding the neutrality of money (see Lucas, 1996 cited in Walsh, 2003). A theoretical explanation follows.

To understand impulse response functions, note that the contemporaneous shock (or innovation) denoted ε_{jt} in Equation 1 will have an impact on contemporaneous and future values of x_j, as well as future values of all other variables in the system. Tracing such effects facilitates an understanding of the interactions among the variables. Specifically, by recasting the VAR model into its moving average representation, impulse response functions, which trace the effects of a one standard deviation change in ε_t on the x_t sequences over time, are necessarily the coefficients of the moving average terms. In a given period, say p ($p = 0,1,2,...$), of or after the shock, the impact of a t-period shock to variable j on another variable k may be denoted by the moving average term ε_{jt}^{k}, and can be measured by the coefficient of ε_{jt}^{k}, say ϕ_{jp}^{k}. A plot of ϕ_{jp}^{k} against p therefore provides a visual depiction of the reactions of the variables in the system to various shocks over time.

Correlation in innovations across the equations implies that some component of the shock would commonly be attributable to more than one variable. As indicated during the discussion of the identification problem, the study addressed this problem by computing generalized impulse response functions, following Pesaran and Shin (1998). Nonetheless, the variable ordering displayed in Table 5 was used in order to restrict all domestic variables from having an impact on the international commodity price index while permitting the converse effects. It is usually the case that the full impact of the shocks is realized over a long period, such that tracing the impulse response functions over long enough forecasting horizons is recommended, especially when dealing with long-memory series. In this study, the functions were traced over a four-year horizon. No significant changes in the patterns of the functions were discernible after four years.

Further, the study examined variance decompositions. A forecast error variance decomposition for a given left-hand variable measures the proportion of its total variability due to shocks in the variable itself relative to shocks in all other variables in the VAR model, at various forecasting horizons. If shocks to all other variables in the

system explain none of the forecast error variance in x_{jt} at all forecasting horizons, then the x_{jt} sequence is exogenous. Conversely, if the forecast error variance in x_{jt} can entirely be explained in terms of shocks to other variables in the system but its own shocks, then x_{jt} is perfectly endogenous. Usually, the proportion of the variance attributable to the variable itself is high at short forecasting horizons and declines as the horizon increases. As with the impulse responses, the variance decompositions were generated over a four-year forecasting horizon, and the variable ordering in Table 5 was adopted.

5. Results and discussions

VAR order determination

The VAR orders suggested by the model selection criteria are presented in Appendix III. In addition, for each ultimately chosen model, the Appendix shows the structure of stability. The LR tests suggested VAR models of order 7 in all cases except Model 4, for which an order of 11 was preferred. The SIC and HQ, consistently suggested very low VAR orders of 1 and 2 respectively, while both FPE and AIC never preferred orders that were greater than the LR-suggested orders. Therefore, the orders suggested by the LR test were selected so as to increase the chance of accounting for serial correlation. Equation-specific Breusch-Godfrey test results, which are available from the author on request, also showed no evidence of up to fifth order serial correlation. Moreover, the modulus inverse roots of the characteristic AR polynomials of all the chosen models were within the unit circle (Appendix III). Therefore, the VAR models were acceptable for the application of causality testing and innovation accounting procedures.

Granger-causality and block exogeneity tests

The Granger-causality and block exogeneity test results obtained in the context of the six VAR systems are in Appendix IV. As expected, world commodity prices were exogenous to the system. The most striking observation was the significant role of the exchange rate in explaining most variables except reserve money and world commodity prices.[7] The exchange rate explained the bank rate, the market interest rate, money supply and prices more strongly than any other single variable in the system. The observed behaviour of the exchange rate had several key implications for the conduct of monetary policy.

First, there was no sturdy evidence for the exchange rate channel of the monetary policy transmission mechanism, since the exchange rate was not influenced by a monetary policy instrument in any of the cases. Except for the outlier effect of *M2* in

Model 4, *EXRATE* was clearly exogenous. This could suggest that the exchange rate effects were transmitted to financial variables and prices independently of monetary policy. This was consistent with the fact that the exchange rate did not float freely during most of the study period, and so could not have been responsive to market fundamentals.

Second, the exchange rate was forcefully the single most important determinant of prices in Malawi, a finding also documented by Ngalawa (2009). It explained prices in all six cases under consideration, being the sole determinant in three. This evidence suggested that, rather than excessively focusing on the inflationary effects of domestic demand as was the dominant practice in the conduct of policy, exchange rate policy aimed at managing imported inflation should be the main preoccupation of the authorities.

A case could also be made for a partial but ineffective interest rate channel: when statistical significance was evaluated at 10%, the bank rate could influence the lending rate in all of the three cases, and the lending rate could explain the supply of credit (hence money supply) in five models. However, the fact that money supply influenced prices in only one of the six cases pointed to the failure of both the interest rate and money supply channels to achieve their intended objectives. This evidence suggested that, through bank rate manipulations, the authorities could influence credit flows and money supply to a reasonable degree, but this would not necessarily have an impact on prices.

Another point worth exploring relates to the endogeneity of policy. There was no evidence that authorities were reactionary to the economy in setting reserve money targets, but evidence of external (*CPRICE*) influences showed in Model 3. However, the authorities were clearly reactionary to the state of the economy in setting the bank rate, since this was induced by the exchange rate, the lending rate and domestic price conditions. This could imply that long-run bank rate policy was more defensive than dynamic in Malawi, in that it sought to correct disequilibrium conditions rather than to influence the course of economic activity.

Finally, recall that monetary authorities in Malawi had clearly set reserve money as the operating target and broad money as the intermediate target, trusting that strong causal relationships existed between reserve money and broad money, and between broad money and prices. This report has already disputed the existence of dominant impulses flowing from broad money to prices. To deal monetary policy a further blow, note that reserve money had no causal implications whatsoever for broad money. However, when statistical significance was evaluated at 10%, broad money could cause reserve money. Thus, while excess liquidity induced mop-up exercises, this did not necessarily resolve the liquidity problem. These results do not agree with the seminal propositions of Friedman and Schwartz (1963).

This analysis shows that both the Keynesian interest rate channel and the classical money supply channel of the monetary policy transmission mechanism could not be sturdily supported by the data. One could argue that these results were an artefact of the causality analysis invoked. To investigate further, innovation accounting procedures were invoked as outlined in the methodology.

Variance decomposition analysis

Table 6 shows the 48-month point estimates of the variance decomposition coefficients. At such a horizon, the world commodity price index was an outstanding predictor in the system: it explained the highest proportion of its own forecast error variances in all six cases, as well as those of the exchange rate (five cases), domestic prices (five cases), the bank rate (two of three cases) and the lending rate (two cases). But *CPRICE* was unimportant in explaining *M0* and *M2*, both of which were largely exogenous to the system.

Table 6: Sample variance decompositions

	Endogenous variable	Percentage of forecast error variance: distribution across innovations					
		CPRICE	M0	LRATE	EXRATE	M2	CPIA
Model 1	*CPRICE*	78.089	6.389	7.297	5.385	1.586	1.255
	M0	9.815	63.037	6.908	5.469	11.656	3.115
	LRATE	25.253	5.897	35.315	25.570	2.318	5.646
	EXRATE	41.565	13.957	3.033	37.264	3.276	0.905
	M2	2.456	20.082	8.087	7.999	57.642	3.734
	CPIA	36.217	5.313	11.053	28.015	1.550	17.852
	Endogenous variable	**Percentage of forecast error variance: distribution across innovations**					
		CPRICE	**M0**	**LRATE**	**EXRATE**	**M2**	**CPIF**
Model 2	*CPRICE*	81.591	1.286	7.059	6.555	1.123	2.386
	M0	16.715	60.754	7.860	5.239	7.933	1.500
	LRATE	23.574	10.378	34.357	26.633	2.524	2.535
	EXRATE	48.860	10.749	2.894	34.050	2.483	0.964
	M2	3.310	22.068	11.169	9.006	52.545	1.901
	CPIF	32.067	11.719	5.560	24.226	1.571	24.857
	Endogenous variable	**Percentage of forecast error variance: distribution across innovations**					
		CPRICE	**M0**	**LRATE**	**EXRATE**	**M2**	**CPIN**
Model 3	*CPRICE*	76.741	6.452	6.746	5.759	1.880	2.422
	M0	9.179	53.598	10.259	11.962	10.295	4.707
	LRATE	26.781	6.163	27.437	23.071	2.305	14.243
	EXRATE	40.727	8.734	7.315	26.698	1.990	14.536
	M2	4.122	17.599	8.590	14.108	53.271	2.309
	CPIN	38.181	4.282	8.475	21.395	2.408	25.260
	Endogenous variable	**Percentage of forecast error variance: distribution across innovations**					
		CPRICE	**BRATE**	**LRATE**	**EXRATE**	**M2**	**CPIA**
Model 4	*CPRICE*	76.984	4.953	3.858	8.005	3.086	3.114
	BRATE	25.193	21.491	13.271	18.543	14.635	6.867
	LRATE	29.771	13.352	17.512	17.319	15.167	6.879
	EXRATE	25.583	8.993	4.044	43.322	12.885	5.173
	M2	28.746	7.562	3.341	4.990	50.014	5.346
	CPIA	32.710	8.490	6.617	26.214	11.232	14.737

	Endogenous variable	Percentage of forecast error variance: distribution across innovations					
		CPRICE	BRATE	LRATE	EXRATE	M2	CPIF
Model 5	*CPRICE*	83.124	3.256	2.344	6.593	1.864	2.818
	BRATE	16.974	19.459	28.207	28.709	4.096	2.556
	LRATE	17.342	13.472	34.116	29.551	3.431	2.088
	EXRATE	40.173	2.927	10.079	38.878	4.671	3.271
	M2	2.640	10.280	3.869	7.472	75.014	0.726
	CPIF	21.555	5.735	14.527	30.240	3.290	24.653
	Endogenous variable	**Percentage of forecast error variance: distribution across innovations**					
		CPRICE	*BRATE*	*LRATE*	*EXRATE*	*M2*	*CPIN*
Model 6	*CPRICE*	75.991	4.942	1.900	5.626	5.503	6.037
	BRATE	24.028	19.208	16.930	22.103	6.645	11.086
	LRATE	26.494	14.475	19.324	23.175	4.927	11.605
	EXRATE	40.818	4.253	7.520	29.378	9.461	8.570
	M2	6.091	7.752	3.283	8.953	72.139	1.781
	CPIN	42.249	2.119	7.827	14.950	4.148	28.706

Note: Entries are 48-month point estimates of the percentages of the forecast error variance of the row variable due to each corresponding column variable.

After controlling for these external effects and the additional significance of own variability in *M0*, *M2* and *LRATE*, the exchange rate was the next most important variable. *EXRATE* explained the highest proportion of the variability in food prices, and was clearly a key predictor of prices in general, the bank rate and the lending rate. Although the exchange rate remained uninfluential in explaining reserve money, the fact that it could account for variability in the lending rate and the bank rate could reflect the long-run endogeneity of monetary policy interventions: authorities were reactionary to the stance of the economy, as reflected in exchange rate dynamics, in determining the course of monetary policy. The fact that determining the bank rate was informed by economic conditions was documented by Kwalingana (2007). This observation was also in agreement with that made under the causality tests. However, the significance of the exchange rate as a predictor of financial variables was not as strong at this forecasting horizon, as was the case in the analysis based on Granger-causality and block exogeneity tests.

It was further noted that reserve money was not particularly influential in explaining the variability in broad money, and that broad money, in turn, hardly influenced prices — evidence of a long-run classical channel of the policy transmission mechanism was lacking. Similarly, the bank rate could hardly explain the variability of the lending rate, and this variability did not explain the variability in broad money and domestic prices — evidence of a long-run Keynesian channel was equally lacking.

The variance decomposition functions depicted in Table 6 were relatively long-horizon (48-month) point estimates. For short-memory series, these estimates could give misleading interpretations. An examination of the evolutions of all the functions revealed that a short-memory reaction actually occurred in terms of the response of the lending rate to a shock from the bank rate. Table 7 provides this evolution for the first 12 months of the reaction of *LRATE* in the last three models.

The variability in the forecast error of *LRATE* attributable to *BRATE* was very high in the initial periods, being higher than that due to the *BRATE* itself in Model 6 for most of the first year. However, this variability significantly declined until the picture

in Table 6 was reached. Note that in Model 6, at its peak in the third month, about 53% of the variability in *LRATE* could actually be explained by *BRATE*, against only 14% in the 48th period (Table 6). This trend reflected the near-instantaneous reaction of market interest rates to bank rate changes (hence monetary policy shocks), and provided support for some causality (which was weak in a statistical significance sense) flowing from *BRATE* to *LRATE* (Appendix IV).

A related observation could be made with respect to the significance of *CPRICE*. While this variable was largely unimportant in the causality tests because the lag structures were short, it was quite important in the long-horizon variance decomposition analysis, as already discussed.

The preceding short-horizon observations suggested that a tabular presentation of the point estimates of the variance decompositions could be challenged: there was no guarantee that other short-memory effects were not missed out. To address this, and to capture a different metric for unearthing the interrelationships, the impulse response functions are presented graphically in this paper.

Table 7: Short memory in the lending rate's reaction to policy

	Time	**Percentage of forecast error variance of LRATE**					
		CPRICE	*BRATE*	*LRATE*	*EXRATE*	*M2*	*CPIA*
Model 4	1	0.314	45.120	54.566	0.000	0.000	0.000
	2	2.729	41.815	49.689	0.550	1.457	3.760
	3	7.874	34.252	41.687	3.826	4.774	7.587
	4	10.541	28.779	44.908	5.343	3.613	6.816
	5	14.053	27.241	43.337	5.904	2.962	6.504
	6	17.661	23.542	41.999	6.033	2.979	7.785
	7	23.102	18.179	36.776	9.849	3.503	8.591
	8	25.938	14.888	32.480	14.747	3.527	8.420
	9	30.279	12.394	28.355	16.728	3.643	8.603
	10	31.772	10.978	25.882	19.582	3.341	8.445
	11	33.458	9.900	24.115	21.084	3.131	8.311
	12	35.128	9.067	22.795	21.487	3.338	8.185

	Time	**Percentage of forecast error variance of LRATE**					
		CPRICE	*BRATE*	*LRATE*	*EXRATE*	*M2*	*CPIF*
Model 5	1	0.292	42.386	57.322	0.000	0.000	0.000
	2	0.178	42.669	54.549	0.747	0.481	1.376
	3	0.557	40.537	49.495	4.661	1.447	3.303
	4	1.129	37.721	50.616	6.104	1.046	3.384
	5	1.538	39.357	48.463	6.823	0.906	2.914
	6	1.648	36.937	49.169	7.850	1.036	3.360
	7	1.772	32.410	47.302	13.967	1.269	3.280
	8	1.536	28.277	43.724	21.895	1.667	2.902
	9	1.526	25.102	41.803	26.667	2.189	2.713
	10	1.606	22.870	40.553	29.870	2.564	2.537
	11	1.754	21.267	39.788	32.019	2.843	2.329
	12	1.920	19.956	39.547	33.360	3.041	2.176

	Time	Percentage of forecast error variance of LRATE					
		CPRICE	*BRATE*	*LRATE*	*EXRATE*	*M2*	*CPIN*
Model 6	1	0.004	51.643	48.353	0.000	0.000	0.000
	2	0.124	56.273	39.387	1.542	0.428	2.246
	3	0.630	52.823	34.044	5.668	1.308	5.527
	4	0.907	51.088	34.004	7.242	1.030	5.730
	5	1.163	50.875	30.900	7.655	0.994	8.414
	6	1.460	48.531	30.124	8.777	1.179	9.929
	7	2.177	41.594	28.397	14.436	1.351	12.046
	8	2.328	35.702	26.412	22.152	1.636	11.771
	9	3.134	31.404	25.314	26.944	2.179	11.026
	10	3.966	28.047	24.756	30.075	2.542	10.613
	11	4.596	25.628	24.733	31.916	2.809	10.318
	12	5.102	23.911	24.895	33.062	3.044	9.987

Note: Entries are point estimates of the percentages of the forecast error variance of LRATE in the first year.

Impulse response analysis

As a precursor to the discussion of the generalized impulse response functions depicted in Appendix V, note that the graphs generally tended to converge towards zero, conforming to the results of the VAR stability analysis. Moreover, in keeping with both the causality and variance decomposition analyses, shocks from *CPRICE* had significant short horizon effects only for *M0*; for other variables (notably *EXRATE*, prices and *LRATE*), the effects of *CPRICE* shocks only became noticeably significant after at least 10 months. The variance decompositions should be interpreted with a degree of caution, recognizing that a lot of intermediate dynamics are not reflected in the point estimates reported.

In keeping with the Granger-causality results, the first major observation to make on the impulse responses was that all the variables except *CPRICE* responded to *EXRATE* innovations more strongly than those from any other variable in the system, and the reactions typically remained significant for anything between 5 and 20 months. The weakest of these reactions tended to be in monetary aggregates. Most importantly, with the exception of own shocks, *EXRATE* shocks were the most important in describing domestic prices regardless of how prices were measured. In keeping with the theory, domestic currency depreciation/devaluation was inflationary: at the peak of the significance, a one standard deviation positive shock to the logarithm of the exchange rate (measure as MK/US$) could increase the logarithm of price by 0.02 of a unit within the first year after the shock. These reactions tended to be closely uniform across the six models, as summarized in Table 8.

Table 8: The inflationary effect of the depreciation/devaluation of the kwacha

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Impulse response	0.017	0.021	0.022	0.017	0.020	0.019
Period	12	11	4	11	12	4

Note: This table shows the effect of a 1.0 standard deviation positive shock in the logarithm of EXRATE on the logarithm of the domestic price. The impulse response coefficients are the maximum significant estimates, in units of the log of price. "Period" is the month after the initial shock in which the response, as defined, was recorded.

Secondly, the exchange rate explained the stance of monetary policy more strongly under a bank rate instrument than under a reserve money instrument. Thus, one could conclude that the likely reaction of authorities to exchange rate movements would be to adjust the bank rate rather than money supply. Given that the exchange rate was closely controlled under a managed float over most of the study period, it made sense that the effects of any significant movement in the exchange rate, which were typically jumps, should be curbed by the bank rate (which followed a step-step function over time) rather than reserve money. This supported the observation that the bank rate was more endogenous than reserve money.

Thirdly, the exchange rate instantaneously reacted to reserve money in a manner that remained significant for 5–10 months. Mild effects on the exchange rate from an *M2* shock could also be traced. Exchange rate developments were also informed by non-food inflation. In two cases (Models 3 and 6), the effects of *CPIN* innovations on *EXRATE* were significant and died off only after about a year. This result showed that exchange rate policy was informed by monetary developments, and was not as exogenous as the Granger-causality tests suggested. Moreover, authorities were reactionary to price developments in non-food markets in setting exchange rate policy. This could reflect the fact that exchange rate movements were likely to have an impact on the importation of raw materials and intermediate inputs for the industrial sector, rather than the productive activities of the heavily subsistence-based and currently subsidy-receiving agricultural sector of the economy. This effect also showed in the all-items CPI in Model 4.

Fourthly, the effect of a positive shock to *M0* on *M2* reached its peak within the first month; so did the effect of a positive shock to *M2* on *M0*. These effects had very short memory (and died off after about six months), which explains why they were hardly picked in the two prior metrics. Nonetheless, the impulse response analysis could not dispute the absence of a strong link between money supply and prices. The observed ineffectiveness of the classical view to the monetary policy transmission mechanism in Malawi remained largely unchallenged.

A final point, and in keeping with prior observations, is that an increase in the bank rate instantaneously increased the lending rate. The effects reached their peaks in about five months, but died off almost immediately. At the peaks of these effects, a one standard deviation shock to the bank rate could induce an increase in the lending rate of about 0.6 of a unit. However, the observation that both the bank rate and the lending rate had no significant forecasting power for prices was further supported in this analysis. Therefore, the evidence regarding the ineffectiveness of the interest rate channel remained unequivocal.

6. Conclusion

This paper investigated the effectiveness of monetary policy in Malawi within the environment of six-variable VAR models. The bank rate and reserve money were the potential measures of the stance of monetary policy, while the lending rate, the exchange rate and broad money were the intermediate targets. Price was the objective variable, and the analysis controlled for exogenous shocks by including the world commodity price index. Three measures of price were considered, namely the all-items composite consumer price index, the food price index and the non-food price index. Monthly data from January 1994 to March 2009 were used in the analysis, to coincide with the liberalization of the financial markets. Granger-causality and block exogeneity tests were conducted, and the dynamics were further traced by computing variance decompositions and impulse response functions. From a monetary policy perspective, two key results could be consistently drawn from the analysis.

First, the evidence suggested that none of the conventional views of the policy transmission mechanism was fully and effectively at work. Although the lending rate instantaneously responded to bank rate adjustments and although the lending rate somewhat influenced money supply, the effects were hardly transmitted to prices. This result located a breakdown of the Keynesian interest rate view of the monetary policy transmission mechanism, as well as its monetarist variants. Thus, the study could not confirm the arguments and findings of Taylor (1995), Al-Mashat and Billmeier (2007) and Cheng (2006) in support of the interest rate channel. Further, the link between reserve money and broad money was largely weak and, more importantly, money supply had no predictive power for prices. This finding rendered suspicious the effectiveness of the classical view of the policy transmission mechanism which posits that strong and dominant impulses run from money supply to prices (Friedman and Schwartz, 1963). It also confirmed the fact that the quantity theory of money did not seem to hold in Malawi: contrary to the quantity theory, rising money supply seemed to correlate with falling prices, especially after 2004. This result was in contrast with those documented by Chimobi and Igwe (2010) and by Lozano (2008).

The second key result of the analysis was that prices in Malawi were largely influenced by the exchange rate (hence open-economy effects). The exchange rate itself tended to respond to changes in reserve money and domestic prices, especially non-food prices. To this extent, it could be argued that the effect of the exchange rate on prices could be attributable to the exchange rate channel of the monetary policy transmission mechanism. However, the exchange rate effects on prices persisted even when the bank rate (which had no influence on the exchange rate) was used in place of reserve money as a policy instrument, suggesting that the effects were not necessarily induced by monetary policy.

The finding that the exchange rate was the most important variable in explaining prices was consistent with analytical results documented for Egypt (see Al-Mashat and Billmeier, 2007), Kenya (Rotich et al., 2007), Ghana (Ocran, 2007) and Nigeria (Olubusoye and Oyaromade, 2008). They also supported the evidence presented by Ngalawa (2009) for Malawi. Together, all these studies suggest that the exchange rate is a key variable in explaining inflation in Africa. This study presents additional evidence from Malawi.

Lessons and recommendations

The key lesson arising from this analysis is that imported inflation was a greater cause for concern in Malawi than demand-pull inflation, and that exchange rate policy was more relevant and more effective in controlling inflation than monetary policy per se. This was reflective of the country's precarious foreign reserve position and its vulnerability to external shocks.

From the foregoing, the study recommends that authorities should be more concerned with imported cost-push inflation rather than demand-pull inflation arising from domestic money market conditions. This recommendation calls for a shift in the operations of RBM from anchoring its policy interventions on money market conditions on the basis of monetarist arguments, to explicitly focusing more on foreign exchange market conditions as the primary mechanism for controlling inflation. In the short term, pursuing a prudent exchange rate policy that recognizes the country's precarious foreign reserve position could be critical in deepening domestic price stability. Beyond the short term, price stability could be sustained by implementing policies directed towards building a strong foreign exchange reserve base and developing a sustainable approach to the country's reliance on development assistance.

Further research

This analysis could benefit from further research, and two lines of enquiry can be identified. First, aside from the foregoing rather direct interpretation of the significance of the exchange rate, the findings may be linked to the discussion of fiscal dominance (particularly the impact of donor aid) presented in Section 3. Being a recipient of significant amounts of official development assistance, government tended to spend such assistance on non-tradable goods in an environment of exchange rate

controls. Thus, Malawi might be a typical illustration of the case where the monetization of donor aid could depict a relation between inflation and the exchange rate. This effect requires further exploration. Along the same lines, as discussed in Section 2, the Malawi kwacha was usually an overvalued currency in an environment of persistently thin foreign reserves. It would merit exploring, in a general equilibrium framework, whether the gains from currency overvaluation (in terms of low inflation) justified the costs in terms of the depletion of foreign reserves, foreign exchange scarcity and rationing.

Secondly, in subsequent work, the relevance of three more variables may be investigated, namely oil prices (probably in place of the world commodity price), the inter-bank market rate and the Treasury bill rate. The significance of the international effect documented in this report motivates an investigation of whether changes in oil prices significantly affect consumer prices, and how this relates with other variables in the system. In addition, the significant role of open market operations as a vehicle for influencing liquidity, and the similitude between the conduct of monetary policy in Malawi and USA, locate the attraction of investigating the relevance of both the inter-bank market rate and the Treasury bill rate as potential measures of the stance of monetary policy and policy instruments. The inter-bank rate is the equivalent of the federal funds rate, which is considered a measure of the stance of monetary policy in the USA.

Notes

1. The fiscal calendar runs from July to June.
2. This is according to an article by the IMF Africa Department published in the *IMF Survey Magazine* of 1 April 2010.
3. In the ensuing analysis, the maximum commercial bank lending rate was used instead, due to lack of adequate monthly data on the base rate.
4. In order to formalize the use of OMO as a monetary policy tool rather than an activity solely premised on meeting the government's budgetary requirements, the Central Bank introduced the RBM bill in August 2000. Effectively, trading in government securities involves only a few commercial banks and financial institutions.
5. The LRR ratio was set at 30% in 2000, 27.5% in mid 2004, 20% in February 2006, and 15.5% by the end of 2006.
6. Although standard monetary VARs and related methodologies generally include a real output variable — an important inclusion given the literature on the neutrality of money (see Sims, 1980, 1992; Bernanke and Blinder, 1992; Strongin, 1995; Leeper et al., 1996; Bernanke and Mihov, 1998; Cochrane, 1998; Darrat and Dickens, 1999) — a referees' advice to restrict the analysis to policy effects on the various measures of inflation was accepted. Apart from addressing the referees' concerns, this omission resolved an additional problem: real GDP data were only available at the annual frequency and using the industrial production index appeared non-plausible in an agricultural-based

economy such as Malawi. The literature on GDP data interpolation is equally challenged.

7. The effect of world commodity prices, used in this analysis as a control variable, did not belabour us beyond noting that, as expected, this variable was practically exogenous to the system.

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Appendix I: Variable definitions and data sources

This Appendix provides definitions and data sources for the variables used in the study. The sample was from January 1994 to March 2009. Data on all variables marked with * were sourced from the International Financial Statistics up to December 2005, and from the Reserve Bank of Malawi (RBM) thereafter. Data on variables marked ** were sourced from the National Statistical Office. None of the data were seasonally adjusted at source except those marketed S/A, such that seasonal effects were considered during modelling. In all cases, end-of-period data were used. Interest rates were expressed as annual percentage rates. In the analyses, all variables except the interest rates were expressed in natural logarithmic levels.

BRATE: The bank rate, also called the discount rate *.

CPIA: The all-items index of prices of consumer goods and services for urban and rural areas; base = 2000, S/A **.

CPIF: The index of food prices for urban and rural areas; base = 2000. Food prices constitute 58.1% of CPIA, S/A **.

CPIN: The index of non-food prices for urban and rural areas; base = 2000. Food prices constitute 41.9% of CPIA **. The items included are tobacco and beverages (accounting for 5.9% of CPIA), clothing and footwear (8.5%), housing (12.1%), household operations (4.1%), transportation (5.1%) and miscellaneous (6.2%).

CPRICE: World commodity price index (for fuels and non-fuels); base = 2005. Index of prices of fuel and non-fuel product.

Source: downloaded from www.indexmundi.co./commodities/ on 15 November 2009

EXRATE: The official exchange rate in MK/US$*.

LRATE: Maximum commercial bank lending interest rate*.

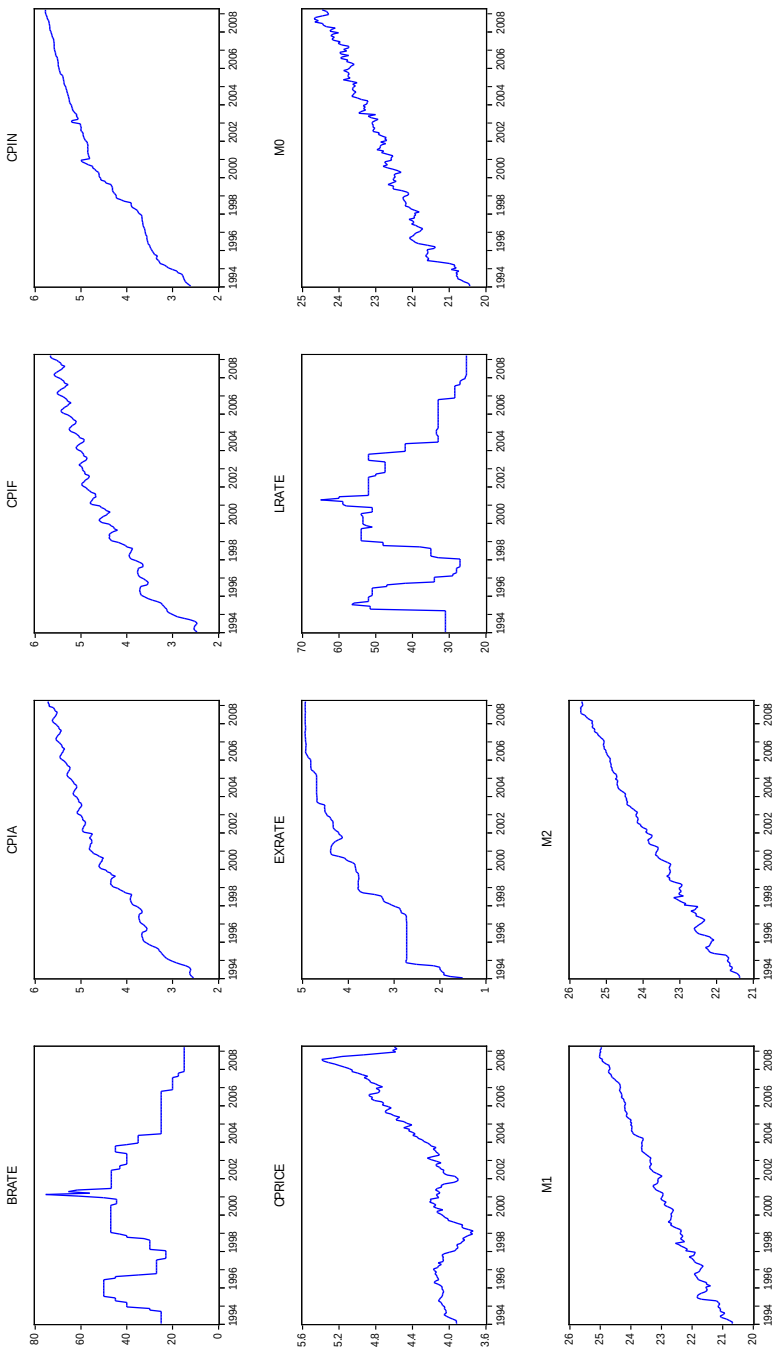
M0: Reserve money, defined as the sum of currency outside banks, currency in banks, commercial bank deposits with the RBM, and deposits of statutory bodies with the RBM*.

M1: Narrow money, defined as the sum of currency outside banks and private demand deposits*.

M2: Broad money, defined as the sum of M1 and private time and saving deposits*.

Appendix II: Series used in the analysis: January 1994–March 2009

Note: For variables definitions see Appendix I. With the exception of BRATE and LRATE, which are expressed in per cent per annum, all other variables are in natural logarithms.



Appendix III: VAR order determination

This Appendix shows the results of lag length selection tests, as well as the stability properties of the chosen VAR models. The entries have the following interpretations:

LR: VAR order suggested by the likelihood ratio test

FPE: VAR order suggested by the forecast prediction error criterion

AIC: VAR order suggested by the Akaike information criterion

SIC: VAR order suggested by the Schwarz information criterion

HQ: VAR order suggested by the Hannan-Quinn information criterion

|Inverse root|: absolute value of the highest inverse root of the characteristic AR polynomial.

	Suggested VAR order by criterion					Chosen VAR Model	
Model	**LR**	**FPE**	**AIC**	**SIC**	**HQ**	**Order**	**|Inverse Root|**
1	7	2	2	1	2	7	0.9534
2	7	2	3	1	2	7	0.9622
3	7	2	2	1	2	7	0.9692
4	11	2	7	1	2	11	0.9738
5	7	4	7	1	2	7	0.9651
6	7	5	5	1	2	7	0.9708

Appendix IV: Granger causality and block exogeneity tests

Entries show the probabilities of accepting the null hypothesis that the corresponding group of column variables did not Granger-cause the row variable, based on Wald test χ^2-statistics. 'ALL' captures the p-values based on the block exogeneity test: a test for the null hypothesis of the joint insignificance of all groups of column variables. * denotes statistical significance at 95% confidence level or higher. Diagonal entries are omitted since they do not reflect causal implications.

Model 1

	∑CPRICE	∑M0	∑LRATE	∑EXRATE	∑M2	∑CPIA	ALL
CPRICE		0.943	0.856	0.573	0.926	0.583	0.966
M0	0.055		0.150	0.789	0.062	0.817	0.126
LRATE	0.316	0.939		0.000*	0.483	0.001*	0.000*
EXRATE	0.505	0.642	0.506		0.722	0.914	0.761
M2	0.999	0.427	0.056	0.144		0.350	0.103
CPIA	0.937	0.623	0.307	0.048*	0.209		0.024*

Model 2

	∑CPRICE	∑M0	∑LRATE	∑EXRATE	∑M2	∑CPIF	ALL
CPRICE		0.979	0.824	0.550	0.974	0.371	0.929
M0	0.052		0.037*	0.731	0.176	0.611	0.085
LRATE	0.780	0.920		0.000*	0.516	0.195	0.000*
EXRATE	0.432	0.497	0.598		0.630	0.317	0.446
M2	0.997	0.652	0.029*	0.078		0.720	0.206
CPIF	0.196	0.786	0.005*	0.049*	0.421		0.006*

Model 3

	∑CPRICE	∑M0	∑LRATE	∑EXRATE	∑M2	∑CPIN	ALL
CPRICE		0.903	0.879	0.755	0.919	0.323	0.915
M0	0.023*		0.214	0.462	0.053	0.287	0.038*
LRATE	0.448	0.979		0.004*	0.730	0.013*	0.000*
EXRATE	0.585	0.061	0.207		0.311	0.102	0.255
M2	0.910	0.501	0.090	0.095		0.321	0.096
CPIN	0.487	0.271	0.684	0.004*	0.515		0.089

Model 4

	∑CPRICE	∑BRATE	∑LRATE	∑EXRATE	∑M2	∑CPIA	ALL
CPRICE		0.965	0.948	0.969	0.724	0.628	0.998
BRATE	0.010*		0.004*	0.053	0.104	0.426	0.000*
LRATE	0.205	0.069		0.000*	0.007*	0.010*	0.000*
EXRATE	0.235	0.462	0.821		0.038*	0.114	0.121
M2	0.846	0.355	0.275	0.030*		0.812	0.083
CPIA	0.942	0.001*	0.008*	0.009*	0.022*		0.000*

Model 5

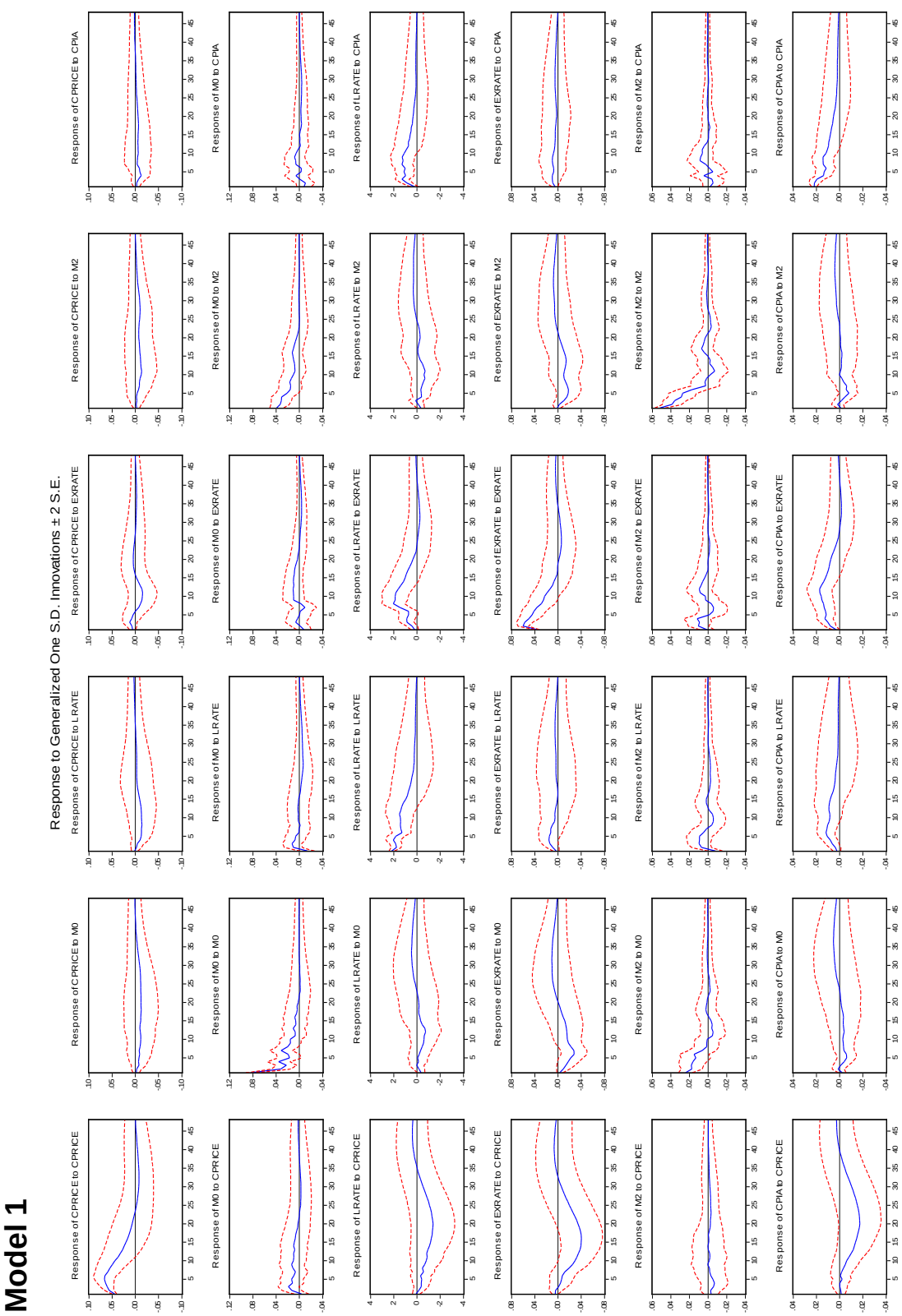
	∑CPRICE	∑BRATE	∑LRATE	∑EXRATE	∑M2	∑CPIF	ALL
CPRICE		0.907	0.855	0.623	0.917	0.526	0.896
BRATE	0.201		0.005*	0.000*	0.765	0.010*	0.000*
LRATE	0.755	0.069		0.000*	0.367	0.125	0.000*
EXRATE	0.448	0.234	0.601		0.559	0.223	0.293
M2	0.965	0.045*	0.002*	0.048*		0.687	0.023*
CPIF	0.145	0.254	0.001*	0.022*	0.135		0.001*

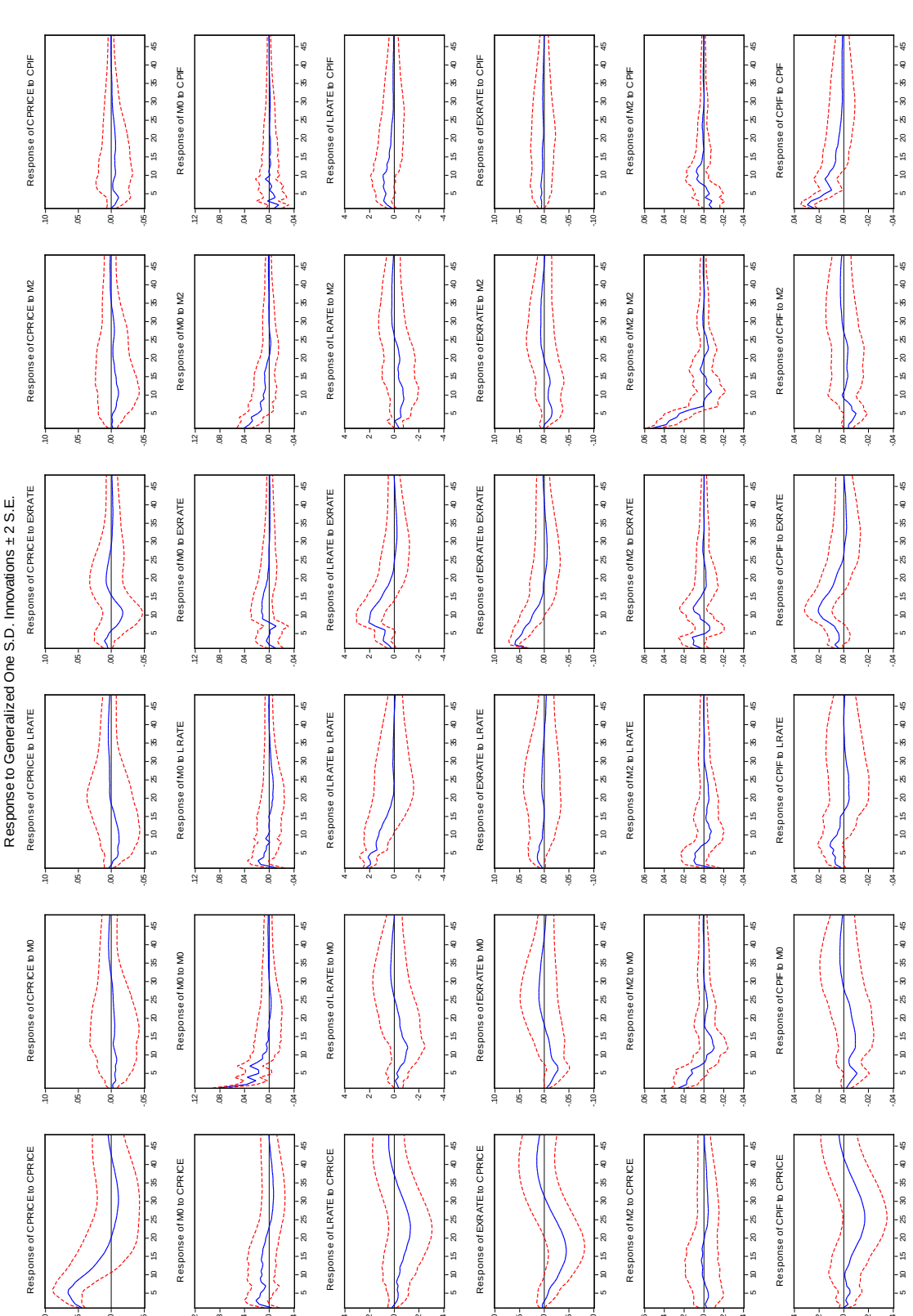
Model 6

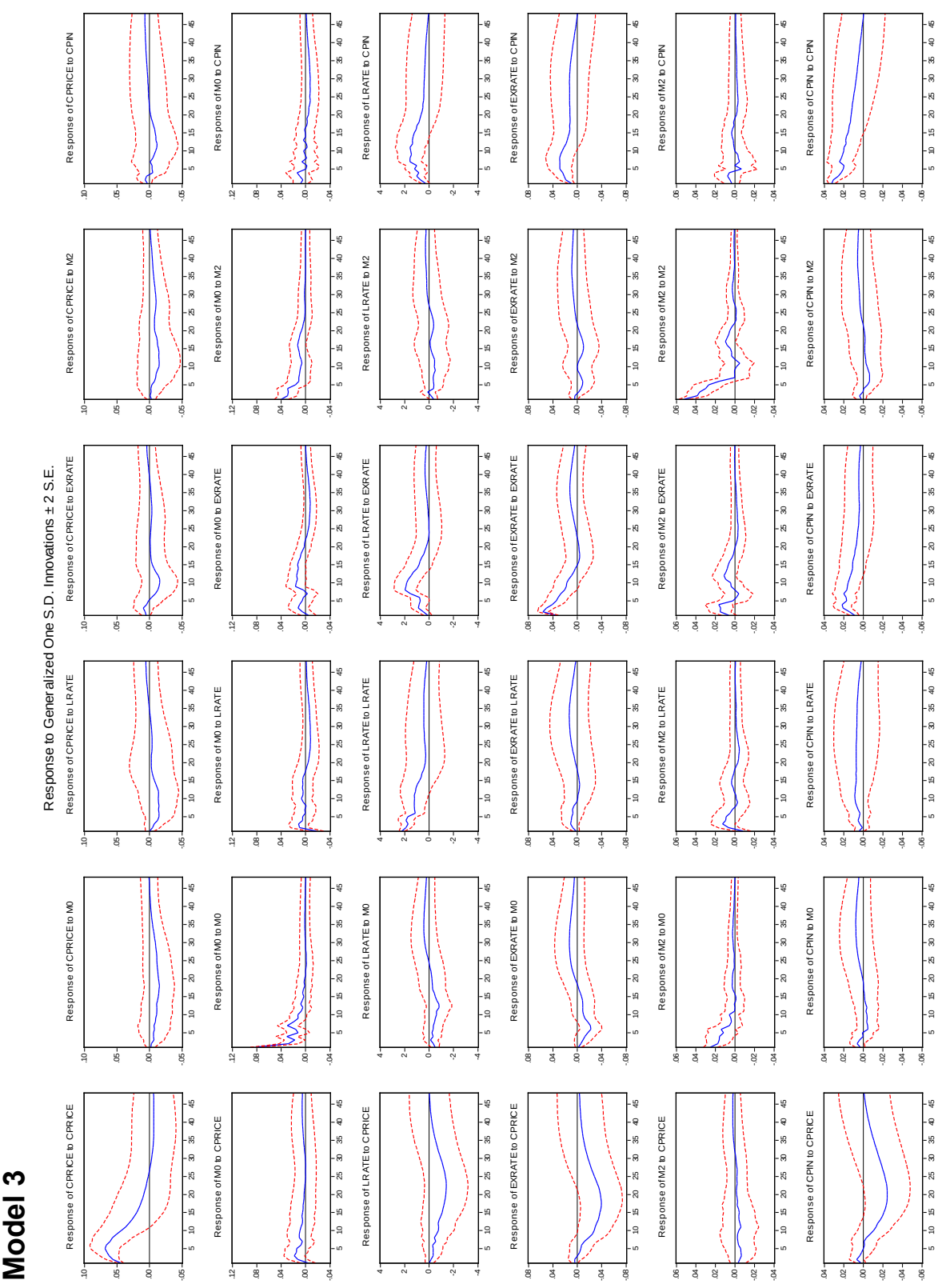
	∑CPRICE	∑BRATE	∑LRATE	∑EXRATE	∑M2	∑CPIN	ALL
CPRICE		0.267	0.441	0.478	0.591	0.115	0.650
BRATE	0.185		0.280	0.006*	0.553	0.097	0.000*
LRATE	0.578	0.100		0.001*	0.635	0.007*	0.000*
EXRATE	0.487	0.219	0.709		0.331	0.499	0.456
M2	0.939	0.114	0.008*	0.128		0.723	0.025*
CPIN	0.688	0.973	0.975	0.037*	0.910		0.350

Appendix V: Impulse responses

The graphs show responses to one standard deviation innovations. Identification was accomplished following Pesaran and Shin (1998) to achieve generalized impulse responses that were insensitive to variable ordering. Time after initial shock, in months, is recorded on horizontal axes.


Model 1
Response to Generalized One S.D. Innovations ± 2 S.E.
Response of CPRICE to CPRICE
Response of CPRICE to M0
Response of CPRICE to LRATE
Response of CPRICE to EXRATE
Response of CPRICE to M2
Response of CPRICE to CPIA
Response of M0 to CPRICE
Response of M0 to M0
Response of M0 to LRATE
Response of M0 to EXRATE
Response of M0 to M2
Response of M0 to CPIA
Response of LRATE to CPRICE
Response of LRATE to M0
Response of LRATE to LRATE
Response of LRATE to EXRATE
Response of LRATE to M2
Response of LRATE to CPIA
Response of EXRATE to CPRICE
Response of EXRATE to M0
Response of EXRATE to LRATE
Response of EXRATE to EXRATE
Response of EXRATE to M2
Response of EXRATE to CPIA
Response of M2 to CPRICE
Response of M2 to M0
Response of M2 to LRATE
Response of M2 to EXRATE
Response of M2 to M2
Response of M2 to CPIA
Response of CPIA to CPRICE
Response of CPIA to M0
Response of CPIA to LRATE
Response of CPIA to EXRATE
Response of CPIA to M2
Response of CPIA to CPIA


Model 2
Response to Generalized One S.D. Innovations ± 2 S.E.
Response of CPRICE to CPRICE
Response of CPRICE to M0
Response of CPRICE to LRATE
Response of CPRICE to EXRATE
Response of CPRICE to M2
Response of CPRICE to CPIF
Response of M0 to CPRICE
Response of M0 to M0
Response of M0 to LRATE
Response of M0 to EXRATE
Response of M0 to M2
Response of M0 to CPIF
Response of LRATE to CPRICE
Response of LRATE to M0
Response of LRATE to LRATE
Response of LRATE to EXRATE
Response of LRATE to M2
Response of LRATE to CPIF
Response of EXRATE to CPRICE
Response of EXRATE to M0
Response of EXRATE to LRATE
Response of EXRATE to EXRATE
Response of EXRATE to M2
Response of EXRATE to CPIF
Response of M2 to CPRICE
Response of M2 to M0
Response of M2 to LRATE
Response of M2 to EXRATE
Response of M2 to M2
Response of M2 to CPIF
Response of CPIF to CPRICE
Response of CPIF to M0
Response of CPIF to LRATE
Response of CPIF to EXRATE
Response of CPIF to M2
Response of CPIF to CPIF


Model 3
Response to Generalized One S.D. Innovations ± 2 S.E.
Response of CPRICE to CPRICE
Response of CPRICE to M0
Response of CPRICE to LRATE
Response of CPRICE to EXRATE
Response of CPRICE to M2
Response of CPRICE to CPIN
Response of M0 to CPRICE
Response of M0 to M0
Response of M0 to LRATE
Response of M0 to EXRATE
Response of M0 to M2
Response of M0 to CPIN
Response of LRATE to CPRICE
Response of LRATE to M0
Response of LRATE to LRATE
Response of LRATE to EXRATE
Response of LRATE to M2
Response of LRATE to CPIN
Response of EXRATE to CPRICE
Response of EXRATE to M0
Response of EXRATE to LRATE
Response of EXRATE to EXRATE
Response of EXRATE to M2
Response of EXRATE to CPIN
Response of M2 to CPRICE
Response of M2 to M0
Response of M2 to LRATE
Response of M2 to EXRATE
Response of M2 to M2
Response of M2 to CPIN
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Response of CPIN to LRATE
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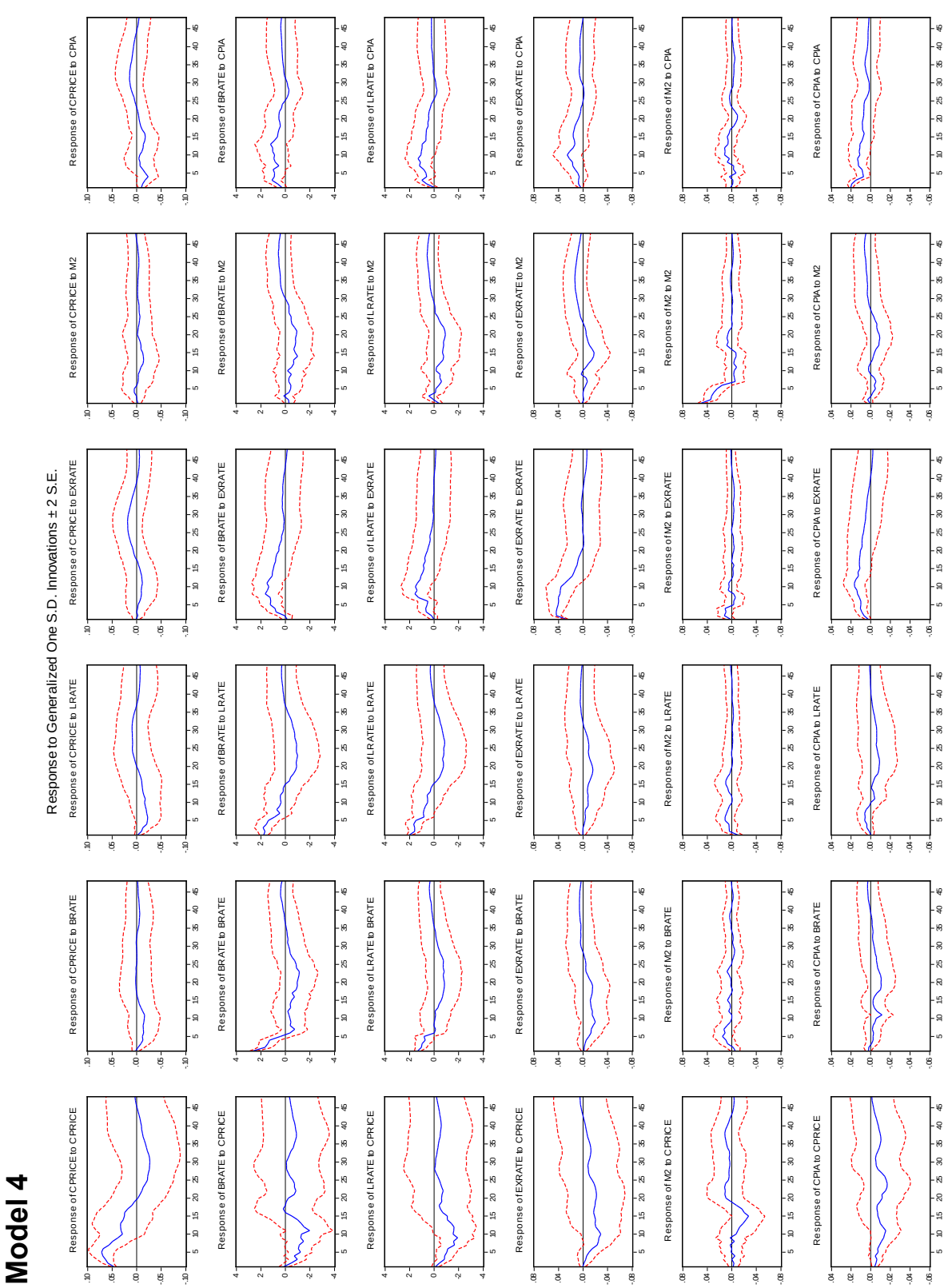
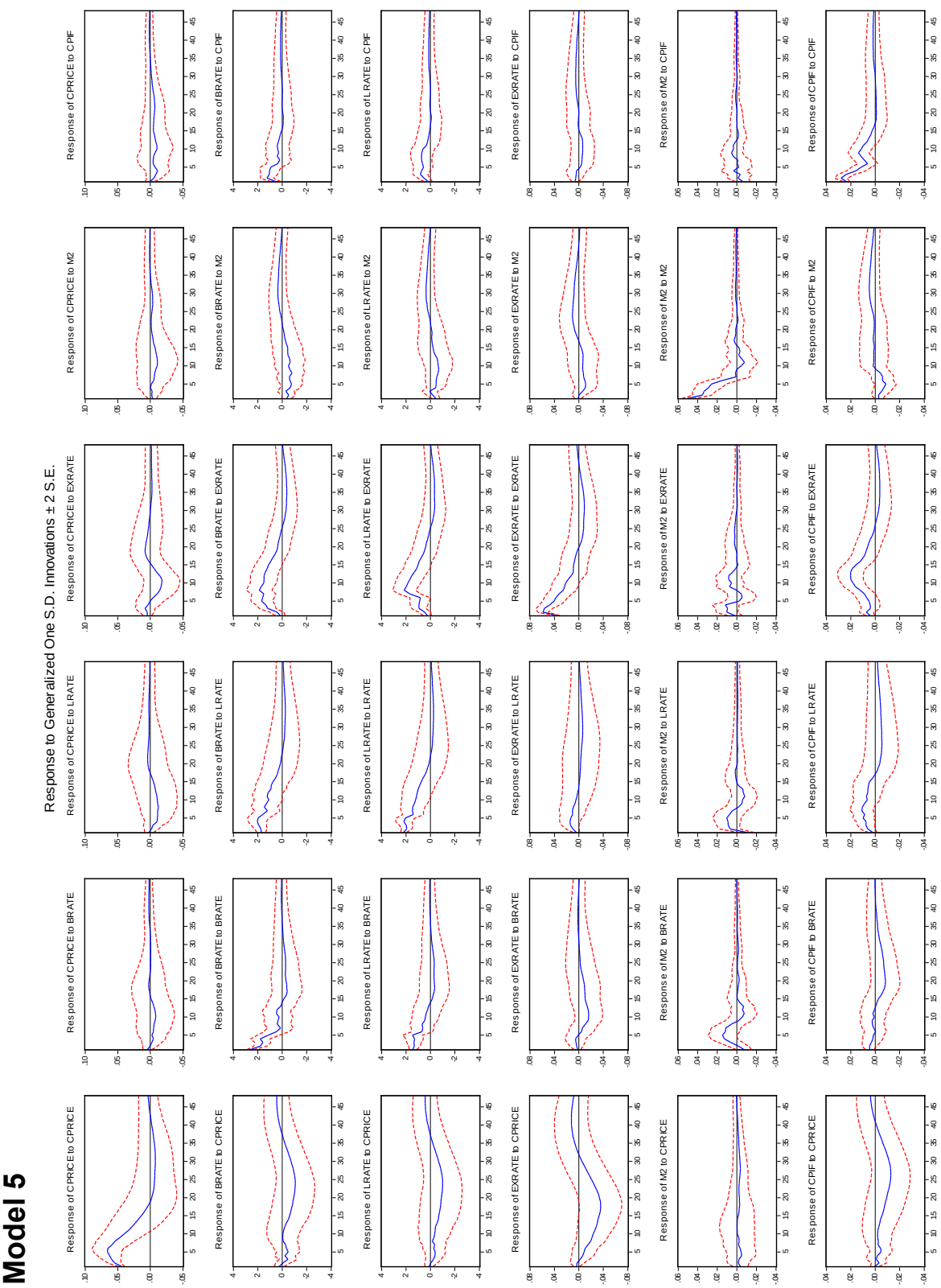

Model 4
Response to Generalized One S.D. Innovations ± 2 S.E.
Response of CPRICE to CPRICE
Response of CPRICE to BRATE
Response of CPRICE to LRATE
Response of CPRICE to EXRATE
Response of CPRICE to M2
Response of CPRICE to CPIA
Response of BRATE to CPRICE
Response of BRATE to BRATE
Response of BRATE to LRATE
Response of BRATE to EXRATE
Response of BRATE to M2
Response of BRATE to CPIA
Response of LRATE to CPRICE
Response of LRATE to BRATE
Response of LRATE to LRATE
Response of LRATE to EXRATE
Response of LRATE to M2
Response of LRATE to CPIA
Response of EXRATE to CPRICE
Response of EXRATE to BRATE
Response of EXRATE to LRATE
Response of EXRATE to EXRATE
Response of EXRATE to M2
Response of EXRATE to CPIA
Response of M2 to CPRICE
Response of M2 to BRATE
Response of M2 to LRATE
Response of M2 to EXRATE
Response of M2 to M2
Response of M2 to CPIA
Response of CPIA to CPRICE
Response of CPIA to BRATE
Response of CPIA to LRATE
Response of CPIA to EXRATE
Response of CPIA to M2
Response of CPIA to CPIA


Model 5
Response to Generalized One S.D. Innovations ± 2 S.E.
Response of CPRICE to CPRICE
Response of CPRICE to BRATE
Response of CPRICE to LRATE
Response of CPRICE to EXRATE
Response of CPRICE to M2
Response of CPRICE to CPIF
Response of BRATE to CPRICE
Response of BRATE to BRATE
Response of BRATE to LRATE
Response of BRATE to EXRATE
Response of BRATE to M2
Response of BRATE to CPIF
Response of LRATE to CPRICE
Response of LRATE to BRATE
Response of LRATE to LRATE
Response of LRATE to EXRATE
Response of LRATE to M2
Response of LRATE to CPIF
Response of EXRATE to CPRICE
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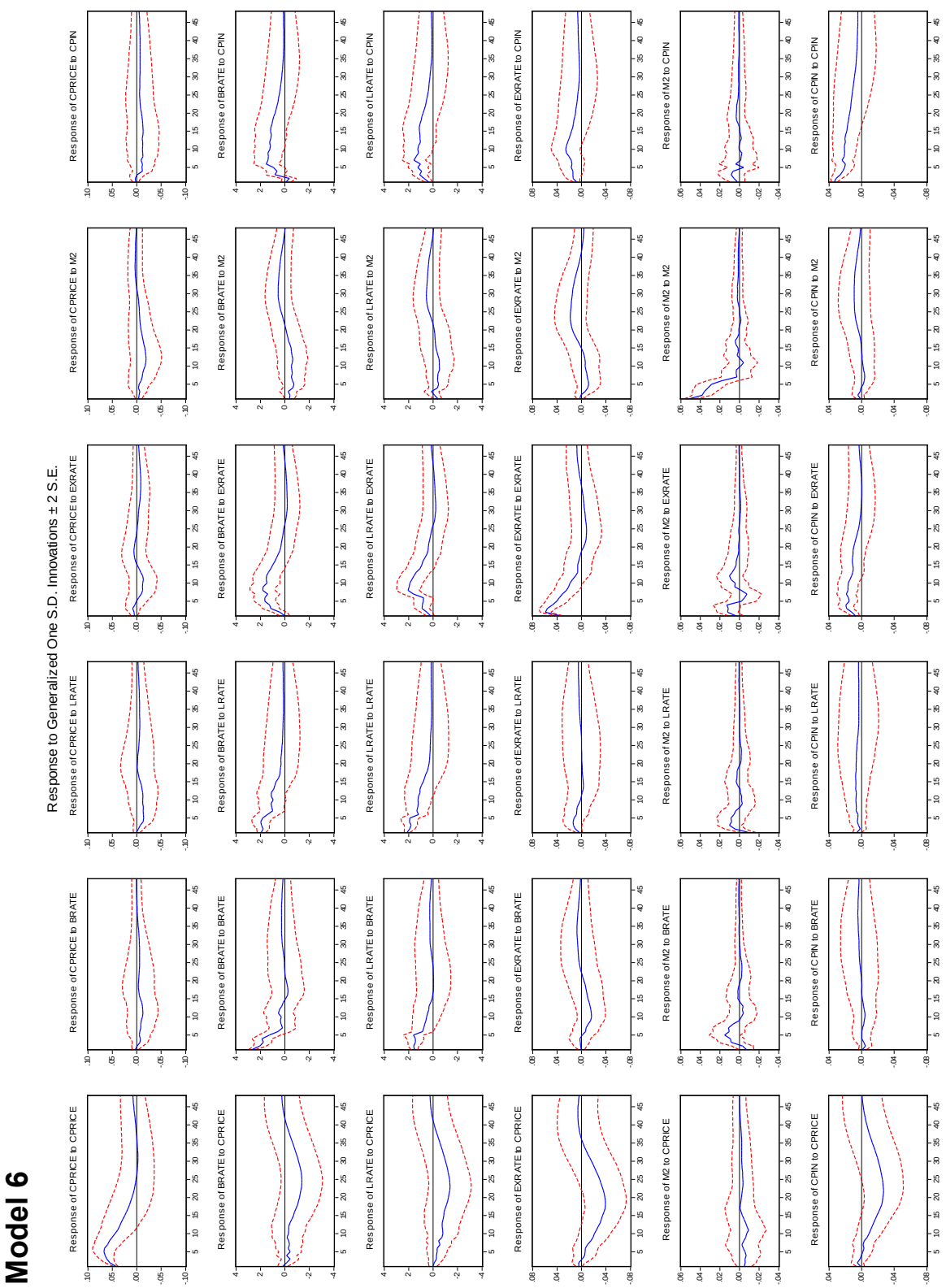
Response of CPIF to M2
Response of CPIF to CPIF


Model 6
Response to Generalized One S.D. Innovations ± 2 S.E.
Response of CPRICE to CPRICE
Response of CPRICE to BRATE
Response of CPRICE to LRATE
Response of CPRICE to EXRATE
Response of CPRICE to M2
Response of CPRICE to CPIN
Response of BRATE to CPRICE
Response of BRATE to BRATE
Response of BRATE to LRATE
Response of BRATE to EXRATE
Response of BRATE to M2
Response of BRATE to CPIN
Response of LRATE to CPRICE
Response of LRATE to BRATE
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Response of CPIN to CPIN

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