Uneven Transmission: Monetary Policy, Sectoral Asymmetries, and the Planning Gap Under Malawi 2063

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Abstract

This paper examines the sectoral transmission of monetary policy in Malawi and its alignment with the country's long-term national development agenda, Malawi 2063 (MW2063). Moving beyond aggregate models, it disaggregates the effects of monetary shocks across agriculture, manufacturing, and services—the three strategic sectors identified under MW2063. Using a recursively identified Vector Autoregressive (VAR) model and annual data from 1994 to 2024, the study assesses how policy impulses transmitted through interest rate, credit, and exchange rate channels influence sectoral output. Results from impulse response functions and forecast error variance decompositions reveal a highly uneven transmission mechanism: agriculture is particularly sensitive to credit and exchange rate shocks, services respond primarily to exchange rate dynamics, while manufacturing appears largely unresponsive. These asymmetries raise concerns about the efficacy of uniform monetary policy stances in structurally diverse economies. The paper calls for a more differentiated, sector-sensitive monetary framework, aligned with Malawi's national development planning architecture. Importantly, the realisation of this alignment demands greater institutional convergence: harmonising the Reserve Bank of Malawi's stabilisation mandate with the developmental roles of the Ministry of Finance and Economic Affairs and the National Planning Commission.

Key Words: Monetary Policy; Transmission Mechanisms; Interest Rate Channel; Credit Channel; Exchange Rate Channel; Sectoral Output; Recursive VAR; Malawi 2063

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1. Introduction

Monetary policy is traditionally viewed through the lens of aggregate macroeconomic stabilisation, with price stability as its principal target. However, in structurally diverse economies like Malawi, the assumption of uniform policy transmission across sectors is increasingly untenable. Sectoral heterogeneity in production structures, access to finance, and exposure to global markets can cause monetary shocks to reverberate unevenly, amplifying vulnerabilities in some sectors while leaving others relatively unaffected. Recognising and addressing these asymmetries is essential if monetary policy is to serve not only as a tool of stabilisation but also as an enabler of structural transformation (Mishra, Montiel & Spilimbergo, 2012; Mishkin, 1996).

This imperative is particularly relevant in Malawi, where the national development blueprint, Malawi 2063 (MW2063), identifies agriculture, manufacturing, and services (particularly tourism) as the three strategic pillars of long-term growth and transformation (Government of Malawi, 2021a). Yet, despite their prioritisation in national planning documents, the empirical foundations for sector-specific monetary calibration remain thin, limiting policymakers' ability to align monetary instruments with sectoral growth dynamics. This disconnect raises concerns about the coherence of macroeconomic stabilisation efforts with broader structural transformation goals.

Literature from sub-Saharan Africa underscores this concern. Monetary transmission mechanisms in the region often exhibit asymmetric sectoral effects, particularly when financial markets are shallow or sectoral credit penetration is low (Nwosa & Olufemi, 2011; Nampewo et al., 2013). In Malawi, however, most empirical studies focus on aggregate outcomes such as inflation and output growth (Chavula, 2016; Mangani, 2012) or narrow financial sector metrics (Jansen, Mlambo & Kamanga, 2013), with limited attention to sectoral disaggregation. This has left a gap in understanding how macroeconomic tools interface with the structure of the real economy.

This limitation is compounded by institutional constraints. The Reserve Bank of Malawi (RBM), while nominally independent, operates under conditions of limited instrument autonomy and is often constrained by shallow domestic financial markets, periods of fiscal dominance, and weak policy coordination mechanisms (Mapila, 2024; Reserve Bank of Malawi, 2022). These constraints hinder the flexibility and efficacy of monetary policy in supporting real sector transformation, making sectoral analysis even more urgent.

This paper addresses this policy-design gap by examining the sectoral transmission of monetary policy in Malawi and evaluating its alignment with MW2063. Specifically, the study employs a recursively identified Vector Autoregressive (VAR) model on three decades of annual data (1994–2024) to trace how monetary impulses, transmitted through interest rate, credit, and exchange rate channels, differentially influence output in agriculture, manufacturing, and services. Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD) are used to reveal the structural asymmetries in Malawi's monetary transmission mechanism by quantifying sector-specific responses to policy shocks.

The findings show that agriculture is particularly sensitive to credit shocks and exchange rate movements, reflecting its dependence on external inputs and constrained access to finance. Services are shaped predominantly by exchange rate dynamics, owing to their import intensity and exposure to external demand, while manufacturing appears largely insulated from monetary instruments, highlighting potential disconnects between macro-financial conditions and industrial

policy. These asymmetries suggest that uniform monetary stances may inadvertently reinforce existing structural inequalities, undermining the broader aims of MW2063.

The paper advocates for a more nuanced sector-sensitive approach to monetary policy, one explicitly linked to the national planning architecture, including the MW2063 First 10-Year Implementation Plan (MIP-1). Realising this alignment calls for institutional convergence: harmonising the RBM's stabilisation mandate with the developmental roles of the Ministry of Finance and Economic Affairs (MoFEA) and the National Planning Commission (NPC), so that monetary policy becomes not just a countercyclical tool but a lever for inclusive and strategic development (Government of Malawi, 2021b).

The remainder of the paper is organised as follows. Section 2 presents a review of the theoretical and empirical literature on monetary transmission and sectoral heterogeneity. Section 3 outlines the methodological framework and data sources used in the analysis. Section 4 presents and discusses the empirical findings within the context of the MW2063 development agenda. Section 5 concludes with key reflections on the implications of the findings for monetary policy design and structural transformation in Malawi.

2. Literature Review

2.1. Theoretical Framework: Sectoral Transmission of Monetary Policy in a Development Planning Context

Monetary policy transmission refers to the mechanism through which policy actions, primarily changes in the central bank's policy rate, affect the real economy via intermediate variables such as interest rates, credit, exchange rates, and asset prices. These mechanisms transmit policy-induced impulses to aggregate demand, output, and inflation (Mishkin, 2021).

Grounded in the Keynesian theoretical framework of monetary policy transmission in the real sector, this study follows the tradition which emphasises the dominance of aggregate demand in determining short-run output fluctuations due to nominal and real rigidities. Specifically, the analysis aligns with New Keynesian extensions that incorporate intertemporal expectations, forward-looking behaviour, and financial frictions into dynamic macroeconomic models (Clarida, Galí & Gertler, 1999; Woodford, 2003; Ireland, 2005).

In the context of small open economies such as Malawi, monetary transmission is shaped by structural characteristics including underdeveloped financial markets, limited financial inclusion, dependence on external trade, and exposure to global shocks. Consequently, the operation of monetary policy channels may diverge from canonical models based on advanced economies, both in their sequencing and intensity (Mangani, 2011; Chirwa & Odhiambo, 2016).

This study identifies four canonical transmission channels: the interest rate, credit, exchange rate, and asset price channels. The first three are retained for empirical estimation, while the asset price channel is discussed conceptually but excluded due to context-specific limitations.

The salience and relative potency of these channels are further shaped by sector-specific structural characteristics. Agriculture, which depends heavily on imported inputs and seasonal credit, is highly vulnerable to exchange rate shocks and credit constraints. Manufacturing, while capital-intensive, remains largely disconnected from formal finance in Malawi, potentially muting interest

rate transmission. Services, particularly those reliant on external demand or imported goods such as tourism and logistics, are likely to exhibit stronger responses to exchange rate fluctuations (Chirwa & Odhiambo, 2016; Mangani, 2012). These differences reflect underlying structural asymmetries, reinforcing the need for sector-disaggregated analysis.

2.1.1. Interest Rate Channel: Primary Transmission Mechanism

The interest rate channel is the most traditional and extensively studied conduit for monetary policy. It operates through adjustments in the central bank's policy rate, which influence market interest rates, the cost of capital, and the intertemporal decisions of households and firms. Under conditions of nominal price stickiness, changes in nominal interest rates translate into variations in real interest rates, which affect investment and consumption decisions (Bernanke & Gertler, 1995; Mankiw, 1985; Singh, 2014).

This relationship is formalised through the Taylor Rule, which specifies the short-term nominal interest rate as a function of deviations in inflation and output from their respective targets:

$$i_t = \emptyset_0 + \emptyset_\pi(\pi_t - \pi^*) + \emptyset_y(y_t - y^*) \qquad (1)$$

Where:

- i_t = nominal short-term interest rate
- π_t, π^*= actual and target inflation
- y_t, y^* = actual and potential output

Under this transmission mechanism, contractionary monetary policy (increase in i_t) raises the real interest rate $r_t = i_t - E_t(\pi_{t+1})$, thereby increasing the cost of borrowing. This suppresses capital formation and consumption, especially of durables. In Malawi, the interest rate channel remains critical due to the prominence of bank-intermediated credit and the use of the Treasury bill rate as the primary policy signal (Mangani, 2012; Ngalawa, 2009).

2.1.2. Credit Channel: Financial Market Frictions and Amplification Effects

The credit channel complements the interest rate channel by capturing the effects of monetary policy through information asymmetries and financial frictions. It operates via two sub-channels:

- The **balance sheet channel** (Bernanke & Gertler, 1995; Angelopoulou & Gibson, 2009) posits that monetary tightening reduces firm and household net worth, thereby increasing the external finance premium and weakening loan demand.

- The **bank lending channel** suggests that higher policy rates reduce bank reserves and deposits, limiting the loanable funds available for bank-dependent borrowers, particularly small and medium enterprises (Mishkin, 2007; Ghosh, 2019).

In Malawi, where the credit market is segmented and access to formal finance remains constrained for most agricultural producers and informal firms, the credit channel is especially relevant. Borrowers with limited collateral or credit histories face disproportionately large financing constraints when monetary policy tightens (Chirwa & Odhiambo, 2016).

2.1.3. Exchange Rate Channel: External Transmission in an Open Economy

The exchange rate channel captures how monetary policy affects the real economy through changes in the relative price of domestic and foreign goods. In an open economy, higher domestic interest rates attract capital inflows and cause the domestic currency to appreciate. Under the Uncovered Interest Parity (UIP) condition, the expected change in the exchange rate equals the interest rate differential:

$$E_t(e_{t+1}) - e_t = i_t - i_t^* \qquad (2)$$

Where:

- e_t = nominal exchange rate (domestic currency per unit of foreign currency)
- i_t, i_t^* = domestic and foreign interest rates

A currency appreciation reduces export competitiveness and encourages imports, thereby negatively impacting output in export-oriented and import-competing sectors (Giovanni & Shambaugh, 2008; Gruen & Shuetrim, 1994). In Malawi, this channel is particularly relevant for manufacturing sectors reliant on imported intermediate goods or oriented toward regional export markets (Mangani, 2011; Nampewo et al., 2013).

2.1.4. Asset Price Channel: Theoretical Relevance and Empirical Exclusion

The asset price channel transmits monetary policy impulses through changes in financial and real estate asset prices. It operates via two distinct mechanisms:

- **Tobin's q Theory of Investment** (Tobin, 1969):

$$q = \frac{Market\ Value\ of\ Existing\ Capital}{Replacement\ Cost\ of\ Capital} \qquad (3)$$

Higher q values following expansionary policy encourage investment by making new capital formation more profitable.

- **Wealth Effect:** Rising asset prices increase household net wealth, stimulating consumption in accordance with life-cycle or permanent income hypotheses (Mishkin, 2007).

However, several factors limit the operational relevance of this channel in Malawi:

- The Malawi Stock Exchange is thin, with fewer than 20 listed firms and minimal public participation. Market capitalisation remains below 10% of the gross domestic product (RBM, 2022).
- Household asset ownership is concentrated in non-financial assets, often outside formal markets.

- Informal land tenure systems and limited mortgage finance reduce monetary policy transmission through real estate prices.

This channel is omitted from the empirical specification in line with empirical precedents for low-income countries (Nampewo et al., 2013; Mangani, 2011). Its theoretical relevance is acknowledged but constrained by institutional and structural factors

2.1.5. A Joint Theoretical Model: Modified Open-Economy IS Equation

The interaction of these transmission mechanisms can be synthesised through a modified open-economy IS curve, capturing forward- and backwards-looking behaviour, interest rate dynamics, and financial frictions (Ireland, 2005; Sznajderska, 2011):

$$y_t = \gamma_1 y_{t-1} + \gamma_2 E_1(y_{t+1}) - \gamma_3 r_t + \gamma_4 q_t - \gamma_5 s_t + \varepsilon_t \quad (4)$$

Where:

- y_t = real output
- r_t = real interest rate (interest rate channel)
- q_t = real exchange rate (exchange rate channel)
- s_t = interest rate spread or credit constraint proxy (credit channel)
- ε_t = structural shocks

This conceptual model guides the empirical analysis, which subsequently employs a recursive VAR model to identify sector-specific responses to monetary policy shocks through the three retained channels.

2.1.6. Summary and Sectoral Implications of Transmission Channels

The table below provides a synthesis of the transmission channels discussed, outlining their underlying mechanisms, empirical proxies, sectoral relevance in the Malawian context, and inclusion status in the empirical model. The interest rate channel remains the most robust and broadly applicable. The credit channel captures financing constraints in agriculture and the informal sector, while the exchange rate channel accounts for openness to trade. The asset price channel is omitted due to structural limitations, though its conceptual role is acknowledged

Table 1: Transmission Mechanisms, Proxies, and Sectoral Sensitivities

Transmission Channel	Theoretical Mechanism	Proxy Variable(s)	Sectoral Sensitivity	Empirically Modelled
Interest Rate	Cost of capital; intertemporal substitution	Treasury bill rate, lending rate	Manufacturing, services, construction	Yes
Credit	Financial frictions; loan supply constraints	Private sector credit	Agriculture, informal SMEs	Yes
Exchange Rate	Trade competitiveness; import prices	Nominal exchange rate	Export-oriented and import-dependent sectors	Yes
Asset Price	Tobin's q; wealth effect on consumption	Stock prices, real estate values	Minimal – underdeveloped financial/asset markets	Excluded

Source: Author's synthesis based on Bernanke & Gertler (1995), Mishkin (2007, 2021), Mangani (2011), and Nampewo et al. (2013).

2.2. Review of Related Empirical Literature

A substantial body of empirical literature on Malawi's monetary policy transmission relies on aggregate macroeconomic frameworks that assume uniformity across sectors. While these models offer valuable insights into overall policy effectiveness, they tend to abstract from structural heterogeneity and institutional frictions that shape sector-specific dynamics. As a result, they may obscure critical asymmetries rooted in variations in credit access, trade orientation, and capital intensity. This study addresses that analytical blind spot by centring sectoral heterogeneity in its empirical strategy.

In the Malawian context, empirical investigations have traditionally focused on headline outcomes—particularly inflation and aggregate output. Foundational studies by Ngalawa (2009) and Mangani (2012) employed structural vector autoregressive (SVAR) models to estimate the macroeconomic impact of monetary policy shocks. Ngalawa (2009) demonstrated that the central bank pursues hybrid policy rules, influencing both price levels and output. Mangani (2012), however, cast doubt on the effectiveness of monetary policy in stabilising prices. While these studies contributed to early understandings of policy transmission, they remained rooted at the macro level, offering limited insight into disaggregated effects.

More recent contributions introduced methodological innovation but maintained an aggregate lens. Mwabutwa et al. (2013) applied a time-varying parameter VAR model with stochastic volatility to examine the evolution of monetary transmission post-liberalisation. Their results showed changing responsiveness of real variables over time. Similarly, Chavula (2016) found weak linkages between policy rates and real output using a small macroeconometric model, calling into

question the reliability of traditional transmission channels. Yet despite their technical advances, these studies continued to treat the economy as a homogeneous entity.

Disaggregated analyses remain rare in Malawi, though some recent efforts show a shift. Matola (2023) applied both ARDL and VAR techniques to examine the responsiveness of industrial output to monetary policy shocks. The findings suggest limited pass-through, potentially due to credit constraints, informality, or infrastructure bottlenecks. However, the study did not include agriculture or services, leaving much of the economy unexplored. Jansen et al. (2013) contributed a narrower firm-level perspective by analysing listed companies but similarly lacked sectoral breadth or a multi-channel framework.

In contrast, sector-sensitive studies elsewhere in sub-Saharan Africa illustrate how structural characteristics shape transmission outcomes. Nampewo et al. (2013), using a recursive VAR model in Uganda, found that credit and exchange rate channels produced differentiated responses across sectors, with the exchange rate emerging as the most potent conduit. Nwosa and Olufemi (2011) reported comparable patterns in Nigeria: the interest rate channel had stronger effects on agriculture and manufacturing, while services and construction were more sensitive to exchange rate shocks. These findings emphasise how seasonality, import dependency, and financial market depth mediate sectoral reactions.

Internationally, comparative evidence reinforces the importance of disaggregated analysis. Bittencourt et al. (2013) showed that contractionary monetary policy in South Africa disproportionately affected employment in interest-sensitive sectors, exacerbating income inequality. Singh (2014), employing a structural VAR model in India, found that services and manufacturing exhibited distinct response trajectories to policy shocks, underscoring the need for sector-calibrated instruments. Khundrakpam and Jain (2012) similarly observed delayed but significant impacts of interest rate and credit channels on GDP components, with a relatively weak exchange rate effect—an observation consistent across many developing economies.

Research from high-income contexts affirms these asymmetries. Tena and Tremayne (2009) demonstrated that UK manufacturing sub-sectors responded unevenly to monetary tightening, and that accounting for threshold effects improved the explanatory power of empirical models. In Canada, Farès and Srour (2001) found that construction and manufacturing were more responsive to interest rate changes than services, attributing these patterns to sectoral differences in capital intensity, output durability, and export orientation. These studies confirm that even in financially advanced economies, sectoral characteristics are central to understanding monetary transmission.

The theoretical underpinnings of this literature trace back to Bernanke and Gertler (1995), who used a recursive VAR framework to highlight how credit market frictions amplify monetary policy effects, particularly in capital-intensive sectors. Christiano, Eichenbaum, and Evans (2005) advanced a New Keynesian-compatible VAR model to trace the dynamic effects of policy shocks, while Taylor (1995) provided the rule-based policy framework that continues to anchor empirical investigations.

In summary, the literature increasingly recognises that monetary transmission is neither uniform nor temporally fixed but instead shaped by structural conditions and sectoral configurations. In Malawi, however, empirical research remains largely aggregated, offering limited visibility into

how priority sectors (agriculture, manufacturing, and services) respond to policy interventions. This paper contributes to closing that gap by employing a recursive VAR model identified through a Cholesky decomposition to trace the effects of interest rate, credit, and exchange rate shocks on sectoral output over the period 1994–2024. In doing so, it links macroeconomic analysis more directly to Malawi's long-term structural transformation agenda under MW2063.

3. Methodology

3.1. Analytical Approach

This study adopts a recursively identified VAR model to assess the sectoral effects of monetary policy in Malawi. The VAR framework is well-suited to examining the dynamic interactions among macroeconomic variables in data-limited settings without imposing strong theoretical restrictions (Sims, 1980; Stock & Watson, 2001). Structural shocks are identified using a Cholesky decomposition of the variance–covariance matrix of reduced-form residuals, allowing for the simulation of IRFs and FEVDs.

This approach follows established practice in the monetary transmission literature (Bernanke & Gertler, 1995; Christiano, Eichenbaum & Evans, 2005), where policy shocks are traced through multiple channels—interest rate, credit, and exchange rate—to assess their impact on real activity. The method is particularly suitable for low-income economies like Malawi, where monetary policy instruments adjust more rapidly than real output, and where institutional lags and financial frictions delay sectoral responses. The recursive structure reflects these timing asymmetries by treating monetary variables as contemporaneously exogenous and allowing output to respond with a lag.

The model selection is further justified by precedent in similar contexts, notably Nampewo et al. (2013), who applied a recursive VAR to assess sectoral responses to monetary shocks in Uganda. Given the structural and institutional similarities between Uganda and Malawi, this identification strategy is both theoretically and contextually appropriate. Compared to structural VARs, which require strong identifying restrictions, and ARDL models, which focus primarily on long-run equilibrium, the recursive VAR offers a more flexible and empirically grounded tool for capturing sector-specific transmission dynamics.

3.2.Model Specification

The analysis estimates three separate reduced-form VAR models, each tailored to one of Malawi's major productive sectors: agriculture, manufacturing, and services. While the macroeconomic variables remain the same across models, each includes a distinct measure of sectoral output as the dependent variable.

The general form of the VAR(p) model is:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \mu + \varepsilon_t \qquad (5)$$

Where:

- Y_t is the vector of endogenous variables
- A_i are matrices of autoregressive coefficients
- μ is a vector of deterministic components (constant)
- ε_t is a vector of white-noise residuals

The endogenous variables are:

i. Treasury bill rate (TB) – proxy for monetary policy stance
ii. Lending rate (LR) – captures the interest rate channel
iii. Private sector credit (PR) – captures the credit channel
iv. Nominal exchange rate (EXC) – captures the exchange rate channel and is proxied by real effective exchange rate (REER) for reasons discussed below
v. Consumer Price Index (CPI) – controls for inflationary dynamics
vi. Sectoral output – real value added for agriculture (AGR), manufacturing (MAN), or services (SER)

3.3. Identification Strategy

To identify structural shocks, the study applies a recursive Cholesky decomposition to the variance–covariance matrix of the reduced-form residuals. This strategy imposes a causal ordering of variables based on the timing assumptions that reflect both economic theory and the institutional policy environment in Malawi. The ordering is specified as:

$$TB \rightarrow LR \rightarrow PR \rightarrow REER \rightarrow CPI \rightarrow Sectoral\ Output$$

This structure assumes that policy instruments (TB) are set contemporaneously, influencing lending rates (LR) and credit (PR) within the same period. Exchange rate (REER) adjustments follow monetary and financial conditions, with prices (CPI) adjusting thereafter. Real output in each sector is assumed to respond last, consistent with adjustment lags in investment, production, and employment. This recursive ordering mirrors the institutional sequencing observed in Malawi and comparable developing economies and is consistent with earlier applications in sub-Saharan Africa (e.g. Nampewo et al., 2013; Nwosa and Olufemi, 2011).

3.4. Data and Variable Description

The study uses annual time series data from 1994 to 2024, sourced from the Reserve Bank of Malawi (RBM), the National Statistical Office (NSO), and the World Bank (WB).

Notably, although the theoretical framework discusses the nominal exchange rate, the empirical model employs the real effective exchange rate (REER), which more accurately captures Malawi's competitiveness across multiple trading partners.

All real variables (e.g., sectoral output, CPI, PR) are expressed in natural logarithms, while interest rates and the exchange rate are used in levels. Table 2 summarises the variables included in the recursive VAR model, along with their definitions and data sources.

Table 2: Description of Variables and Data Sources

Variable	Description	Source
TB	Nominal 91-day Treasury bill rate (%)	RBM
LR	Average lending rate to private sector (%)	RBM
PR	Credit to private sector (nominal, local currency units)	WB
REER	Real Effective Exchange Rate index (2010 = 100)	WB
CPI	Consumer Price Index (2010 = 100)	NSO, WB
AGR	Real value added in agriculture (constant 2010 prices)	NSO, WB
MAN	Real value added in manufacturing (constant 2010 prices)	NSO, WB
SER	Real value added in services (constant 2010 prices)	NSO, WB

Source: Author's compilation based on data from RBM, NSO and WB.

3.5. Estimation Procedure

The estimation follows these steps:

a) **Unit Root Testing**: Stationarity is assessed using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests.

b) **Lag Selection**: The optimal lag length is determined using the Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn Criterion (HQ).

c) **Granger Causality Testing:** VAR Granger causality (Block Exogeneity Wald Tests) is conducted within the VAR framework to assess whether monetary policy variables (TB, LR, PR, REER) jointly Granger-cause sectoral output. This preliminary step supports the assessment of dynamic interlinkages and informs the interpretation of VAR results.

d) **VAR Estimation**: Separate VARs are estimated for each sector.

e) **Impulse Response Analysis**: One-standard-deviation structural shocks are simulated to examine the dynamic responses of sectoral output.

f) **Forecast Error Variance Decomposition**: FEVD is used to quantify the proportion of output variation attributable to each monetary policy variable over a 10-year horizon.

g) **Diagnostic Tests**: Residual autocorrelation (LM test), heteroskedasticity (White test), and normality (Jarque-Bera test) are conducted to assess model robustness.

4. Results and Discussion

This section presents and interprets the results from the recursively identified VAR models estimated separately for agriculture, manufacturing, and services. The aim is to trace the dynamic responses of sectoral output to monetary policy shocks transmitted through interest rate, credit, and exchange rate channels. The results are analysed in relation to theoretical expectations and Malawi's development ambitions under MW2063. The discussion integrates unit root and lag diagnostics, VAR Granger causality tests, model stability checks, impulse response functions (IRFs), and forecast error variance decomposition (FEVD)

4.1. Stationarity and Lag Selection

Unit root tests using the ADF and PP procedures were performed on all variables. The results, presented in Table 3, confirm that all series are integrated of order one, I (1). This supports the use of a level VAR model consistent with the Sims (1980) framework for I (1) data.

Table 3: Augmented Dickey-Fuller and Philip Perron unit root test results

Variable	Augmented Dickey-Fuller (ADF)		Philips-Perron (PP)		Order of Integration
	Level	First difference	Level	First difference	
TB	-1.7913	-5.8742***	-1.7487	-5.8379***	I (1)
LR	-2.4458	-4.8721***	-2.2127	-4.8746***	I (1)
Log PR	-0.4564	-4.9556***	-0.5987	-4.9574***	I (1)
REER	-1.8202	-5.5905***	-1.6888	-6.7972***	I (1)
Log CPI	-0.7115	-3.4907**	-2.1151	-4.8672***	I (1)
Log AGR	-0.4876	-10.613***	-0.7227	-10.242***	I (1)
Log MAN	-1.1433	-5.7983***	-1.2231	-6.2688***	I (1)
Log SER	-2.1469	-5.8255***	-5.5622***	-5.8191***	I (1)

*Note: *** p<0.01 statistically significant at 1%, ** p<0.05 statistically significant at 5%, * p<0.1 statistically significant at 10%.*

Logarithmic transformation was applied to sectoral output (AGR, MAN, SER), the Consumer Price Index (CPI), and private sector credit (PR) to stabilise variance and facilitate proportional interpretation of shocks in the impulse response analysis. The Real Effective Exchange Rate (REER) was retained in the model based on its I (1) behaviour and empirical relevance in capturing Malawi's external competitiveness in a multi-currency trade context.

The optimal lag length was selected using the Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn Criterion (HQ). As shown in Table 4, all criteria favoured a lag length of one for each sectoral model.

Table 4: Lag Length Selection Criteria by Sector

Sector	LR	FPE	AIC	SC	HQ	Selected Lag
Agriculture	1	1	1	1	1	1*
Manufacturing	1	1	1	1	1	1*
Services	1	2	3	1	1	1*

*Note: * indicates optimal lag length*

4.2. Granger Causality Tests

VAR Granger causality was tested using the Block Exogeneity Wald test to assess whether monetary policy variables (Treasury bill rate, lending rate, private sector credit, and REER) jointly Granger-cause output in each sector. The results are summarised in Table 5.

Table 5: VAR Granger Causality/Block Exogeneity Wald Tests Results (p-values)

Null Hypothesis	AGR Output	MAN Output	SER Output
TB does not Granger-cause output	0.1965	0.2783	0.9560
LR does not Granger-cause output	0.2990	0.2916	0.7113
PR does not Granger-cause output	0.0155	0.4163	0.2915
REER does not Granger-cause output	0.7053	0.6719	0.5830

*Note: *** p<0.01 statistically significant at 1%, ** p<0.05 statistically significant at 5%, * p<0.1 statistically significant at 10%.*

The test results show that private sector credit (PR) significantly Granger-causes output in agriculture ($p = 0.0155$), reinforcing the notion that credit access is vital for agricultural production. In contrast, no monetary variable significantly predicts output in manufacturing or services at the 5% significance level. This suggests that the immediate predictive power of monetary instruments is weak outside the agricultural sector, though this does not preclude dynamic or lagged effects captured through IRFs.

4.3. Diagnostic Tests

Diagnostic tests were conducted to assess the statistical validity and robustness of the VAR models estimated for each sector. The results, summarised in Table 6, confirm that the models satisfy the core assumptions required for reliable inference in VAR analysis.

Tests for serial correlation using the Lagrange Multiplier (LM) procedure reveal no evidence of autocorrelation in the residuals for any of the three models. This indicates that the selected lag structure adequately captures the short-run dynamics of the system (Lütkepohl, 2005).

Assessment of residual normality using the Jarque–Bera test shows that the agriculture and services models satisfy the assumption of multivariate normality. However, the manufacturing model exhibits significant deviation from normality. While this may affect the validity of asymptotic inference in small samples, impulse IRFs and FEVDs remain interpretable under the Central Limit Theorem, especially when bootstrapped standard errors are employed (Kilian & Lütkepohl, 2017; Efron & Tibshirani, 1993).

The White test for heteroskedasticity indicates no strong evidence of residual variance instability across the models. The services model yields a borderline p-value (p = 0.052), which suggests some mild heteroskedasticity but not to a degree that undermines the model's reliability.

Crucially, all models pass the stability condition, with all inverse roots of the autoregressive characteristic polynomial lying strictly within the unit circle. This confirms that the systems are dynamically stable and suitable for computing IRFs and FEVDs over a 10-period horizon (Sims, 1980; Lütkepohl, 2005).

Table 6: Summary of VAR Diagnostic Tests

Test	Agriculture	Manufacturing	Services	Interpretation
LM Serial Correlation	p = 0.42	p = 0.74	p = 0.34	No residual autocorrelation in any model
Jarque-Bera Normality	p = 0.59	**p = 0.000***	p = 0.33	Only manufacturing residuals deviate from normality
White Heteroskedasticity	p = 0.20	p = 0.14	**p = 0.052***	No strong evidence of heteroskedasticity (services borderline)
Stability (roots < 1)	✓	✓	✓	All models are dynamically stable

*Note: *** p<0.01 statistically significant at 1%, ** p<0.05 statistically significant at 5%, * p<0.1 statistically significant at 10%.*

In summary, the diagnostics affirm that the VAR models are correctly specified and robust. Although the manufacturing model exhibits non-normal residuals and the services model shows borderline heteroskedasticity, these issues are unlikely to bias the core results, particularly given the use of bootstrapped confidence intervals.

4.4. Impulse Response Analysis and Interpretation

The IRFs trace the response of real value added in agriculture, manufacturing, and services to one-standard-deviation shocks in the Treasury bill rate (TB), lending rate (LR), private sector credit (L_PR), and the real effective exchange rate (REER), over a 10-year forecast horizon. Statistical significance is assessed using 95% confidence intervals generated via 1,000 Monte Carlo bootstraps. The results are displayed in Figures 1 through 3.

4.4.1. Agriculture Sector

Agriculture exhibits the strongest and most immediate negative response to contractionary monetary policy. A one-standard-deviation increase in the Treasury bill rate results in a sharp decline in agricultural output, which reaches its lowest point within the first two years and then gradually recovers (Figure 1). Lending rate shocks also reduce output, although the effect is more gradual and somewhat less pronounced. In contrast, positive shocks to private sector credit generate a delayed but sustained increase in output, underscoring the critical role of financial access in enabling input acquisition and seasonal production. The real effective exchange rate has a weaker and statistically less consistent influence on agriculture, suggesting that external competitiveness is a secondary concern relative to domestic financing conditions in this sector.

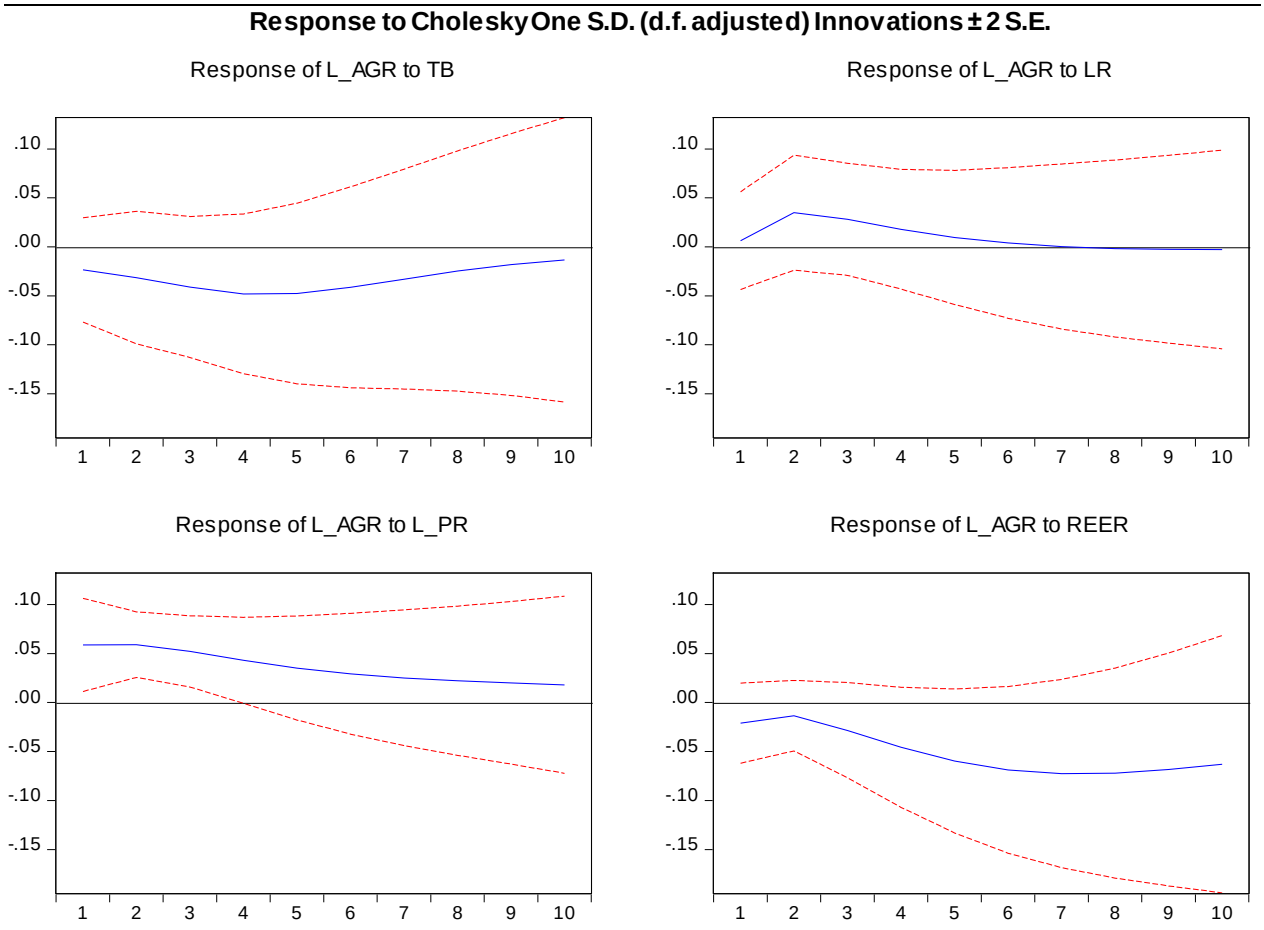

Figure 1: *Impulse Response Functions – Agriculture Output to Monetary Shocks (1994–2024)*

4.4.2. Manufacturing Sector

Manufacturing output is highly sensitive to interest rate shocks, particularly the policy rate. As shown in Figure 2, an increase in the Treasury bill rate triggers an immediate and statistically significant contraction in manufacturing output, with effects persisting well into the medium term. This is consistent with the sector's reliance on capital investment, which is closely tied to borrowing costs. Lending rate shocks similarly suppress output, though their magnitude is smaller.

Interestingly, shocks to private sector credit elicit a positive response over time, highlighting the stimulative effect of improved lending conditions on industrial activity. The exchange rate channel also exerts a negative influence, albeit more gradually, likely reflecting manufacturing's dependence on imported inputs and partial exposure to regional export markets.

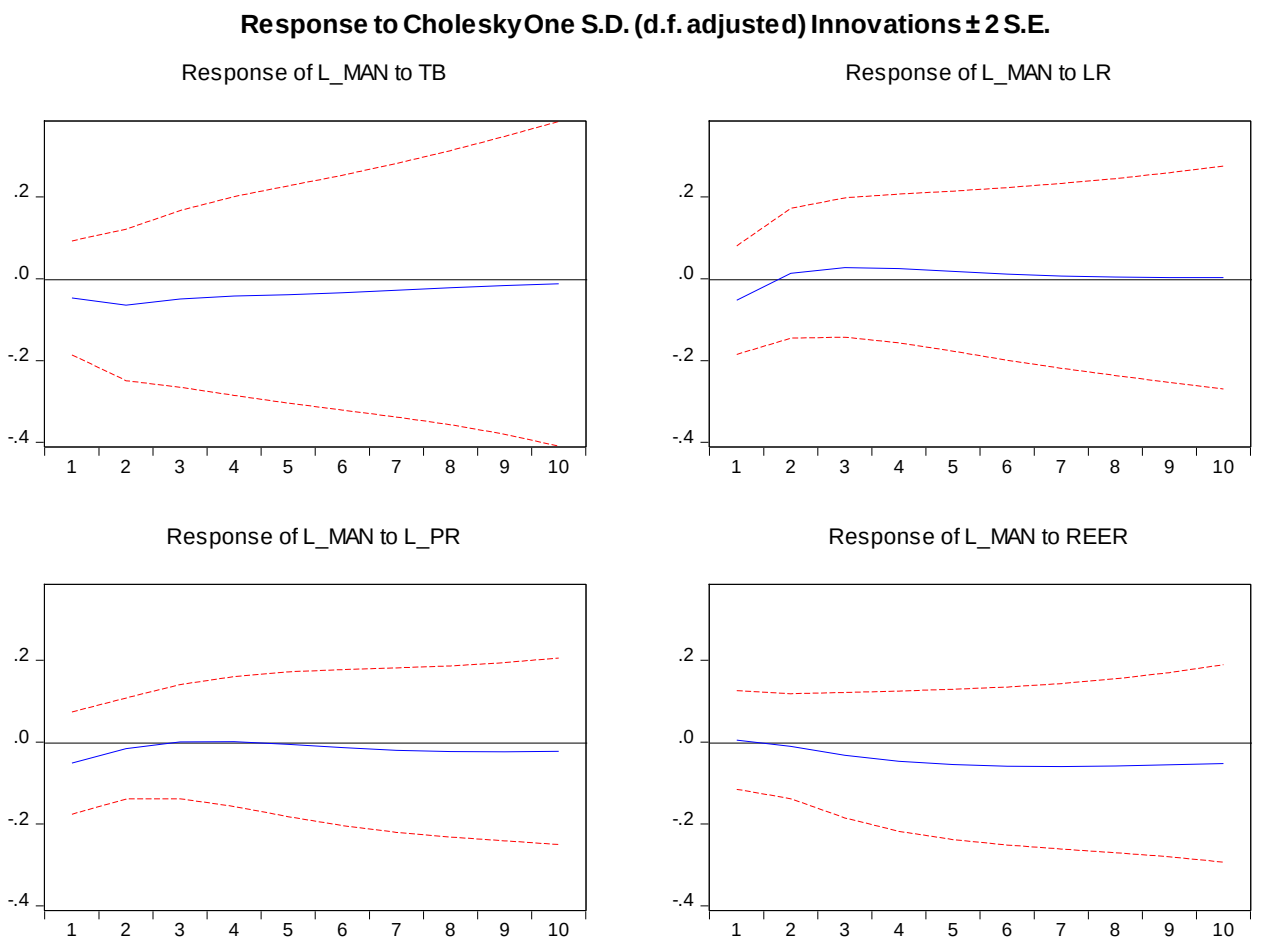

Figure 2: Impulse Response Functions – Manufacturing Output to Monetary Shocks (1994–2024)

4.4.3. Services Sector

The services sector responds quite differently to monetary policy shocks. As illustrated in Figure 3, interest rate variables (TB and LR) have minimal and statistically insignificant effects on services output, suggesting that conventional monetary tightening has limited traction in this domain. However, shocks to private sector credit produce a modest but positive effect, while REER shocks exert the most substantial and statistically significant influence. A depreciation of the real effective exchange rate leads to a pronounced increase in services output, peaking around year three. This positive response reflects the external orientation of service sub-sectors such as tourism, ICT, and logistics, which benefit from improved price competitiveness when the domestic currency weakens.

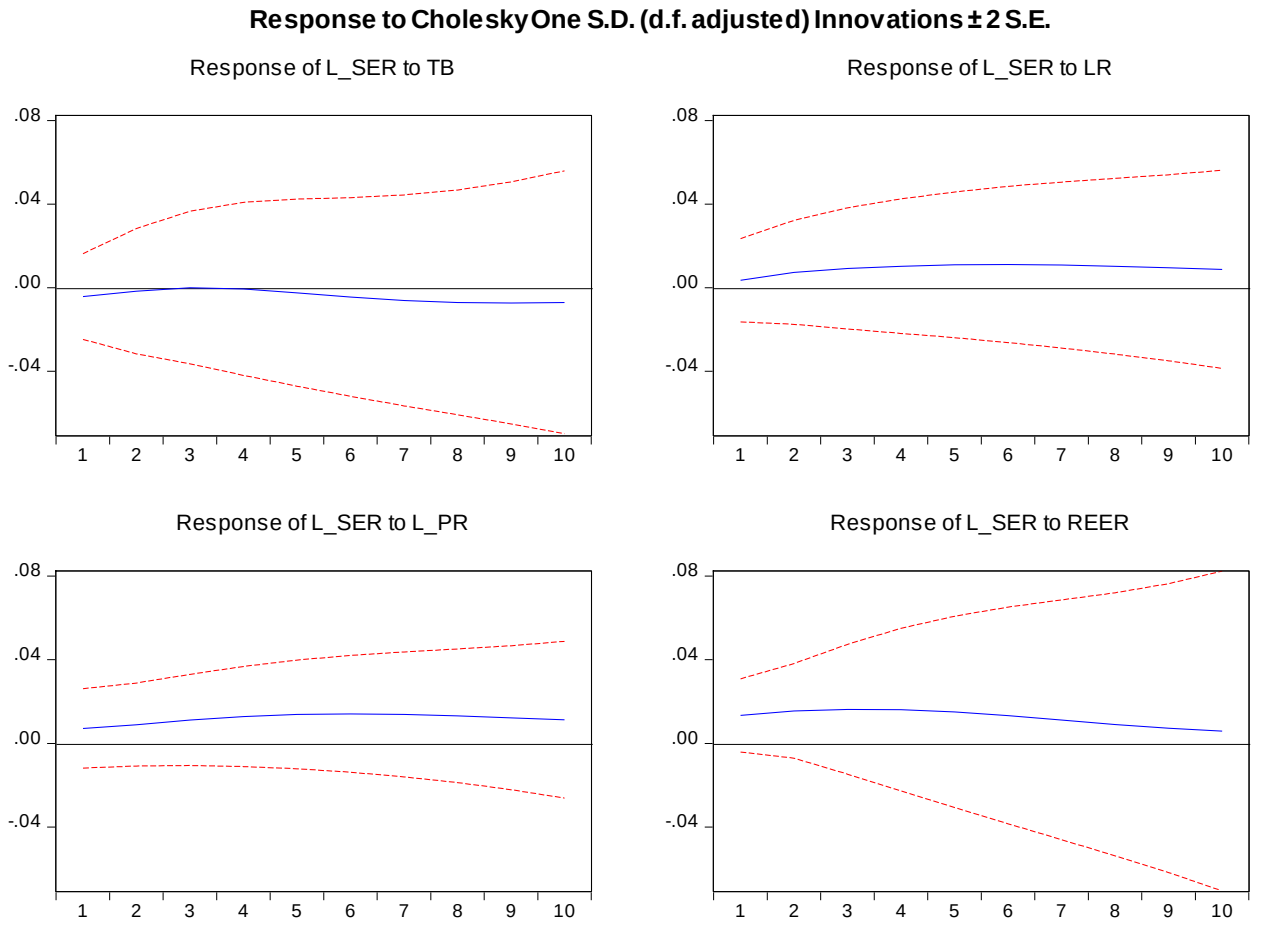

Figure 3: Impulse Response Functions – Services Output to Monetary Shocks (1994–2024)

4.4.4. Policy Implications

Taken together, the IRFs highlight pronounced asymmetries in how monetary policy is transmitted across sectors in Malawi. Agriculture is highly responsive to credit and interest rate shocks, indicating vulnerability to liquidity constraints. Manufacturing is most sensitive to the cost of capital, while services are primarily shaped by exchange rate dynamics. These sectoral differences in timing, magnitude, and direction of response emphasise the need for a differentiated monetary policy stance that considers the structural conditions of each sector.

Uniform adjustments in interest rates or credit conditions may generate unintended distributional consequences, stimulating one sector while simultaneously constraining another. Policymakers must therefore be attentive to these asymmetries when designing and sequencing monetary interventions, particularly in light of Malawi's structural transformation agenda under MW2063.

4.5. Forecast Error Variance Decomposition and Interpretation

To quantify the relative contribution of each monetary policy variable to sectoral output variation over time, FEVDs were computed for a 10-year horizon. The analysis focuses on four transmission variables: the Treasury bill rate (TB), lending rate (LR), private sector credit (L_PR), and the real

effective exchange rate (REER). The results, summarised in Table 7 and detailed in Appendix Tables A–C, provide complementary insights to the impulse response analysis by highlighting which channels exert the most persistent influence on sectoral output.

Table 7: Forecast Error Variance Decomposition at Year 10 (% Contribution to Output Variance)

Sector	TB (%)	LR (%)	L_PR (%)	REER (%)
Agriculture Sector	13.0	2.8	17.0	34.3
Manufacturing Sector	3.1	1.0	1.0	4.6
Services Sector	1.7	6.4	10.5	11.9

Note: Own shocks (e.g. L_AGR, L_MAN, L_SER) are excluded from the table for interpretive clarity. See Appendix A to C for complete results.

4.5.1. Agriculture Sector

In the agriculture sector, the FEVD results reinforce the findings from the IRFs by confirming the dominant role of the exchange rate and credit channels. By year 10, REER shocks account for 34.3 percent of the variance in agricultural output, reflecting the sector's exposure to imported inputs such as fertilizer, fuel, and equipment. Credit shocks contribute a further 17 percent, underscoring the continued importance of liquidity and financial access for production planning and input procurement. Interest rate effects, both through the policy rate and lending rate, are comparatively modest, suggesting that indirect channels of monetary transmission are more relevant than price-based channels in the agricultural context.

4.5.2. Manufacturing Sector

In manufacturing, monetary policy shocks account for a far smaller share of output variation. The REER contributes just 4.6 percent of total forecast error variance, and each of the other channels contributes less than 4 percent. The overwhelming dominance of own-sector shocks in the variance decomposition (as shown in Appendix B) implies that factors outside the model, such as electricity reliability, supply chain rigidities, and regulatory constraints, may be more important in driving manufacturing output than monetary conditions. This limited responsiveness suggests a weak monetary transmission mechanism in manufacturing, potentially due to the sector's relatively low access to formal finance and limited participation in trade-exposed value chains.

4.5.3. Services Sector

The services sector presents a more balanced picture. REER shocks explain 11.9 percent of output variance, while private sector credit accounts for 10.5 percent, and the lending rate contributes 6.4 percent. These results mirror the IRF findings by highlighting the sector's dual sensitivity to both foreign exchange conditions and domestic credit availability. Services subsectors such as tourism, ICT, and transport are often dependent on imported technology and exposed to external demand, making them particularly responsive to exchange rate fluctuations. At the same time, growth in service delivery platforms, fintech, and small-scale enterprises depends on access to credit and liquidity, explaining the observed contribution of financial channels.

4.5.4. Policy Implications

Taken together, the FEVD results confirm that monetary policy influences sectoral output in asymmetric and sector-specific ways. Agriculture is shaped most strongly by REER and credit conditions; services by REER, credit, and liquidity; and manufacturing by largely non-monetary factors. These findings have important policy implications. A uniform tightening of monetary policy, for example, through interest rate hikes or broad credit contraction, would have disproportionately negative effects on agriculture and services, while having a negligible impact on manufacturing. Conversely, a more targeted use of monetary instruments, complemented by sector-specific fiscal or structural reforms, could enhance macroeconomic coherence and better align monetary policy with Malawi's development objectives under MW2063.

This underscores the need for a sector-sensitive monetary policy framework, one that accounts for the distinct responsiveness of each sector to different transmission channels. They also call for enhanced coordination between the RBM, MoFEA, and NPC to ensure that macroeconomic tools are deployed in a manner consistent with structural transformation goals.

5. Concluding Remarks

This paper set out to examine the sectoral transmission of monetary policy in Malawi, using a recursive VAR model estimated on annual data from 1994 to 2024. The analysis focused on three sectors—agriculture, manufacturing, and services—that are explicitly prioritised in Malawi's long-term development framework, MW2063. The empirical strategy traced the impact of monetary policy shocks transmitted through the interest rate, credit, and exchange rate channels, using IRFs and FEVD to assess sectoral responses over time.

The results reveal distinct sectoral asymmetries in the effects of monetary policy. Agricultural output is most sensitive to changes in private sector credit, underscoring the importance of financial access in supporting seasonal production and input acquisition. Manufacturing, by contrast, reacts more strongly to interest rate shocks, reflecting the sector's reliance on capital investment and its exposure to financing costs. Services, particularly those linked to tourism and trade, are influenced primarily by exchange rate dynamics, which shape input costs and external competitiveness.

These findings carry important implications for macroeconomic management and structural transformation in Malawi. First, they challenge the notion that monetary policy is sector-neutral. The evidence shows that identical policy actions, such as interest rate hikes or credit tightening, can yield divergent effects across sectors, potentially reinforcing structural imbalances. Second, they underscore the need for monetary policy calibration that is informed not only by inflation dynamics but also by the financing needs and operational constraints of strategic sectors. Third, the results emphasise that understanding monetary transmission in a disaggregated manner is not only analytically sound but policy-critical in the context of long-term national planning frameworks.

From a policy perspective, three key recommendations emerge. First, the RBM should incorporate sectoral impact assessments into its policy deliberations. Tools such as sector-disaggregated VAR models, like the one developed in this study, can offer timely insights into how proposed monetary actions might influence different parts of the economy. Second, improved coordination is needed between monetary authorities, fiscal agencies, and development planning institutions. The RBM,

MoFEA, and NPC Commission should establish formal mechanisms for policy alignment to ensure that monetary decisions support rather than undermine sectoral strategies under MW2063. Third, financial sector reforms should be accelerated to deepen access to credit, particularly for smallholder farmers and industrial enterprises. Innovative financing instruments—such as seasonal credit facilities, blended finance, and targeted interest subsidies—can mitigate the adverse effects of monetary tightening on production.

In closing, the study provides empirical evidence that monetary policy in Malawi is neither neutral nor uniformly transmitted across sectors. Its effects are mediated by structural characteristics such as financing constraints, input dependencies, and trade orientation. This study contributes to the growing literature on macro-sectoral coherence in developing economies by demonstrating that monetary policy can either constrain or catalyse structural transformation depending on its alignment with sectoral realities. Future research could extend the present analysis by employing nonlinear or threshold VAR models to test for asymmetry between expansionary and contractionary shocks, or by integrating fiscal policy variables into a broader macroeconomic framework. As Malawi moves toward its MW2063 vision, ensuring that monetary policy is not just stabilising but also enabling of inclusive growth will be critical to delivering on the country's developmental ambitions.

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Appendices

Appendix A: Forecast Error Variance Decomposition for Agriculture Output (L_AGR)

Percentage contributions to forecast error variance over a 10-period horizon. Cholesky ordering: TB, LR, L_PR, REER, L_AGR.

Period	Standard Error	TB (%)	LR (%)	L_PR (%)	REER (%)	L_AGR (%)
1	7.05	3.53	0.25	21.86	2.85	71.51
2	8.77	6.64	5.41	29.68	2.71	55.56
3	9.74	10.66	6.76	31.76	4.77	46.05
4	10.42	14.49	6.17	29.95	9.23	40.16
5	10.87	16.45	5.17	26.72	14.97	36.69
6	11.15	16.60	4.30	23.61	20.67	34.82
7	11.31	15.81	3.68	21.12	25.53	33.86
8	11.40	14.76	3.25	19.28	29.35	33.36
9	11.46	13.78	2.96	17.96	32.20	33.09
10	11.49	12.99	2.75	17.03	34.29	32.94

Appendix B: Forecast Error Variance Decomposition for Manufacturing Output (L_MAN)

Percentage contributions to forecast error variance over a 10-period horizon. Cholesky ordering: TB, LR, L_PR, REER, L_MAN.

Period	Standard Error	TB (%)	LR (%)	L_PR (%)	REER (%)	L_MAN (%)
1	6.83	2.21	2.74	2.63	0.03	92.40
2	8.16	3.88	1.77	1.75	0.08	92.51
3	8.88	4.14	1.71	1.35	0.54	92.25
4	9.44	4.13	1.67	1.12	1.29	91.79
5	9.82	4.06	1.54	0.97	2.11	91.32
6	10.04	3.91	1.39	0.91	2.86	90.93
7	10.15	3.70	1.25	0.91	3.48	90.65
8	10.21	3.47	1.14	0.95	3.96	90.48
9	10.24	3.25	1.05	1.00	4.31	90.39
10	10.26	3.06	0.98	1.03	4.57	90.37

Appendix C: Forecast Error Variance Decomposition for Services Output (L_SER)

Percentage contributions to forecast error variance over a 10-period horizon. Cholesky ordering: TB, LR, L_PR, REER, L_SER.

Period	Standard Error	TB (%)	LR (%)	L_PR (%)	REER (%)	L_SER (%)
1	7.05	0.87	0.62	2.49	8.63	87.39
2	8.34	0.52	1.67	3.30	10.52	83.99
3	8.77	0.36	2.64	4.46	11.90	80.65
4	8.99	0.29	3.52	5.74	12.85	77.61
5	9.16	0.31	4.31	6.98	13.35	75.05
6	9.30	0.47	4.99	8.08	13.44	73.03
7	9.42	0.75	5.53	8.98	13.22	71.52
8	9.52	1.10	5.95	9.66	12.82	70.47
9	9.60	1.43	6.24	10.16	12.35	69.82
10	9.66	1.70	6.43	10.49	11.89	69.48