THE IMPACT OF MONETARY POLICY ON INCOME INEQUALITIES: EVIDENCE FROM MALAWI 1990 TO 2022

MASTER OF ARTS (ECONOMICS) THESIS

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THE IMPACT OF MONETARY POLICY ON INCOME INEQUALITIES: EVIDENCE FROM MALAWI 1990 TO 2022

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DECLARATION

I, Cephus Chakuchanya Chiwowa, affirm that this thesis represents my independent work and has never been submitted for similar purposes to this or any other university or institution of higher learning. Proper acknowledgments have been given for the use of other's work. All errors contained herein are the author's sole responsibility.

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Full Legal Name

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Signature

December, 2024

Date

CERTIFICATE OF APPROVAL

The undersigned certifies that this thesis represents the student's work and effort and acknowledges where other sources of information are used. The thesis is submitted with our approval.

Signature: _____ Date _____

Farai Chigaru, Ph.D.

Supervisor

DEDICATION

This one is dedicated to my late mother, Maureen Foster Chimunthu Banda, for believing in my dreams. May her spirit of hard work stay with me forever. I am forever grateful to God for this great opportunity in life, and may this stand in memory as a reference point for my future endeavours.

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ABSTRACT

Monetary policies are pivotal in influencing income inequality within a country, with the potential to either exacerbate or alleviate economic disparities. A review of literature in Malawi and sub-Saharan countries shows that there needs to be more literature on the subject matter to formulate substantive policies to move a large percentage of the population from poverty. The study's primary objective was to investigate the impact of monetary policy on income distribution in Malawi. This study used time series data from 1990-2022. Using the Ordinary Least Squares (OLS), Vector Autoregressive (VAR) estimation techniques, and Impulse Response Functions (IRFs) generated from the VAR model to analyse the dynamic impact of monetary policy on income inequality in Malawi, the study finds that Real effective exchange rate significantly affects income inequality in Malawi. On average, a one Standard Deviation shock to the Real effective exchange rate increases income inequality until the sixth period of the shock. Economic growth increases income inequality, but with minimal impact. The study also finds that one positive innovation shock in the Inflation rate increases income inequality. Conversely, a shock to the real interest rate negatively affects income inequality. Real interest rates bring change in the Gini coefficient as there are traceable short-run to long-run effects of a 1-6year period. The study recommends that the government may consider the exchange rates as a policy indicator in guiding domestic and foreign claims for goods and services, and income distribution in the country. The consideration may take the form of seasonal exchange rate policies to regulate the demand for foreign goods and the pricing of domestic goods. The government may also consider intensifying social safety net programs, labor training, and recruitment policies to curb the income inequality that continues dividing the nation into different economic spectrums. More importantly, the government should regulate the real interest rates through interest rate capping to control the worsening economic gap.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIC:	Akaike Information Criteria
ADF:	Augmented Dickey-Fuller Test
BLUE:	Best Linear Unbiased Estimators
CLRM:	Classical Linear Regression Model
GDP:	Gross Domestic Product
IRF:	Impulse Response Functions
LRR:	Liquidity Reserve Requirement
NSO:	National Statistical Office
OECD:	Organisation for Economic Cooperations and Development
OLS:	Ordinary Least Squares
OMO:	Open Market Operations
RBM:	Reserve Bank of Malawi
SDGs:	Sustainable Development Goals
VAR:	Vector Autoregressive
SADC:	Southern Africa Development Community
SSA:	Sub-Saharan Africa

CHAPTER 1

INTRODUCTION

1.1 Background

Income inequality is a growing public concern for policymakers in both developing and developed countries. Several attempts have been made to address income gaps and the increasing disparities in wealth and income distribution in Malawi through progressive taxes, social safety nets, and labor programs (World Bank, 2022). The broader global efforts of reducing income inequality as envisioned in Sustainable Development Goal Number 10 (UN, 2015) have also led to substantial efforts by authorities in different jurisdictions to identify policies that help reduce household income inequalities. Central to these efforts is understanding the causes of increased income gaps. The increased income inequality shows that Malawi's overarching development programs are not effectively addressing the redistribution component of the economic growth outcome (Mwakilama, 2018; Mussa,2017).

In recent years, there has been a growing recognition of the vital links between monetary policy and income inequality. Several factors have consistently been discovered as the main drivers of the differences in income distribution within and across countries. Such factors range from technological progress, population economics, globalization, the structure of the labor market, the structure of the economy, political capture, pervasive social norms, and fiscal policies (Oxfam, 2019; Bernanke, 2015).

The exploration of the impact of monetary policy on income inequality in Malawi necessitates a nuanced understanding of both Malawi's economic landscape and the historical context of income inequality within the nation.

Malawi, a country with a complex economic structure, has witnessed various shifts in its monetary policies over the years (Makwenda,2018). These policies, as Andersen et al. (2022) note, have profound implications on income distribution and inequality. The

intricate relationship between central bank policies and income inequality is not unique to Malawi but is a global phenomenon, as observed by Colciago, Samarina, and de Haan (2019) in their comprehensive survey. They underscore the significant role that central bank policies play in shaping income and wealth disparities.

Historically, Malawi has experienced varying degrees of income inequality, influenced by both domestic economic policies and external economic forces. This historical context is vital in understanding the current state of income inequality in the country. Domonkos, Fisera, and Siranova (2023) highlight the long-term impact of income inequality on the transmission of monetary policies to bank rates, a factor that is particularly relevant in the Malawian context. Furthermore, the studies by Siami-Namini and Hudson (2019) delve into the broader relationship between inflation and income inequality, which is pertinent to understanding Malawi's situation, given its periods of high inflation.

The relationship between fiscal policy, economic growth, and income inequality in SubSaharan Africa, as investigated by Aremo and Abiodun (2020), provides a broader regional perspective that is essential for situating Malawi within the larger African economic context. Their findings suggest a complex interplay between these variables, which is likely reflected in the Malawian context as well. Similarly, Khan et al. (2022) emphasize the role of financial inclusion in influencing poverty, income inequality, and financial stability in African countries, a perspective that resonates with Malawi's economic challenges and opportunities.

The work of Jobarteh and Kaya (2019) revisits the financial development and income inequality nexus in Africa, offering insights that could apply to Malawi, given its stage of financial development. The intersection of fintech, financial inclusion, and income inequality, as explored by Chinoda and Mashamba (2021), provides a contemporary angle to this discussion, considering the growing influence of financial technology in Africa.

This aspect is particularly relevant in analyzing how modern financial solutions could impact income distribution in Malawi.

Furthermore, the global perspective on the relationship between aid, microfinance, and income inequality provided by Castells-Quintana, Larrú, and Lacalle-Calderón (2019) offers an additional dimension to this analysis. Considering Malawi's reliance on international aid and the growing prominence of microfinance in the country, this perspective is crucial. Finally, the distributional considerations for monetary policy strategy, as discussed by Feiveson et al. (2020), are directly applicable to Malawi's situation, providing a framework to understand how monetary policy decisions can impact different income groups within the country.

1.2 Problem Statement

According to the United Nations, the percentage share of income in Malawi that accrues to the bottom 10 percent of the population has remained virtually stagnant at 2.9 percent from 2004 to 2019 and only declined marginally in 2010 and 2016. During this period, the additional income that accrued to the bottom 20 percent relative to the bottom 10 percent is significantly lower compared to the income that accrued to the top 20 percent relative to the top 10 percent hence (UN, 2023). Consequently, inequality has increased further for the same period as the entire population is taken into account despite little improvements in per capita incomes thereby hindering the national aspirations to attain the United Nations Sustainable Development Goals (SDGs). This means that the nation is still grappling to attain the United Nations (SDGs), specifically Goal Number 10 of reduced income inequality. This study aims to provide a platform that will help monetary policy authorities to develop policies that will help to reduce income inequality gaps.

Studies have been done to determine the different causes of income inequality. These efforts of inequality analysis have largely focused on fiscal and social policies as opposed to monetary policy.

Although Mussa declared in general that, “inequality is not an accident nor is it inevitable; it originates from policy choices” (Mussa & Masanjara, 2015, p.20), the fiscal and social have indeed dominated literature. Monetary policy and its consequences though important,

have been understudied. The Oxfam report for the Southern African Development Community (SADC) highlights that Southern Africa is the most unequal region in Africa (Oxfam, 2023). While Malawi performs relatively well compared to other countries in Southern Africa, the level of inequality remains concerning. It ranks 7th out of the 15 countries assessed in the SADC region (Oxfam, 2023).

The problem in literature is threefold: Firstly, much of the existing literature, such as the works of Colciago et al. (2019) and Siami-Namini and Hudson (2019), focuses on a broader global or regional perspective. There is a dearth of research specifically focused on the Malawian context, where economic conditions and policy responses may differ markedly from other regions.

Secondly, while the impact of monetary policy on income inequality has been studied in various economies, less attention has been given to how these policies interact with specific local factors in developing countries like Malawi. For example, the role of informal economies, prevalent in many African countries, is often overlooked in mainstream economic analyses.

Lastly, there is a need for more empirical research on the long-term effects of monetary policy on income distribution. Studies like those by Domonkos et al. (2023) begin to address this, but more focused research on the prolonged effects of such policies in Malawi could provide deeper insights.

Therefore, this study will ascertain the importance of monetary policy in understanding income inequalities by estimating variables that are significant and have a causal effect on income inequality in Malawi.

1.3 Main Objective of the Study

The study objective is to analyze the impact of monetary policy on income inequality in Malawi.

Specifically:

i. To evaluate the role of monetary policy in influencing key economic indicators. ii.

To explore the impact of policy rate on income distribution in Malawi.

1.4 Study Hypotheses

i. Monetary policy does not influence key macroeconomic variables in Malawi. ii.

Monetary policy does not affect income distribution in Malawi

1.5 Significance of the Study

Therefore, this research is pivotal for several reasons. Firstly, it addresses a critical gap in the understanding of how macroeconomic policies, particularly those related to monetary control, directly or indirectly influence income distribution within a developing country context. Given the unique economic landscape of Malawi, this study offers insights that are not only locally relevant but also contribute to the broader discourse on economic policy and inequality in similar economies.

Secondly, the study will contribute to policy discourse on the dynamic relationship between monetary policy and income inequality, providing a benchmark for monetary policy stance in the short run as well as in the long run.

1.6 Organisation of the Study

The study's skeleton is structured as follows: Chapter 2 presents the monetary policy and income inequality overview in Malawi, the stylised evidence on Income inequality, and stylised facts of income inequality. Chapter 3 presents the literature reviews, the theoretical literature review, which explores the theories regarding the effects of monetary policy, the Monetary Transmission mechanism, and income distribution, and the empirical literature review. Chapter 4 presents the Methodology and data, the estimation strategy, variable description and data, and diagnostic tests. Chapter 5 presents the Empirical results and

interpretations, descriptive analysis, diagnostic tests, VAR order determination, Granger causality test, Var stability test, OLS regression results and interpretation, and the impulse response function interpretation. Chapter 6 presents the conclusions and policy recommendations.

CHAPTER 2

OVERVIEW OF INCOME INEQUALITY AND MONETARY POLICY DYNAMICS IN MALAWI

2.1 Chapter overview

This chapter overviews the stylised facts of income inequality and the dynamics of monetary policy in Malawi from 1990 to 2022. During the study period, it was observed that monetary policy in Malawi orbited through different regimes, namely the 1964-1986 period, which is commonly known as the financial repression regime; the 1987 to around 1993 regime associated with the financial sector reform; and the financial liberalization regime that commenced around 1994, during which multiparty democracy was practiced. It was also discovered that tracing the long-term augmentation of income inequality in Malawi is challenging because of missing data.

2.2 Stylised Facts of Income Inequality in Malawi

Kwengere (2011) chronicled how the 'hurt' tax and 'Thangata' system of labour accentuated income gaps in the period leading to independence. During this period the highlight was the white settlers' appropriation of the best land for major farming while leaving the locals in abject poverty in barren and poor topographic land.

The post-independence period (1964-1980s) saw income inequality decreasing in Malawi as evidenced by the decrease in the share of the top 0.25 percent which significantly jumped from 7.7 percent in 1964 to 5.3 percent in 1979 (Martorano, 2010). Income inequality is shown to sharply increase between 1979-1980 as Pryor (1988) showed.

It has also been established that the period of the early multiparty regime corresponds with the highest Gini coefficient in the post-multiparty democracy in Malawi (1997). This period

might be attributed to rising food prices and rising in the general prices of goods and services which affected mostly the poor households and hence increased the already high-income gaps. In general, the first years in the decade of multiparty democracy show comparatively high values of the Gini coefficient as can be observed in Figure 1. Between 1998 and 2004, inequality declined significantly to around 39 percent. This can be attributed to the Starter Pack Programme in those years. This period also showed a general reduction in income inequality compared to the first-decade trends.

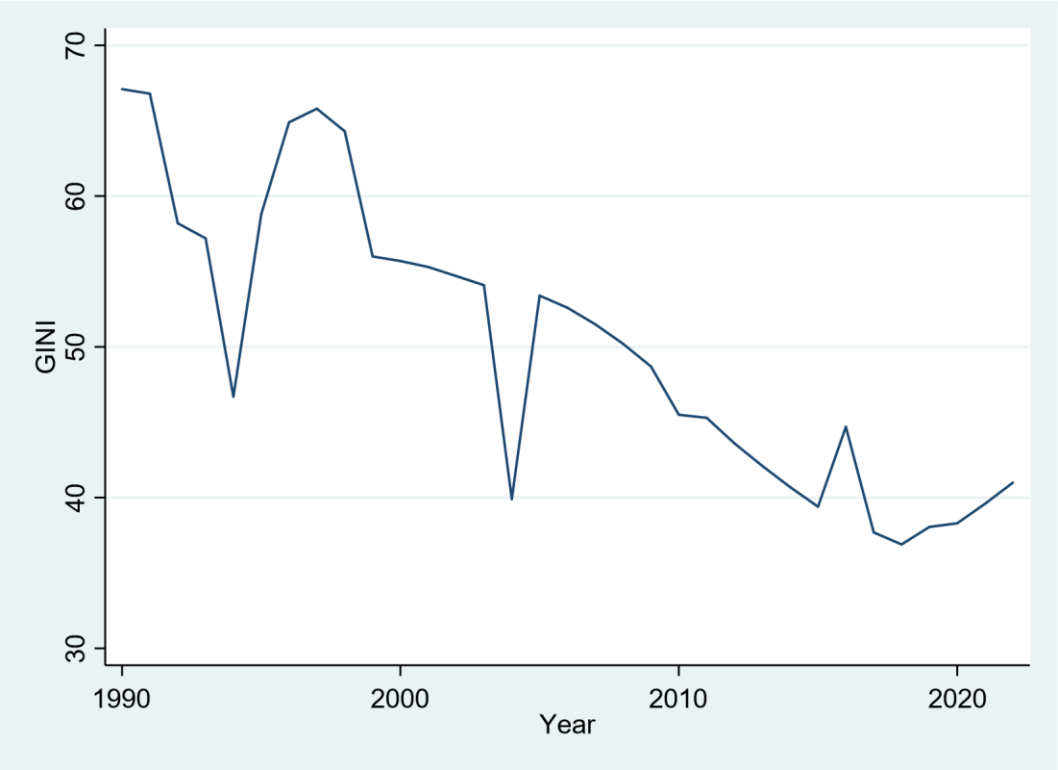

Figure 1: Trends in the Gini Coefficient (%)

In the later years after 2009, Gini coefficient has been fluctuating without showing stability towards reduction. The aftermath of 2009 indicated that the Gini coefficient was unstable with both decreasing and increasing trends over time. It is for this reason that income inequality has remained significantly stagnant on average.

2.3 The Evolution of Monetary Policy in Malawi

Monetary policy in Malawi has evolved through 3 regimes namely financial repression, financial reforms, and financial liberalization (Makwenda, 2018). In the postindependence, monetary policy was guided through direct control of interest rates, credit, exchange rates and foreign exchange. On average the policy rate has fluctuated significantly with both higher and lower values recorded until in the late 19809s. The Liquidity Reserve Requirement (LRR) money supply, Open Market Operations (OMO), Exchange rate, and Policy Rate were used as monetary policy tool. Over the years, only the Bank rate and the exchange rate were found to be more effective as monetary policy instruments ((Makwenda, 2018; Mangani, 2018; Matola, 2023; Ngalawa, 2018).

Since 1964, Malawi has implemented various exchange rate regimes. Initially, the Malawi kwacha was pegged to the British pound at a one-to-one ratio until 1973, when it transitioned to a trade-weighted average of the United States dollar and the British pound from 1973 to 1975. During the late 1970s and early 1980s, the kwacha was pegged to the International Monetary Fund's (IMF) Special Drawing Rights (SDR). Subsequently, it was tied to seven major currencies, including the US dollar, British pound, German deutschemark, South African rand, French franc, Japanese yen, and Dutch guilder. Following the financial liberalization in 1994, the kwacha was intermittently floated, fixed, or pegged.

From 1990, the policy rate and exchange rate has shown notable fluctuations. Figure 2 shows the fluctuations of these monetary policy variables:

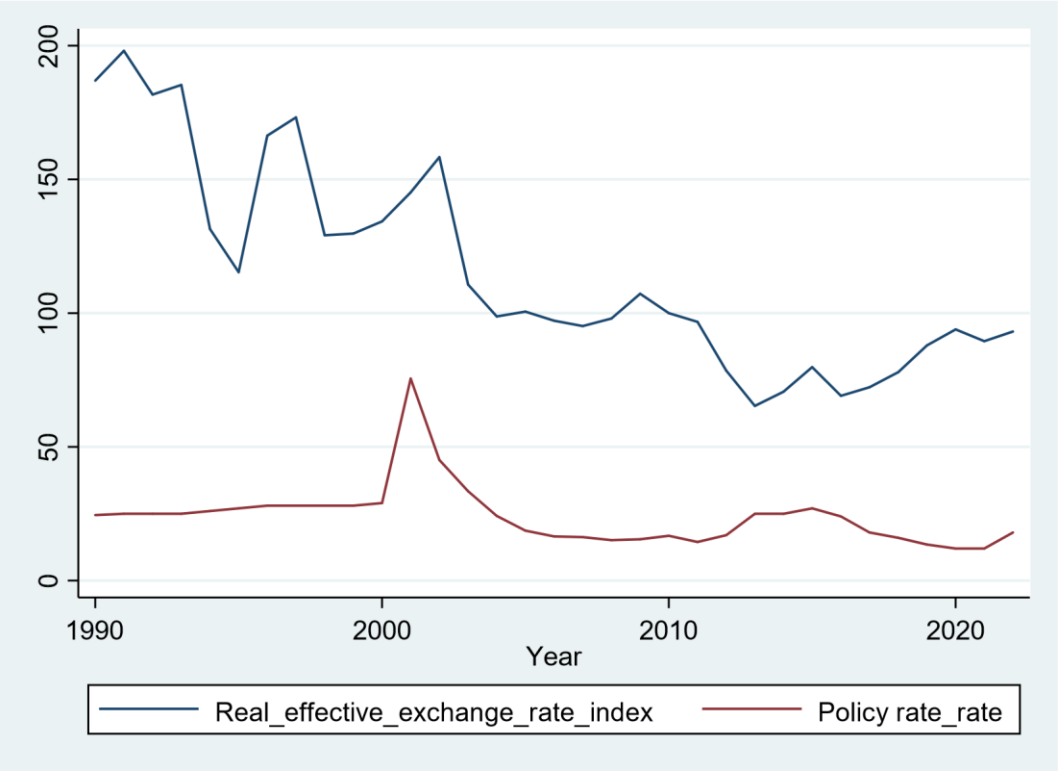

Figure 2: Effective Exchange Rate and Policy Rate

The Policy rate has shown considerable stability over time, with the highest rate recorded in the year 2001. This could be the case because of the famine which increased food prices and necessitated the authorities to increase the policy rate to arrest inflationary pressures. The exchange rate has fluctuated over time with a pattern that shows a dynamic mean and a changing variance with 1991 recording the most prominent. The devaluation of the Kwacha in this period might have caused the local currency to lose its value.

CHAPTER 3

LITERATURE REVIEW

3.1 Theoretical Framework Linking Monetary Policy to Income Inequality

In examining Monetary Police dynamics and income inequality, contributions from various theories have been explored to relate these existing economic theories to the topic. This section explores theories that include Keynesian Economics on investment, and the Monetary Transmission mechanism.

3.1.1 Keynesian Economics

In his book, The General Theory of Employment, Interest and Money (Keynes, 1936), Keynes made several theoretical propositions that governments should undertake. One of these theoretical frameworks connecting monetary policy to income inequality is underpinned by the proposition of Investment during the economic downturn. In these times, Maynard Keynes proposed that lowering interest rates, for instance, can boost investment and consumption but may also lead to increased asset prices, benefiting those who already hold assets hence increasing income inequality.

Keynesian Economics also postulates that aggregate demand plays a crucial role in output growth and unemployment levels (Chavula, 2016). During the economic downturn, the government can increase its spending and implement tax cuts which eventually have the potential to stimulate aggregate demand and reduce the unemployment rate.

This in turn can alleviate income inequality by increasing employment opportunities and free up more resources for consumption for groups in the lower income blanket. In this regard, Keynes also acknowledged that inflation erodes real wages and the purchasing power of money. The effects of inflation are not uniform among the lower-income groups and higher-income earners. The lower income earners might be affected by the rigidity of

their income due to rising prices and may experience a decline in their real wages hence exacerbating income inequality.

Keynes held that progressive taxation policies could be used as a tool for the redistribution of income (Sangkuhl, 1958). This involves taxing higher income groups at higher rates and using the revenue to fund social programmes and fiscal policy implementation aimed at reducing income gaps between the higher earners and the lower earners.

Critics of Keynes agree with him that inflation can destroy the purchasing power of fixed income, which might eventually affect lower-income individuals more than their counterparts.

3.1.2 Economic Growth Versus Income Inequality

In neoclassical economics, it is believed that there is a trade-off between equality and efficiency along with economic growth. This idea is presented by Okun (1975), who uses the metaphor of a "leaky bucket" to illustrate it. In this analogy, when wealth is redistributed from more affluent individuals to those who are less fortunate, a fraction of it is inevitably lost in the process, much like water leaking from a bucket. The pursuit of equality influences incentives, leading politicians to weigh the balance between equity and economic efficiency.

Kaldor (1955) offers justification for this trade-off, proposing that wealthier individuals tend to have a greater marginal propensity to save than those with lower incomes. If we accept that GDP growth directly correlates with the savings rate, then it follows that economies with higher levels of inequality are likely to achieve quicker growth. Furthermore, this suggests that income redistribution measures, such as progressive taxation, could lead to a decline in the overall savings rate of the economy.

In the realm of neoclassical economics, a critical assumption is that a delicate balance exists between equality and efficiency, alongside economic growth. This notion is vividly articulated by Okun (1975), who employs the striking metaphor of a "leaky bucket." In this compelling analogy, when funds are shifted from the wealthy to the underprivileged, a

portion inevitably escapes, much like water trickling out of a bucket. This pursuit of equality is likely to impact incentives, compelling politicians to make essential choices between prioritizing fairness or fostering economic efficiency.

Kaldor (1955) provides insightful reasoning for this trade-off, indicating that affluent individuals exhibit a higher marginal propensity to save when compared to their less wealthy counterparts. If we accept the premise that GDP growth directly ties to the savings rate, then economies characterized by greater inequality are generally poised for swifter growth. Additionally, this perspective implies that income redistribution initiatives, such as progressive taxation, might diminish the overall savings rate within the economy.

3.1.3 Dual Economy Theory

This theory examines how different sectors of the economy, such as agriculture and industry contribute to income inequality by creating dualistic economic structures.
According to Todaro and Smith (2015) "In the Lewis model, the underdeveloped economy consists of two sectors: a traditional, overpopulated, rural subsistence sector characterized by zero marginal labor productivity—a situation that permits Lewis to classify this as surplus labor in the sense that it can be withdrawn from the traditional agricultural sector without any loss of output—and a high-productivity modern, urban industrial sector into which labor from the subsistence sector is gradually transferred. The primary focus of the model is on both the process of labor transfer and the growth of output and employment in the modern sector" (p. 153). This change leads to a growing economic divide between traditional ways of making a living and the more modern, city-based industries. Over time, these differences in income and opportunities become very noticeable.

3.1.4 The Theory of Bargaining Power

The theory of bargaining power hypothesizes that where bargaining power in a contract persistently gives one party more power than the other, it can lead to disparities in the gains

accrued from the transaction (Ahlquist, 2017). From this theory, it can be deduced that income inequality results from a power struggle between employers and employees. It can also be true that those with special skills and highly skilled individuals will have greater bargaining power and can negotiate higher wages, leaving the ones with lower skills and hence perpetuating and increasing income disparities.

Guschanski and Onaran (2021) examined 14 OECD countries and highlighted the impact of bargaining power, particularly the reduced bargaining power of unemployed individuals. This situation perpetuates the status quo for lower-income groups and contributes to increasing income inequality. Their findings indicate that the wage share has declined as a result of this decrease in bargaining power.

3.2.1 The Theory of Monetary Policy Transmission Mechanism

Mian and Sufi (2014) explained the mechanism through which interest rates affect income inequality using an investment model. They found that lower interest rates induce investment and consumption hence boosting GDP and employment levels. However, they argued that the economic benefits pile up more to financial asset owners and owners of capital who are able to access credit at a lower opportunity cost and this leads to growing levels of income inequality.

Domonkos, Fisera, and Siranova (2023) contribute to this theoretical framework by discussing income inequality as a long-term conditioning factor in the transmission of monetary policy to bank rates. Their study suggests that pre-existing income disparities can affect how monetary policy impacts are felt across different income levels, with wealthier individuals potentially benefiting more from lower interest rates due to their higher levels of asset ownership.

3.2 Empirical Literature

Siami-Namini and Hudson (2019) use panel data of 24 developed countries to run a Vector

Error Correlation Model (VECM). Their focus was on the role of inflation in this dynamic, discussing how monetary policy aimed at controlling inflation can have disparate effects on various socio-economic groups. Inflation can erode the real income of wage earners, who are often at the lower end of the income spectrum, while those with assets can hedge against inflation, thereby exacerbating income inequality.

Aremo and Abiodun (2020) conducted a multivariate Granger causality analysis to examine the relationship between fiscal policy, economic growth, and income inequality in SubSaharan African countries. Their research provides insights into how government spending and taxation, along with monetary policy, affect income distribution. The findings suggest a complex interaction between fiscal and monetary policies in influencing income inequality.

Another channel through which monetary policy transmits to income distribution is the income channel. Eggertsson and Mehrotta (2014) established that by influencing overall economic activity, employment levels, and wages monetary policy affects the overall income distribution. They established that while economic growth may impact all income groups by creating jobs and increasing aggregate wages, the distribution of income might not be on an equitable basis. The capitalists who have greater access to capital may benefit more from increased revenue which translates to more investments and consequently proliferates the income gap.

Monetary policy impacts household income and wealth primarily through its effect on asset prices. It influences the value of households' holdings in two main asset classes: fixed assets, such as a primary residence and other real estate, and financial assets, like stocks (Makwenda, 2018). When interest rates are lowered, the cost of borrowing decreases, which encourages investors to take out loans to make beneficial investments. In Malawi, where a significant portion of borrowing occurs through informal financial institutions, lower interest rates can exacerbate income inequality.

This is because those with higher disposable incomes are able to take advantage of the reduced borrowing costs, gaining more benefits from investments.

3.2.1 Impact of Monetary Policy on Income Distribution

The exploration of the impact of monetary policy on income distribution has garnered significant attention in economic literature, particularly in terms of how central bank decisions influence the economic divide. The research conducted by Andersen et al. (2022) offers a profound insight into this dynamic, focusing on the role of key monetary instruments like interest rates and quantitative easing. They used individual tax data records for the entire population of Denmark, which is not feasible in the Malawi context because of lack of such data. Their analysis, which highlights the differential effects of these policies on various income groups, is particularly relevant for understanding the situation in Malawi, where monetary policy plays a crucial role in shaping income distribution patterns. This foundational perspective is essential for policymakers who need to balance the objectives of monetary stability and equitable income distribution.

Additionally, the research by Jobarteh and Kaya (2019) on the financial development and income inequality nexus in Africa provides a foundation for this study. Their work highlights the complex interplay between financial sector development and income distribution, a theme that this research aims to explore within the specific context of Malawi's monetary policy. The relevance of this approach lies in its potential to unravel how monetary policy decisions, often aimed at stabilizing the economy or spurring growth, can have unintended distributional effects.

Furthermore, the intersection of fintech, financial inclusion, and income inequality, as investigated by Chinoda and Mashamba (2021), offers a contemporary perspective that is essential for Malawi. They used structural equation modelling (SEMI). The SEMI has the ability to control for measurement error.With the increasing role of technology in finance, understanding how monetary policy intersects with these developments becomes crucial.

In a similar vein, the work of Feiveson et al. (2020) using average inflation targeting models, delves into the distributional considerations of monetary policy strategy, providing a broad view of how central bank actions can affect different segments of the population. Their research points out that the effects of monetary policy are not uniformly distributed

across the income spectrum, often disproportionately affecting low and middle-income groups. This aspect is especially critical for countries like Malawi, where a significant portion of the population falls into these income categories.

Samarina and Nguyen (2019) extend this discussion by examining the impact of monetary policy on income inequality in the euro area. They applied a panel vector autoregression (PVAR) model with an exogenous euro area Proxy-SVAR framework to examine the impact of monetary policy on income inequality in the euro area. Their study provides a comparative analysis demonstrating that the effects of monetary policy on income distribution can vary significantly across different economic contexts. This comparative approach offers valuable insights that can be applied to the Malawian context, emphasizing the need for tailored monetary policies that consider local economic conditions and the specific challenges of income inequality.

Furthermore, the study by Taghizadeh-Hesary, Yoshino, and Shimizu (2020) explores the combined impact of monetary and tax policy on income inequality in Japan. Their findings highlight the complex interplay between different economic policies and their collective impact on income distribution. This research is particularly instructive for understanding the potential synergy or conflict between monetary policy and other fiscal measures in influencing income inequality. For a country like Malawi, where both monetary and fiscal policies are pivotal in shaping economic outcomes, such insights are invaluable.

3.2.2 Monetary Policy, Inflation, and Income Inequality

The relationship between monetary policy, inflation, and income inequality is a critical area of study. Siami-Namini and Hudson (2019) explore how inflation affects income disparities, noting that inflationary pressures can impact different economic groups in various ways.

This is especially relevant for Malawi, which has experienced fluctuating inflation rates. Their findings highlight the need to understand how monetary policies aimed at controlling

inflation can inadvertently influence income distribution, offering valuable insights for economic analysis in developing countries.

Aremo and Abiodun (2020) further expand this discussion by investigating the connections among fiscal policy, economic growth, and income inequality in Sub-Saharan African countries. Their research sheds light on the complex interplay between these factors, providing a broader context for understanding Malawi's experience. This perspective is essential for comprehending how combined monetary and fiscal policies can affect income distribution in the region.

Khan et al. (2022) contribute to this discourse by examining the role of financial inclusion in affecting poverty, income inequality, and financial stability in African countries. Their empirical evidence from 54 African nations, including Malawi, suggests that financial inclusion—shaped by monetary policy—can have varying impacts on income distribution.

A global perspective on the relationship between aid, microfinance, and income inequality is provided by Castells-Quintana, Larrú, and Lacalle-Calderón (2019). Their analysis suggests that international aid and microfinance, when interacting with monetary policy, can significantly affect income inequality.

The global and comparative analysis of monetary policy's impact on income inequality provides a broader framework for understanding Malawi's specific situation. CastellsQuintana, Larrú, and Lacalle-Calderón's (2019) comprehensive analysis in "Aid, Microfinance and Income Inequality: A Global View," published in the *Revista de Economía Mundial*, highlights the complex relationship between external financial assistance, microfinance initiatives, and income distribution. Understanding these dynamics is crucial for effectively utilizing or modifying such policies and tools in Malawi.

Additionally, the research by Taghizadeh-Hesary, Yoshino, and Shimizu (2020), presented in "The Impact of Monetary and Tax Policy on Income Inequality in Japan" in *The World Economy*, provides insights applicable to various economic contexts, including Malawi. Their study demonstrates how monetary and fiscal policies can interact to influence income distribution and offers lessons that can be applied in different settings.

Moreover, Samarina and Nguyen's (2019) work on the effects of monetary policy on income inequality in the euro area, featured in the *Journal of Money, Credit and Banking*, enriches this global perspective. Their findings underscore the diverse impacts that monetary policy adjustments can have across economies, highlighting the importance of considering the unique economic structures and conditions when analyzing policy effects.

3.2.3 Financial Inclusion and Income Inequality

The intersection of monetary policy with financial inclusion and its effect on income inequality is increasingly recognized as a pivotal area of economic research. Khan et al. (2022) in their study on "Does financial inclusion induce poverty, income inequality, and financial stability: empirical evidence from the 54 African countries?", provide empirical evidence of how financial inclusion, which is often influenced by a country's monetary policy, impacts poverty and income inequality. Their research, encompassing a broad range of African countries, offers valuable insights into the potential for financial inclusion initiatives to affect income distribution, which is highly relevant to the Malawian context.

In Malawi the results indicate that the policy rate is the most effective monetary policy instrument than the reserve money and that the exchange rate channel of transmission mechanism dominated the period of study than the policy rate and real interest rate channels (Makwenda, 2018). This means that the exchange rate, policy rate, and real interest rate variables can be used in monetary policy models in Malawi as policy instruments. This also justifies the variables adopted by this study.

CHAPTER 4

METHODOLOGY AND DATA

4.1 Introduction

The proposed methodology for this study, focusing on economic modeling, encompasses a structured approach designed to analyze the impact of monetary policy on income inequality in Malawi effectively. This methodology integrates quantitative techniques with a focus on econometric modeling, ensuring that the analysis is both rigorous and comprehensive.

4.2 Estimation Strategy

4.2.1 OLS Regression Analysis

Regression analysis, as the primary tool for this study, will be instrumental in examining the relationship between monetary policy indicators and income inequality. As Bloomfield and Fisher (2019) articulate in their work on quantitative research design, regression analysis is a powerful statistical tool for identifying and quantifying relationships between variables. It allows for the estimation of the magnitude and direction of the impact that independent variables (in this case, monetary policy indicators) have on a dependent variable (income inequality). The regression model will be carefully structured to include relevant monetary policy indicators such as interest rates, inflation rates, and money supply, acknowledging their potential impact on income distribution within the economy. This method is selected for its ability to isolate the effect of each independent variable while controlling for other factors, thereby providing a clear view of the causal relationships at play.

The Ordinary Least Squares (OLS) method will be the primary technique used for regression analysis. This method is widely recognized for its effectiveness in providing

unbiased estimations of coefficients in linear regression models, as detailed by Bloomfield and Fisher (2019). OLS regression is particularly suitable for this study as it allows for a clear and straightforward interpretation of how changes in monetary policy indicators are associated with shifts in income inequality.

This study will follow the work of Miljkovic & Shaik (2010) who proposed the classical time series linear regression model that can be applied using the Ordinary least squares method (OLS) for analyzing data, defined it as:

$$\mathrm{GIN_t} = \beta_0 + PR_t + \beta_{2\mathrm{Rt}} + \beta_3\mathrm{EXG} + \beta\ \ 4_{\mathrm{It}} + \beta_5\mathrm{GDPGR_t} + \beta_6\mathrm{U_t} + \varepsilon_t \quad (1)$$

Where:

GIN = Gini coefficient, a proxy of income inequality

PR = Policy Rate

R = Real Interest Rate

EXG = Rea Effective Exchange Rate

I = Inflation Rate

GDPGR = GDP Growth Rate

U = Unemployment Rate

4.2.2 Vector Autoregressive Model (VAR)

This model will be estimated using time-series data, with careful selection of lags based on criteria like the Akaike Information Criterion (AIC). The AIC is a widely used method for lag selection in time-series models, as it helps in identifying the model that best fits the data without overfitting, as suggested by Law (2022).

The VAR model is well-suited for this study due to its ability to analyze interdependencies and the temporal nature of relationships among variables. Additionally, it effectively

captures the dynamic interactions between economic factors. This study follows the model established by Samarina and Nguyen (2019) and focuses on defining the Malawi-level VAR.

To estimate the model, let X_t be a vector of endogenous variables at time *t,* where:

$$Y_t = \begin{bmatrix} x_{1t} \\ x_{2t} \\ x_{3t} \\ \cdot \\ \cdot \\ \cdot \\ \lfloor x_{kt} \rfloor \end{bmatrix} \qquad Y_t = \begin{bmatrix} x_{1t} \\ x_{2t} \\ x_{3t} \end{bmatrix} \tag{2}$$

represents a vector of variables (i.e., income inequality, policy rate, interest rates, GDP growth rate, inflation rate, exchange rate, and unemployment rate).

In general, the variables are stated as:

x_{1t}: Income inequality (a proxy for the Gini coefficient)

x_{2t}: Monetary policy instruments (Policy rate, Interest rates, exchange rates)

x_{3t}: Macroeconomic variables (Inflation, GDP, unemployment rate)

The VAR model for is hereby expressed as follows:

$$Y_t = \propto + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \theta_3 Y_{t-3} \ldots + \theta_\rho Y_{t-\rho} + \boldsymbol{\varepsilon_t} \tag{3}$$

$$\boldsymbol{Y_t = C + \sum_{j=1}^{\rho} A_j Y_{t-j} + \varepsilon_t, \qquad \varepsilon_t \sim \mathcal{N}(0, \Sigma_0)} \tag{4}$$

Where:

$\propto$ is a constant vector

θ_1, θ_2, θ_3, …, $\theta_{\boldsymbol{\rho}}$ are coefficients matrices for lags 1 to **ρ**.

$Y_{t-1}, Y_{t-2}, Y_{t-3}, \ldots, Y_{t-\rho}$ are lagged values of the endogenous variables

ε_t is a vector of white noise disturbances

As already articulated, the baseline model to be used is the VAR model. The conventional practice in the existing literature shows the employment of impulse response analysis to investigate the effects of monetary policy. According to Ahiadorme (2020), the effects of monetary policy shock are investigated through an impulse response analysis once the VAR model has been identified and estimated

4.2.3 Impulse Response Analysis

This will be conducted to understand how a shock to monetary policy affects income inequality over time. This will entail examining the response of each variable to a one-unit shock in another variable. The impulse response functions provide an understanding of the distribution effect of monetary policy, unlike other models.

4.3 Variable Selection

4.3.1 Dependent Variable

The dependent variable in this study is income inequality, which will be measured using a proxy Gini coefficient. These measures provide a quantitative assessment of the distribution of income within the population, reflecting the degree of inequality.

4.3.2 Independent Variables

The independent variables will include key monetary policy instruments and indicators of central bank policy rates, real interest rates, and Real effective exchange rate.

These variables are chosen based on their recognized influence on economic conditions and their potential to impact income distribution, as suggested by economic theories and previous empirical studies (Makwenda, 2018; Matola, 2023; Ngalawa, 2018).

4.3.3 Control Variables

To ensure that the analysis accounts for other factors that may influence income inequality, control variables GDP growth rate, unemployment rates, and Inflation will be included in the models. These variables are essential for providing a more comprehensive and accurate picture of the economic environment in which monetary policy operates. As Bloomfield and Fisher (2019) suggest, including control variables is crucial in quantitative research to mitigate the effects of confounding variables, thereby enhancing the validity of the study's findings.

4.4 Variable Definitions

4.4.1 Gini coefficient

Income inequality is defined as the unequal distribution of income within a population of a country. As a proxy for income inequality, the Gini coefficients can reveal how changes in economic variables impact income distribution. Positive coefficients on lagged Gini index values might indicate a feedback loop where positive coefficients might be considered to exacerbate inequality, while negative coefficients might suggest policies or economic conditions that reduce inequality. The Gini is comparatively easy to understand and has a desirable graphical representation which is why the Gini coefficient is preferred in most studies (Gondwe, 2016). As a matter of measurement, the Gini coefficient ranges from 0 (representing equal distribution) and 1 where one person possesses all the income of the economy, representing a complete inequality. Graphically, the Gini coefficient is calculated as the area above the curve but below the line of perfect equality divided by the total area below the line of perfect equality.

In the years where the Gini coefficient is not captured, the mean and variance of income will be used to estimate the Gini coefficient using the formula:

$$G = \left[(1/2) * \left(1 + \left(\frac{\sigma^2}{mean^2} \right) \right) \right]$$

(5)

This equation is adopted from the work of Corral and Martnez (2010).

4.4.2 The policy rate

According to the Bank of England, a policy rate is a short-term reference rate set by a central bank. It provides a basis for short-term interest rate determination. The success of monetary policy largely depends on how the central bank steers the economy in the desired direction (Chiumia & Palamuleni, 2020). In this case, the policy rate acts as a foundation of monetary policy instruments that can affect the Gini coefficient and consequently income inequality. The expected priori is that an increase in the policy rate will increase income inequality because the increase in the policy rate through pass-through measures to the retail bank interest rates and this will be passed on to the consumers of the loan and hence increase in prices which usually affect those already economically challenged and this increases the income gap.

4.4.3 Real Interest Rate

Given Malawi's status as a developing economy, real interest rates play a crucial role in credit and pricing. Real interest rates are the nominal interest rates adjusted for inflation, and considered by financial institutions as a price of credit. Higher interest rates might indicate efforts to curb inflation or stabilize the currency, while lower rates could stimulate economic activity and reduce unemployment but risk inflationary pressures.

4.4.4 Real Effective Exchange Rate (REER)

The REER is a measure of the value of a country’s currency relative to a basket of other major common trading currencies adjusted for inflation. The REER is expressed as: REER= NEER * CPID/CPIF, where CPID is the domestic consumer price index and CPIF is the weighted average of the consumer price indices of Malawi’s five biggest trade

partners South Africa, Zimbabwe, the United States, the United Kingdom, and Germany, and NEER is the nominal effective exchange rate Simwaka (2004). This measure is important for this study as it is stable because of the little fluctuations of the average basket of the currencies.

4.4.5 Inflation Rate GDP deflator

Inflation is the general increase in the prices of goods and services. As a measure of inflation, the GDP deflator is a more accurate measure of inflation because it includes all goods and services. Since inflation can erode the purchasing power of low-income groups as low-income groups spend a high percentage of their income on necessities when price rises, its inclusion in the model is justified.

4.4.6 GDP Growth Rate

This measures the total growth of output produced in a country. In essence, it is the growth rate of the market value of all final goods and services produced within a country over a particular or specified period. GDP Growth rate is an inflation-adjusted measure that reflects the value of all goods and services produced by an economy in a given period, say a year, expressed in base year prices. The change in GDP will be used as a measure of economic growth in this study since the economic priori GDP growth rate leads to a reduction in income inequality. Chirwa (2022) found that the GDP growth rate affects income inequality negatively.

4.4.7 Unemployment Rate

The Unemployment rate is a widely used indicator of an economy's performance as it reflects the ability of the economy to generate employment activities if the unemployment rate is lower. Lower unemployment also signifies that the majority of the population is employed and is earning income which might eventually lead to a reduction in income inequality.

4.4.3 Interest Rate, Exchange Rate, Bank Rate, Inflation, and Unemployment

Given Malawi's status as a developing economy, these variables are crucial indicators of monetary policy effectiveness, inflationary pressures, and exchange rate stability. Higher interest rates might indicate efforts to curb inflation or stabilize the currency, while lower rates could stimulate economic activity and reduce unemployment but risk inflationary pressures.

4.5 Expected Signs of the Variables

The table below shows the expected influence of the variables used on the dependent variable, the plus sign shows a positive influence and the minus sign shows a negative influence.

Table 1: Expected Signs

VARIABLE	PARAMETER	EXPECTED SIGN
Policy Rate	β_1	+
Real interest rate	β_2	+
Real effective exchange rate	β_3	-
Inflation GDP deflector	β_4	+
GDP growth rate	β_5	-
Unemployment rate	β_6	+

4.6 Data Collection

The quantitative data for this study will be sourced from a range of reliable and authoritative sources. As emphasized by Bloomfield and Fisher (2019), the choice of data sources is

crucial in quantitative research to ensure accuracy and representativeness. National income and expenditure surveys will be utilized as primary data sources, providing detailed insights into the income distribution and economic conditions of households in Malawi. Additionally, central bank reports will be critical for obtaining accurate and up-to-date information on monetary policy decisions and implementations. These reports are invaluable for understanding the nuances of monetary policy changes and their rationale. International financial institutions' databases, such as those from the World Bank and International Monetary Fund, will also be tapped for broader economic indicators and comparative data.

This comprehensive approach to data collection ensures a rich and varied dataset, enabling a nuanced analysis of the impact of monetary policy on income inequality.

The study will encompass a comprehensive time frame, which is essential for capturing the various phases of monetary policy changes and their impacts. This longitudinal approach allows for the observation of trends and patterns over time, providing a deeper understanding of the temporal dynamics of monetary policy effects on income inequality. As Law (2022) notes in his work on building valid and credible simulation models, a wellchosen time frame is critical for capturing the full extent of the processes and changes under study.

4.7 Diagnostic Tests

To ensure the dependability of the regression model, various diagnostic tests will be performed. These tests will cover aspects such as autocorrelation, multicollinearity, and heteroskedasticity, each tackling a distinct possible concern in regression analysis.

4.7.1 Test for Stationarity

A time series is considered stationary if its mean and variance remain constant over time (Gujarat, 2008). The assumptions of estimation and hypothesis testing in econometric analysis rely on the data being stationary. Consequently, this study will employ the

Augmented-Dickey-Fuller (ADF) test for unit root to determine whether the variables exhibit stationarity or non-stationarity prior to conducting the regression and VAR model, in order to prevent spurious results that could compromise the accuracy of the estimated parameters. When the data is not stationary at its original levels, which is often the case with time series variables, one effective method to achieve stationarity is through differencing the time series data until stationarity is reached (Asteriou and Hall, 2007).

4.7.2 Cointegration test

In time series data, two variables are considered cointegrated when there is a long-term equilibrium relationship between them. This relationship indicates that the variables move together over time, and the difference between them remains constant. A linear combination of two non-stationary time series can eliminate the stochastic trends found within each series, resulting in a stationary error term. If a variable is non-stationary in its level, the first difference of the data is often used. Differencing the data may reveal the presence of a long-run relationship between the variables. This study will utilize the Johansen test for multiple cointegration or the Engle-Granger test for cointegration involving two variables.

4.7.3 Normality Test

A challenge when working with time series data is that the residuals or error terms might not follow a normal distribution; therefore, normality tests such as the Shapiro-Wilk test and Jarque-Bera test will be employed to determine if the residuals exhibit a normal distribution or not. The Jarque-Bera test has an asymptotic distribution and considers both skewness, which reflects the lack of symmetry, and kurtosis, which indicates the peakedness of the distribution, to assess whether the distribution is normal. For a perfectly normal distribution, kurtosis equals 3 while skewness equals 0, and the mode, mean, and median are identical, with all significant values concentrated around the mean.

4.7.4 Multicollinearity Test

Multicollinearity refers to a situation where there is a perfect or exact correlation among the variables being analyzed. One of the assumptions of the Classical Linear Regression Model (CLRM) is the absence of a linear relationship between all or some independent variables (Gujarat, 2008). Although the OLS estimators are considered BLUE, making accurate predictions becomes challenging due to the large variances and covariances associated with them.

As a result, the confidence intervals are often much wider, which may lead to the acceptance of the null hypothesis of zero. The significance of one or more coefficients might appear statistically insignificant, even if the R-squared value suggests otherwise. It's possible for the overall goodness of fit to be quite high, while the parameters and their standard errors may be highly sensitive to small variations (Gujarat, 2008). For these reasons, testing for multicollinearity is essential. The research will employ a correlation matrix to detect the presence of multicollinearity.

4.7.5 Heteroscedasticity Test

Another assumption of the CLRM is that the variance of each error term is constant. This situation is termed homoscedasticity. Lack of equal variance represents heteroscedasticity (Gujarati, 2004). Heteroscedasticity causes the OLS estimators to no longer be best in the class of linear and unbiased estimators. The breusch-Pagan test will be conducted for heteroscedasticity.

4.7.6 Test for Serial Correlation

One of the assumptions of the Classical Linear Regression Model (CLRM) is that, there is no autocorrelation between the disturbance terms. In the presence of autocorrelation, the Ordinary Least Squares (OLS) estimators are best and unbiased but they do not have minimum variance, hence they are inefficient, as a result OLS estimators are not Best Linear Unbiased Estimators (BLUE). Although the estimators are best and unbiased

estimators (BUE) their significance T-test and F-test are misleading (Gujarat, 2008). To test for serial correlation, the Breusch-Godfrey test will be conducted.

4.7.7 Model Specification Test

In order to test if the model was correctly specified and that there are no omitted variables, the Ramsey Reset test will be conducted.

4.7.8 Stability and Robustness in VAR

For the Vector Autoregressive (VAR) model, ensuring stability and robustness is crucial, given the complexity of dealing with multiple interdependent time-series variables. The stability of the VAR model will be checked using methods such as the Eigenvalue of Matrix, which helps in determining whether the system is stable and the results are reliable over time. Additionally, impulse response functions will be used to understand the dynamic interactions between variables in the model. This involves observing how a shock to one variable affects other variables over time, providing insights into the causal relationships within the VAR model. These techniques are essential for confirming that the VAR model accurately captures the dynamics of the economic relationships under investigation.

4.7.9 Granger Causality Test

The Granger causality analysis of monetary policy variables and the Gini coefficient is conducted to establish the direction of causality.

4.8 Software Tool for Economic Modeling

Stata 15.0 will be the primary software used for regression analysis and VAR modeling. Its robustness and wide range of econometric analysis capabilities makes it an ideal choice for the study. Stata provides a user-friendly interface and a comprehensive set of tools for conducting various statistical tests, making it suitable for both the regression and diagnostic testing phases of the study.

4.9 Conclusion

The proposed research on "The Impact of Monetary Policy on Income Inequality in Malawi" is set to embark on a comprehensive journey using a quantitative approach, primarily centered around sophisticated economic modeling.

This study, with its robust and methodically structured design, aims to unravel the intricate dynamics of monetary policy and its effects on income distribution within the specific context of Malawi's economy. The employment of quantitative methods, particularly advanced econometric models like regression analysis and Vector Autoregression (VAR), underscores the commitment to empirical rigor and precision in understanding these complex relationships.

This study aims to provide a detailed and accurate depiction of the impact of monetary policy over time by carefully analyzing quantitative data from national income and expenditure surveys, central bank reports, and international financial databases. By selecting an appropriate time frame, the study will ensure a comprehensive understanding of both the immediate and long-term effects of these policies on income inequality.

The implementation of diagnostic tests to validate the regression model, along with stability and robustness checks for the VAR model, is essential in establishing the reliability and accuracy of the findings. This careful attention to testing model assumptions and validity demonstrates the study's commitment to producing results that are not only statistically significant but also meaningful and representative of real-world economic dynamics.

The study aims to offer valuable insights for policymakers, economists, and scholars by providing a deeper understanding of how monetary decisions impact economic disparities. By highlighting these critical aspects, the research seeks to inform policy interventions that could promote more equitable economic outcomes in Malawi. Additionally, it may serve as a model for other similar economies facing the challenges of income inequality.

CHAPTER 5

EMPIRICAL RESULTS AND DISCUSSION

5.1 Introduction

This chapter organizes the results attained from engaging the methodologies described in Chapter Four. The impulse response function (IRF) results obtained from the Vector Autoregressive (VAR) model are presented in the Appendix. The chapter contains data for the descriptive statistics and the results from the OLS and VAR models. The segment on outcomes and explanations also includes diagnostic tests as required to estimate time series models. Furthermore, the chapter provides the economic and statistical implications of the findings.

5.2 Descriptive Analysis

Table 2 below provides an overview of the descriptive analysis of the study. Where the summary tables postulate an outline of the central tendency, variability, and range of the variables concerned in the study. The period under consideration in this study is from 19902022, making a total of 33 observations for each variable in the dataset.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
year	33	2006	9.67	1990	2022
gdp growth	33	4.019	4.903	-10.24	16.729
inflation gdp defl~r	33	22.545	21.683	4.1	112.694
real effective exc~d	33	115.679	38.751	65.326	198.073
real interest rate	33	11.848	12.114	-29.221	34.954
gini	33	49.63	10.173	34	67.1
policyrate	33	24.016	11.63	12	75.53
unemploymentrate	33	3.091	1.016	.91	4.98
e	33	0	4.833	-9.644	10.949

Source: Authors computations using data from the WDI, RBM, STATISTA, and NSO

From Table 1, the dependent variable is the Gini Coefficient in percentage. It can be seen that the average value of the Gini index between 1990-2022 is estimated at 49.63 percent while ranging between 34.95-67.1 percent with a standard deviation of about 10.2 percent.

Also, it could be observed that the policy rate has an average of 24 percent and a standard deviation of 24 percent, a minimum of 12 percent, and a maximum of 75.5 percent. In contrast, the average real interest rate was about 11.85 percent and a standard deviation of 12 percent, with a minimum of minus 29 percent and a maximum of 35 percent. In terms of the real effective exchange rate, the average is approximated at 116 and a standard deviation of 38.75, with a minimum of 65 and a maximum of 198 against Malawi's major trading partners.

The Inflation, GDP price deflator has an average of 22.5 percent and a standard deviation of 21.68 percent, with a maximum of approximately 112.7 percent in the year 2002 and a minimum of about 4 percent in 2007. interestingly, the lower inflation rate is associated with an impactful GDP growth of 9.6 percent. As can also be observed in Table 1, GDP growth has an average of 4 percent and a standard deviation of about 4.9 percent, with a maximum for the period of about 16.7 percent and a minimum of a contraction of minus 10 percent. The unemployment rate in Malawi has ranged between 0.9 percent and about 5 percent with an average of about 3.1 percent and a standard deviation of about 1 percent.

5.3 Diagnostic Tests

5.3.1 Unit Root Tests

In regression analysis involving time series data, a critical assumption is that the time series under consideration is stationary (Gujarati, 2012). The mean and variance of a stationary time series do not change over time. A unit root is a special case of non-stationarity, where the time series has a trend. According to Gujarati (2012), a non-stationary time series can only be studied for a period under consideration but it is not possible to generalise to other

periods and can lead to spurious regression. For the series to be said it is integrated of order zero i.e. I(0), the series has to be stationary in levels.

However, if the series demonstrates non-stationarity but becomes stationary when differentiated once, then it is said to be integrated of order one denoted as I(1). In general, a time series is predicted to have a unit root integrated of order d, denoted as I(d). The unit root is associated with nonsense regression. The null hypothesis for the test is that there is a unit root which means that it is nonstationary and so when the test static is greater than the critical value in absolute terms, we reject the null hypothesis

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The study uses the Augmented Dickey-Fuller (ADF) test for stationarity test. ***Table 3:***

Unit Root Test Results

Variable	ADF test statistic	1% critical value	
Residuals	-2.461	-3.716	I(0)

The test's null hypothesis (H0) is that the variable follows a Random Walk without drift, represented as d=0. The results are interpreted by comparing the test statistics against critical values obtained at a 1% confidence level. You fail to reject the null hypothesis when the test statistic is greater than the critical values and determine that a unit root is present, indicating non-stationarity. However, if the test statistic is less than the critical values, the null premise is rejected and concludes that the variables are stationary. The results, therefore, show that the variable is non-stationary at I(0) since the ADF test statistic of the residuals -2.461 is greater than the critical value at 1 percent, hence we fail to reject the null supposition that the series has a random walk without drift, d = 0.=

Table 4: Unit Root Test after First Difference Results

Variable	ADF test statistic	1 % critical value	
Residuals	-4.327	-3.723	I(1)

The Residuals, e, were found to be stationary after differencing as the test statistic was lower than the critical value at a 1 percent significance level.

The unit root test was also conducted for each variable. The null hypothesis for the test is that there is a unit root which means that it is nonstationary and so when the test static is greater than the critical value in absolute terms the null hypothesis is refuted. From Table 3, the results show that some variables were stationary in levels while other variables were stationary at first difference. Given these results of a mixture of I (0) and I

(1) variables, estimation of the VAR model is allowed (Ng'ong'ola, 2018). The comprehensive analysis of the Dickey-Fuller Test results are provided in appendix I.

5.3.2 Heteroscedasticity

The classical linear regression model (CLRM) assumes that the error term in the regression model has equal variance across observations, which is known as homoscedasticity(Gujarati, 2012). However, when the variance of the error terms changes across observations it is known as heteroscedaciticy. The Breusch-Pagan-Godfrey (BPG) test will be conducted to test for heteroscedasticity.

Table 5: Breusch-Pagan-Godfrey Test Results

Chi2(1)	Prob > Chi2
0.00	0.9527

The null hypothesis H(0) is that there is constant variance with an alternative supposition

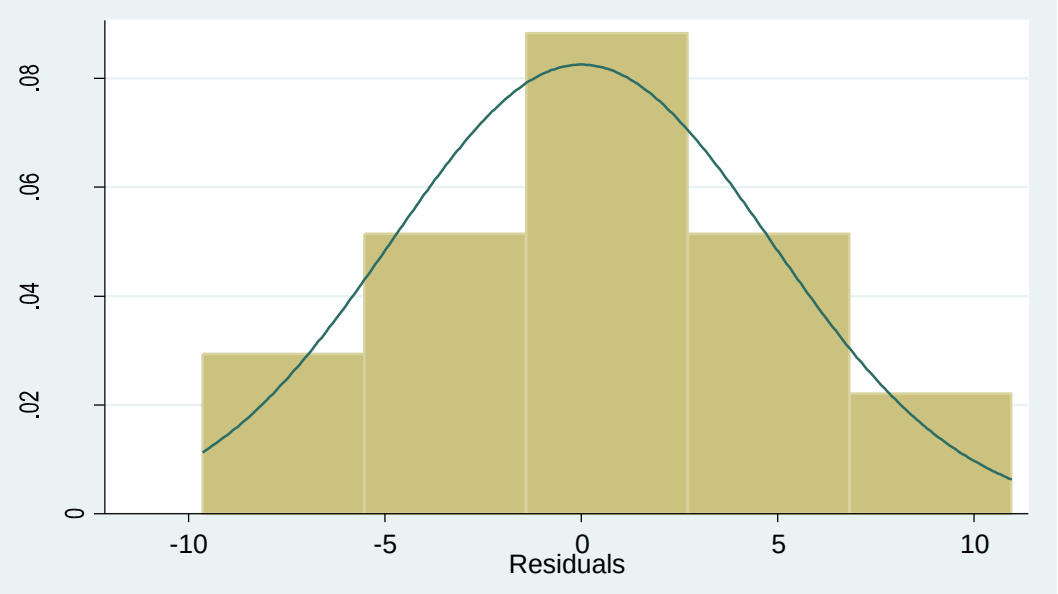
H(1)of unequal variance across observations. The results are interpreted by comparing the Probability value (P-value) to a chosen level of significance, say 0.05. Thus if the P-value is lower than the significance level we reject the null hypothesis of equal variance and conclude that there is evidence of heteroscedasticity. On the contrary, if the P-value is more than or equal to the level of significance we fail to reject the null hypothesis and conclude that there is no significant evidence of heteroscedasticity.

In this context, the P-value (0.9527) is greater than the significance level (0.05), we therefore fail to reject the null hypothesis of equal variance.

5.3.3 Normality Test

The normality distribution is a direct consequence of the central Limit Theorem. As such, the normality of the error is one of the basic premises in regression analysis. It is assumed that a normal distribution of error terms emerges whenever the sample size is large enough and specific properties and statistical tests (Hernandez, 2021). Figure 2 below shows a graph of residuals.

Figure 3: Histogram for Normality Test results



The histogram resembles a symmetric bell which is the first confirmation of normal distribution. This graphical method is not particularly a statistical test. The Shapiro-Wilk test is used to formally test for normality. For this test, the null supposition is that the data follows a normal distribution, while the alternative hypothesis is that the data does not follow a normal distribution.

Table 6: Shapiro-Wilk Test Results

Variable	Observations	W	V	Z	Prob>z
Residuals	33	0.98551	0.495	-1.463	0.92833

The decision criteria are that the value of W should range between 0 and 1, with a value closer to 1 indicating weightier evidence of normal distribution of the data as the null hypothesis fails to be rejected, and a value closer to 0 indicating sufficient evidence of rejecting the null hypothesis and concluding that the data is not normally distributed. In this case, W is closer to 1 and the p-value is greater than 0.05 hence we fail to reject the null hypothesis that the data follows normal distribution.

5.3.4 Multicollinearity Test

One of the assumptions of the classical linear regression model (CLRM) is that there is no exact linear relationship among the predictors. If there are one or more such relationships among the regressors it is said that the variables are collinear (Gujarati, 2012). When variables are collinear, statistical inference becomes wobbly with large variances and covariance even if the OLS estimators are still BLUE. A measure of the extent to which the variance of the OLS estimator is inflated due to multicollinearity, known as the Variance Inflation Factor (VIF) will be used.

Table 7: VIF Collinearity Test Results

VARIABLE	VIF
Inflation Rate	8.85
Real Interest Rate	8.51
Policy Rate	3.72
Real Effective Exchange Rate	2.47
GDP Growth	1.35
Unemployment Rate	1.23
Mean VIF	**4.35**

A VIF greater than 10 is evidence that multicollinearity exists among the regressors. This means that the higher the VIF the more unbearable the collinearity and the coefficients become unstable. If the VIF values are less than 10, there is no evidence of multicollinearity. In this case, the mean value of the VIF (4.35) indicates that the regressors are not collinear.

5.3.5 The Ramsey RESET Test for Model Specification

Ramsey's regression specification error test, RESET for short, is a general test of model specification errors in terms of omitted variables (Gujarati, 2012). The null hypothesis is that the model has no omitted variables while the alternative hypothesis is that the model has omitted variables.

Table 8: Ramsey RESET Test Results

F (3,23)	Prob>F
1.42	0.2614

The results of the Ramsey reset test which is concerned with misspecification errors such as the omission of relevant variables or incorrect functional form showed that there were

no omitted variables in the model since at the standard level of 0.05, the P-value (0.2614) is substantially greater than the level of significance, hence we fail to reject the null hypothesis and conclude that there is no indication of omitted variables in the model and that the model is correctly specified.

5.3.6 VAR order determination

The most common criteria considered for lag selection are the log-likelihood (LL), Likelihood Ratio (LR), degrees of freedom (df), p-value, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hanna-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC). The FPE suggested a VAR model of order 3, which is in contrast with the LR, AIC, HQIC, and SBIC criteria as they suggest the lag length of the VAR model to be 4. The AIC is chosen for this model.

Table 9: The Selection Order Criteria Results

Selection-order criteria
Sample: 1994 - 2022 Number of obs = 29

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
3	-275.849	362.820	49	0.000	469934*	29.645	31.919	36.906
4	5571.830	11695*	49	0.000	.	-370.264*	-367.267*	-360.693*

Endogenous: gini policyrate_rate real_interest_rate real_effective_exchange_rate_ind inflation_gdp_deflator gdp_growth unemploymentrate
Exogenous: _cons

But based on the inconsistencies of the selection criteria FPE, AIC, HQIC, and SBIC the Optimum lag selection chosen was lag 2 which minimizes the error and at the same time avoids reducing the degrees of freedom in the model.

Also, since the data set is yearly, the number of lags is typically 1 or 2. Therefore 2 is chosen as the optimal lag length. The smaller p-value confirms that including lags continues to significantly improve the model.

Table 10: Estimate of a VAR model with summary statistics

	Coef.	**Std. Err.**	**z**	**P>z**	**[95% Confidence interval]**	
Gini coefficient						
Gini coefficient						
L1.	0.618	0.146	4.220	0.000	0.331	0.905
L2.	0.123	0.175	0.710	0.480	-0.219	0.466
Policy rate						
L1.	0.039	0.090	0.430	0.670	-0.139	0.216
L2.	-0.662	0.129	-5.110	0.000	-0.916	-0.408
Real Interest rate						
L1.	-0.171	0.236	-0.720	0.470	-0.634	0.293
L2.	0.883	0.180	4.900	0.000	0.529	1.236
Real Effective Exchange rate						
L1.	-0.116	0.043	-2.670	0.008	-0.200	-0.031
L2.	0.209	0.058	3.570	0.000	0.094	0.324
Inflation						
L1.	0.239	0.144	1.660	0.096	-0.043	0.522

L2.	0.433	0.114	3.810	0.000	0.210	0.655
GDP growth						
L1.	0.143	0.212	0.670	0.500	-0.273	0.559
L2.	0.572	0.247	2.320	0.020	0.089	1.056
Unemployment rate						
L1.	-0.973	0.630	-1.540	0.122	-2.207	0.261
L2.	0.454	0.653	0.690	0.487	-0.826	1.734
_cons	-9.702	6.530	-1.490	0.137	-22.501	5.098

5.4 Interpretation of the VAR model output

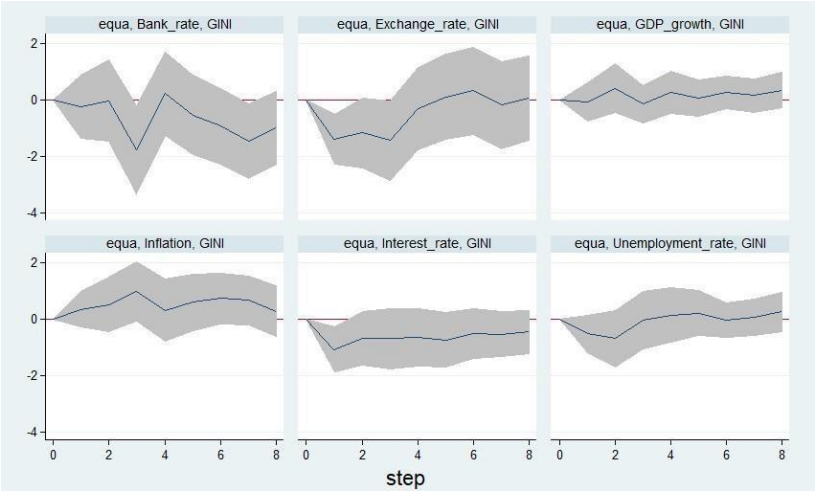
Upon examining the p-value (P>z), it is evident that the policy rate from two periods ago negatively impacts the Gini coefficient in the current period, all else being equal. Additionally, an increase in the real interest rate from two periods ago results in a rise in the Gini coefficient in the current period, holding other factors constant. Furthermore, the first lag of the exchange rate shows a negative effect on income inequality at a 5 percent significance level on average, whereas the second lag has a positive effect on the Gini coefficient. Notably, a one-unit rise in the inflation rate from two periods ago corresponds to a 0.441-unit increase in the Gini coefficient in the current period, also at the 5 percent significance level, all else being equal. GDP growth over the past two periods has a positive influence on the Gini coefficient as well, while the unemployment rate does not demonstrate any significance in the vector auto-regression model for the Gini coefficient.

5.5 Effects of Monetary Policy on Income Inequality

The VAR model in Table 8 has been used to generate impulse response functions that show the response of the Gini coefficient to shocks in the monetary policy variables. The

impulse variable is listed first on each graph while the response variable is listed next. In this case, the response variable is the Gini coefficient. Another critical point is that the response functions are generated for 8 periods. As it will be evidenced, Income inequality as measured by the Gini coefficient reacts differently to distinct monetary policy shocks.

Figure 4: Standard Monetary Policy Shock using IRFs



From the impulse response function above it can be observed that over time Gini coefficient has a negative deviation as the policy rate changes. The Gini coefficient deviates negatively in the first 3 years and then deviates slightly positively in the upward direction due to one standard deviation shock to the policy rate. This means that one innovation to the policy rate temporarily decreases income inequality. This negative response continues sharply until the third period when it starts to go up and then hits a steady state in the long run from the fifth period. Therefore, shocks to policy rate will generally have a negative impact on income inequality both in the short run and long run. The finding is consistence with the monetary transmission mechanism as explained by Mian and Sufi (2014) that lower interest encourages the rich to borrow than people in the lower income group. The high-income groups invest from the borrowing thereby perpetuating and increasing income gaps between the high-income owners and lowincome owners.

A one Standard Deviation (STD) shock to the real effective exchange rate increases the Gini coefficient on average until the sixth period when it starts to gradually decline.

Succinctly, a real effective exchange rate will have a negative impact on the Gini coefficient in the short run and a positive impact on the Gini coefficient in the long run.

The Gini coefficient produces a small change from a change in GDP growth rate in the early years, increasing as GDP grows, it then deviates upwards and downwards with about -1 and +1 for a short time and then remains constant.

This finding is consistent with the theoretical framework proposed by Okun (1975), which argued that high incomes will lead to more people saving, hence the redistribution of income tends to be uneven. The observation that income inequality increases with income inequality in the initial years of the shock confirms the theoretical proposition by Okun (1975) that there is a sacrifice of equality when there is a growth in the output of an economy. Although this study finds this relationship occurring in the short run, it does not support the general insinuation of the theory as it finds negligible impact in the long run

One innovation shock to inflation initially increases income inequality until the third period. It declines between the third and fourth periods and starts increasing again until the sixth period when it starts to steadily decline where it remains in the positive region. In summary, a shock to the inflation rate has a positive impact on the Gini coefficient in both the short run and the long run. The study contradicts the findings by Siami-Namini and Hudson (2019) that there is a negative relationship between inflation and income inequality implying that as inflation rises income inequality decreases. Income inequality then reaches a minimum and then starts rising again.

A one SD shock on the real interest initially decreases the Gini coefficient in the first period and increases from the first period to the second period where it remains in its steady state. In general, a shock to real interest has a negative impact on the Gini coefficient and remains constant in the long run.

The Gini coefficient does change negatively due to a shock in the unemployment rate from the start to period two, it then remains nearly constant in the long run. Contrary to this

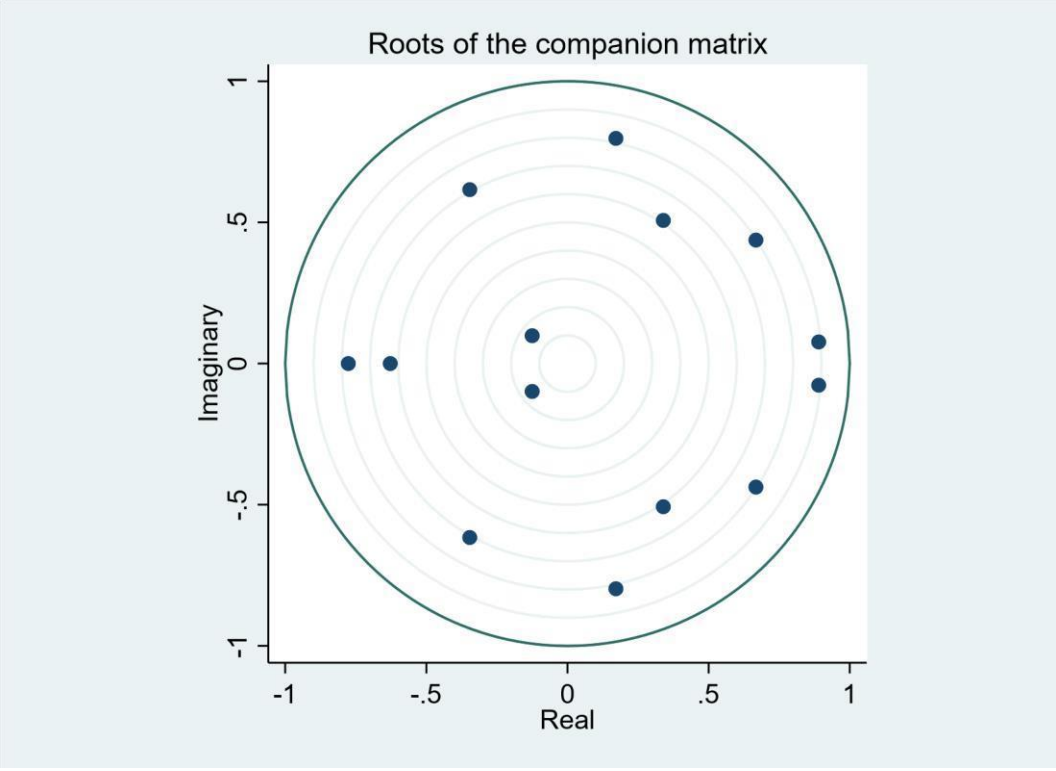
inconsistent finding in this study, the monetary policy transmission mechanism, as specifically argued by Mian and Sufi (2014) observed that there is a clear negative relationship between the real interest rate and income inequality.

5.5.1 VAR Stability Test

According to Lutkepoh (1993), the stability in the estimated VAR model is attained if the modulus for each Eigenvalue of Matrix A is strictly less than 1. Appendix II shows the VAR stability graph with Eigenvalues less than 1.

As it can also be observed, all the Eigenvalues of the VAR model lie inside the unit circle, indicating that the VAR model is stable. This also means that the effects of shocks or innovations in the VAR system dissipate over time.

Figure 5: Stability of the VAR model



5.5.2 Granger Causality Test

The Granger causality between the monetary policy variables and the Gini coefficient is used to determine the direction of causality. The two hypotheses will help in the interpretation of table 10:

> ***Null:*** *Lagged (2 lags) excluded variable does not cause a decrease/increase (affect) in Gini coefficient.*
>
> ***Alt:*** *Lagged (2 lags) excluded variable cause a decrease/increase (affect) in Gini coefficient.*

The decision criteria are that you reject the null hypothesis of no causality if the p-value is lower or equal to 0.05 significance level. if the p-value is greater than 0.05 we cannot reject the null hypothesis of no causality ***Table 11: Granger Causality Test***

Equation	**Excluded**	**Chi2**	**df**	**Prob > Chi2**
Gini coefficient	Policy rate	28.803	2	0.000
Gini coefficient	Interest rate	24.755	2	0.000
Gini coefficient	Exchange rate	16.028	2	0.000

Gini coefficient	Inflation	25.302	2	0.000
Gini coefficient	GDP growth	7.872	2	0.020
Gini coefficient	Unemployment rate	2.5446	2	0.280
Gini coefficient	ALL	68.974	12	0.000

Interpretation

These results concur with the VAR Model results, as it can be observed that the Policy rate, Real interest rate, Exchange rate, and Inflation rate have a P-value of less than 0.05 which suggests there is a significant effect on the Gini coefficient. All the Monetary Policy variables bar the Unemployment rate contain evidence to suggest that Granger causality exists.

Appendix III presents the full Granger causality table which shows how monetary policy Granger causes the key economic indicators namely Inflation, GDP growth, and

Unemployment rate. Between Inflation rate and monetary policy, evidence suggests that Policy rate and real effective exchange rate Granger causes inflation since their p-values of 0.000 are lower than the level of significance 0.05. From the causality analysis, there is also evidence to suggest that the monetary policy variables Real interest rate and Real effective exchange rate Granger causes variations in the macroeconomic indicator variable GDP growth rate, as the p-values 0.041 and 0.000 respectively, are both less than the 0.05 level of significance. Significantly monetary policy variables which include the Policy rate, Real interest rate, and Real effective exchange rate both Granger cause unemployment rate as their p-values are lower than the 0.05 level of significance.

In conclusion, the null hypothesis is that all the variables in the model do not Granger cause income inequality. By comparing the P-value (0.000) against the level of significance (0.05), which is less than the significant level, we refute the null hypothesis and settle that there is Granger causality from the excluded variables as a group to the Gini coefficient.

5.6 OLS Regression Analysis

Having fulfilled the diagnostic tests that are initially required for the Ordinary least squares model, the study then estimated the regression to determine which variables contribute to income inequality in Malawi. Using the OLS the estimations were carried out using the data from 1990-2022, giving a total of 33 possible observations. The results of the regression are summarised in the table:

Table 12: OLS Regression Output

gini	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
policyrate_rate	-.016	.157	-0.10	.921	-.339	.307	
real_interest_rate	.32	.228	1.40	.173	-.149	.789	
real_effective_exc ~d	.248	.038	6.44	0	.169	.326	***
inflation_gdp_defl ~r	.154	.13	1.18	.249	-.114	.421	
gdp_growth	.484	.225	2.15	.041	.022	.947	**

unemploymentrate	.642	1.033	0.62	.54	-1.483	2.766
Constant	10.197	6.904	1.48	.152	-3.995	24.389

Mean dependent var	49.630	SD dependent var	10.173
R-squared	0.774	Number of obs	33
F-test	14.863	Prob > F	0.000
Akaike crit. (AIC)	210.618	Bayesian crit. (BIC)	221.093

*** p<.01, ** p<.05, * p<.1

Source: Authors computation

Interpretation

The regression model shows that the real effective exchange rate and GDP growth rate are the significant factors that are causing an increase in the Gini coefficients. The results show that the R-squared is 0.7743 which means that about 77% of variations in the Gini coefficient are explained by the predictor variables during the period of the study. The Fstatistic of 14.86 with a corresponding probability P>F [0.0000] measures the overall statistical influence of the explanatory variables in explaining the dependent variable. It was found to be statistically significant at 5% level. This indicates that the variables included in the model explain approximately the variations of the Gini coefficient in Malawi.

The output from the regression output shows a significant relationship between Real effective exchange rate and Gini coefficient. The coefficient of Real effective exchange rate carries the priori expected positive sign which shows that a positive relationship between real effective exchange rate and income inequality exists since its p-value was 0.0000 it is significant at the 5% level.

The interpretation of the coefficient of about 0.25 is that if we increase the Real effective exchange rate by 1%, on average, the Gini coefficient goes up by about 0.25%, holding

Policy rate, Real interest rate, Inflation rate, GDP growth rate and unemployment rate constant.

The variable GDP growth rate was found to be statistically significant at the conventional level of significance with a p-value of 0.041 and a coefficient of .484396. This means that there is a significant relationship between economic growth and income inequality. With the positive coefficient of GDP growth rate, it shows that a 1% increase in GDP growth will lead to about 0.48% increase in the Gini coefficient. The positive sign runs contrary to the priori expected positive sign.

The coefficient of the Policy rate was found to be negative, implying a negative relationship between Policy rate and income inequality. However, the coefficient was found to be statistically insignificant to the Gini coefficient since the p-value of 0.921 is greater than the critical value at a 5% level of significance, leading to acceptance of the null hypothesis that the coefficient is equal to zero. This means that as per data used in this study, there is no evidence that domestic investment significantly contributes to Income inequality in Malawi.

The Real interest rate, Inflation rate, and unemployment rate have a positive economic relationship with the Gini coefficient evidenced by their positive coefficient but they are not statistically significant.

CHAPTER 6

CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Introduction

This final chapter summarises the findings of the research, policy recommendations constructed from the findings of this study, limitations of the study, and also areas for further study cognate of this research area.

6.2 Summary of the findings

The study was set out to empirically analyse the dynamic impact of Monetary Policy on income inequality in Malawi. This study is set over a period of 33 years, between 1990 to 2022. The general objective was to investigate the relationship between monetary policy and income inequality in Malawi. During the research, it was observed that monetary policy in Malawi has orbited through different regimes namely the 1964-1986 which is commonly known as the financial repression regime, the 1987 to around 1993 regime associated with the financial sector reform, and the financial liberalization regime which commenced around 1994 during which multiparty democracy was practiced. It has also been established that the period of the early multiparty regime corresponds with the highest Gini coefficient in the post-multiparty democracy in Malawi (1997). Along the way, there have been notable inflation values with the years 1995, 1996, and 2002 amongst the highest. The Gini coefficient has also fluctuated, which can be demarcated between the period from 1990-1999 with the highest average Gini coefficient, the 20002009 decade has the lowest Gini coefficient, and between 2010-2019 that has seen the average values surpassing the 2000-2009 decade.

The study adopted the OLS model to evaluate the statistical and economic significance of monetary policies and economic indicators on the dependent variable, namely the Gini coefficient. It further adopted a VAR model to examine the dynamic impact of the variables included in the model.

In the VAR model, individual constants might be difficult to interpret and make sense of, hence the IRFs were utilized to examine the dynamic responses of the variables in the system to shocks. The IRFs trace the reaction of the variables over time due to innovations or shocks. The response function graphs being the focal point of the VAR model analysis (Gujarati, 2012), were determined to analyse the impact of shocks to the monetary policy on the income distribution for future periods and the persistence of the shocks. Before estimating the OLS and VAR models, stationarity tests were conducted on the variables, for the OLS model the variables were nonstationary in levels but became stationary after first differencing, and for the VAR model, the stability test showed that the variables were all stable as their eigenvalues all lied within the unit circle and were all less than 1. The residuals of the OLS model were tested whether they were normally distributed using the Shapiro-Wilk test and it was established that they followed a normal distribution. The OLS model was also tested whether there were omitted variables in the model utilizing the Ramsey Reset test and the results showed that the model had no omitted variables. The OLS model was further tested for heteroskedastic and collinearity as these are common problems in times series data and the model had no heteroscedasticity and the variables were not collinear. To determine the optimal lag length, The VAR orders recommended the lag length choice criteria suggested lag length of 2, using the AIC. The model was also subjected to the Granger causality test to determine whether the monetary policy variables Granger cause income inequality. The results showed that the Policy rate, Real interest rate, Real effective exchange rate, Inflation rate, and GDP growth all Granger causes a change in the Gini coefficient while the Unemployment rate does not Granger cause the Gini coefficient. The impulse response function (IRF) was used in tracing the effects of a change in monetary policy on the Gini coefficient, in both the short-run and long-run, in which results showed both short-run effects and long-run effects. The OLS results showed

that the Real effective rate and GDP growth rate are significant in explaining the Gini coefficient in Malawi.

6.3 Policy Implications

Considering that Real effective exchange rate shocks are significant and have positive effects on the Gini coefficient, it means that an increase in the exchange rate which occurs mostly during the tobacco selling period increases foreign demand for goods and services as they become cheaper which causes loss of business by domestic producers and a reduction of the exchange rate might reduce income inequality as domestic demand increases. It is therefore imperative for the government to consider the exchange rates as a policy indicator in guiding domestic and foreign claims for goods and services, and income distribution in the country. The consideration may take the form of seasonal exchange rate policies to regulate the demand for foreign goods and the pricing of domestic goods.

Given that GDP growth rate innovations also affect the Gini coefficient positively, the government can consider working on the distribution component of the resultant economic growth as Mussa (2015) also suggested. It may consider intensifying social safety net programs, labour training, and recruitment policies to curb the income inequality that is continuing to divide the nation into different economic spectrums.

The unearthing of the real interest rate as a conduit of positive shock on the Gini coefficient can also be taken as a policy incentive by the government to regulate the real interest rate through interest rate capping to control the worsening economic gap.

6.4 Direction for Further Study

The study only focused on analysing the impact of monetary policy variables on income inequality due to the challenges in the availability of the Gini coefficient data but the researcher recommends that further studies can be explored to understand how monetary policy affects different income groups. Furthermore, a study on financial inclusion versus

monetary policy can be undertaken to understand the role of monetary policy in encouraging or discouraging financial integration.

It can be noted that other measures of income inequality like consumption inequality can be used as a proxy of economic inequality and a comparative study can be done in terms of the use of income inequality and consumption inequality.

6.5 Conclusion

This study has analyzed dynamics in Policy rate, Real interest rate, Real effective exchange rate, inflation rate, GDP growth rate, and Unemployment rate in Malawi via a time series data set from 1990 to 2022. The results suggest that factors such as Real effective exchange rates, and GDP growth rate affect income inequality significantly. Further, the results showed that the Policy rate, Real interest rate, Real effective exchange rate, Inflation rate, and GDP growth all Granger causes a change in the Gini coefficient while the Unemployment rate does not Granger cause the Gini coefficient. These findings have important implications on monetary policy decisions and directions in both the short run and the long run.

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APPENDICES

APPENDIX I: UNIT ROOT TEST

```
. dfuller gini, trend lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        31

                                 ———— Interpolated Dickey-Fuller ————
                 Test         1% Critical       5% Critical      10% Critical
Statistic          Value             Value             Value

 Z(t)            -3.642            -4.325            -3.576            -3.226


MacKinnon approximate p-value for Z(t) = 0.0265


. dfuller inflation_gdp_deflator, trend regress lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        31

                                 ———— Interpolated Dickey-Fuller ————
                 Test         1% Critical       5% Critical      10% Critical
Statistic          Value             Value             Value

 Z(t)            -3.845            -4.325            -3.576            -3.226


MacKinnon approximate p-value for Z(t) = 0.0144
```

D.inflatio~r	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inflation_~r						
L1.	-.9640549	.2507578	-3.84	0.001	-1.478567	-.4495424
LD.	.0097869	.1843091	0.05	0.958	-.3683841	.3879579

_trend	-.9711509	.4768418	-2.04	0.052	-1.94955	.0072477
_cons	38.9956	12.44177	3.13	0.004	13.46719	64.52401

```
. dfuller

Augmented                                                     =        31
```

```
 Z(t)                real_effective_exchange_rate_ind, drift regress lags(1)
Dickey-Fuller
         test  for unit root         Number

         of obs

                              ———————— Z(t) has t-distribution ————————
                Test          1% Critical       5% Critical      10% Critical

         Statistic             Value             Value             Value
         -2.441              -2.467            -1.701            -1.313
```

```
p-value for Z(t) = 0.0106
```

D. real_effective_exchange_rate_ind	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
real_effective_exchange_rate_inc						
L1.	-.2213888	.0906851	-2.44	0.021	-.4071487	-.0356288
LD.	.0372158	.1726689	0.22	0.831	-.3164804	.390912
_cons	21.99408	10.96162	2.01	0.055	-.4597923	44.44795

```
. dfuller gdp_growth, drift regress lags(1)
```

```
. dfuller

Augmented                                                     =        31
```

Augmented Dickey-Fuller test for unit root — Number of obs = 31

	Test	Z(t) has t-distribution 1% Critical	5% Critical	10% Critical
Statistic	Value	Value	Value	
Z(t)	-3.523	-2.467	-1.701	-1.313

p-value for Z(t) = 0.0007

D.gdp_growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_growth L1.						
LD.	-1.041369	.2956113	-3.52	0.001	-1.646902	-.4358369
	-.2105466	.1823698	-1.15	0.258	-.5841143	.1630211
_cons	3.961589	1.486955	2.66	0.013	.9156986	7.007479

```
real_interest_rate, drift regress lags(1)

Dickey-Fuller test for unit root         Number of obs
```

Test	Z(t) has t-distribution 1% Critical	5% Critical	10% Critical
Statistic	Value	Value	Value
-3.053	-2.467	-1.701	-1.313

```
. dfuller

Augmented                                                     =        31
```

p-value for Z(t) = 0.0025

D. real_interest_rate	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
real_interest_rate L1.	-.7674487	.2514031	-3.05	0.005	-1.282425	-.2524727
LD.	-.121398	.1915062	-0.63	0.531	-.5136806	.2708846
_cons	9.16934	3.357691	2.73	0.011	2.291421	16.04726

Z(t)

```
. dfuller policyrate_rate, regress lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        31

                                 ———— Interpolated Dickey-Fuller ————
                 Test         1% Critical       5% Critical      10% Critical
Statistic          Value             Value             Value

 Z(t)             -3.937            -3.709            -2.983            -2.623

                                                                        MacKinnon
approximate p-value for Z(t) = 0.0018
```

```
. dfuller

Augmented                                                     =        31
```

D. policyrate_rate	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
policyrate_rate L1.	-1.068969	.2715175	-3.94	0.000	-1.625148	-.5127909
LD.	.034487	.1888699	0.18	0.856	-.3523954	.4213694
cons	190706.6	190690.3	1.00	0.326	-199904.7	581317.9

```
                                                  unemploymentrate, regress lags(1)

      Dickey-Fuller test for unit root         Number of obs
```

Test	Interpolated Dickey-Fuller		
	1% Critical	5% Critical	10% Critical
Statistic	Value	Value	Value
-3.818	-3.709	-2.983	-2.623

MacKinnon approximate p-value for Z(t) = 0.0027

D. unemploymentrate	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Z(t)						
unemploymentrate L1.	-.9874044	.2585886	-3.82	0.001	-1.517099	-.4577096
LD.	.1417341	.1959595	0.72	0.476	-.2596707	.5431389
_cons	3.237356	.8959254	3.61	0.001	1.402136	5.072575

```
. dfuller

Augmented                                                 =         31
```

Selection-order criteria
Sample: 1994 - 2022 Number of obs = 29

lag	LL	LR	df	p	FPE	AIC
3	-275.849	362.820	49	0.000	469934*	29.645
4	5571.830	11695*	49	0.000	.	-370.264*

Endogenous: gini policyrate_rate real_interest_rate

real_effective_exchange_rate_ind
inflation_gdp_deflator gdp_growth
unemploymentrate
Exogenous: _cons

APPENDIX II: GRANGER CAUSALITY TEST

Equation	Excluded	chi2	df	Prob>Chi2
gini	policyrate_rate	28.803	2	0.000
gini	real_interest_r~e	24.755	2	0.000
gini	real_effective_~d	16.028	2	0.000
gini	inflation_gdp_d~r	25.302	2	0.000
gini	gdp_growth	7.872	2	0.020
gini	unemployment	2.545	2	0.280
gini	ALL	68.974	12	0.000

policyrate_rate	gini	0.219	2	0.896
policyrate_rate	real_interest_r~e	9.973	2	0.007
policyrate_rate	real_effective_~d	3.917	2	0.141
policyrate_rate	inflation_gdp_d~r	13.664	2	0.001
policyrate_rate	gdp_growth	2.499	2	0.287
policyrate_rate	unemploymentrate	0.198	2	0.906
policyrate_rate	ALL	25.051	12	0.015

real_interest_r~e		gini	13.029	2	0.001
real_interest_r~e		policyrate_rate	113.030	2	0.000
real_interest_r~e		real_effecti ve_~d	23.985	2	0.000
real_interest_r~e		inflation_gdp_d~r	0.647	2	0.724
real_interest_r~e		gdp_growth	5.145	2	0.076
real_interest_r~e		unemployment rate	3.007	2	0.222
real_interest_r~e		ALL	206.480	12	0.000
real_effecti ve_~d		gini	2.417	2	0.299
real_effecti ve_~d		policyrate_rate	27.302	2	0.000
real_effecti ve_~d		real_interest_r~e	19.503	2	0.000
real_effecti ve_~d		inflation_gdp_d~r	24.086	2	0.000
real_effecti ve_~d		gdp_growth	4.743	2	0.093

real_effecti ve_~d	unemploym entrate	0.480	2	0.787

	real_effecti ve_~d	ALL	45.290	12	0.000
	inflation_gd p_d~r	gini	3.112	2	0.211
inflation_gd	policyrate_r	251.700	p_d~r	ate	2	0.000
inflation_gd	real_interes	2.391	p_d~r	t_r~e	2	0.303
inflation_gd	real_effecti	50.418	p_d~r	ve_~d	2	0.000
	inflation_gd p_d~r	gdp_growth	6.706	2	0.035
	inflation_gd p_d~r	unemploym entrate	12.120	2	0.002
	inflation_gd p_d~r	ALL	515.960	12	0.000
	gdp_growth	gini	3.445	2	0.179
	gdp_growth	policyrate_r	0.507	2	ate 0.776
	gdp_growth	real_interes	6.372	2	t_r~e 0.041
	gdp_growth	real_effecti ve_~d	29.470	2	0.000
	gdp_growth	inflation_gd p_d~r	2.592	2	0.274
	gdp_growth	unemploym entrate	2.498	2	0.287

gdp_growth	ALL	51.788	12
			0.000
unemploym entrate	gini	11.643	2
			0.003
unemploym entrate	policyrate_r ate	6.222	2
			0.045
unemploym entrate	real_interes t_r~e	8.425	2
			0.015
unemploym entrate	real_effecti ve_~d	7.457	2
			0.024
unemploym entrate	inflation_gd p_d~r	7.006	2
			0.030
unemploym entrate	gdp_growth	6.717	2
			0.035
unemploym entrate	ALL	33.358	12
			0.001

APPENDIX III: STABILITY OF THE VAR MODEL

Eigenvalue stability condition

Eigenvalue		Modulus	
0.890	-	.07658646i	0.893
0.171	-	.7975947i	0.816
0.668	-	.4375455i	0.798
-0.777		0.777	
-0.346	-	.616064i	0.707
-0.628		0.628	
0.339	-	.5070585i	0.610
-0.125	-	.09875216i	0.160

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.