THE IMPACT OF GOVERNMENT DOMESTIC BORROWING ON HEADLINE INFLATION IN MALAWI

MASTER OF ARTS (ECONOMICS) THESIS

BY

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DECLARATION

I the undersigned hereby declare that this thesis/dissertation is my own original work which has not been submitted to any other institution for similar purposes. Where other people's work has been used acknowledgements have been made.

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The undersigned certify that this thesis represents the student's own work and effort and has been submitted with our approval.

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DEDICATION

I dedicate this work to my son Tuntufye Kyala Nohakalala Timothy Michael Sabila Gondwe.

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ABSTRACT

This study aims to determine whether there is any empirical support for limiting domestic borrowing to reduce upside inflationary pressures in Malawi, as suggested by a new orthodox neoclassical inflation theory such as the Fiscal Theory of Price Level (FTPL). The study investigates the short run and long-term effects of total domestic government borrowing on Malawi's headline inflation rate. The study adopts an Autoregressive Distributed Lag (ARDL) cointegration technique on time series for the period from 1980 to 2020 for Malawi to test the inflationary effect of government domestic borrowing while controlling for demand-driven inflation variables such as per capita Gross Domestic Product (GDP) growth, exchange rate growth (appreciation or depreciation), growth in money supply, and oil prices as a cost-push inflation driver. The analysis found that, while the FTPL holds in the short run at a significant level of 5.0%, inflation is insensitive to domestic government borrowing in the long run. On the other hand, the statistical significance of the exchange rate coefficient over the long term, even at 1%, indicates that Malawi's inflation is more imported and highly susceptible to fluctuations in the value of the local currency. These findings imply that policies aimed at import substitution, which would reduce the economy's high appetite for imports, and export base diversification, which would increase export levels, would help to reduce the rise in inflationary pressure.

Key Words: Inflation, ARDL Model, Unit root test, Long-run, Short-run, Cointegration

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ABBREVIATIONS

ADF	Augmented Dickey Fuller test
AfDB	African Development Bank
AIC	Alkaike information Criteria
APM	Automatic Pricing Mechanism
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed Lag Model
CPI	Consumer Price Index
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Squares of Recursive Residuals
DSP	Difference Stationary Process
ECF	Extended Credit Facility
ECM	Error Correction Model
ECT	Error Correction Term
FTPL	Fiscal Theory of Price Level
GDP	Gross Domestic Product
HIPC	Heavily Indebted Poor Countries
I (0)	Integrated of Order Zero
I (1)	Integrated of Order One
IMF	International Monetary Fund
LIC	Low Income Countries
NSO	National Statistics Office
OLS	Ordinary Least Squares
OMO	Open Market Operations
PP	Phillips Peron
RBM	Reserve Bank of Malawi
SSA	Sub Saharan Africa
TSP	Trend Stationary Process
USD	United States Dollar
WB	World Bank

CHAPTER ONE

INTRODUCTION

1.1 Background

Researchers and policymakers alike are interested in understanding inflationary processes for individual countries or regions because of their significance to the overall performance of the economy. The formulation of macroeconomic policies, both monetary and fiscal, heavily relies on developments around headline inflation. A nation's monetary authority, such as the Reserve Bank of Malawi (RBM), adopts monetary policy to preserve domestic price stability by regulating interest rates or inflation. On the other hand, fiscal policy is used by the government through spending and taxation as its main instruments to drive the economy. The government primarily sells bonds to the private sector through the RBM to finance budget deficits that arise when public spending exceeds revenue.

In a fiscally dominating context, Sargent, and Wallace (1981) shows how funding the of budget deficit through domestic borrowing causes inflation. They argue that if monetary policy predominates over fiscal policy, it independently determines how much revenue should be provided to the fiscal authorities through "seignorage" of money creation. Conversely, where fiscal policy is dominant, domestic borrowing by the fiscal authority to cover budget deficits forces the monetary authority to tighten the monetary base to reduce inflationary pressure. Such measures, however, ultimately lead to inflation since the monetary authority is forced to use new money creation to repay the maturing debt or pay interest on the outstanding debt.

International organizations including the International Monetary Fund (IMF), African Development Bank (AfDB), and World Bank (WB), as well as various domestic parties, have warned the Malawian government against taking on a significant amount of domestic debt. The warning is in accordance with the conventional neoclassical belief that the goal of price stability of monetary policy may be compromised when government

expenditure consistently outpaces available revenue. Following this warning, the government pledges to tighten fiscal policy through fiscal discipline to adhere to the conditions related to donor-funding programs, such as the IMF Extended Credit Facility (ECF) (IMF 2010-2020). For instance, in 2012, the government agreed to the IMF's strict fiscal spending guidelines and a restriction banning net domestic borrowing. The action was in line with research by Alesina and Ardagna (2020), which found that strict fiscal policies based on reductions in government spending are more successful in managing budget deficits and slowing the rise of domestic debt.

However, the rise in domestic government borrowing shows that the stringent fiscal policy implementation was a failure. The fact that actual government expenditure exceeded both the original and revised budget predictions further support this. Government domestic debt has historically increased following the widening government's national deficit. The national budget deficit as a percentage of GDP has risen from 0.46% in 2005 to 8.8% in 2020 (Ministry of Finance, 2020). Similar to this, government domestic debt as a percentage of GDP was recorded at 4.5% in 1995, which was the lowest level in 41 years. Since then, it has remained high, reaching 31.0% by the end of 2020. The government's domestic borrowing trend, especially in the 5 years to 2020 has been consistently above the IMF's international recommended ceiling for low to medium-developed countries like Malawi of 20% of GDP (Ministry of Finance 2020).

Inflation in Malawi has displayed some volatile trends over the years. Referring to published figures by the National Statistical Office (NSO) of Malawi, annual headline inflation ranged from 7.4% to 83.1% for the period 1980 to 2020.

This study assesses whether government domestic borrowing is a significant factor in explaining the variability of headline inflation in Malawi between 1980 and 2020. To achieve this, the study estimates an Autoregressive Distributed Lag (ARDL) model of inflation on government domestic borrowing expressed as a percentage of GDP while controlling for the impact of money supply growth, growth in real per capita income, exchange rate growth, and growth in world oil prices on inflation.

1.2 Problem statement

The Fiscal Theory of Price Level (FTPL) contends that government fiscal policy, including debt and taxes present and future, is the major predictor of price level or inflation (Woodridge 1995). The FTPL builds on the work of Sargent and Wallace on fiscal dominance. Sargent and Wallace's (1981) work established that a fiscally dominant government running chronic budget deficits will typically finance the deficits through money creation, which has the unintended consequence of inducing inflation. According to this hypothesis, it is specifically the act of financing the budget deficit by domestic borrowing that causes inflation. This implies that inflation would not be created from government borrowing if the budget deficit were primarily financed by foreign borrowing. The FTPL offers a solid theoretical foundation for examining the inflationary impact of government domestic borrowing in Malawi.

The relationship between government domestic borrowing and headline inflation for Malawi is not entirely evident, in contrast to the positive relationship between the two variables suggested by the FTPL. A simple plot of the two variables for the years 1980–2020 reveals a murky relationship and/or an apparent inverse correlation between Malawi's government domestic borrowing and headline inflation (see Figure 1).

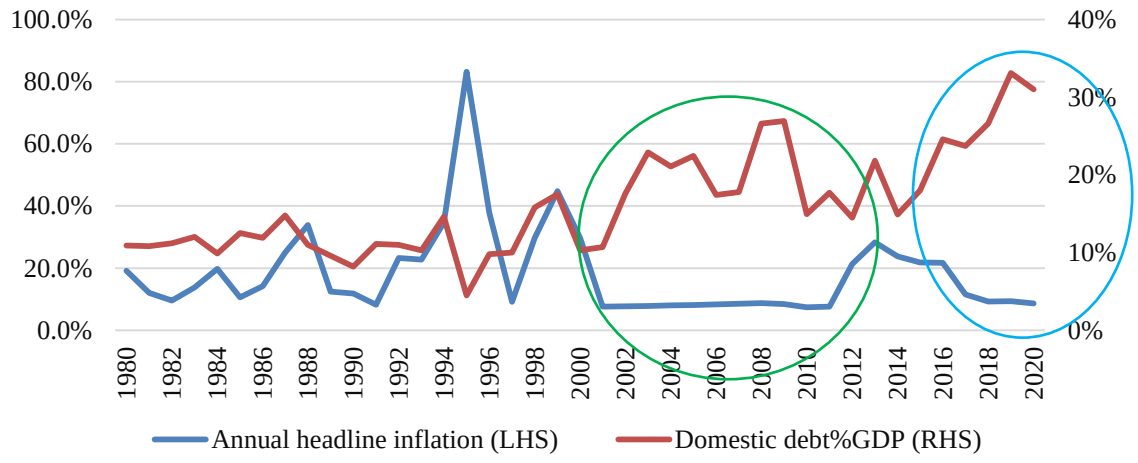

Figure 1: Government domestic borrrowing % GDP and headline inflation

Source (s): National Statistical Office (NSO), Reserve Bank of Malawi (RBM)

The graph shows a mildly positive relationship between annual average headline inflation for the period 1980 to 2000 and the domestic government debt as a percentage of GDP. But from 2001 to 2011, the correlation is ambiguous, and from 2016 on, it turns out to be negative. The FTPL, which presupposes a positive relationship between the two variables, conflicts with the hazy and negative correlation between domestic government debt and headline inflation displayed in some regions of the figure. Given the apparent unclear relationship between government domestic debt stock and headline inflation and the seemingly negative association between the two variables, extensive research into the inflationary impact of high total domestic debt levels in Malawi is warranted. In addition, considering time series data for the period 1980 to 2020, the correlation coefficient between total government domestic debt as a percentage of GDP and headline inflation is negative 0.4, which is similarly at odds with the FTPL.

While the positive relationship between total government domestic borrowing and headline inflation has been established in several studies elsewhere (Ribeiro & Baldini 2015; Haider & Khan 2007; Nguyen 2015; Ahmad et al. 2012; Bildirici & Ersin 2007; Aimola & Odhiambo 2021), such evidence is not available for Malawi. The limited available literature on inflation in Malawi has extensively explored the impact of money and supply factors on headline inflation in Malawi (Simwaka 2011, Mangani 2012, and Chavula 2021), with Matchaya (2011) digressing to explore the impact of output with a focus on establishing the differential inflationary impact of booms and recessions on headline inflation. Closer to filling the gap is an in-depth study of the deficit-inflation relationship by Mangani (2021), which reveals no conclusive evidence for either the significance of fiscal deficits or the role of money growth in the inflationary process in Malawi. Mangani (2021) tackled an aspect of the domestic financing of the budget deficit by looking at the inflationary effect of credit from the private sector, which revealed no inflationary effect. However, this proxy for domestic borrowing does not align with the aggregated form of all sources of borrowing that is used by IMF and World Bank when rendering the policy prescriptions.

The lack of statistical evidence on the relationship between total government domestic borrowing and headline inflation in Malawi is despite such a relationship forming the basis of macroeconomic guidance provided by foreign lenders like the IMF and World

Bank, which has been the core of monetary and fiscal policies over the years. This suggests that the policy guidance and implementation rely on evidence established elsewhere, thereby ignoring the fact that Malawi's country-specific attributes have the potential to invalidate such established evidence. This calls for the establishment of such evidence locally to ensure that such policy advice and implementation are applicable. This study, therefore, tries to establish the missing link between total government domestic borrowing and headline inflation in Malawi for the period 1980–2020.

The dearth of research on Malawi's total domestic debt stock and headline inflation, the divergent visual associations between the two variables and the underlying assumptions of economic theory, and the substantial economic changes that have affected Malawi's economic environment over the review period all point to the urgent need for this study. This study will help ascertain whether the fiscal restraint strategies specifically the curtailing of total government domestic borrowing, promoted by the World Bank and the IMF are indeed the most effective strategies to deal with Malawi's high inflationary challenges.

1.3 Research objectives of the study

1.3.1 General objective of the study

The main objective of the study is to investigate the impact of government domestic borrowing on headline inflation in Malawi for the period 1980 to 2020.

1.3.2 Specific objectives of the study

The specific objectives of the study are:

i. Analyze the impact of government domestic borrowing on headline inflation in Malawi in the short run.

ii. Examine the impact of government domestic borrowing on headline inflation in Malawi in the long run.

The following variables, borrowed from the conventional quantity theory of money, are controlled for in the study's analysis of the effect of government domestic borrowing on

headline inflation in Malawi: money growth, GDP per capita growth, exchange rate growth, and global oil price inflation.

1.4 Research questions

In trying to achieve the objective outlined above, the study answers the research questions below:

i. What is the impact government domestic borrowing on headline inflation for Malawi in the short run?
ii. What is the effect of government domestic borrowing on headline inflation in the long run?

1.5 Testable hypotheses

To answer the research questions above the following null hypotheses are tested:

i. H_0: Government domestic borrowing does not affect headline inflation for Malawi in the short run.
   H_1: Government domestic borrowing does affect headline inflation for Malawi in the short run.
ii. H_0: Government domestic borrowing does not affect headline inflation for Malawi in the long run.
   H_1: Government domestic borrowing affects headline inflation for Malawi in the long run.

1.6 Significance of the study

By examining how total domestic government borrowing affects headline inflation in Malawi, the study will contribute to the body of literature by addressing the question of whether Malawi's inflationary issues could be partially resolved by controlling the amount of total domestic government borrowing. The study will clarify if the macroeconomic policy directives geared toward fiscal discipline imposed by the IMF and World Bank are applicable in Malawi in the short and long terms or both, in addition to enhancing the existing literature on the subject with this evidence-based knowledge.

CHAPTER TWO

OVERVIEW OF PUBLIC DEBT AND HEADLINE INFLATION IN MALAWI

2.1 Public debt in Malawi

The total amount of outstanding debt owed by a nation's central government is known as public debt, also known as government debt. It is normally presented as a percentage of Gross Domestic Product (GDP). Public debt for Malawi comprises of domestic debt and external debt. Domestic debt is a term used to describe the total amount of domestic borrowing committed through the issuance of government instruments, such as bonds and bills. On the other hand, the portion of the overall public debt that is owing to creditors outside the country is known as external debt, also known as foreign debt. Public debt for Malawi exceeds the Sub-Saharan Africa (SSA) levels. The average total debt as a percentage of GDP for Malawi for the period 2000-2020 stood at 77%, almost double the SSA average of 39% (IMF 2022). That said, aside from Tanzania which recorded a total debt GDP ratio of 44.9% in 2019, compared to the other 2 neighbors, the debt situation for Malawi was better off, at 61% of GDP, lower than the 79.5% of GDP and 61.9% of GDP for Mozambique and Zambia respectively.

Between 1994 and 2005, the total public debt stock exceeded 100% of GDP, with a large portion of that debt being external debt. After the Heavily Indebted Poor Countries (HIPC) relief in 2006, there was a dramatic drop in public debt. However, Olaoye (2022) noted that the 2006 debt relief only had a marginal effect on economic outcomes including economic growth and inflation for the Sub Saharan Africa (SSA) with corruption negatively impacting its effectiveness. Meanwhile, the SSA economies seem to have shifted away from traditional concessional sources of financing towards market-based lenders dominated by China.

Apart from the shift in foreign borrowing to non-traditional foreign lenders in line with the SSA Region, the public debt for Malawi has steadily shifted in recent years from

being mostly external to being primarily domestic due to the continued deepening of budget deficits on the one hand and the withdrawal of donor funding in 2013. As a result, there is a continuous breach of internationally set domestic borrowing ceiling for low-income countries of 20%.

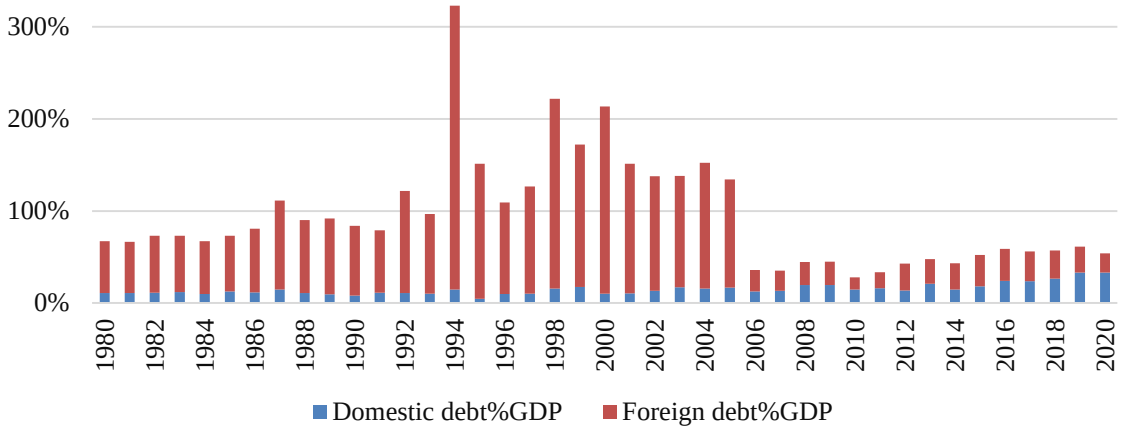

Figure 2: Public debt historical trend (% of GDP)

Source (s): Ministry of finance, Reserve Bank of Malawi (RBM)

2.1.1 Rationale for incurring public debt.

To close the national budget deficit (the difference between total government spending and total government receipts), the government borrows money. It also uses this money to pay down debt from prior fiscal years. This suggests that the public debt and the national budget deficit need to be positively correlated.

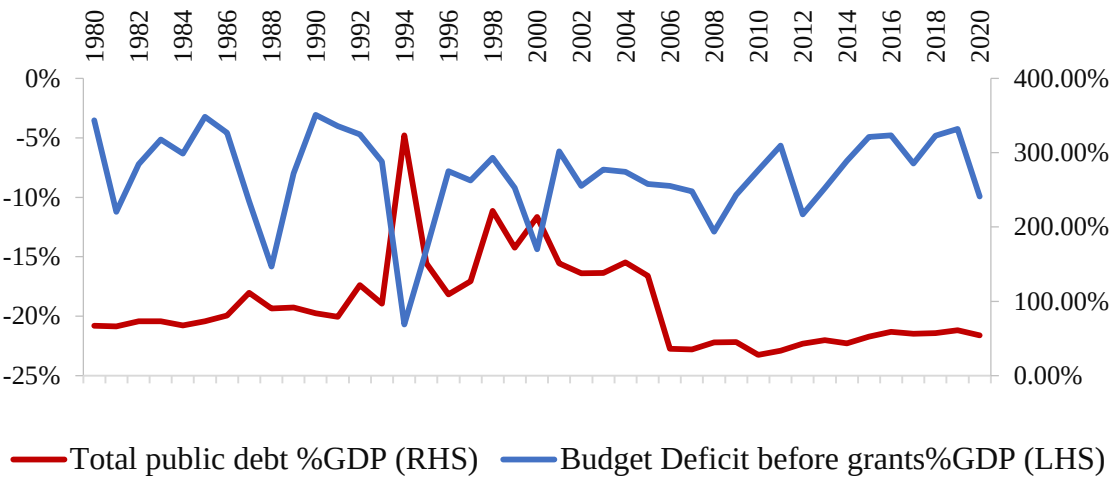

Figure 3: National budget deficit and public debt (% of GDP)

Source (s): Ministry of finance, Reserve Bank of Malawi (RBM)

For the period 1980 to 2020, the plot demonstrates a very weak positive association between the national budget deficit and the total public debt as a percentage of GDP. The fact that there is only a minimal association between the national budget deficit and overall public debt indicates that most of Malawi's borrowing is used to settle debt from prior fiscal years.

2.1.2 A comparison of maturing and issued government securities.

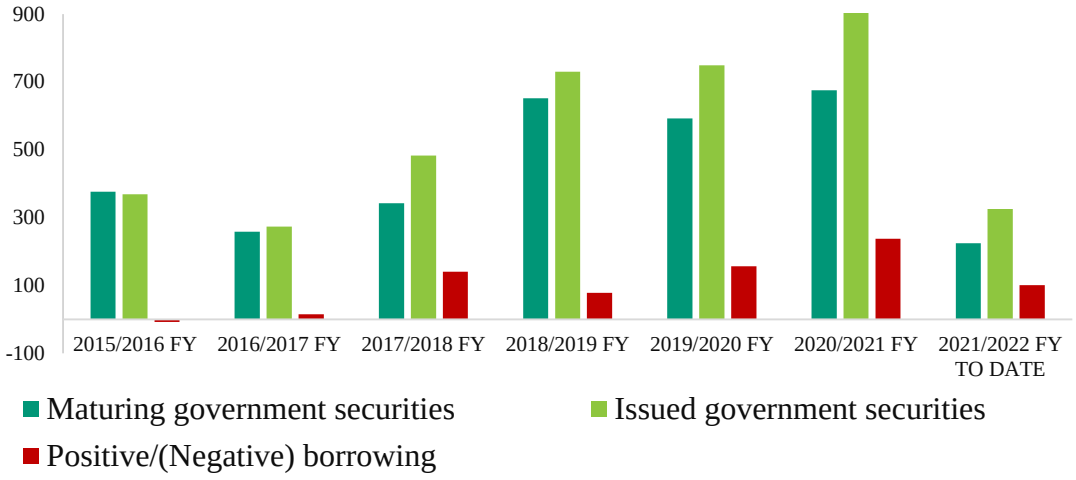

Figure 4: Maturing versus issued government securities ((MK'bn)

Source (s): Reserve Bank of Malawi (RBM)

The government borrows money domestically on a more regular basis to pay off outstanding debt stocks from prior fiscal years. The amount of net domestic borrowing (net positive borrowing) increased over the period under review, which reflects the growing need for financing current expenditure demands.

2.1.3 Outlook on government borrowing

The analysis above demonstrates that Malawi government borrows to partly finance the country's budget deficit and to pay off outstanding debt (for the previous six fiscal years to the fiscal year 2021/22, issued government securities have consistently surpassed maturing government securities).

The projected deficit for 2021–2025 is comparable to that of the periods from 1995–2000 and 2014–2020 in terms of a percentage of GDP. The average national budget deficit from 1995 to 2000 was 7.4% of GDP, and the average public debt was 121.9% of GDP. The average public debt as a proportion of GDP was 46.8% from 2014 to 2020, while the average national budget deficit was 6.2% of GDP.

The projected budget deficit for the years 2022–2025 is 8.9% of GDP on average, up from the averages of 7.4% and 6.2% of GDP for the years 1995–2000 and 2014–2020, respectively. In the meantime, the public debt stock is already high at 54.0% of GDP as of 2020, above the internationally advised ceiling of 50% of GDP (30% of GDP for external debt and 20% of GDP for domestic debt). Therefore, there is a high likelihood that the government would continue to borrow substantially in order to close the national budget deficit, which is anticipated to be high, and pay off outstanding debt (that is reported at above the recommended ceiling).

2.2 Headline inflation in Malawi

2.2.1 Definition and measure of inflation in Malawi

Headline inflation is a measure of growth in prices of a basket of goods and services that is consumed by most households. Headline inflation is measured as the growth in the Consumer Price Index (CPI). The CPI is computed by Malawi's National Statistical Office (NSO), which also publishes headline inflation each month. The CPI is a weighted average market value of prices for a basket of consumer goods and services purchased by

households. There were 12 components in Malawi's CPI as of 2020, with the food component accounting for 45.2% of the total. The huge component of housing, water and electricity, which was the second largest basket as of 2020, may suggest that computed inflation dynamics vary significantly between rural and urban areas.

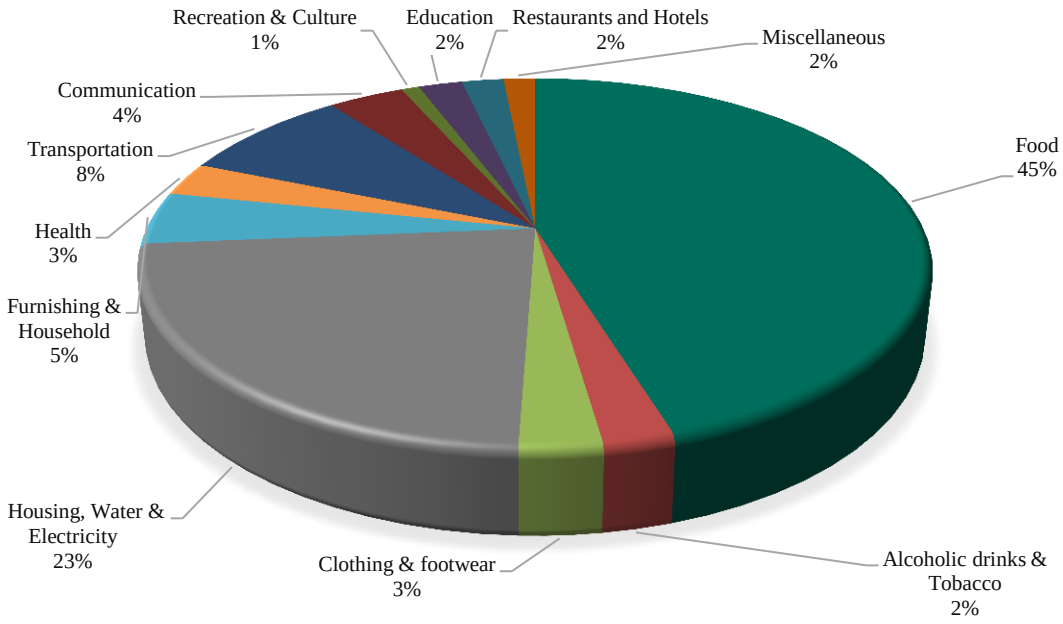

Figure 5: Composition of the Consumer Price Index (CPI) as at 2020

Source: National Statistical Office (NSO)

2.2.2 Headline inflation trend for Malawi

Malawi's headline inflation has been volatile because of weather-related shocks, currency shocks, and global commodity price shocks. This is true because Malawi is predominantly an agrarian economy, which is dependent on rain-fed agriculture activities, as well as the fact that it is a net importer of finished goods and services, and necessary inputs for most production processes. Malawi's headline inflation rate accounts for both food and non-food inflation. The former largely reflects agricultural food costs while the latter is driven mostly by currency fluctuations that also have an impact on

domestic fuel prices through the Automatic Pricing Mechanism (APM). Fuel pump prices determine transportation costs hence the transportation component, the third largest basket of the CPI. It should be noted that a currency shock has the potential to affect many CPI baskets and thus have a multiplier effect on overall inflation.

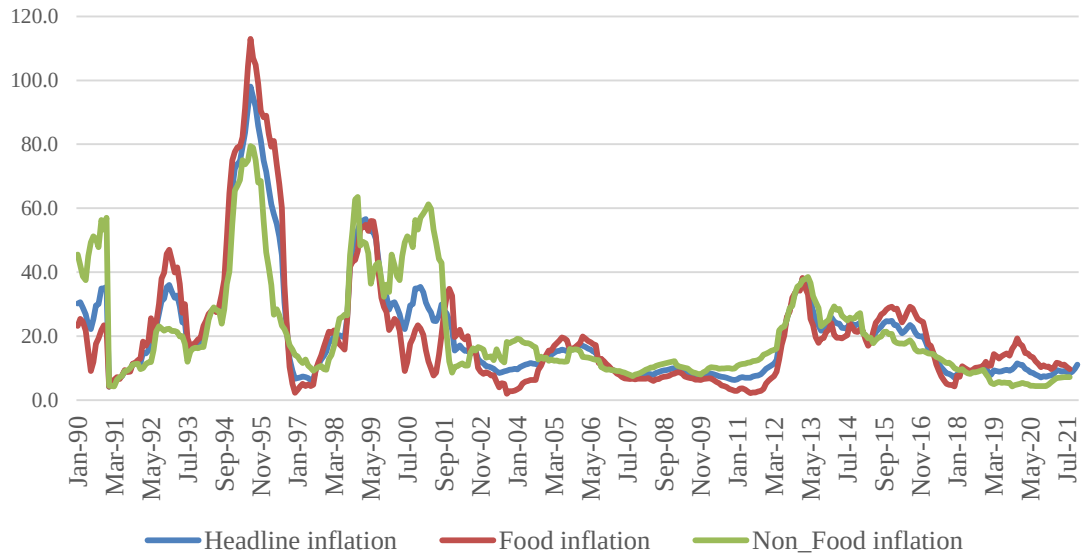

Figure 6: Headline inflation trend for Malawi

Source: NSO

The composition of the CPI shows that the food largest basket is the largest among the 12, as such, it is obvious that shocks to food supply would have significant impact on the overall CPI. Malawi's economy is dominated by rain-fed agriculture which accounts for around 24% of GDP. As such, food inflation displays strong seasonal patterns where the period far from harvest (September to March) is associated with high food inflation. Given that the economy is dominated by subsistence farmers and food prices are largely shaped by the agriculture cycle and subject to strong seasonal patterns, the seasonality of headline inflation tracks closely that of food inflation. A severe drought experienced in 1995 explains that spike in food inflation that also filtered through the overall CPI. After the 1995 drought, the economy recorded unfavorable weather patterns in form of flooding and some episodes of dry spells in farming seasons of 2001/2002, 2015/2016 and 2019/2020. The increased recurrence of weather shocks, as reflected in the spikes of

inflation for affected years, manifests the adverse impact of climate change especially in increasing the volatility of headline inflation for Malawi.

Exchange rate being the key price for non-food inflation especially for a net-importer economy like Malawi, shifts in the exchange rate regime transmit through non-food inflation to the headline inflation. For example, periods with fixed exchange rate regime, 2000 to early 2012, are associated with stable non-food inflation. In May 2012, Malawi switched from a fixed to a floating exchange rate regime that was subject to classic overshooting of non-food inflation which was further compounded by a sudden stop in external budget support following the large-scale theft of public funds called the "cash-gate scandal". Financing the fiscal deficit in the aftermath of the scandal was done through printing money and by increased issuance of government securities to the private sector. The shift to a flexible exchange rate regime contributed to the high volatility in non-food inflation for the period late 2012 to early 2019. Increased foreign exchange market intervention by the RBM through running up or down of official foreign reserves changed the ruling foreign exchange regime from fully flexible to semi-fixed from 2019. The resultant reduction in the volatility of non-food inflation from the RBM's actions transmitted through to the overall CPI. This confirmed the impact of multiplier effect of exchange rate dynamics on headline inflation.

While shocks to the food inflation component largely contribute to the spikes in headline inflation, those transmitting through the non-food inflation for example the currency shocks magnify the volatility in the headline inflation.

Malawi comes fifth in terms of economies with highest average inflation for the period 1996-2020 in the SSA Region according to data by the IMF (IMF 2022). The 25-year average inflation for Malawi of 17.4% beats the SSA average of 11.1% and trails behind only Angola (228.4%), Democratic Republic of Congo (92.8%), South Sudan (87.9%) and Zimbabwe (37.00%). The missing of all the 3 neighbors to Malawi in the top 5 of list, implies that, inflationary pressures in Malawi are worse comparing to Mozambique, Zambia and Tanzania with averages of 10.1%, 15.3% and 8.0% in the 25-year period.

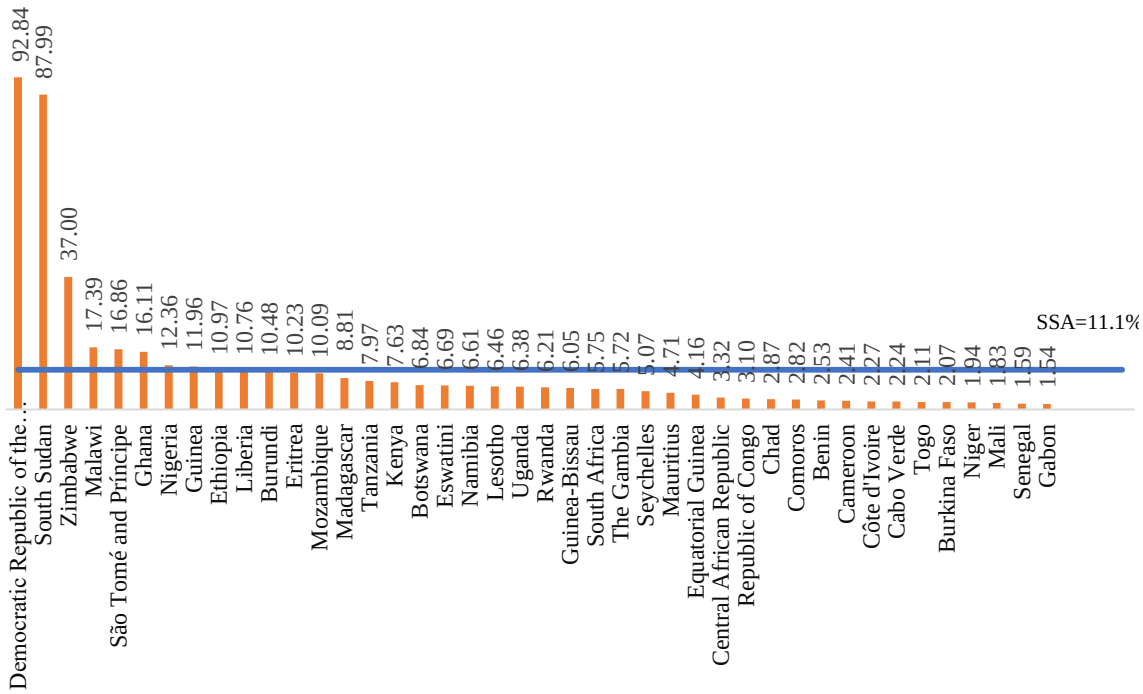

Figure 7: Average inflation (1996-2020) for SSA countries

Source: IMF World Economic Outlook

With the high inflation environment compared to the neighbors, Malawi inflation mitigation drive needs to be more strong and well-focused by targeting those indicators that really drive inflation up. Economic theory presupposes that public debt, especially from domestic sources, is one of the drivers of inflation. As such, the fact that Malawi's public debt is relatively high compared to some fellows within the SSA (and 2 out of 3 of its neighbors) and the noted shift to domestic borrowing, calls for statistical evidence on domestic borrowing-inflation link as this will aid in proper targeting of the inflation mitigating measures for Malawi. An appropriate targeting in arresting inflationary pressures will not only improve macroeconomic environment through reduction of the inflation volatility that triggers macroeconomic volatility and increase uncertainties, it will also improve the competitiveness of the economy on the regional front in attracting Foreign Direct Investments (FDI).

CHAPTER THREE

LITERATURE REVIEW

3.1 Theoretical framework

3.1.1 Different theories of inflation

In the literature, various schools of thought have identified a variety of factors as the drivers of headline inflation. Important variables such as monetary and fiscal indicators have been discovered to be critical in explaining inflationary processes in various countries and/or regions worldwide. As a result, the drivers of inflationary processes in different countries do not have to be the same. Inflationary processes are influenced by country and region-specific characteristics. Theoretical considerations must precede any attempt to comprehend Malawi's inflationary process. Therefore, this section provides an overview of the various theoretical explanations for headline inflation.

3.1.1.1 The quantity theory of money

One of the oldest surviving economic doctrines is the quantity theory of money. According to Friedman's (1963) quantity theory of money, changes in the general price level are primarily determined by changes in the quantity of money in circulation. The quantity theory of money was at the heart of 19th-century classical monetary analysis, serving as the dominant conceptual framework for interpreting contemporary financial events and serving as the intellectual foundation of orthodox policy prescriptions aimed at preserving the gold standard.

3.1.1.2 Demand-pull and cost-push theories of inflation

Keynes (1936) argues that inflation can be caused by either an increase in demand (demand push) or an increase in cost (cost push). Demand-pull inflation is created by an increase in the aggregate demand that is over and above the increase in aggregate supply, which can originate from high exports, strong investment, a rise in the money supply, or the government financing its spending by borrowing. If a given economy is at its full employment output level, an increase in government expenditure (G), an increase in private consumption (C), and an increase in private investment (I) will create an increase in aggregate demand. This creates an inflationary situation because at optimum or full employment of output (maximum utilization of scarce resources), an economy is unable to increase its output or aggregate supply in response to an increase in aggregate demand. According to Keynes, unexpected increases in aggregate demand create an "inflationary gap" that leads to inflation under full employment conditions.

Keynes' theory of cost-push inflation, on the other hand, attributes the primary cause of inflation to supply-side factors. Inflation will result from rising production costs. Cost-push inflation is commonly thought to be primarily a wage inflation process because wages account for a higher proportion of total costs. As the economy approaches full employment and skill shortages worsen, powerful and militant trade unions that negotiate wage increases more than productivity increases are more likely to succeed in their wage claims. Input price increases also cause cost-push inflation. An increase in the price of fertilizer, oil, and many other basic inputs or intermediate goods used as component parts in the manufacturing process, for example, will result in higher consumer prices. Depreciation of a local currency may also drive cost-push inflation as it results in increases in the price of imported foodstuffs, raw materials, and capital equipment, which then leads to a rise in production costs.

According to Keynes' demand and cost push theories, the closer the economy is to full employment, the greater the inflationary pressure, and when unemployment is high, the lower the inflationary pressure.

3.1.2 Theoretical framework guiding this study.

3.1.2.1 Fiscal Theory of Price level (FTPL)

The FTPL was proposed by Woodford (1995). According to the theory, the primary determinant of price level or inflation is government fiscal policy, which includes debt and taxes (both present and future). The FTPL conforms to an orthodox neoclassical viewpoint, which contends that when government spending consistently exceeds available revenue, the resulting deficit and financing obligations may jeopardize the monetary policy goal of price stability by creating a regime of fiscal dominance. The FTPL builds on the work of Sargent and Wallace on fiscal dominance. Sargent and Wallace (1981) defined fiscal dominance as a situation in which an unrealistic inflation target leads to insufficient seigniorage revenue in the short run, which must be compensated for by higher seigniorage, and thus inflation in the long run. This argument agrees with FTPL only that it attaches a condition of fiscal dominance.

In contrast to fiscal dominance, when monetary policy dominates fiscal policy, the monetary authority sets monetary policy independently, for example, by announcing growth rates for base money for the current and all future periods (Sargent & Wallace 1981). The monetary authority determines the amount of revenue it will provide to the fiscal authority through seigniorage in this manner. The fiscal authority is then constrained by bond demand because it must set its budgets in such a way that any deficits can be financed by a combination of the seigniorage chosen by the monetary authority and bond sales to the public. Because it is completely free to choose any path for base rates under this coordination scheme, the monetary authority can permanently control inflation in a monetarist economy.

According to the FTPL, the government's intertemporal budget equation should be viewed as an equilibrium condition, which includes determining the price level. When the solvency condition is violated, the market-clearing mechanism adjusts the price level to restore equilibrium. This means that if there is a negative shock that increases the nominal stock of liabilities and the market anticipates a fall in future primary surpluses in the absence of corrective fiscal measures or accommodative monetary policy, the real

value of government debt must fall to reach a new equilibrium. In turn, with no adjustments in primary surpluses, a new equilibrium could be reached only by raising prices. As a result, the FTPL contends that if primary surpluses are arbitrary and weakly correlated or uncorrelated with public liabilities, prices must adjust to ensure fiscal solvency; and a Fiscal Dominance regime would prevail even if monetary policy was not accommodating of fiscal needs. Price level would then be determined by fiscal policy.

Sargent and Wallace (1981) make two assumptions in illustrating the impact of government domestic borrowing on inflation. To begin, the public's demand for government bonds is an increasing function of the real rate of return on bonds, with an initial range in which demand is positive at rates of return that are negative or less than the economy's growth rate. Such a demand function would imply that monetary policy influences the real rate of interest on government bonds and that, for some monetary policies involving low enough bond supplies, seigniorage can be earned on bonds as well as base money. As a result, a sufficiently tight current monetary policy can imply rapid growth in government interest-bearing debt, such that future inflation is higher than it would have been if current monetary policy had been less tight.

Secondly, Sargent and Wallace (1981) assume that the fiscal policy path (e.g., fiscal deficit, D(t)) is predetermined and unaffected by current or future monetary policies. Because monetary authority influences the extent to which seigniorage is used as a source of revenue, monetary and fiscal policies must simply be coordinated. If the fiscal authority takes the first step, monetary policy must follow suit for D(t) to hold.

$$D(t)=\{[H(t)–H(t-1)]/p(t)\}+\{B(t)–B(t-1)[1+R(t-1)]\} \quad (1)$$

Where D(t) denotes fiscal policy at time t, which is defined as real expenditures on everything except interest on government debt minus real tax collections, H(t) symbolizes monetary policy, which is defined as the stock of base or high-powered money controlled by a monetary policy institution such as the Reserve Bank of Malawi (RBM), p(t) represents the price level at time t, R(t-1) is the real rate of interest on government bonds, and B(t) is government borrowing from the private sector.

Assuming N(t) is the population at time (t), with n being the population growth, then the per capita form of the government's budget constraint will be presented as:

$$\frac{B(t)}{N(t)} = \left\{\frac{[1+R(t-1)]}{1+n}\right\} * \left[\frac{B(t-1)}{N(t-1)}\right] + \left[\frac{D(t)}{N(t)}\right] - \left\{\frac{[H(t)-H(t-1)]}{[N(t)p(t)]}\right\} \quad (2)$$

Assuming the rate of return on government securities (R) exceeds the population growth rate (n) and that the high-powered money (H_t) exhibits constant income velocity then H(t) will be given by:

$$H(t) = (1+\Theta)H(t-1) \quad (3)$$

The equation (iii) will reflect a tight monetary policy, the smaller the Θ.

Assuming constant population and income growth (n) and constant income velocity for high-powered money (Ht), the price level at any time t is proportional to the time t stock of base money per capita, H(t)/N(t) for some positive h, thus:

$$p(t) = \left(\frac{1}{h}\right)\left[\frac{H(t)}{N(t)}\right] \quad (4)$$

Substituting (iii) into (iv) to find the inflation rate (p(t)/p(t-1) = (1+Θ) (1+n), this implies that when specifying a monetary policy, a Θ and a T, simultaneously, a choice on the inflation rate for the periods t = 2, 3 is for the periods t = 2, 3, …, T is made. It is noted that inflation rate after T depends on the stock of interest-bearing real government debt per capita (also defined as per capita stock), (B_t/N_t) = b_Θ attained at T to be held constant thereafter. To find the dependence of the inflation rate for t > T, on per capita stock at time T, $b_\Theta(T)$, equation (ii) is used for any date t > T, substituting into it B(t)/N(t) = B{t-1)/N(t-1) = $b_\Theta(T)$ and H(t)= hN(t)p(t) as implied by (iv) above. The result is written as:

$$1 - \left[\frac{1}{(1+n)}\right]\left[\frac{p(t-1)}{p(t)}\right] = \left\{\left[\frac{D(t)}{N(t)}\right] + \frac{\left\{\frac{[R(t-1)-n]}{1+n}\right\}b(T)}{h}\right\} \quad (5)$$

Using equations (iii) and (iv) and the per capita stock definition at time t, $b_t = B_t/N_t$, then equation (ii) can be written as:

$$b(t) = \left\{\frac{[1+R(t-1)]}{1+n}\right\}b(t-1) + \left[\frac{D(t)}{N(t)}\right] - \left[\frac{h\Theta}{1+\Theta}\right] \quad (6)$$

By repeated substitution, Sargent, and Wallace (1981) proved that any t > 2 and t < T, $b_\Theta(T)$ is larger the smaller Θ is. This implies that it may not be possible for the monetary authority to be consistent with fiscal policy if the D(t) sequence is too big for too long as

this increases the per capita stock which requires monetary policy to print more money, hence creating inflation.

3.2. Empirical evidence

3.2.1 Similar studies in developing countries.

Several cross-country and country-specific studies have been carried out to determine the impact of government domestic borrowing on headline inflation in developing countries. Single equation Error Correction Models (ECM), Vector Autoregressive (VAR) models, Autoregressive Distributed Lag Models (ARDL), and Two Stage Least Square (TSLS) estimation are the most used estimation techniques in inflation studies in developing countries. This section summarizes these studies, including the models used in the estimations and the findings.

Nguyen (2015) finds that fiscal policy with a high level of public debt to finance budget deficits is inflationary in selected Asian economies when examining the impact of public debt on inflation in Asian developing countries. This conclusion is supported by PMG (Pooled Mean Group) estimation and panel differenced GMM Arellano-Bond regression, both of which show that public debt has a statistically significant coefficient.

The Fiscal Theory of Price Levels (FTPL) is tested in Ribeiro and Baldini (2011) study on fiscal and monetary determinants of inflation in low-income countries in Sub-Saharan Africa (SSA). According to the analysis, the occurrence of wealth effects of changes in nominal public debt may pass through to prices by increasing inflation variability, as predicted by the FTPL determination. As a result, nominal public liabilities, as measured by either money growth or nominal public debt, are important for price stability. The study also shows that differences in the exchange rate regime corresponded to differences in the relative importance of monetary and fiscal sources of inflation in different SSA countries. Overall, the analysis indicates that from 1980 to 2005, SSA was characterized by a general lack of fiscal discipline, resulting in increasing the possibility of inflation due to fiscal imbalances. However, for other countries, including Malawi, the study finds no clear relationship between fiscal discipline and inflation, making it difficult to determine the type of exchange rate regime applicable to these countries. For Zambia,

one of Malawi's neighboring countries, public borrowing does not feature among both the short-run and long-run sources of overall inflation. According to Chipili (2021), the external sector market; the exchange rate, world non-food prices and energy prices are key drivers of inflation for Zambia in both the short run and long run.

Bildirici and Ersin (2007) classified developing countries into three groups when studying domestic debt, inflation, and economic crises: countries with high inflation, which results in rising domestic debt costs; countries with low inflation rates and low borrowing costs; and countries with low inflation, high borrowing, and countries with low borrowing costs, and fiscal discipline. The study, which employs both the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS), concludes that it is the cost of borrowing and active fiscal regimes that reduce emerging economies' immunity to economic crises, rather than the domestic debt/GDP ratio. In particular, the study finds that active fiscal policy has a greater impact on inflation in developed countries than in developing countries.

A study by Haider and Khan (2007) on the impact of volatility in government borrowing on inflation in Pakistan using monthly data (July 1992-June 2007) finds that government borrowing has an impact on inflation in both the short and long run. The Auto Regressive Distributed Lag Model (ARDL) is used in this study to establish the long run relationship, and the Error Correction Model is used to establish the short run impact (ECM). Another study examines the domestic debt and inflationary effects in Pakistan over a longer period, from 1970 to 2009 (Ahmad, Sheikh, & Tariq 2012). This study, like Haider and Khan (2007), finds that domestic debt and debt servicing raised the price level in Pakistan during the study period. In contrast to these findings, Aimola and Odhiambo (2021) conclude that the impact of public debt on inflation in Nigeria is statistically insignificant, regardless of whether the regression is in the short or long run. According to the findings of this study, inflation in Nigeria may be influenced by factors other than public debt.

Bhattarai et al. (2014) investigates the role of public debt in inflation dynamics and evaluate whether the level of public debt affects inflation dynamics. According to the study, a higher level of public debt leads to a greater equilibrium response of inflation to

various shocks affecting the economy under both active fiscal policy and passive monetary policy (where fiscal dominance exists). This study finds no causal relationship between public debt and inflation, but rather that high government debt makes inflation vulnerable to other economic shocks, including non-monetary shocks such as political instability. This study, like the others discussed in this paper, concludes that fiscal dominance is a necessary condition for the public debt-inflation relationship.

Even though inflation in low-income countries (LICs) fell by two-thirds since the mid-1970s, to 5% in 2017, Ha et al. (2019) argues that rising public and private debt in many LICs, which could weaken commitment to strong fiscal and monetary frameworks, and thus reverse the inflationary trend. This study also emphasizes the possibility of tight labor markets or commodity price volatility reigniting the LICs' high inflation environment. This point of view is consistent with the findings of Bhattarai et al. (2014), who discovered that high public debt increases inflation's responsiveness to economic shocks.

3.2.2 Related studies in Malawi

Simwaka et al. (2011) uses monthly data ranging from January 1995 to March 2011 to assess the effect of money supply on headline inflation for Malawi. Malawi's headline inflation process is estimated using the ARDL model, with a focus on the effects of monetary policy using the money supply as a proxy variable. The findings of this analysis indicate that over the studied period, inflation in Malawi is a function of both monetary and supply-side factors after controlling for currency rate and other supply factors. In particular, the study discovers that inflation is driven by monetary supply expansion with lags of roughly three to six months. Simwaka et al. (2011) advises the Reserve Bank of Malawi (RBM) to make sure that the broad money supply grows in line with nominal GDP in accordance with the study's conclusions. As previously said, this analysis prioritizes monetary policy while omitting the role of fiscal policy in the inflationary process.

Matchaya (2011) digressed from ascertaining the sources of inflation in Malawi only to exploring the differential inflationary impact between booms and recessions on domestic

prices by vector autoregressive models of order two in changes of the variables, impulse response functions as well as error variance decomposition analysis. The results from this study demonstrate a clear differential impact between booms and recessions on inflation such that the impact of recessions was more pronounced though it was less persistent. Additionally, from this study, money supply, exchange rates, past values of inflation, recessions and booms were the main determinants of inflation. Therefore, the study recommends that policies aimed at controlling money supply, interest rates as well as exchange rates are desired, as changes in these variables do generate significant changes in inflation levels. Clearly, fiscal drivers of inflation, specifically the inflationary effect of domestic financing of budget deficit, was given a blind eye in this study.

Still focusing on the inflationary effect of monetary policy, Mangani (2012), investigates the transmission mechanism of monetary policy through to domestic prices while recognizing several factors that characterize the economy including market imperfections, fiscal dominance, and vulnerability to external shocks. This study adopts vector autoregressive type of modelling while testing for Granger-causality and block exogeneity tests as well as conducting innovation accounting analyses to describe the dynamic interrelationships among monetary policy, financial variables, and prices. The study refutes any conventional channel of the monetary policy transmission mechanism, but instead establishes that the exchange rate is the most important variable in predicting prices in Malawi. That being the case, Mangani (2012), recommends that authorities should be more concerned with imported cost-push inflation rather than demand-pull inflation.

Another study by Chavula (2021), examines the main factors that have driven inflation rate in Malawi since 2001 with a focus on exploring factors that would sustain deceleration of headline inflation in Malawi by employing the ARDL model framework, using quarterly data, over the period of 2001–2019. Like Simwaka et, al. (2011), this study reveals that reduction in headline inflation has mainly been driven by money supply growth, in addition to fiscal deficits, and output growth in the short run. In the long run, the study concludes that it is only output that drives a decline in inflation in Malawi. Despite considering both monetary and fiscal policy in determining the drivers

to headline inflation, this study as well, does not account for the inflationary impact of financing national budget deficits through domestic borrowing.

Cognizant of the importance of establishing the link between fiscal policy and headline inflation in Malawi, Mangani (2021) tests the fiscal dominance in Malawi with particular attention to the impact of fiscal policy (budget deficit and money supply growth) on headline inflation. After modelling headline inflation as an ARDL process and complimenting it with the two stage least squares estimation method alongside the OLS for the period 1970 to 2016, the study finds no clear evidence to support the importance of fiscal deficits nor that of money growth in Malawi's inflation process. In contrast to this study, which analyzes the impact of fiscal policy on the Malawi inflation process for the period 1970–2016 using of both budget deficits and financing in the form of credit from the private sector to the public sector, the current study focuses on the inflationary effect of domestic financing by looking at the impact of total domestic debt. In response to the data adequacy issue raised in the Mangani (2021) study, the current study truncated the starting period of the study from 1970 to 1980 because that period includes a complete data set on government domestic debt. By using the total stock of domestic debt rather than private sector credit, this study tries to align the measure of domestic financing for the budget deficit as an inflationary source with the IMF and World Bank's thresholds for domestic borrowing that would reduce the pressure of inflation. As a result, the established link from this study would affirm the appropriateness of such recommendations without some objections arising from the variations in the indicators employed to measure domestic borrowing.

3.2.3 Summary of literature

According to conceptual literature, headline inflation in Malawi has historically been quite volatile. There is a chance that headline inflation will return to the medium to long-term average of the mid to upper teens, notwithstanding the observed stability in the single digits from 2017 to 2020. According to the composition of the CPI in 2021, if food inflation drivers are effectively addressed, 53.7% of headline inflation can be held under control. This leaves about 46.3%, which is classified as non-food and whose drivers include high government domestic borrowing (IMF 2010–2020).

The Ministry of Finance confirms that financing needs for the government have been on an upward trend especially in the 4 fiscal years to 2021, driven by high deficits and debt repayments (Ministry of Finance 2022). As such, the forecast for government domestic borrowing is still elevated as the government is likely to continue borrowing substantially to cover the predicted widening national budget deficit and settle outstanding domestic debt (that is already above the recommended ceiling). If government domestic borrowing is a significant element driving the inflationary process, the prospect for headline inflation may likewise deteriorate because of the worsening outlook for domestic government borrowing.

Empirical research has demonstrated that although a study of the direct effects of total domestic government domestic borrowing has been done in some developing and emerging nations, including the SSA Region, it has not been done domestically. Except for the Mangani (2021) study, the studies that have been done on Malawi's inflationary process have mainly focused on supply and monetary factors. Therefore, by examining how total government domestic borrowing affects headline inflation in Malawi, this study will add to the body of knowledge on the topic by identifying the short and long run inflationary effects of total government domestic borrowing and establishing whether the fiscal restraint policies that have been advocated are in fact a part of Malawi's inflationary mitigation measures.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Method of data analysis

In this study, the methods of analysis are both descriptive and econometric. The study uses an Autoregressive Distributed Lag (ARDL) model to investigate the short- and long-run relationships suggested by the study's objectives. Priority is given to the ARDL model since it can establish whether there is a long-term relationship among distinct variables. STATA 15 is employed to analyze all the estimations of the collected data in the study.

4.2 Model specification

The deficit-inflation relationship in Malawi is examined by Mangani (2021) using an Autoregressive Distributed Lag process (ARDL), a two-stage least squares estimation approach, and ordinary least squares. Using annual time series data, this study adapts the method to examine the relationship between domestic borrowing and inflation in Malawi. The underlying ARDL inflationary process is assumed to be of order 1, q, denoted:

$$Inf_t = \alpha_0 + \alpha_1 Inf_{t-1} + \sum_{j=0}^{q} \beta_j x'_{t-j} + \mu_{t,} \qquad \forall t = 1,2,\dots,T, \tag{7}$$

Where:

Inf_t = average annual headline inflation in the current year, t,

Inf_{t-1} = the first-order autoregressive term

x'_{t-j} = a vector of current and lagged exogenous variables impacting on current headline inflation which includes government domestic debt as a percentage of GDP as the key independent variable, supported by the FTPL. The study controls money supply growth,

GDP per capita growth, exchange rate growth and global oil price inflation adapted from the standard quantity of money, demand-pull, and cost-push theories of inflation.

μ_t = the uncorrelated error term

α_0 = the intercept

α_1, β_j = slope parameters

4.3 Data type, sources, and collection method

The study analyzes time series secondary data covering a sample period of 1980 to 2020, representing a sample size of 41, to assess the effect of government domestic borrowing on headline inflation in Malawi. The Reserve Bank of Malawi provided the data for government domestic borrowing, and the National Statistical Office (NSO) of Malawi provided the information on headline inflation. These sources were picked because they serve as official sources of such information for Malawi. Following recommendations from economic theory and literature, information on the other research variables that were controlled for was gathered from a variety of sources, as is shown in the table below.

Table 1: Data sources

Variable	**Data source**
Headline inflation (inflation)	National Statistical Office (NSO), from http://www.nsomalawi.mw/index.php?option=com_content&view=article&id=186:malawi-consumer-price-indices-dashboard&catid/. and /or NSO monthly inflations statistical reports
Domestic debt stock as a percentage of GDP (DdebtGDP)	Reserve Bank of Malawi (RBM), from RBM's Financial and Economic Reviews.

Variable	Data source
GDP per capita growth (GDPppc)	World Development Indicators, from https://data.worldbank.org/country/malawi.
Money supply growth (gmsupp)	RBM, from https://www.rbm.mw/Statistics/FinancialData/MonetarySurvey.
Growth in oil prices (goilp)	World Bank Commodity Prices, from http://pubdocs.worldbank.org/en/561011486076393416/CMO-Historical-Data-Monthly.xlsx.
Growth in Exchange Rate (gxrate)	RBM, from https://www.rbm.mw/Statistics/FinancialData/ExchangeRates.

4.4 Estimation procedure

Running a traditional time series regression model, as demonstrated in certain research in the reviewed literature, presupposes that the data-generating processes are stationary and that the moments of the variables under investigation are time-invariant. Most macroeconomic variables, however, are likely to increase over time, making them non-stationary as the economy develops and increases through time. Such regression is known as "spurious regression" since it will only display an illogical association when non-stationary variables are used. The consistency property of Ordinary Least Squares (OLS) estimators does not hold in this scenario since the coefficients and variance are not

consistent. The estimators' sampling distributions will be non-standard, invalidating the conventional statistics (t and F) based on the normality assumption (Maddala, 1992).

Trend stationary processes (TSP) and difference stationary processes (DSP) are the two categories of stationary series. These two distinctions result from de-trending and differencing, two often employed methods for transforming non-stationary series into stationary series. The proper number of differencing required for a series to become stationary is known as the order of integration. As a result, if a time series, say X, becomes stationary after being differenced y times, it is said to be integrated of order y and denoted by I(y). The TSP is only advised if the residuals of the series are presumed to exhibit substantial autocorrelation because most economic time series exhibit a DSP-type of non-stationarity. To identify the kind of non-stationarity that applies to the sampled data series, this study performs several stationarity tests (unit root tests).

4.4.1 Unit root tests

To avoid ARDL model crash in the event of an integrated stochastic trend larger than unity, the unit root test is used to identify how many unit roots there are in each of the model's variables. The usage of the ARDL model is further made easier by this method, which confirms that the variables are integrated in orders zero (0) and one (1). Most time series variables are not stationary, as shown by empirical study in a variety of literature; as a result, stationarity must be confirmed before using them in a model to avoid erroneous regression and permit precise prediction. The study runs the following unit root tests; the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. According to published research, presenting variables as growth rates or percentages of GDP, as is done in this study, lowers the likelihood of structural breaks in time series data (Mangani, 2021). Nevertheless, this study validates this by carrying out the structural break Clemente-Montanes-Reyes (CMR) (1998) unit root test.

The CMR test results are primarily relied on in the study due to its great sensitivity in identifying structural breaks. The ADF and PP unit root tests are thought to be unreliable because they could misinterpret structural breaks in the series as proof of non-stationarity. If the series contains a structural break, these tests might not successfully

reject the unit root hypothesis. The series discovered to be integrated in order one, I (1), may be stationary around the structural break(s), I (0), but are incorrectly classified as I (1). The model's coefficients might not hold true over the entire sample if structural breaks go undetected. To reduce judgment error from the ADF and PP tests in situations where there are numerous structural breaks in a series, the CMR (1998) test compares a null of non-stationarity with structural break(s) to the alternative of stationarity with structural break (s). Another advantage of this test is that no prior knowledge of the structural break points in the series is necessary. The stationarity decision rule is utilized in this test in a manner like that of the ADF or PP.

4.4.2 Test for cointegration

Cointegration is the condition in which at least one stationary linear combination of a set of time series variables that are separately integrated in the same order exists (Harris 1999; Enders 1995). Meeting this requirement suggests that there could be a long-run equilibrium relationship between these variables and testing for cointegration implies examining the possibility of such a long-run equilibrium relationship between economic variables. The Johansen cointegration technique, the Engle-Granger procedure, and the Autoregressive Distributed Lag (ARDL) method are the three main tests for cointegration. The Engle-Granger Approach can only be used if all the variables are integrated in the same order, which is not the case in this study because the variables are integrated in different orders. The Johansen maximum likelihood (1988) is not appropriate for this research because, in addition to requiring the same order of integration for variables, it is inappropriate in a single equation model. Only the ARDL method remains as a viable cointegration test for this analysis.

4.4.2.1 The ARDL method of cointegration

Pesaran et al. (1997, 1999, and 2001) created a new ARDL model that employs a Bounds test for cointegration as a remedy to the drawbacks of the two tests of cointegration previously discussed.

Multiple estimations of variables with different orders of integration—whether they are entirely I (1), strictly I (0), or fractionally integrated—are permitted by the ARDL model bound test of integration. The ARDL model has emerged as the sole more statistically significant method for establishing cointegration in small samples, in contrast to Johansen cointegration techniques, which depend on large data samples for validity. Further, the ARDL approach is sufficient to simultaneously correct for residual serial correlation and can address endogeneity (Tang et al. 2006). Additionally, the ARDL model estimates its long-run and short-run variables simultaneously. The ARDL approach involves two steps for estimating the long-run relationship (Pesaran et al, 2001). Using a bounds test, an equation's variables are first checked to see if there exists a long-run relationship, and then the model's long- and short-run coefficients are estimated. Only once the first step has been verified that cointegration exists, is the second step carried out.

To implement the ARDL bounds testing approach, headline inflation is defined as an I (1) dependent variable, and x_t as a vector of I(d) regressors, (where$0 \leq d \leq 1$) reflecting that the maximum order of integration is unit.

$$\Delta Inf_t = \alpha_0 + \pi_y Inf_{t-1} + \pi_x x_{t-1} + \sum_{i=0}^{p} \beta_i \, \Delta Inf_{t-i} + \sum_{j=0}^{q} \delta_j' \Delta x_{t-j} + \mu_t \qquad (8)$$

where α_0 is a constant, π_y and π_x are the long-run slope coefficient matrices for the dependent variable (Inf) and the independent variables respectively, β_i and δ_j are short-run slope coefficients for the dependent variable and variables, μ_t is the uncorrelated error term, p and q are optimal lag lengths of the dependent and independent variables respectively. The above model is said to be “autoregressive” since it includes p lags of dependent variable while the “distributed lag” aspect comes from the q lags of explanatory variables.

The long-run relationship (cointegration) between headline inflation at a point in time (Inf_t) and the regressors (x_t) of key being the domestic borrowing as a percentage of GDP is tested through the Ordinary Least Squares of equation and then an F-statistic for the joint significance of the coefficients of the lagged levels to test the null H_0: $\pi_y = 0$, $\pi_x = 0$ is computed. Pesaran et al. (2001) prove that under these null hypotheses, the asymptotic

distribution of the F-statistic is non-standard regardless of whether the regressors are integrated of order zero or one [I (0)/I (1)] and provide two adjusted critical values that establish the lower and upper bounds of significance. The null hypothesis of no cointegration is not rejected if the F-statistic is lower than the lower critical value while the null is rejected when the F-statistic is above the upper critical value. The test is inconclusive (inability to reject or fail to reject the null) when the F-statistic falls between the lower and upper critical values.

In addition to the F-statistic, the cointegration test by Pesaran et al. (2001) also includes a t-statistic that is determined by comparing with the relevant lower and upper bounds of significance. Contrary to the F-statistic decision, the null is rejected when the t-statistic is lower than the upper bound critical value and the null is accepted if the t-statistic is higher than the lower bound critical value.

The F-statistic decision rule is mostly utilized to determine whether the variables are cointegrated, whereas the t-statistic is only used to affirm the decision in complementarity.

4.4.3 The ARDL estimation for this study

The ARDL is used to quantify the effect of government domestic borrowing on headline inflation in Malawi because it is excellent at identifying the short- and long-run correlations among variables, which is the study's major purpose. The ARDL approach suggested by Pesaran et al. (1997, 1999, and 2001) used to identify and test the long-run co-integration relationships between variables. After confirming that all the variables are integrated in orders 0 and 1 by stationarity testing, the Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC) were used to determine the appropriate lag lengths for all the variables.

According to equation (iv), an ARDL model was estimated using the dependent variable headline inflation (Inf) and the independent variables domestic debt as a percentage of GDP (DdebtGDP), GDP per capita (GDPppc), growth in money supply (gmsupp), appreciation or depreciation of the Malawi Kwacha against the United States Dollar (gxrate), and growth in global oil prices (goilp) as summarized below.

$$\Delta Infl_t = \alpha_0 + \sum_{i=0}^{a} \rho_i \Delta Infl_{t-i} + \sum_{i=0}^{b} \delta_i \Delta DdebtGDP_{t-i} + \sum_{i=0}^{c} \pi_i \Delta GDPppc_{t-i} + \sum_{i=0}^{d} \varphi_i \Delta gmsupp_{t-i} + \sum_{i=0}^{e} \theta_i \Delta gxrate_{t-i} + \sum_{i=0}^{f} \gamma_i \Delta goilp_{t-i} + \beta_1 Infl_{t-1} + \beta_2 DdebtGDP_{t-1} + \beta_3 GDPppc_{t-1} + \beta_4 gmsupp_{t-1} + \beta_5 gxrate_{t-1} + \beta_6 goilp_{t-1} + \varepsilon_t \quad (9)$$

Where ε_t is a white noise error term, Δ is the first difference operator, the letters a, b, c, d, e and f denote lag length with their respective variables that were determined by the Akaike Information Criterion (AIC), α_0 is the intercept and the rest of the variables are as defined in the preceding paragraph.

Under ARDL bounds test, cointergration is confirmed if the coefficients of all long-term variables, β_i, are jointly statistically significant. This is established if the null hypothesis that all the $\beta_{i,}$ are jointly equal to zero i.e H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ is rejected based on the F-statistics. According to Pesaran et al. (2001), who used the conventional F-statistics, the upper and lower bounds of the crucial values for resolving this hypothesis are given. The null hypothesis, which states that there is no long-run relationship between domestic borrowing, growth in per capita GDP, growth in money supply, growth in exchange rate, and growth in global oil prices, is rejected if the F-statistic is higher than the upper bound critical value. As a result, the long-run relationship is confirmed. However, if the F-statistic is lower than the lower bound critical value, this estimation fails to reject the null that there is no long-run relationship.

After establishing the existence of a long-term relationship, the ARDL model in (ix) was updated while including the error correction term (ECT) to capture the short-run dynamic parameters (adjustment parameters that gauge how quickly short-term disturbances return to the long-term equilibrium), as shown below.

$$\Delta Infl_t = \alpha_0 + \sum_{i=0}^{a} \rho_i \Delta Infl_{t-i} + \sum_{i=0}^{b} \delta_i \Delta DdebtGDP_{t-i} + \sum_{i=0}^{c} \pi_i \Delta GDPppc_{t-i} + \sum_{i=0}^{d} \varphi_i \Delta gmsupp_{t-i} + \sum_{i=0}^{e} \theta_i \Delta gxrate_{t-i} + \sum_{i=0}^{f} \gamma_i \Delta goilp_{t-i} + \beta_1 Infl_{t-1} + \beta_2 DdebtGDP_{t-1} + \beta_3 GDPppc_{t-1} + \beta_4 gmoney_{t-1} + \beta_5 gxrate_{t-1} + \beta_6 goilp_{t-1} + \phi ECT_{t-1} + \varepsilon_t \quad (10)$$

Where ρ_i, δ_i, π_i, φ_i, θ_i, and γ_i are short run coefficients whose statistical significance is tested through the F-statistic. When the p-value of the respective short-run coefficient is below the significance level for example the chosen 5% for this study, the null hypothesis of no short run effect is rejected while if the p-value is greater than 5%, the null is not rejected and a conclusion that such a variable has no short run effect on the dependent variable is made.

ECTt-1 is the error correction term lagged by one period and ϕ is error correction parameter that measures the speed of adjustment of the short-run fluctuations towards the long run equilibrium. The coefficient of error correction term (ϕ) is expected to be statistically significant with a negative sign which implies that any disturbance that occurs in the short-run model will be corrected in the long-run. Additionally, according to Harris (1999), the larger the coefficient of the error correction term in absolute terms, the faster the convergence of the short run deviations to the long run equilibrium.

While the joint significance of all the explanatory variables is established during the test for cointegration where the null H_0: $\beta1 = \beta2 = \beta3 = \beta4 = \beta5 = \beta6 = 0$ is rejected, the individual long-term significance of the explanatory variables was tested using the Wald test on the normalized long-term coefficients. To obtain the normalized long run coefficient (β_i^*), each coefficient of the explanatory variable is divided by the long run coefficient of the dependent variable in differenced form i.e

$$\beta_i^* = -\beta_i / \beta_1 \quad (11)$$

An explanatory variable is said to have a long run effect on the dependent variable if the p-value associated with the Wald statistic test for the variable falls below the chosen

significance level otherwise the null that the normalized coefficient (β_i*) does not have a long run effect on the dependent variable is not rejected.

4.5 Definition of variables and expectation of relationship

From the review of both theoretical and empirical literature and macroeconomics books, the definition of the variables included in the specified model and their expected sign is given below.

Dependent variable

Headline inflation (Inf): The annual percentage change in the prices of a given basket goods (Consumer Price Index, CPI) over time as compared to the price in the base year.

Independent variables

Government domestic borrowing ((DdebtGDP): The inflationary effect of government domestic borrowing follows propositions of the FTPL (Woodridge 1995). To assess the economy's ability to pay off the debt, the annual total government domestic debt stock is expressed as a percentage of nominal Gross Domestic Product (GDP). The benefit of this measure is that it makes it possible to compare the debt positions of nations even when their currencies are different. The results of the literature on how domestic government borrowing affects headline inflation are conflicting. Despite this, this analysis anticipates confirming FTPL's assumption that there is a positive correlation between domestic government borrowing and headline inflation.

Control variables

The model incorporates control variables that were taken from the standard quantity theory of money and Mangani (2021). These consist of the growth of money, the growth in GDP per capita, the growth in exchange rates, and the inflation of oil prices. The growth of the exchange rate and the price of oil, in addition to economic theory, consider the effects coming from external factors on Malawi's domestic price formation process.

Money supply growth (gmsupp): The annual percentage change in narrow money (i.e., the sum of currency in circulation outside banks and private demand deposits held by

commercial banks). The study expects to find a positive relationship between inflation and narrow money supply.

GDP per capita growth (GDPppc): The annual percentage change in GDP per capita in Malawi Kwacha units. A positive relationship between GDP per capita and inflation is expected i.e., a higher GDPppc points to an increase in aggregate demand and holding aggregate supply constant that should result in an uplift in inflation. Therefore, this study expects a positive relationship between CPI and GDP per capita.

Oil price inflation (goilp): The 100 times the logarithmic first difference of West Texas Intermediate (WTI) world oil prices, expressed in Malawi Kwacha. In this study, oil prices are expected to be positively related to headline inflation.

Exchange rate growth (gxrate): The annual percentage change in the units of domestic currency per unit of the United States Dollar (USD). Loss of value at the exchange rate (depreciation) raises the price of imported goods and this creates imported inflation. Exchange rate growth (gxrate) is expected to affect inflation positively.

4.6 Diagnostic tests and model stability

To check the validity and robustness of the ARDL estimation both the long run and short run models; misspecification test, normality test, serial correlation test, Autoregressive Conditional Heteroscedasticity (ARCH) test and cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) test for stability of the model were undertaken.

4.6.1 Misspecification test

Testing for omitted variable bias is important for econometric model since it is related to the assumption that the error term and the independent variables in the model are not correlated ($E(e|X) = 0$). If there are missing variables in the model (sitting in the error term) and are correlated with the included regressors, then our regression coefficients will be inconsistent. This study uses the Ramsey RESET Test to test for omitted-variable bias. The null and alternative hypotheses as below:

H_o: no omitted variable problem

H_1: omitted variable problem

The null hypothesis test for Ramsey's RESET test, which tests whether the model suffers from omitted variable bias or not, is not rejected if the probability value of the test statistic is greater than the standard level of significance.

4.6.2 Normality test

The study uses the Jarque-Bera Normality Test to test the distribution of the residuals for normality. The null and alternative hypothesis are as below:

H_o: normal distribution

H_1: not normal distribution

If the probability value of the Jarque-Bera statistic emerges greater than the standard level of significance, the study will fail to reject the null hypothesis which indicates normal distribution of the residuals. The model specification and the potential for outliers in the data are reviewed if the null hypothesis of a normal distribution is rejected.

4.6.3 Serial correlation test

Serial correlation refers to correlation between members of series of observation ordered in time. This study uses the Breusch-Godfrey (BG) Serial Correlation LM Test to test the series for serial correlation. The study tests the null and alternative hypotheses as below.

H_o: no serial correlation

H_1: serial correlation

If the p-value associated with test statistic emerges greater than the standard significant level, the study will not reject the null hypothesis of no serial correlation in the series. On the other-hand, if the p-value comes out lower than the standard significant level, then the null will be rejected and conclude that there is serial correlation. The study will add higher order lags of the explanatory variables to correct for serial correlation once confirmed.

4.6.4 Autoregressive Conditional Heteroscedasticity (ARCH) test

Classical regression model assumes that the variance of each disturbance term Ui, conditional on the chosen values of the explanatory variables, is some constant number equal to ϭ2. The assumption of homoscedasticity of equal speared (or equal variance) of the error terms. In practice however, it happens that the distribution of Ui, around the explanatory variables does not have a constant variance, a condition called heteroscedasticity to mean that the variances of Ui's are variable or not constant. This study uses the LM ARCH effects test. Under this test, the study will run the null and alternative hypothesis written as below:

H_o: No ARCH effects

H_1: ARCH(p) disturbance

If p-value associated with the test statistics are greater than the standard significance level, the study will not reject the null hypothesis of constant variance in the series. Assuming the heteroscedasticity is confirmed in the estimation, then robust errors will be included in the specification options of the model to mitigate the impact of the problem.

4.6.5 Stability test

The stability of the model for long run and short run relationship is detected by using the cumulative sum of recursive residuals (CUSUM) which helps as to show if coefficients of the parameters are changing systematically and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests which is useful to indicate if the coefficient of regression are changing suddenly using a graph.

The null and alternative hypothesis will be as follows:

H_o: parameter instability

H_1: parameter stability

If the blue line does not cross the red line which is critical line and returns between two critical lines, we will reject the null hypothesis of the parameter instability and conclude that there is parameter stability in the model.

The study also uses the recursive test to confirm the CUSUM and CUSUMSQ results. This test confirms whether the coefficients in a time-series regression are stable over time. The test statistic is constructed from the cumulative sum of either the recursive residuals or the ordinary least-squares (OLS) residuals. When the test statistic from the recursive test falls below the critical value, the null of no structural break is accepted and a conclusion that the parameters are stable over the study period is made.

CHAPTER FIVE

PRESENTATION AND INTERPRETATION OF THE RESULTS

5.1 Descriptive statistics

The mean, median, maximum, and minimum, as well as the standard deviation, are displayed in table 2 for each of the six variables. During the 41-year study period, inflation averaged 18.3%, classifying Malawi as an economy with generally high inflation as the inflation average is 130 basis points (bps) above the established optimal threshold for Malawi of 17.0% (Nkune & Ngalawa 2014). Further, the average headline inflation for period significantly exceeds the average for the Sub-Saharan Africa (SSA) of 11.1% according to the International Monetary Fund data (IMF 2022). Comparing, the average inflation to the optimal threshold as well as the SSA average postulates Malawi as a high inflation economy thereby underscoring the need for a comprehensive understanding of its sources that would aid implementation of appropriate mitigation measures.

Domestic debt was 16.1% of GDP on average for the study period, which is lower than the recommended maximum of 20% for low-income economies like Malawi. However, the highest of 33.1% of GDP was recorded in 2019, while the minimum was 4.5% of GDP in 1995. This illustrates the generally rising trend in total domestic debt. Therefore, it would be expected that any negative consequences of high domestic debt on the macroeconomic environment would have been worsening during the previous few years to 2020.

Over a 41-year period, currency depreciation against the US dollar averaged 20.0% annually, with high volatility recording minimum and maximum annual exchange rate growths of -1.0% and +99.9%, respectively. This shows that Malawi faces more serious issues with managing its exchange rate. While holding population growth, which is stable at around 2.5% per year, GDP per capita grew by an average of 0.7% with a broad range as shown in the minimum and maximum values. This reflects the impact of economic

shocks, primarily weather-related shocks, on the economy. Over the time, there was a trend toward price volatility for oil, with the highest decreases and increases occurring at 42.5% and 111.0%, respectively. With an average annual growth rate of 25.8%, the money supply growth showed considerable stability.

Table 2: Summary of descriptive statistics of variables used

DESCRIPTIVE STATISTICS

Variable	Mean	Standard Deviation	Minimum	Maximum
Inflation	18.27663	14.3565	7.409	83.148
Domestic debt % GDP	16.14746	6.71256	4.5	33.1
Per capita GDP	0.71000	4.79944	-10.56585	15.55822
Money supply	25.77594	13.05494	-6.353932	53.67895
Exchange rate	20.01801	23.5937	-0.996978	99.86755
Oil prices	23.90751	35.16965	-42.54445	110.9758

Table 3 presents a cross correlation matrix of the six variables used in the study. The correlation coefficient between headline inflation and the stock of domestic debt as a percentage of GDP is negative 0.4. The weak negative correlation between these two variables demonstrates a negative relationship between them. Furthermore, as expected, GDP per capita, money supply growth, exchange rate growth, and global oil price growth are all positively correlated with headline inflation. However, aside from the increase in exchange rates, the correlation coefficients are less than 0.5, indicating that these

relationships are generally weak. Moreover, except for the 0.6 pairwise correlation between the growth of the exchange rate and the growth of global oil prices, all other pairwise correlations have correlation coefficients below 0.5, indicating that multicollinearity is not a concern.

Table 3 Cross correlation of variables

	Inflation	Domestic debt % GDP	Per capita GDP	Money supply	Exchange rate	Global oil prices
Inflation	1					
Domestic debt % GDP	-0.3884	1				
Per capita GDP	0.2358	0.0682	1			
Money supply	0.4742	-0.02860	0.1766	1		
Exchange rate	0.6579	-0.2004	-0.1158	0.4614	1	
Global oil prices	0.4776	-0.1508	0.0380	0.4468	0.5631	1

5.2 Stationarity test results

Table 4 presents unit root stationarity tests results from the Augmented Dickey Fuller (ADF), Phillips Perron (PP) and Clemente-Montanes-Reyes (CMR) (1998) stationarity tests at 5% significance level.

Table 4: Stationarity tests results

RESULTS OF UNIT ROOT TESTS

	Test statistics		
Variable	ADF Test	PP test	CMR Test
	CV1 = -3.552 CV2 = -3.556	CV1 = -19.040 CV2 = -18.964	CV1 = -5.490
Inflation	-2.309* -3.812+ (1)	-18.707* -30.718+ (1)	-2.724* (1)
Domestic debt % GDP	-3.010* -6.046+ (1)	-22.494* (0)	-2.579* (1)
Per capita GDP	-3.490* -5.089+ (1)	-53.827* (0)	-3.827* (1)
Money supply	-2.454* -4.611+ (1)	-27.585* (0)	-6.788* (0)
Exchange rate	-2.599* -5.278+ (1)	-23.828* (0)	-4.275* (1)
Global oil prices	-3.687* (0)	-30.668* (0)	-6.122* (0)

CV1 and CV2 are 5% critical values for the tests of the variables in levels and in first difference respectively, "*" and "+" are test statistics for the variables in levels and first difference respectively, in parenthesis are orders of integration of each variable where (0) and (1) means the variable is stationary in levels and in first difference respectively except for the CMR test which does not allow first differencing. For the CMR, (0) and (1) means stationary in levels with structural break and non-stationary in levels with structural break respectively.

The ADF and PP unit root tests have both ruled out the existence of more than one order of integration because all variables that are not stationary in levels become stationary in their first difference. The CMR test results agree with the ADF's conclusion that inflation, domestic debt, per capita GDP, and the exchange rate are non-stationary in levels, whereas growth in oil prices is stationary in levels. The CMR, on the other hand, rejects the ADF's discovery of non-stationarity in money supply growth. The ADF and PP stationarity tests show that variables in this study are integrated in orders zero, I (0), and one, I (1), with no more than one order of integration. This enabled the use of the ARDL model. The CMR also confirms the presence of structural breaks, whose impact on parameter stability is revealed by the parameter stability tests CUSUM and CUSUMSQ.

5.3 The ARDL model specification

The study first determined an appropriate lag order for the various terms using information criteria to create a more efficient model. Table 5 shows the results of the model selection tests. Both the Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC) suggested that the model with a lag order of 2 was the best fit. However, at lag 2, the model suffered from serial correlation, model misspecification, and Autoregressive Conditional Heteroskedasticity (ARCH). The model passed all diagnostic tests at lag 3.

Table 5: Model selection statistics

MODEL SELECTION STATISTICS			
Lag	Information criteria		Breusch-Godfrey serial correlation LM test
	AIC	BIC	χ_1^2(p)
1	7.23874	7.54350	12.328 (0.0004)
2	7.18945*	7.53775*	13.112 (0.0003)
3	7.24102	7.63287	1.437 (0.2307)
4	7.28632	7.72170	0.840 (0.3595)

"*" represents the lag chosen by the Information criterion, χ_1^2 is the BG LM test statistic for the null hypothesis of no 1st order serial correlation and the p in parenthesis represents the corresponding probability of accepting the null hypothesis of no serial correlation.

5.4 Diagnostic test results

5.4.1 Ramsey Reset test and Autoregressive Conditional Heteroscedasticity (ARCH) test results.

The results of the Ramsey Reset and ARCH tests which were conducted on the selected model as shown in table 6.

Table 6: Ramsey Reset test

Ramsey Reset test	ARCH test
F(p)	χ_1^2(p)
1.14 (0.3805)	0.522 (0.4700)

Notes: F is the test statistic for investigating the appropriateness of the model while χ_1^2 is the test statistic for ARCH (1), p denotes the corresponding probability of failing to reject the respective null hypotheses of correct specification and normality or no ARCH effects.

The Ramsey's RESET test, which determines whether the model has omitted variable bias, confirmed that there are no specification errors in the model, implying that it was correctly specified. The ARCH LM test results show that there is no conditional heteroscedasticity in the chosen model because the p-value is significantly greater than the 5.0% significance level.

5.4.2 CUSUM and CUSUMSQ tests results

Figures 8 and 9 show the CUSUM and CUSUMSQ test results. The ARDL estimate passed the CUSUM test. The CUSUMSQ test result, on the other hand, revealed some evidence of mild instability. However, the evidence of mild instability was not supported by the results of recursive estimators, as shown in Table 7.

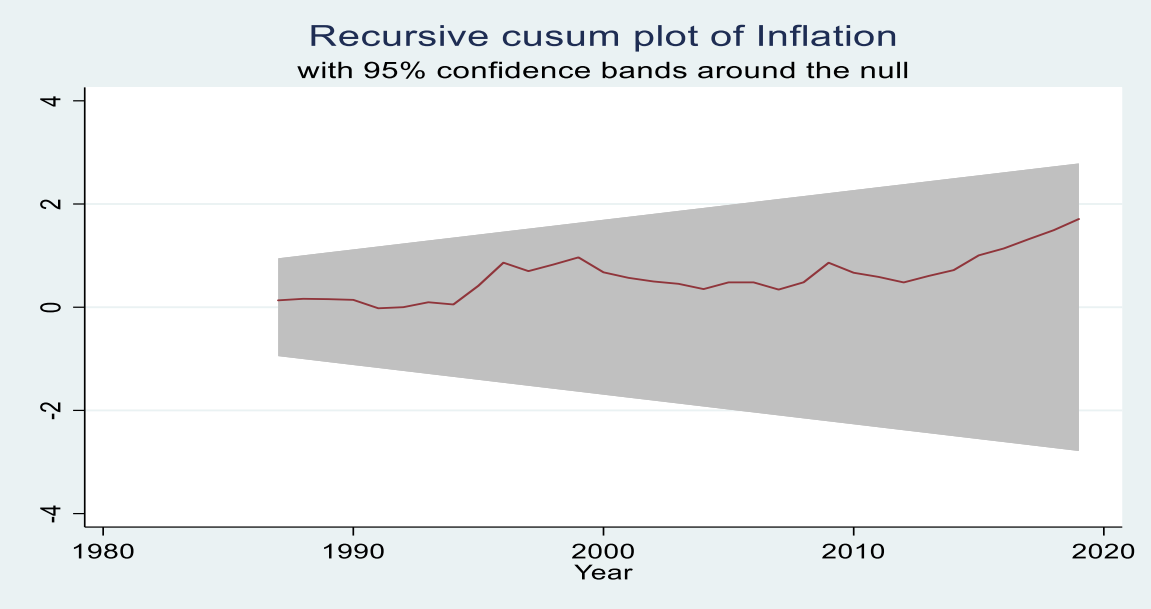

Figure 8: CUSUM test results

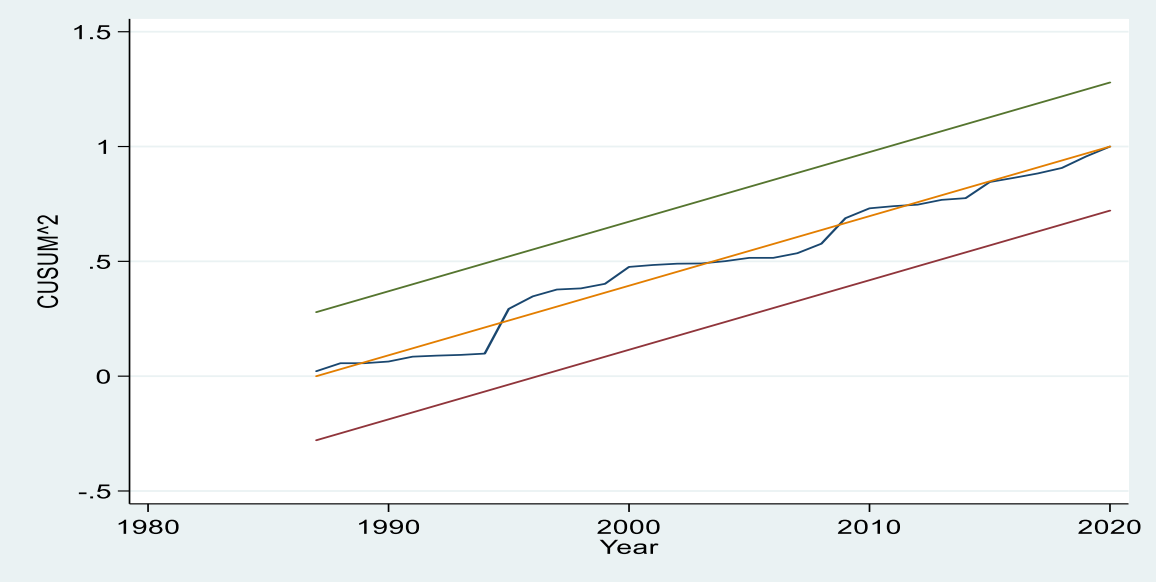

Figure 9: CUSUMSQ tests results

5.4.2.1 Recursive estimation

Table 7 presents recursive estimation results for parameter stability in an endeavor to rule out the possibility of mild instability, as shown by the CUSUMSQ plot above. The results

confirmed parameter stability, as the test statistic falls below the critical values even at the most stringent significance level of 1%.

Table 7: Recursive estimation results

Statistic	Test Statistic	CV (1.0%)	CV (5.0%)	CV (10.0%)
Recursive	0.5260	1.1430	0.9479	0.850

Note: CV refers to Critical Values with the respective significance levels in parentheses.

5.5 ARDL bounds test of cointegration results.

Table 8: Co-integration test results

ARDL BOUNDS TEST OF COINTERGRATION				
	Test statistics			
Significance level	F-statistic		t-statistic	
	7.233		-2.915	
	CV_L	CV_U	CV_L	CV_U
1%	3.41	4.68***	-3.43	-4.79***
5%	2.62	3.79**	-2.86	-4.19**
10%	2.26	3.35*	-2.57	-3.86*

"*", "**", "***" statistically significant at 10%, 5% and 1% significance levels respectively. CV_L and CV_U are lower and upper bound critical values respectively for the F and t statistics.

The results show that the F-statistic is greater than the upper bound critical values of 1%, 5%, and 10%, respectively. As a result, the null hypothesis of no cointegration is rejected. Similarly, the t-statistic falls below the upper bound of critical values at 1%, 5%, and 10%, respectively, allowing the null hypothesis of no cointegration to be rejected. As a result, both the F-statistic and the t-statistic confirmed the presence of a level relationship among variables in the model. The presence of a cointegrating relationship indicates that

the inflationary process depicted in this study is correctly specified and stable over the 41-year sample period.

5.5 Estimation results

5.5.1 Estimation results of the selected ARDL model

Table 9 displays the ECM regression results associated with the previously established cointegrating relationship. These estimates provide direct evidence on Malawi's inflationary process, as modeled in this study. Furthermore, the error correction coefficient is negative 0.46, implying that approximately 46% of headline inflation short-term deviations revert to the long-run average per year, which is statistically significant at 5%. During the estimation process, the lag length for each variable was determined using the Akaike Information Criterion (AIC).

Table 9: ARDL estimation results

	Coefficient	Std. Error	t-statistic	Prob.
ECT (-1)	-0.4596461*	0.1576586	-2.92	0.012
C	-6.85745	7.01379	-0.98	0.346
DInfl(-1)	-0.1586563	0.1312763	-1.21	0.248
DInfl(-2)	-0.4967152*	0.1161123	-4.28	0.001
DdebtGDP(-1)	-0.7835328*	0.230121	-3.40	0.005
DdebtGDP(-2)	-0.2662695	0. 344436	-0.77	0.453
DdebtGDP(-3)	-0.4329396	0.27919	-1.55	0.145
Dgxrate(-1)	0.3127766*	0.0531419	5.89	0.000
DGDPppc(-1)	0.6355927*	0.2840237	2.24	0.043
DGDPppc (-2)	0.5057286	0.3845663	1.32	0.211
DGDPppc (-3)	0.3067965	0.3789654	0.81	0.433
DGDPppc (-4)	-0.2142156	0.2378194	-0.90	0.384

Dgoilp(-1)	-0.0625063	0.0371353	-1.68	0.116
Dgoilp(-2)	0.2063453*	0.0567917	3.63	0.003
Dgoilp(-3)	0.1672205*	0.0466108	3.59	0.003
Dgoilp(-4)	0.1743565*	0.0336908	5.18	0.000
Dgmsupp(-1)	0.3409579*	0.1082142	3.15	0.008
Dgmsupp(-2)	0.1638748	0.1491486	1.10	0.292
Dgmsupp(-3)	0.2409735	0.1087148	2.22	0.045
Infl (-1)	-0.4596461	0.1576586	-2.92	0.012
DdebtGDP (-1)	0.2296246	0.2989116	0.77	0.456
GDPppp (-1)	0.5041274	0.5305334	0.95	0.359
gxrate (-1)	0.4543912*	0.0841238	5.40	0.000
goilp (-1)	-0.3465919*	0.0906756	-3.82	0.002
gmsupp(-1)	0.409881	0.2019803	2.03	0.063
Adj R-squared	0.9083		N	37
Prob (F-statistic)	0.0000		D-Watson stat	1.66479

"*" denotes statistical significance at 5%.

For the period 1980 to 2020, the explanatory variables accounted for approximately 91% of the variation in Malawi's annual headline inflation. This is supported by the F-statistic, which shows that the model is significant at all significant levels of 1%, 5%, and 10%, respectively.

5.5.2 Joint short run effects

The joint significance of each exogenous variables lagged difference terms as specified in the ARDL model for this study was evaluated as reported in table 10.

Table 10: Joint short run effects

Variable	Null hypothesis	F-statistic (p)
Inflation	$\rho_1 = \rho_2 = \rho_3 = 0$	9.20 (0.0032) *
Domestic debt % GDP	$\delta_1 = \delta_2 = \delta_3 = 0$	4.34 (0.0250) *
Per capita GDP	$\pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$	4.29 (0.0198) *
Money supply	$\varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$	4.30 (0.0259) *
Exchange rate	$\theta_1 = 0$	34.64 (0.0001) *
Global oil prices	$\gamma_1 = \gamma_2 = \gamma_3 = \tau_4 = 0$	7.00 (0.0031) *

(p) is the probability of failing to reject the null hypothesis of joint insignificance. "*" represents statistically joint significance of short run effects at 5.0% significance level.

Annual headline inflation is affected in the short run by shocks resulting from lags in their own values, domestic debt, changes in exchange rates, global oil prices, per capita GDP, and money supply, as the p-values of all the respective F-statistics presented are less than the 5% significance level. This allows the null hypotheses of no joint significance of the short-term parameters to be rejected and leads to the conclusion that all the lagged independent variables have a significant impact on headline inflation in the short run.

5.5.3 Long run effects

After the normalization process, the long run sensitivities of the inflationary process for Malawi to its covariates as estimated in this study are as presented in table 11.

Table 11: Long run effects

Variable	LR effect	Null hypothesis	χ_1^2 (p)
Domestic debt % GDP	0.4995683	$-\beta_2/\beta_1$=0	0.41 (0.5200)
Per capita GDP	1.096773	$-\beta_3/\beta_1$=0	1.00 (0.3172)
Exchange rate	0.9885675	$-\beta_4/\beta_1$=0	10.51 (0.0012) *
Global oil prices	-0.7540408	$-\beta_5/\beta_1$=0	7.52 (0.0061) *
Money supply	0.8917316	$-\beta_6/\beta_1$=0	3.85 (0.0504) **

X_1^2 is the Wald test statistic while the p in parenthesis represents the probability of failing to reject the null hypothesis of no long run effect. "*" and "**" denote statistical significance at 5% and 10% respectively.

Domestic debt is not a significant factor in determining the inflationary process in Malawi from 1980 to 2020, according to the results obtained after normalization. At the standard significance levels of 1%, 5%, and 10%, the long-run coefficient of domestic debt is insignificant. This finding is consistent with the Mangani (2021) paper, which concludes that domestic borrowing (financing), as measured by net domestic credit to the public sector, is not inflationary in Malawi. These findings also contradict evidence for developing economies (e.g., Aimola & Odhiambo 2021, Ribeiro & Baldini 2011, Haider & Khan 2007, Bhattarai et al. 2014)), as well as IMF and World Bank proposals for fiscal discipline by mitigating the rise in domestic debt.

According to the quantity theory of money, one of the most important factors in explaining the variability of headline inflation in Malawi was found to be growth in money supply. Even though the coefficient of per capita GDP growth is positive, it is not significant in accordance with the demand-pull theory of inflation. This reflects that such a relationship does not exist for Malawi. In line with (Mangani 2012, Simwaka et al. 2011, Matchaya 2011, Chavula 2021) and the expected importance of imported inflation in Malawi's inflationary process, growth in the exchange rate was found to be highly statistically significant even at the strict level of significance of 1.0%. Growth in exchange rate appears to have a greater impact on headline inflation based on the size of the coefficients, which are close to a unit, as well as the high level of statistical significance. The impact of the exchange rate on headline inflation measures the extent to which fluctuations in the nominal exchange rate affect consumer prices through changes in the prices of imported goods and services. Changes in the prices of imported finished and intermediate goods have an immediate impact on domestic consumer prices. The effects of exchange rate fluctuations and foreign price levels on domestic prices are determined by the economy's structure. This finding emphasizes the inflationary impact of currency depreciation and/or devaluation in Malawi.

Contrary to expectations, the negative sign on global oil price growth is a very surprising result. However, the fact that the impact of global oil prices on Malawian prices is indirect, as it is through the Automatic Pricing Mechanism (APM), could explain this result. The positive and significant relationship between global oil price dynamics and prices in the short run at lags 2-4 suggests that global oil prices have a price lagging effect on headline inflation in the short run.

CHAPTER SIX

CONCLUSION

This chapter presents a summary of the outcome of the estimation results and discussion as well as policy implications of the results before providing areas of further research.

6.1 Summary of estimation results

The study's overarching goal was to determine the effect of government domestic borrowing on headline inflation in Malawi from 1980 to 2020. The study examined the short-run and long-run effects of government domestic borrowing on headline inflation while controlling for changes in oil prices, GDP per capita growth, foreign exchange rate growth, and money supply growth.

The ARDL model revealed that there is a long-run equilibrium relationship between headline inflation and the drivers modeled in this study. This result confirms the existence of a valid and not spurious long run association between the inflation and the current and lagged values of government domestic borrowing, per capita GDP growth, exchange rate appreciation/depreciation, growth in global oil prices and money supply growth. To that effect, the results allowed the estimation of the short run and long run effects of these independent variables on headline inflation.

The normalized coefficients demonstrated that government domestic borrowing in Malawi is not inflationary, as the long-run coefficient would only be significant at significance levels above 52%, which does not sit any closer to statistical prescriptions. This contradicts evidence from similar studies for some developing countries, as well as neo-orthodox theories such as the FTPL. These findings support the conclusion that government domestic borrowing has no long-run effects on headline inflation in Malawi, despite contributing to the short-run deviation from the mean. The results allow the conclusion that containing government domestic borrowing will do little, if anything, to

cushion inflation from rising beyond sustainable thresholds of 17%, for example, the high average of 18.1% established in this study.

The quantity theory of money was supported by this study's finding, which proved that growth in the money supply has a positive long-run effect on headline inflation. This result allows the study to conclude that headline inflation in Malawi, ceteris paribus, is driven by growth in money supply, also supporting the results from similar studies previously done for Malawi. The significance of money supply in explaining headline inflation supports the Reserve Bank of Malawi's policy of mopping up excess banking system liquidity through Open Market Operations (OMO) REPOs to reduce rising inflationary pressures. This finding highlights the importance of closely coordinating monetary policies for example the RBM should ensure that broad money supply expands in line with nominal GDP. Controlling money supply growth within recommended levels would slowdown the rate of inflation expectations, by ensuring that prices in other categories of non-food items slow down following the depressed demand.

The results show that exchange rate depreciation significantly contributes to rising headline inflation in Malawi both in the short run and the long run. This is reflected in the statistical significance of its coefficient at even the most stringent level of 1%, as well as the size of the coefficient's closeness to unit post-normalization. This result aligns so well with the nature of the Malawian economy, which is a net importer of key commodities as well as services while having a very weak export base. With such trade characteristics, the economy suffers from chronic trade deficits that make it very vulnerable to imported inflation as well as any global economic shocks. The relevance of exchange rate growth on headline inflation in Malawi highlights the need for the government to be mindful of foreign exchange and trade policies. This need arises from the fact that any exchange rate and trade policy influence the extent to which imported inflation affects domestic prices. As a result, the authorities' goal should be to enact policies that promote and improve the competitiveness of the economy's exports to strengthen the export base and tame the high appetite for imports. Such policies would eventually narrow down the widening trade deficits, thereby reducing the inflationary pressure emanating from currency depreciation.

Surprisingly, the study found a negative and statistically significant relationship between global oil price growth and headline inflation in Malawi. This result can be explained by the expected indirect or second-round effect of global oil prices on Malawi inflation, because changes in oil prices are simply an input into the Automatic Pricing Mechanism (APM) that determines Malawi's ruling fuel pump prices. The short-run significance of oil price changes on Malawian prices, on the other hand, suggests that the anti-inflationary drive should not lose sight of global oil price dynamics and should possibly continue with the implementation of measures that would reduce fuel importation through substitution with other sources of energy, such as solar and ethanol.

In the short run, the results enable the study to conclude that annual headline inflation is affected by shocks emanating from lagged values themselves, domestic debt, changes in exchange rates, global oil prices, per capita GDP growth, and money supply growth. On the other hand, the study concludes that in the long run, government domestic borrowing and per capita GDP growth do not affect headline inflation in Malawi. In the long run, the study concludes that inflation is driven by exchange rate volatility as well as changes in the money supply, with some indirect impact from global oil price growth.

6.2 Policy recommendations

The findings of this study suggest that fiscal restraint policies, particularly those aimed at containing public domestic debt, may do little to mitigate long-run rising headline inflationary pressure in Malawi. As a result, orthodox neoclassical policy prescriptions from the IMF and World Bank, especially those targeting containment of inflationary pressure through curtailing government domestic borrowing, should not be prioritized. Such policies, as informed by the results of this study, may only alleviate the short-run deviations of inflation from the long-run mean, but with the reversion of inflation to the long-term mean established in this study, inflation eventually returns to high levels. This reflects the fact that addressing high inflation with fiscal restraint policies, such as limiting government domestic borrowing, does not ensure long-term low inflation. As a result of the absence of a long-term relationship, prioritizing such policies may prolong

the high volatility of headline inflation. Volatility in headline inflation triggers overall macroeconomic volatility because inflation is key to macroeconomic policies, consumption, and investment decision-making.

The findings, on the other hand, show that imported inflation is more prevalent in the Malawi inflationary process, reflecting structural challenges affecting Malawi's foreign currency exchange market. As a result, policies focusing on import substitution to reduce the economy's high appetite for imports and export base diversification to increase export levels would aid in mitigating rising inflationary pressure. Narrowing trade deficits through import substitution or export enhancement would also protect the economy from the impact of unfavorable donor conditions, as donors remain the primary alternative source of foreign currency aside from exports.

Malawi is already rich in policies targeted at addressing the challenges rocking the foreign exchange market, especially after the formulation of the Malawi 2063 Agenda (MW2063), a successor to Vision 2020. Export diversification and import substitution policies clearly cut across the MW2063 three pillars of agriculture productivity and commercialization, industrialization, and urbanization. For example, agriculture productivity and commercialization drive the production and supply of raw materials for industrial processing and healthy and nutritious food, while industrialization targets increasing investment to establish both traditional and non-traditional manufacturing firms, technological innovations, mining, and other services. These two pillars, if successfully implemented, would ensure the strengthening of agricultural exports while diversifying the export base to other sectors, for example, mining, in addition to ensuring the local supply of commodities that the country currently imports. Urbanization has the potential to strengthen other sectors, such as the tourism sector, which would support the trickle of foreign currency. As a result, serious adherence to existing policies would guarantee sustainable containment of high inflation in Malawi.

The findings also suggest that mopping up excess banking system liquidity to reduce money supply growth effectively shields the economy from rising inflationary pressures. This finding supports the use of monetary tools, such as OMO REPOs, to combat inflationary pressure. Therefore, RBM’s target of ensuring that money supply growth

does not exceed the nominal GDP growth, if successfully implemented, would assist in taming rising headline inflation both in the short run and long run.

6.3 Limitations of the study

The key source of the study's limitations was the scarcity of data on the main independent variable, the domestic government borrowing stock, which led to a constrained sample size. Given the ideal lag length criterion, which reduces the degrees of freedom, the results presented in this study may have varied if the sample size had been relatively large. However, the results of the diagnostic tests conducted in the study clearly demonstrate that the estimators were unaffected by any potential specification bias, which is frequently linked to data challenges. Therefore, these findings reflect that the study was successful in reducing the possible effects of the limited data.

6.4 Areas of further study

This study unequivocally addressed the research questions of whether the inflationary effect of government domestic borrowing occurs in the short run, the long run, or both while holding all other variables constant. Nonetheless, there is much more that can be investigated in future studies. This includes determining the best channel through which the government's total domestic borrowing affects Malawi's headline inflation. Future research could divide total government borrowing into amounts raised per security to uncover the potential impact of data aggregation. Measuring the inflationary impact of whether the government borrows through commercial banks, RBMs, or statutory corporations would also be an interesting endeavor. To address the issue of data scarcity, additional research could consider interpolating quarterly data.

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APPENDICES

Appendix 1: Lag selection for each of the 6 variables

Selection-order criteria
Sample: **1984 - 2020** Number of obs = **37**

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-152.187				231.019	8.28036	8.29571	8.3239
1	-146.97	10.433*	1	0.001	183.95	8.05244	8.08313	8.13951*
2	-145.854	2.2327	1	0.135	182.842	8.04615	8.09219	8.17676
3	-143.977	3.7535	1	0.053	174.465*	7.99875*	8.06015*	8.17291
4	-143.914	.12587	1	0.723	183.679	8.0494	8.12615	8.2671

Endogenous: Infl
Exogenous: _cons

Selection-order criteria
Sample: **1984 - 2020** Number of obs = **37**

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-123.248				48.3395	6.71611	6.73146	6.75965
1	-108.5	29.496*	1	0.000	22.9935*	5.97299*	6.00368*	6.06006*
2	-107.973	1.0553	1	0.304	23.5941	5.99852	6.04457	6.12913
3	-107.377	1.1905	1	0.275	24.1279	6.0204	6.08179	6.19455
4	-106.119	2.517	1	0.113	23.8125	6.00642	6.08317	6.22412

Endogenous: DdebtGDP
Exogenous: _cons

Selection-order criteria
Sample: **1984 - 2020** Number of obs = **37**

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-185.224				1377.91*	10.0662*	10.0815*	10.1097*
1	-184.387	1.675	1	0.196	1390.19	10.075	10.1057	10.162
2	-183.736	1.3011	1	0.254	1417.06	10.0939	10.1399	10.2245
3	-183.414	.64387	1	0.422	1470.68	10.1305	10.1919	10.3047
4	-183.011	.80737	1	0.369	1520.1	10.1627	10.2395	10.3804

Endogenous: goilp
Exogenous: _cons

Selection-order criteria
Sample: 1984 - 2020 Number of obs = 37

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-170.359				616.96	9.26267	9.27802	9.30621
1	-167.703	5.3119*	1	0.021	564.187	9.17316	9.20386*	9.26023*
2	-166.491	2.4238	1	0.120	557.901*	9.1617*	9.20775	9.29232
3	-165.588	1.8063	1	0.179	561.105	9.16694	9.22833	9.34109
4	-165.542	.09296	1	0.760	591.266	9.21848	9.29523	9.43617

Endogenous: gxrate
Exogenous: _cons

Selection-order criteria
Sample: 1984 - 2020 Number of obs = 37

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-110.201				23.8794	6.01088	6.02623*	6.05442*
1	-109.417	1.5695	1	0.210	24.1612	6.02252	6.05322	6.10959
2	-107.993	2.8464	1	0.092	23.6206*	5.99964*	6.04569	6.13026
3	-107.96	.06649	1	0.797	24.9	6.0519	6.1133	6.22605
4	-107.743	.43523	1	0.509	25.9969	6.09419	6.17094	6.31188

Endogenous: GDPppc
Exogenous: _cons

Selection-order criteria
Sample: 1984 - 2020 Number of obs = 37

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-144.241				150.358	7.85089	7.86624*	7.89442*
1	-143.192	2.0979	1	0.148	149.975	7.84824	7.87894	7.93532
2	-142.529	1.326	1	0.250	152.77	7.86646	7.9125	7.99707
3	-141.084	2.8915	1	0.089	149.206*	7.84236*	7.90376	8.01651
4	-140.979	.2093	1	0.647	156.733	7.89076	7.9675	8.10845

Endogenous: gmsupp
Exogenous: _cons

Note: Using the Akaike Information Criterion (AIC) for lag selection on all the variables, the lag lengths for Inflation, DdebtGDP, oil prices, exchange rate, money supply growth and GDP per capita were 3, 1,0,2,3 and 2 respectively.

Appendix 2: Unit root tests for all the 6 variables modelled in the study

2.1 The Augmented Dickey Fuller (ADF) Unit Root test results

2.1.1 ADF on headline inflation

2.1.1.1 ADF on headline inflation in levels

Augmented Dickey-Fuller test for unit root Number of obs = **37**

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	**-2.309**	**-4.270**	**-3.552**	**-3.211**

MacKinnon approximate p-value for Z(t) = **0.4289**

2.1.1.2 ADF on headline inflation in first difference form

Augmented Dickey-Fuller test for unit root Number of obs = **36**

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	**-3.827**	**-3.675**	**-2.969**	**-2.617**

MacKinnon approximate p-value for Z(t) = **0.0026**

2.1.2 ADF on domestic debt%GDP

2.1.2.1 ADF on domestic debt%GDP in levels

Augmented Dickey-Fuller test for unit root Number of obs = **39**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-3.010**	**-4.251**	**-3.544**	**-3.206**

MacKinnon approximate p-value for Z(t) = **0.1292**

2.1.2.2 ADF on domestic debt%GDP in first difference form

Augmented Dickey-Fuller test for unit root Number of obs = **38**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-6.046**	**-4.260**	**-3.548**	**-3.209**

MacKinnon approximate p-value for Z(t) = **0.0000**

2.1.3 ADF on growth in oil prices

2.1.3.1 ADF on growth in oil prices in levels

Augmented Dickey-Fuller test for unit root Number of obs = **38**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-3.687**	**-4.260**	**-3.548**	**-3.209**

MacKinnon approximate p-value for Z(t) = **0.0232**

2.1.4 ADF on exchange rate growth

2.1.4.1 ADF on exchange rate growth in levels

Augmented Dickey-Fuller test for unit root Number of obs = **38**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-3.426**	**-4.260**	**-3.548**	**-3.209**

MacKinnon approximate p-value for Z(t) = **0.0480**

2.1.4.2 ADF on exchange rate growth in first difference form

Augmented Dickey-Fuller test for unit root Number of obs = **37**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-4.902**	**-4.270**	**-3.552**	**-3.211**

MacKinnon approximate p-value for Z(t) = **0.0003**

2.1.5 ADF on money supply growth

2.1.5.1 ADF on money supply growth in levels

Augmented Dickey-Fuller test for unit root Number of obs = **37**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-2.454**	**-4.270**	**-3.552**	**-3.211**

MacKinnon approximate p-value for Z(t) = **0.3513**

2.1.5.2 ADF on money supply growth in first difference form

Augmented Dickey-Fuller test for unit root Number of obs = **36**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-4.611**	**-4.279**	**-3.556**	**-3.214**

MacKinnon approximate p-value for Z(t) = **0.0010**

2.1.6 ADF on GDP per capita growth

2.1.6.1 ADF on GDP per capita growth in levels

Augmented Dickey-Fuller test for unit root Number of obs = **38**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-3.426**	**-4.260**	**-3.548**	**-3.209**

MacKinnon approximate p-value for Z(t) = **0.0480**

2.1.6.2 ADF on GDP per capita growth in first difference form

Augmented Dickey-Fuller test for unit root Number of obs = **37**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-4.902**	**-4.270**	**-3.552**	**-3.211**

MacKinnon approximate p-value for Z(t) = **0.0003**

Note: The ADF unit root tests results show that Inflation, DdebtGDP, exchange rate, money supply growth and GDP per capita are integrated of order 1, I(1) while growth in oil price is integrated of order zero, I(0).

2.2 Phillips Perron (PP) unit root test results

2.2.1 PP on headline inflation in levels

Phillips-Perron test for unit root — Number of obs = **40**; Newey-West lags = **3**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	**-18.707**	**-24.420**	**-19.040**	**-16.320**
Z(t)	**-3.445**	**-4.242**	**-3.540**	**-3.204**

MacKinnon approximate p-value for Z(t) = **0.0457**

Infl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Infl						
L1.	**.4885438**	**.1437503**	**3.40**	**0.002**	**.1972781**	**.7798095**
_trend	**-.1227868**	**.1777466**	**-0.69**	**0.494**	**-.4829357**	**.2373621**
_cons	**11.72428**	**5.217881**	**2.25**	**0.031**	**1.151852**	**22.29671**

2.2.1.2 PP on headline inflation in difference form

Phillips-Perron test for unit root — Number of obs = 39; Newey-West lags = 3

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	-30.718	-24.292	-18.964	-16.272
Z(t)	-7.166	-4.251	-3.544	-3.206

MacKinnon approximate p-value for Z(t) = 0.0000

D.Infl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
D.Infl						
L1.	-.0701742	.1656067	-0.42	0.674	-.4060401	.2656918
_trend	-.0666509	.2133853	-0.31	0.757	-.4994165	.3661146
_cons	1.229184	4.895821	0.25	0.803	-8.700002	11.15837

2.2.2 PP on domestic Debt%GDP in levels

Phillips-Perron test for unit root — Number of obs = 40; Newey-West lags = 1

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	-22.494	-24.420	-19.040	-16.320
Z(t)	-3.701	-4.242	-3.540	-3.204

MacKinnon approximate p-value for Z(t) = 0.0223

DdebtGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
DdebtGDP						
L1.	.4385563	.1517756	2.89	0.006	.1310297	.7460829
_trend	.2637624	.0825368	3.20	0.003	.0965269	.4309978
_cons	3.952892	1.727119	2.29	0.028	.4534158	7.452367

2.2.3 PP on growth in exchange rate in levels

Phillips-Perron test for unit root — Number of obs = 40, Newey-West lags = 2

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	-23.828	-24.420	-19.040	-16.320
Z(t)	-4.084	-4.242	-3.540	-3.204

MacKinnon approximate p-value for Z(t) = 0.0067

gxrate	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gxrate						
L1.	.369428	.1518584	2.43	0.020	.0617336	.6771223
_trend	-.1734252	.3076616	-0.56	0.576	-.7968069	.4499565
_cons	16.51421	7.916571	2.09	0.044	.4737102	32.5547

2.2.4 PP on growth in money supply in levels

Phillips-Perron test for unit root — Number of obs = 40, Newey-West lags = 3

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	-27.585	-24.420	-19.040	-16.320
Z(t)	-4.481	-4.242	-3.540	-3.204

MacKinnon approximate p-value for Z(t) = 0.0016

gmsupp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gmsupp						
L1.	.2843982	.1581867	1.80	0.080	-.0361185	.6049149
_trend	.0507599	.1784862	0.28	0.778	-.3108875	.4124074
_cons	17.52323	5.549415	3.16	0.003	6.279046	28.76741

2.2.5 PP on GDP per capita growth in levels

Phillips-Perron test for unit root — Number of obs = 40; Newey-West lags = 2

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	-52.270	-24.420	-19.040	-16.320
Z(t)	-7.475	-4.242	-3.540	-3.204

MacKinnon approximate p-value for Z(t) = 0.0000

GDPppc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPppc						
L1.	-.2253966	.1622239	-1.39	0.173	-.5540934	.1033001
_trend	.1181348	.0672038	1.76	0.087	-.0180331	.2543027
_cons	-1.459516	1.540943	-0.95	0.350	-4.581763	1.662731

2.2.6 PP on growth in oil prices in levels

Phillips-Perron test for unit root — Number of obs = 40; Newey-West lags = 0

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	-30.668	-24.420	-19.040	-16.320
Z(t)	-4.616	-4.242	-3.540	-3.204

MacKinnon approximate p-value for Z(t) = 0.0010

goilp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
goilp						
L1.	.2333062	.1660848	1.40	0.168	-.1032136	.569826
_trend	-.0783374	.4890824	-0.16	0.874	-1.069312	.9126376
_cons	19.7466	11.99772	1.65	0.108	-4.563095	44.05629

Note: The PP unit root tests results show that growth in oil prices, DdebtGDP, exchange rate, money supply growth and GDP per capita are integrated of order zero, I(0) while headline inflation is integrated of order one, I(1).

2.3 The Clemente-Montanes-Reyes (CMR) Unit Root test results

2.3.1 CMR test on headline inflation

Clemente-Montañés-Reyes unit-root test with double mean shifts, AO model

Infl T = 37 optimal breakpoints : **1993** , **1998**

AR(**4**)	du1	du2	(rho - 1)	const
Coefficients:	**21.99927**	**-24.41852**	**-0.72491**	**16.89193**
t-statistics:	**3.425**	**-3.998**	**-2.724**	
P-values:	0.002	0.001	-5.490 (5% crit. value)	

2.3.2 CMR test on domestic Debt%GDP

DdebtGDP T = 37 optimal breakpoints : **1999** , **2017**

AR(**9**)	du1	du2	(rho - 1)	const
Coefficients:	**7.73320**	**11.13500**	**-3.42427**	**11.37180**
t-statistics:	**6.026**	**4.520**	**-2.579**	
P-values:	0.000	0.001	-5.490 (5% crit. value)	

2.3.3 CMR test on growth in exchange rate

gxrate T = 37 optimal breakpoints : **1992** , **2002**

AR(**6**)	du1	du2	(rho - 1)	const
Coefficients:	**26.97547**	**-24.69968**	**-2.25440**	**12.43951**
t-statistics:	**3.010**	**-2.939**	**-4.275**	
P-values:	0.009	0.010	-5.490 (5% crit. value)	

2.3.4 CMR test on growth in oil prices

Clemente-Montañés-Reyes unit-root test with double mean shifts, AO model

goilp T = 37 optimal breakpoints : **1991** , **2007**

AR(**2**)	du1	du2	(rho - 1)	const
Coefficients:	**33.49570**	**-28.45563**	**-1.81825**	**9.23795**
t-statistics:	**2.703**	**-2.348**	**-6.122**	
P-values:	0.011	0.025	-5.490 (5% crit. value)	

2.3.5 CMR test on growth in money supply

Clemente-Montañés-Reyes unit-root test with double mean shifts, AO model

gmsupp T = 37 optimal breakpoints : **1992** , **2002**

AR(**1**)	du1	du2	(rho - 1)	const
Coefficients:	**17.33327**	**-10.88512**	**-1.36589**	**18.71742**
t-statistics:	**3.555**	**-2.381**	**-6.788**	
P-values:	0.001	0.023	-5.490 (5% crit. value)	

2.3.6 CMR test on GDP per capita growth

Clemente-Montañés-Reyes unit-root test with double mean shifts, AO model

GDPppc T = 37 optimal breakpoints : **1992** , **1999**

AR(**2**)	du1	du2	(rho - 1)	const
Coefficients:	**4.92444**	**-1.81320**	**-1.03646**	**-1.72432**
t-statistics:	**2.302**	**-0.910**	**-3.827**	
P-values:	0.028	0.370	-5.490 (5% crit. value)	

Note: The CMR unit root tests results show that growth in oil prices, DdebtGDP, exchange rate, headline inflation and GDP per capita are integrated of order one, I (1) while growth in oil prices and money supply growth are integrated of order zero, I (0).

Appendix 3: ARDL model selection with diagnostic tests

3.1 Optimal lag selection

Selection-order criteria
Sample: **1984 - 2020** Number of obs = **37**

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	**-133.141**				**108.436**	**7.52115**	**7.61324**	**7.78238**
1	**-126.917**	**12.449***	**1**	**0.000**	**81.8979**	**7.23874**	**7.34618**	**7.5435**
2	**-125.005**	**3.8238**	**1**	**0.051**	**78.1401***	**7.18945***	**7.31224***	**7.53775***
3	**-124.959**	**.09162**	**1**	**0.762**	**82.5246**	**7.24102**	**7.37917**	**7.63287**
4	**-124.797**	**.32405**	**1**	**0.569**	**86.6791**	**7.28632**	**7.43981**	**7.7217**

Endogenous: Infl
Exogenous: GDPppc DdebtGDP gxrate goilp gmsupp _cons

3.2 Diagnostic tests of the optimally lagged model

3.2.1 Serial correlation test

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	**0.701**	**1**	**0.4025**

3.2.2 Functional form test

Ramsey RESET test using powers of the fitted values of D.Infl
Ho: model has no omitted variables
F(3, 11) = **5.29**
Prob > F = **0.0168**

3.2.3 Autoregressive Conditional heteroscedasticity (ARCH) test

LM test for autoregressive conditional heteroskedasticity (ARCH)

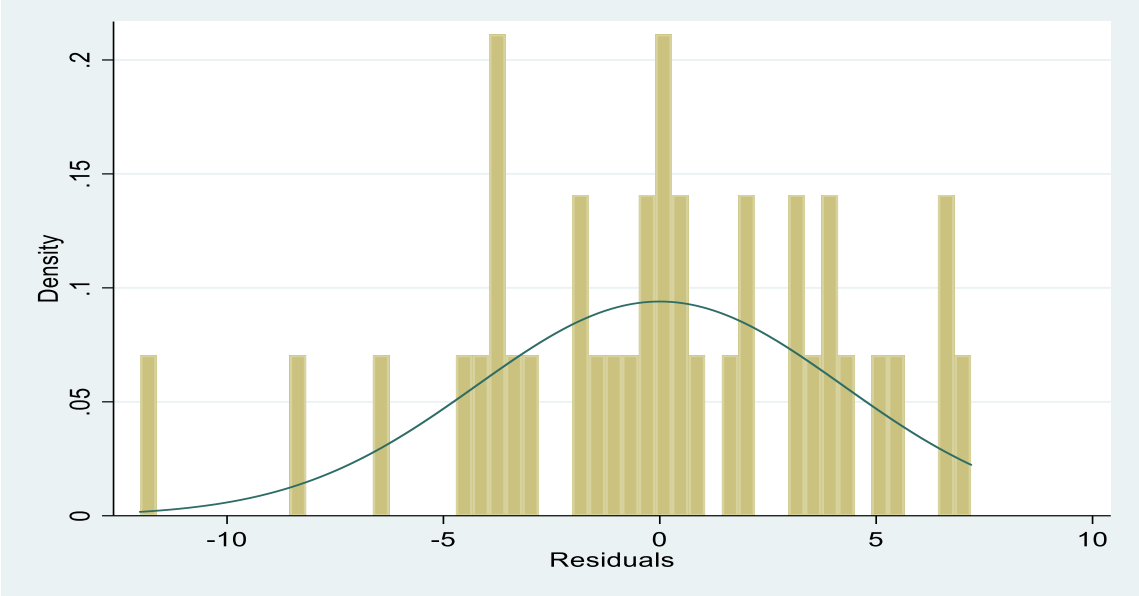
lags(*p*)	chi2	df	Prob > chi2
1	**4.916**	**1**	**0.0266**

H0: no ARCH effects *vs.* H1: ARCH(*p*) disturbance

3.2.4 Normality test

Skewness/Kurtosis tests for Normality

				joint	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
et	**37**	**0.1621**	**0.3643**	**2.99**	**0.2238**



Note: The AIC and BIC selected model at optimal lag 2 has omitted variables, with heteroscedastic errors also reflected in the skewed distribution of the series from the normality test. In mitigation, a higher order was added, and the model was re-estimated at lag 3.

3.3 Diagnostic tests results of the selected model

3.3.1 Serial correlation test

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	**1.437**	**1**	**0.2307**

H0: no serial correlation

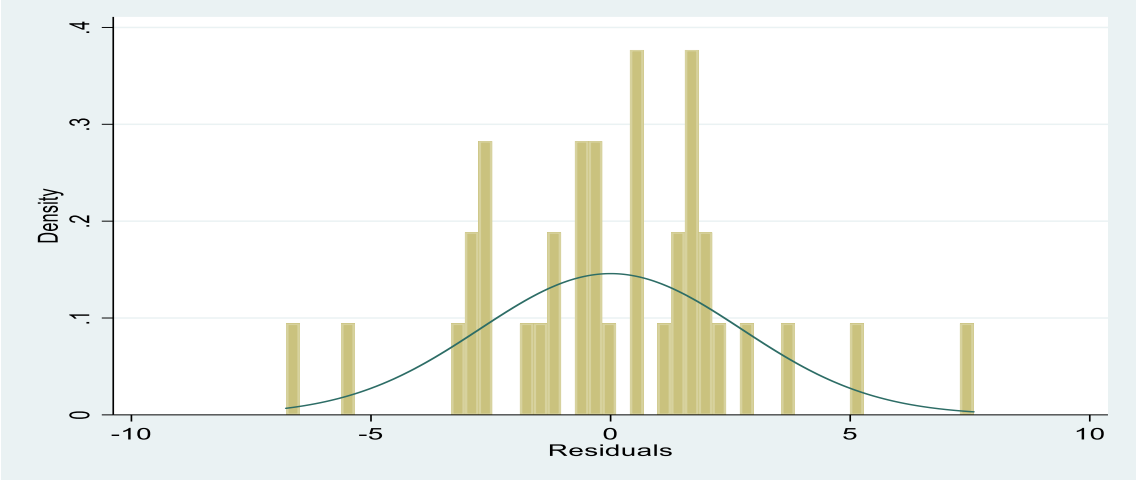
3.3.2 Functional form test

```
Ramsey RESET test using powers of the fitted values of D.Infl
       Ho:  model has no omitted variables
                  F(3, 10) =      1.14
                  Prob > F =      0.3805
```

3.3.3 Normality test

Skewness/Kurtosis tests for Normality

				joint	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
et	**37**	**0.8177**	**0.1151**	**2.73**	**0.2556**



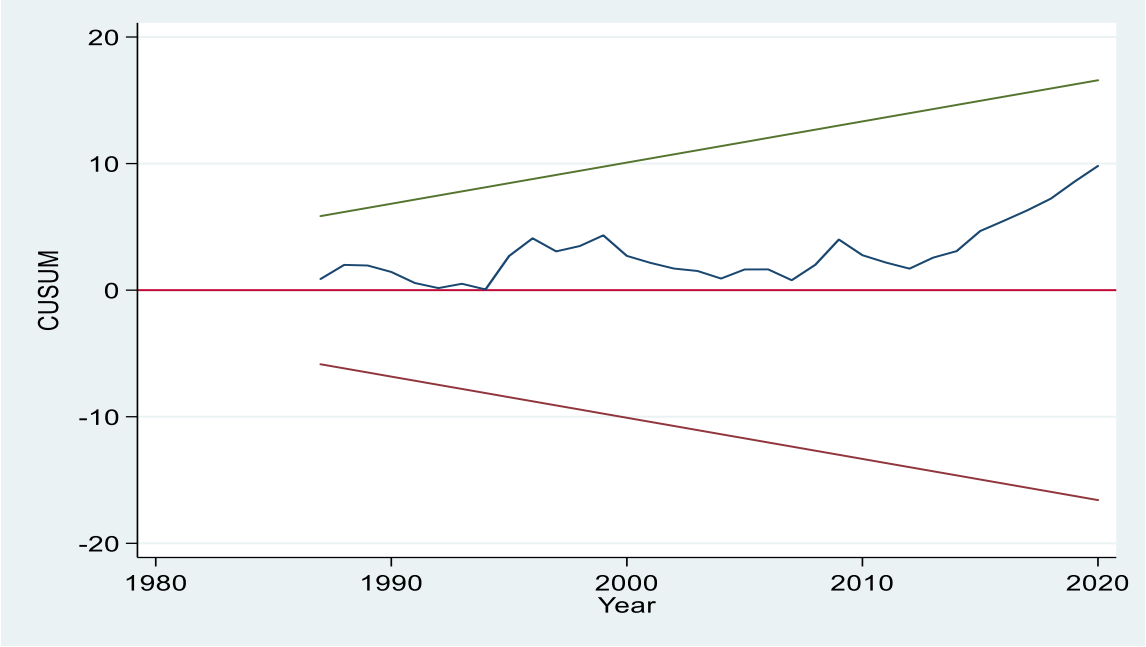
3.3.4 ARCH test

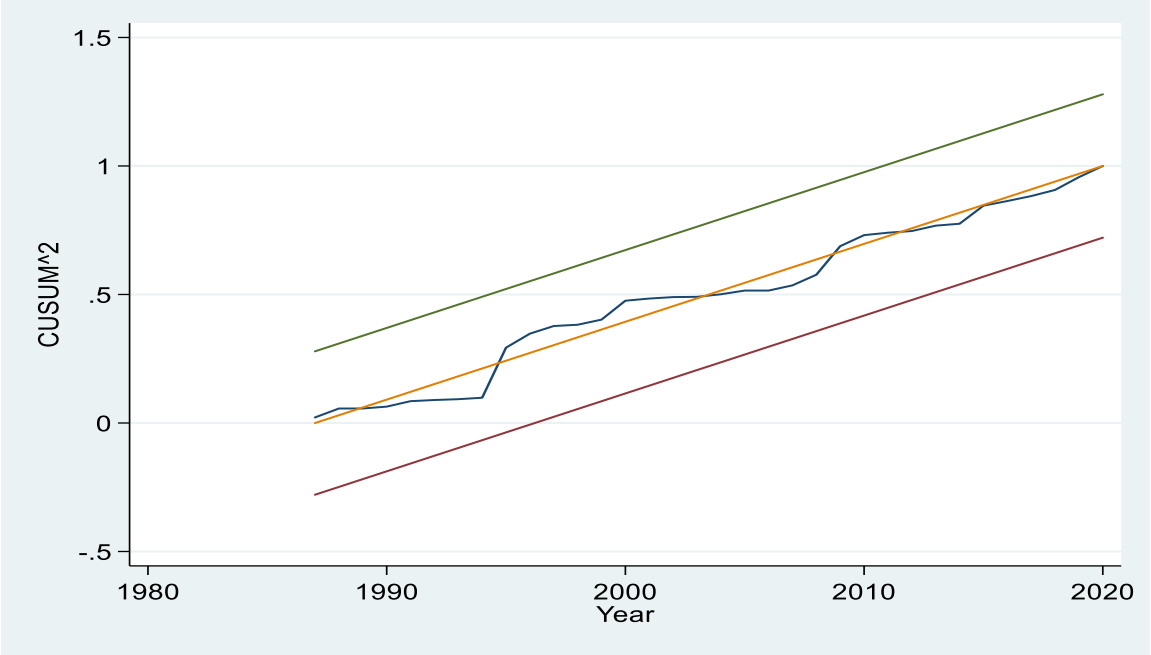
LM test for autoregressive conditional heteroskedasticity (ARCH)

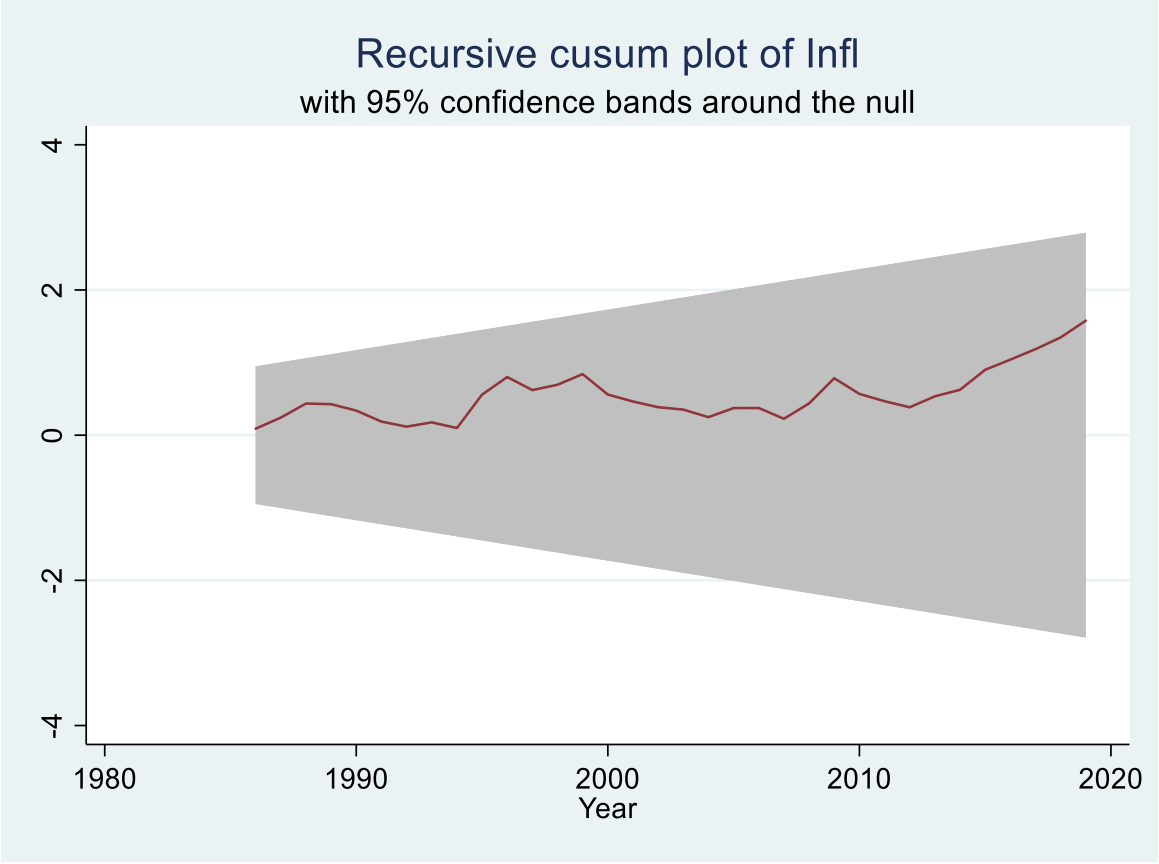
lags(*p*)	chi2	df	Prob > chi2
1	**0.522**	**1**	**0.4700**

H0: no ARCH effects *vs.* H1: ARCH(*p*) disturbance

3.3.5 Test of parameter stability




1.5
1
.5
0
-.5
CUSUM^2
1980
1990
2000
2010
2020
Year


Recursive cusum plot of Infl
with 95% confidence bands around the null
4
2
0
-2
-4
1980
1990
2000
2010
2020
Year

Cumulative sum test for parameter stability

Sample: **1980 -** **2019** Number of obs = **40**
Ho: No structural break

Statistic	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
recursive	**0.5260**	**1.1430**	**0.9479**	**0.850**

Note: At lag 3, the model passed all the diagnostic tests of serial correlation, correct functional form (no omitted variables), normality, ARCH, and test pf parameter stability.

Appendix 4: ARDL model estimation results

4.1 Bound test of cointegration results

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = **7.233**

t = **-2.915**

Critical Values (0.1-0.01), **F-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_5	**2.26**	**3.35**	**2.62**	**3.79**	**2.96**	**4.18**	**3.41**	**4.68**

accept if F < critical value for I(0) regressors

reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), **t-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_5	**-2.57**	**-3.86**	**-2.86**	**-4.19**	**-3.13**	**-4.46**	**-3.43**	**-4.79**

accept if t > critical value for I(0) regressors

reject if t < critical value for I(1) regressors

k: # of non-deterministic regressors in long-run relationship

Critical values from Pesaran/Shin/Smith (2001)

4.2 ARDL short run and long run estimation results

	Coefficient	Std. Error	t-statistic	Prob.
ECT (-1)	-0.4596461*	0.1576586	-2.92	0.012
C	-6.85745	7.01379	-0.98	0.346
DInfl (-1)	-0.1586563	0.1312763	-1.21	0.248
DInfl (-2)	-0.4967152*	0.1161123	-4.28	0.001
DdebtGDP (-1)	-0.7835328*	0.230121	-3.40	0.005

DdebtGDP (-2)	-0.2662695	0. 3444368	-0.77	0.453
DdebtGDP (-3)	-0.4329396	0.27919	-1.55	0.145
Dgxrate (-1)	0.3127766*	0.0531419	5.89	0.000
DGDPppc (-1)	0.6355927*	0.2840237	2.24	0.043
DGDPppc (-2)	0.5057286	0.3845663	1.32	0.211
DGDPppc (-3)	0.3067965	0.3789654	0.81	0.433
DGDPppc (-4)	-0.2142156	0.2378194	-0.90	0.384
Dgoilp (-1)	-0.0625063	0.0371353	-1.68	0.116
Dgoilp (-2)	0.2063453*	0.0567917	3.63	0.003
Dgoilp (-3)	0.1672205*	0.0466108	3.59	0.003
Dgoilp (-4)	0.1743565*	0.0336908	5.18	0.000
Dgmsupp (-1)	0.3409579*	0.1082142	3.15	0.008
Dgmsupp (-2)	0.1638748	0.1491486	1.10	0.292
Dgmsupp (-3)	0.2409735	0.1087148	2.22	0.045
Infl (-1)	-0.4596461	0.1576586	-2.92	0.012
DdebtGDP (-1)	0.2296246	0.2989116	0.77	0.456
GDPppc (-1)	0.5041274	0.5305334	0.95	0.359
gxrate (-1)	0.4543912*	0.0841238	5.40	0.000
goilp (-1)	-0.3465919*	0.0906756	-3.82	0.002
gmsupp (-1)	0.409881	0.2019803	2.03	0.063
Adj R-squared	0.9083		N	37
Prob (F-statistic)	0.0000		D-Watson stat	1.66479

"*" denotes statistical significance at 5%.