

Relationship Between Public Debt and Inflation in Kenya

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Abstract:

The public debt situation has become a significant worry in many developing countries due to its potential implications for important macroeconomic outcomes, in particular inflation. Inflation is typically measured in terms of the Consumer Price Index (CPI), the Producer Price Index (PPI) and Wholesale Price Index (WPI). However, most developed economies keep a check on the relatively stable price levels, there are countries in the developing world that are still suffering from chronic inflation. Public debts in Kenya are large and growing significantly in recent decades, this has raised doubts about its implications for macroeconomic stability and price behaviour. Most of the previous literature has focused on how government borrowing affects economic performance, particularly economic growth comparatively little attention has been directed toward the implications of public debt for price movements. In addition, concerns relating to simultaneity and reverse causation among debt, growth, and inflation have not been adequately addressed. As a result, knowledge regarding the role of public borrowing in shaping inflationary trends within developing economies such as Kenya remains incomplete. This study explored the extent to which government indebtedness is associated with inflationary developments in Kenya over the period 1991 to 2023, with emphasis on both immediate responses as well as longer-term adjustments. A non-experimental longitudinal design was adopted. Following diagnostic evaluation of the data, estimation was undertaken using the Autoregressive Distributed Lag framework together with an Error Correction specification. The adjustment parameter was negative and highly significant ($ADJ = -0.922, p = 0.000$), indicating that deviations from equilibrium were corrected rapidly and that a durable long-run association existed among the variables included in the model. Results from the long-run estimates revealed that domestic borrowing, monetary expansion, and economic growth contributed to rising price levels, while fiscal deficit recorded a positive but statistically insignificant coefficient. By contrast, external debt and exchange rate variables were linked with lower inflationary pressures during the same period. Short-run estimates produced a different pattern. External borrowing and fiscal imbalance displayed positive coefficients, although neither reached conventional significance levels, whereas changes in the exchange rate were associated with higher inflation and remained statistically important. Domestic debt, money supply, and economic growth displayed negative coefficients and were found to be significant within the short-term adjustment process. The findings suggest that the composition and financing of the capital stock of the financial system is key. The composition of public debt has an important impact on the inflation outcomes in Kenya. Consequently, policies aimed at prudent domestic borrowing, effective management of monetary expansion, productive deployment of borrowed resources, and exchange rate stability are essential for sustaining long-term price stability.

Key words: public debt, fiscal deficit, inflation, money supply, Kenya

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I. Introduction

1.1 Background to the Study

Across the globe, policymakers are faced with the challenge of price stabilization, unemployment reduction, and the enhancement of economic growth. Okara & Mutuku (2019) and Basu & Mark (2011) argued that taming inflation remains a nightmare to policymakers in both advanced and developing economies. According to Mutwiri (2017), a general increase in commodity prices without quality improvements is inflation. Empirically, inflation is examined via various indices, namely; the Consumer Price Index (CPI), the Wholesale Price Index (WPI), the Producer Price Index (PPI) and the GDP deflator (Were et al, 2013).

Response to inflation in advanced economies differs from that in emerging economies. While policymakers in underdeveloped countries labor at reducing inflation, their advanced economies' counterparts focus at maintaining low and stable inflation. The latter could be achieved through ensuring that money supply grows at a fixed rate (Nyoni, 2018). Sargent & Wallace (1981) and Schwarz & Friedman demonstrated that, money demand function is stable. Thus, inflationary pressures in an economy would always arise from the money supply side.

Romer indicated a consensus among economists that when inflation is high, it should be reduced. Disagreement, nevertheless, arises with regard to moderate inflation. That is, whereas some economists believe that moderate inflation should be left to be moderate, others believe it should be reduced. Thus, central banks often target the rate of inflation through anchoring households' expectations. Existing literature establishes a connection between inflation and public debt by first linking inflation to fiscal imbalances which in turn causes public borrowing.

Public debt debate has been of interest over the years (Kia, 2006). On one side of the divide, are classical economists who believe that indebtedness unnecessarily burdens both present and future generations, while holders of the 'Treasury View' believe that public borrowing crowds out the private sector (Peacock, 1954). However, Keynesian thinkers argue that public borrowing entails the government tapping into otherwise idle financial resources owned by private individuals. Keynesian thinkers, thus, consider economic growth as a direct consequence of the government expenditure multiplier, which in turn arises from public borrowing.

The globe witnessed an average inflation rate of 11.1% between 1980 to 2018 with the African average being 13.8%. In Kenya, inflation has been persistently high, averaging 11.3% over the period 1990 to 2018 (CBK, 2019). Nyoni (2018), CBK (2019), Kiptui (2009), and Were et al (2013) attribute high inflation to persistent rise in fuel and food stuffs prices. This prodigy has endured despite the various policy responses done by both monetary and fiscal authorities to tame inflation (Were et al, 2013; CBK, 2019).

Over the years, Kenya's public debt has been rising, and a larger part of it comes from outside the country (BPS, 2020). This also goes along with ongoing budget shortfalls (QEBR, 2020). The Republic of Kenya (2020) report showed that interest payments on public debt have been going up steadily. This poses risk to the country's ability to service its debt. As interest payments go up, the country's capital per worker is expected to go down. This could hurt productivity, which would then slow down economic growth.

Boote and Thugge (1997) argued that economic performance deteriorates whenever the fiscal deficit-to-GDP ratio rises beyond 5 percent. In addition, debt sustainability assessments undertaken by the International Monetary Fund (IMF) together with the World Bank (WB) indicate that the expansion of public debt should remain below the growth rate of national output. Even then, an alternative to borrowing might not help much. While seignorage, for instance, could be used to finance a budget deficit, it tends to be inflationary (Sargent & Wallace, 1981). Kenya's experience with deficit financing indicates absence of seignorage as a plausible means. This leaves public borrowing as the only option the country has exploited over the years.

1.2 Overview Public debt in Kenya

Figure 1.1 suggests Kenya's tax revenue has been on upward trend over the years. This has been attributed to enhanced efficiency in tax administration as well as broadening the tax base (Nyoni, 2018). Over the same period, however, government expenditures rose. Mwani et al (2016) consider an expanded public sector and an increase in government investment on infrastructural projects as the key drivers of the increase in government spending. Kenya's fiscal gap has worsened over the years suggesting that government spending has outstripped government revenues (Mutwiri, 2017). As the fiscal gap worsened, the government was forced to borrow, both domestically and abroad in financing budget deficits (Ochieng & Gideon, 2016; Okari & Mutuku, 2019). A rise in public indebtedness, on the other hand, exacerbated inflation which in turn catapulted the country's public indebtedness (Were, 2001; Mwega, 2009; Mwangi, 2017). Figure 1.2 suggests that Kenya's budget deficits have worsened generally.

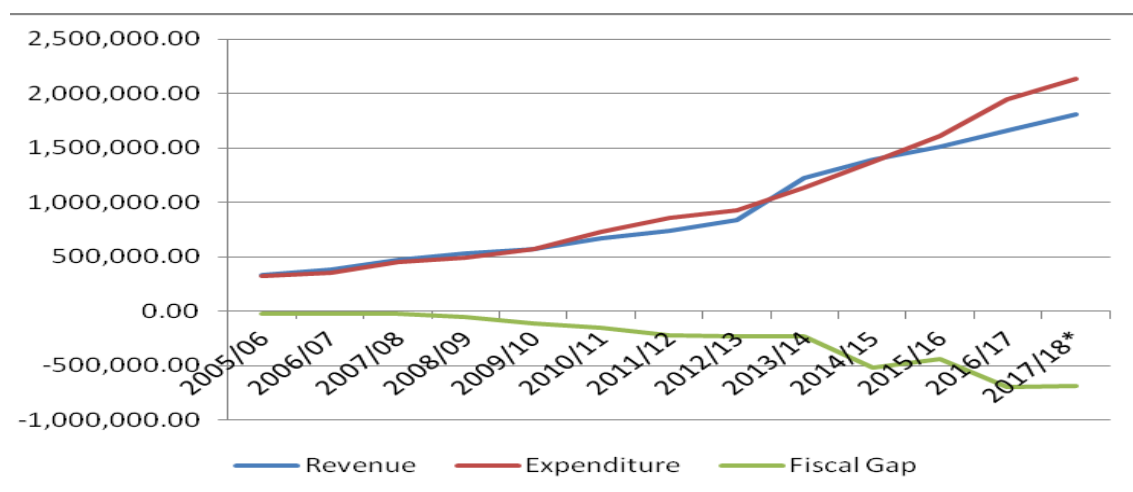


Figure 1.1: The fiscal gap in Kenya from 2005/2006 fiscal year

Figure 1.1 shows the fiscal gap in Kenya from the 2005/2006 fiscal year to 2017/18. It shows that the government has been spending more than it brings in. Kenya's tax revenues have been going up steadily during this time. This is mostly because of reforms that made the tax base bigger and made it easier to collect taxes (Nyoni, 2018). Even though things are getting better, spending has always grown faster than income. This is because public sector wages are going up, the government is spending more on social programs, funding for counties following the implementation of the devolution under the 2010 Constitution and great infrastructure investments such as the Standard Gauge Railway (Mweni, Muriithi, & Muturi, 2016). The fiscal gap grew a lot between 2008 and 2010, which was when the government started using fiscal stimulus programs to sustain the economy in the face of the global financial crisis and the possible uncertainties with the economy after the election (Ochieng & Gideon, 2016). The gap stayed big after 2013 because of more spending obligations due to devolution. It probably got bigger in 2020 when the COVID-19 pandemic led to lower revenues and higher costs for health and social protection (Republic of Kenya, 2020).

This ongoing fiscal imbalance is structural, not temporary. To address the deficit, the government has had to borrow from both local and foreign sources. The outcome has been a progressive expansion of public debt, together with associated costs of servicing that debt (BPS, 2020). If deficits aren't credibly offset by future surpluses, rising debt risks pushing out private investment and could lead to inflation (Sargent & Wallace, 1981). Figure 1.1 shows that we need to consolidate our finances by getting more money from taxes, spending it more wisely, and managing our debt to promote the economy and sustain economic growth over the long term (IMF & WB, 2020).

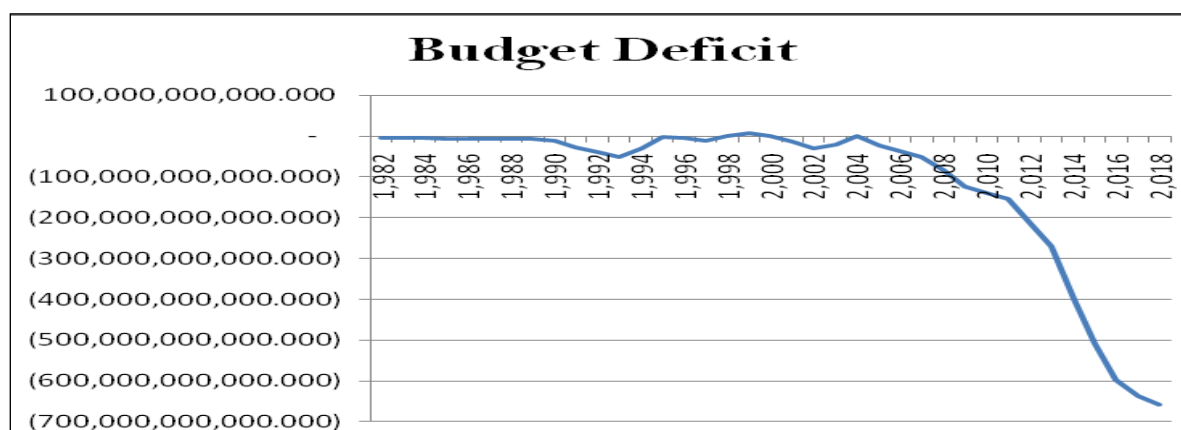


Figure 1.1: Budget deficits for period 1982 and 2018

Figure 1.2 presents Kenya's budget deficits between 1982 and 2018, illustrating the long-term fiscal trajectory of the country. When government's spending surpasses the revenue collected within a given financial year, necessitating financing through borrowing or other measures creates budget deficit. The figure shows that Kenya has run persistent deficits across most of the period, although the magnitude has varied in response to political, economic, and global events.

Kenya's deficits were moderate in the 1980s, but they started to get worse in the early 1990s because of structural problems like lower agricultural productivity, higher public sector wages, and governance issues that made donors less willing to help (Ndung'u, 2003). During the mid-1990s, structural adjustment programs tried to bring the deficit down for a short time (Were et al., 2013). But in the 2000s, the government used expansionary fiscal policy to pay for Vision 2030 flagship projects, such as infrastructure investments in roads, energy, and transport (Mwega, 2009). This made the deficits bigger.

After 2013, budget deficits stayed high, averaging more than 6% of GDP. This was because of spending obligations related to devolution and more borrowing to pay for development programs (BPS, 2020). The deficits worsened due to fluctuations of commodity prices in the world market and during dry spells, making tax collection more difficult. In this period, continued deficit led to a sharp rise in public debt, which in turn led to concerns regarding the sustainability of the budget and debt repayment (IMF & WB, 2020). The fiscal deficit is structurally unsustainable and credible fiscal consolidation plays a very critical role in Kenya, as illustrated in Figure 1.2. These measures such as getting more money, reducing expenses and better management of government funds are necessary to pull the economy back into balance and to maintain the economy's stability (Ochieng & Gideon, 2016).

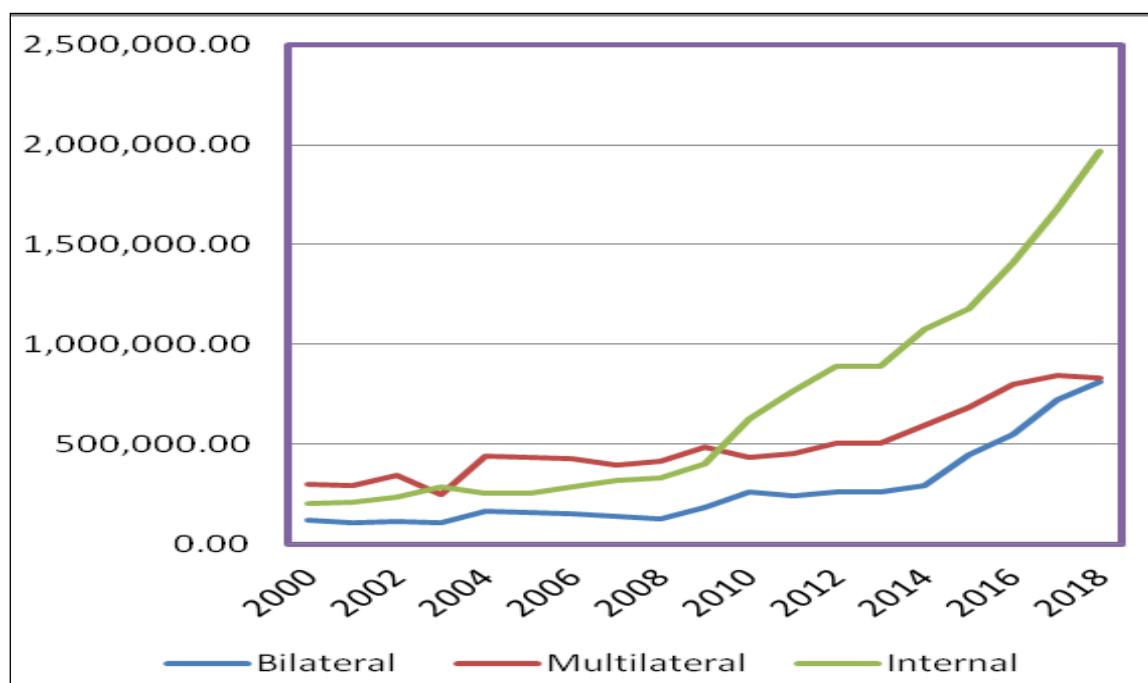


Figure 1.2: External and internal borrowing trend from 2000 to 2018, data from KNBS Economic Survey

Figure 1.3 shows how Kenya's borrowing from both inside and outside the country changed from 2000 to 2018. It shows how the kinds of public debt changed over the course of about twenty years. Kenya mostly got concessional external loans from both bilateral and multilateral partners in the early 2000s. This was because it had trouble getting money from international capital markets (Ndung'u, 2003). People didn't borrow a lot of money from each other at first. However, as the government relied more and more on Treasury bills and bonds to make up for budget shortfalls, borrowing from each other slowly went up (Were et al., 2013). Kenya's borrowing habits changed a lot in 2013, when they started to borrow a lot more from businesses outside of the country. Selling Eurobonds in 2014 and the years after that was part of this (Mwega, 2009). This diversification enabled the government to raise more funds for implementing infrastructure projects such as the Standard Gauge Railway, as well as investing in energy (BPS, 2020). Meanwhile, intrafinancial borrowing continued to rise. The biggest purchasers of government bonds were the commercial banks and pension funds. The data also reveals the total borrowing has been increasing indicating that external and domestic debt also increased significantly in this period. External borrowing was more costly because it involved longer-term borrowing, but was also riskier in terms of exchange rate fluctuations. This was especially true when the Kenyan shilling lost value, which made it harder to pay back debt in other currencies (IMF & WB, 2020). The increase in borrowing within the country led to higher interest rates, which may have made private investors less likely to put their money into businesses. Figure 1.3 shows that Kenya is becoming more and more dependent on loans to pay for its plans for growth. It stresses the importance of responsible debt management, balancing borrowing from outside sources with borrowing from inside sources, and effectively using borrowed money in investments that generate long term returns supporting sustainable economic growth (Ochieng & Gideon, 2016). Figure 1.4 shows that both Kenya's inflation and its domestic debt are rising. From 1990 to 2008, external debt was usually higher than domestic debt. But from 2009 to 2018, people in the country owed more money than people who lived outside the country. People are more likely to borrow money from each other now that they are more interested in the independence of monetary policy from outside factors (Mutwiri, 2017; Were et al., 2013).

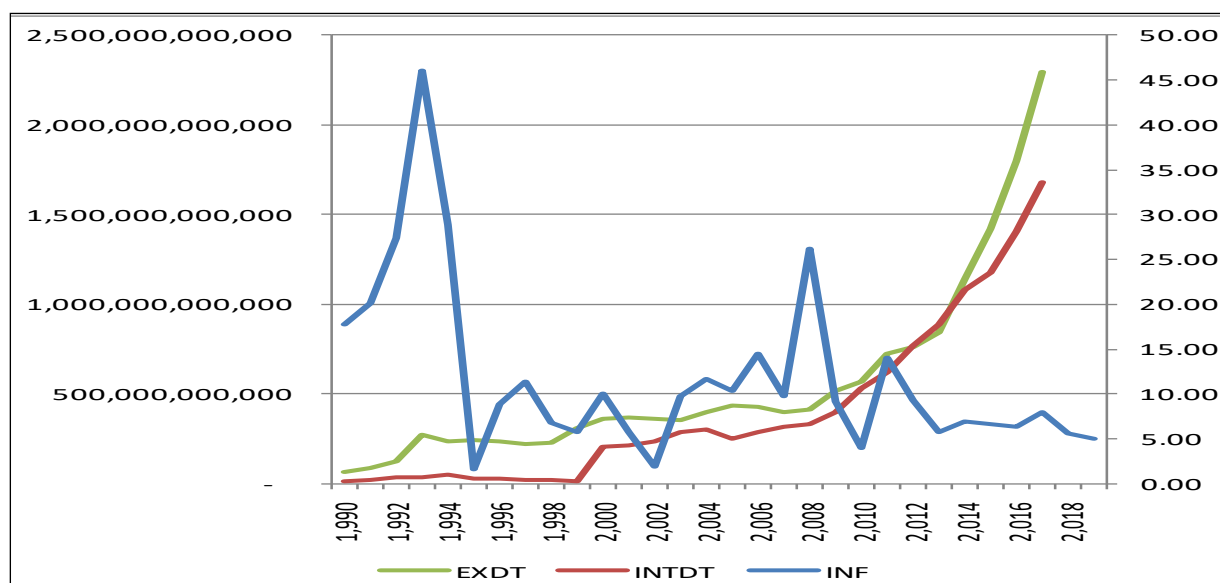


Figure 1.3: The annual inflation trend, external debt stock and internal debt stock from 1990, Data from World Bank-IMF data and KNBS

Figure 1.4 shows how Kenya's inflation, foreign debt, and domestic debt have changed every year since 1990. It shows how changes in the public debt and prices that stay the same affect each other. Kenya's economy was unstable in the early 1990s because the government didn't have strict rules about money, the value of the dollar changed, and the amount of money in circulation wasn't stable (Ndung'u, 2003). By the end of the 1990s, inflation had dropped to single digits, thanks to structural adjustment programs. Stricter monetary and fiscal policies made this easier (Matete & Maingi, 2024). As inflation slowed down, the graph shows that Kenya's mix of public debt started to change. The government's inability to produce enough money to make up for meant it had to go into debt to its own people. Even as the government had to reduce spending to cope with the budget deficits, the internal debt stock continued to rise. BPS (2020) reported that more and more attention was given to the Treasury bills and bonds by institutional investors and commercial banks. The amount of debt in the country was going up while inflation was going down. This could lead to the government being better able to control money, and lead to greater confidence in government bonds.

The debt due to other nations increased as well, particularly since 2000 when it was possible to obtain loans at low interest rates and then business loans. Since 2013 Kenya has been part of the global capital market by beginning to issue Eurobonds. As a result of this, the people were able to obtain loans more easily than they would have been able to in other countries. This led to significant increase in the debt in foreign currencies for the nation (IMF & WB, 2020). These variables are correlated, that is they move in the same direction, while there have been some exceptions, shows, for the most part, that inflation has remained relatively low since the early 2000s. But the fast rise in both external and internal debt is a big threat to the economy as a whole. Excessive borrowing by the government can make it difficult for people to invest in business activities (Ochieng & Gideon, 2016). A better coordination of fiscal and monetary policies is required to prevent price inflation and limit debt (see Fig.1.4).

1.3 Overview of Inflation in Kenya and other Regions

Inflation is considered as an important macroeconomic indicator because it measures the overall price level, and affects household welfare, investment decisions and overall economic health. The Central Bank in Kenya had implemented inflation targeting policy with a target of 5 percent, with a tolerance of ± 2.5 percent. However, this goal has failed to be met as inflation has continued to move up and down as a result of a variety of internal and external factors such as changes in the exchange rate, food and energy prices, weather related shocks, and developments in the global economy.

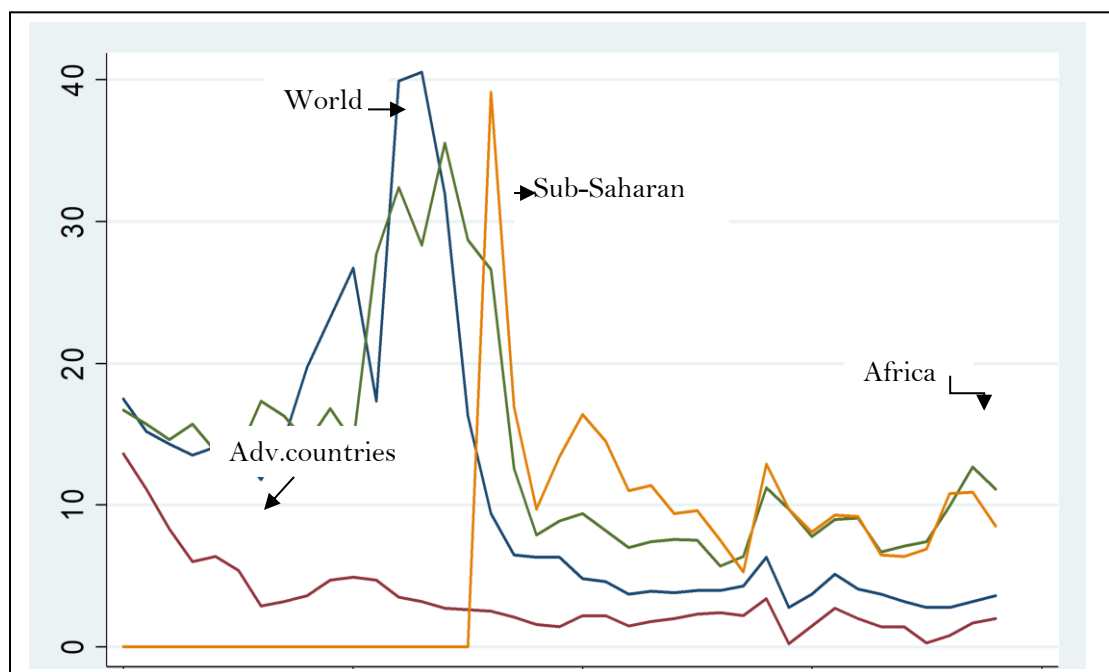


Figure 1.4: Inflation rate; World, Advanced countries, Africa and Sub-Saharan, IMF 2019

The inflation rates for the world, advanced economies, Africa and Sub-Saharan Africa are shown in Figure 1.5 in the study period. As indicated in the figure, for most areas, inflation has fallen since the 1990s, though at varying rates and levels of stability. Economies which are advanced have consistently had relatively low and stable inflation rates, which has been achieved through effective monetary policy frameworks, sound institutions and stable financial markets and mature financial systems. Many African and Sub-Saharan African, on the other hand, the inflation rates were relatively high in the economies and the volatility was large in the markets and mature financial systems. In contrast, many African and Sub-Saharan African economies experienced relatively higher inflation rates and greater volatility.

A number of factors including fiscal deficits, exchange rate instability, production shortages, unfavorable climate, international commodity prices, etc. have contributed to inflation in most African nations. While a number of countries have made efforts to make their economies more stable, inflationary pressures resurface in times of domestic and external economic shocks. The inflation experience of Kenya is representative of many Sub-Saharan African (SSA) countries. The factors such as food prices, fuel expenses, exchange rate fluctuations and climatic conditions have consistently been significant drivers of inflation in the past. With the significance of maintaining price stability as a supportive policy for economic growth and protection of the purchasing power of the household, it has remained an important target of economic policy.

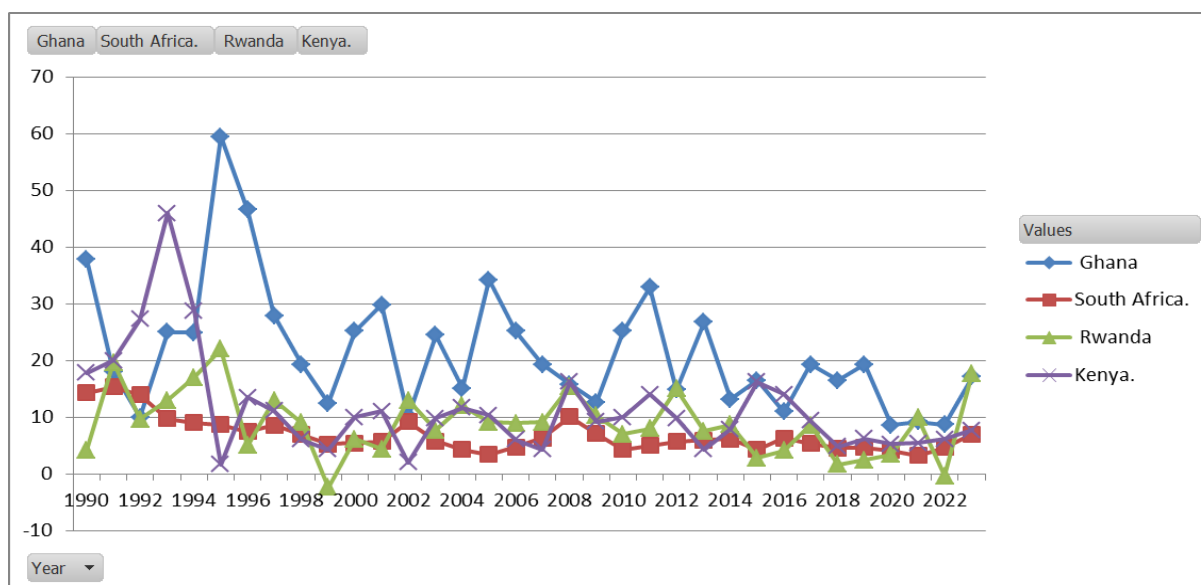


Figure 1.5: Inflation rate for selected African economies, Source: IMF 2019 Release data

This figure (Figure 1.6) shows the inflation rates of selected African economies. There is a significant difference in the inflation performance of different countries, as indicated by the figure. The inflation rates in some economies have been fairly flat and low, whereas in others, there have been significant swings caused by macroeconomic imbalances and external shocks. Other countries like South Africa and Botswana have adopted macroeconomic policies that have been conducive to maintaining single-digit inflation. This is because reliable central banks and strict fiscal policies are found in their central banks (IMF, 2021). Conversely, nations with poor institutions and/or higher shock risk, typically have higher inflation. For instance, if the price of oil rises, so do the prices for countries which rely on oil exports. The lower the value of a currency, the lower the prices (Blanchard, 2017). In the past, both Sudan and Zimbabwe experienced high inflation rates. This was the case for the majority mainly due to the fact that they used to borrow money to settle their debts and their economies were not stable (Ndung'u, 2003). In general, inflation in Kenya has remained in the range of the inflation experienced by some of the Sub-Saharan African economies, but there were some times when inflationary pressures were felt in the economy due to economic uncertainty. Kenya's Central Bank's (CBK) actions to improve the monetary system and maintain inflation stability have helped to defuse the inflation clock and reduce its volatility since the middle of the 2010s (CBK, 2020). The number indicates that African economies should do more to make their monetary policy more stable, make more goods, and borrow less money (IMF & WB, 2020). Inflation at a sustainable level is crucial to ensure that people's purchasing power is preserved, that investment takes place and that progress can be realized over time. Moreover, the differences underscore the importance of proper fiscal and monetary policies to promote sustainable price stability in the African economies (Matete and Maingi, 2024)

1.4 Statement of the problem

Although public debt has been on the increase in Kenya for the past three decades, very little is known about the effects of debt accumulation on the inflation rate. A gradual increase in the debt that is held in the country, both internal and external, occurred, as well as periods of inflationary pressure, which have impacted on the cost of living and over-all macroeconomic stability during the study period. As government borrowing continues to increase, concerns have emerged regarding its potential implications for price stability.

Although numerous studies have examined issues relating to public debt, most have mainly concentrated on debt management, fiscal management, and economic growth. Consequently, inflationary consequences of public borrowing have received relatively less attention, particularly within the Kenyan context. In addition, previous studies have reported mixed findings on how public debt influences inflation, making it difficult to draw definitive policy conclusions. Various studies, including: Reinhart & Rogoff (2010), Panizza & Presbitero (2012), and Arisa (2020) indicated the nexus from debt to growth without the possibility of reverse causality. Following Okun, the nexus can be stretched to debt-to-inflation. Reinhart & Rogoff (2010) demonstrated that debt levels exceeding 90% of GDP suppressed capital accumulation, and stifled growth. Thus, debt tends to have deleterious effects on growth (Moyo, 2018). This catapults negative supply shocks which tend to be inflationary.

External debt is seen as a substitute for foreign direct investment with countries becoming increasingly attracted to debt ownership as opposed to equity ownership. It is possible; however, that economic stagnation leads to high debt accumulation. Consequently, failure to account for this culminates into the simultaneity bias

(Pescatori, Sandri, & Simon, 2014). Besides, there could be other factors which contemporaneously cause both low growth and high debt accumulation (Pescatori, Sandri, & Simon, 2014). Thus, high levels of indebtedness, on one hand, may hold back growth while, on the other hand, economic retardation could offset indebtedness, or both may be offset by other factors.

The growing dependence on borrowing to finance fiscal deficits and development expenditures underscores the need to understand whether public debt contributes to inflationary pressures in Kenya. Policymakers seeking to achieve sustainable debt management while maintaining stable prices ought to address this knowledge gap to facilitate their goal. To fill this gap, the study investigated how public debt influenced inflation in Kenya during the period 1991 to 2023, with emphasis on both short-term and long-term effects.

1.5 Study Questions

The study was guided by the following enquiries:

- i. To what extent is inflation associated with public debt in Kenya in the long run?
- ii. How are inflationary developments in Kenya linked to public debt dynamics in the short term?

1.6 Study Objectives

The purpose of this study was to evaluate the role played by public debt in shaping inflationary trends in Kenya between 1991 and 2023. Specifically, the study aimed to:

- a. To determine whether short-term variations in government borrowing affect inflation patterns in Kenya.
- b. To assess the extent to which public debt contributes to inflation over the long term.

1.7 significance of the Study

This research provides empirical findings that may enrich understanding of debates concerning the macroeconomic consequences of public debt and its role in shaping inflationary trends. Specifically, the relevance of this research is reflected in the following areas: IMF (2021) consider high indebtedness as catastrophic to emerging markets, including Kenya. Previous studies including Were (2001) and Were et al (2013) focused on the effect of inflation on an economy's capacity to service debt. Moyo (2018) considered public indebtedness as a burden both to current and future generations without delving into the implications of debt on inflation. Despite extensive research on public debt, little attention has been given to its influence on inflation, this work attempts to fill that gap.

The insights generated yielded valuable insights to both monetary and fiscal authorities. For fiscal authorities, the evidence shed light on the importance of a balanced budget. To monetary authorities, the findings inform the need for policy responses in the face of increased government borrowing.

1.8 Coverage, Structure and Limitations of the Research

This research utilized annual time-series observations covering 1991–2023. Chapter One introduces the study by outlining the background, problem statement, study questions, objectives, and relevance of the research. The succeeding chapter analyzes the theoretical perspectives and documented findings relating to public debt and inflation. Chapter three presents the methodology, covering the theoretical framework, model formulation, variables operationalization, data sources, diagnostic testing procedures and analytical techniques employed in the study. The fourth chapter contains descriptive analysis, diagnostic test results, correlation analysis and ARDL error correction estimates. The final chapter summarizes the main findings, draws the study's conclusions, discusses policy implications and identifies areas that may benefit from further investigation. One limitation of the study is its emphasis on the public debt–inflation relationship, without explicitly examining other factors that may also influence inflationary trends.

II. LITERATURE REVIEW

2.0 Introduction

This section reviews both theoretical perspectives and empirical literature relating to public debt and inflation. The theoretical review explains mechanisms through which government borrowing can influence price stability, whereas evidence from earlier studies is examined to establish what is already known about the relationship between debt accumulation and inflation. Furthermore, the review assisted in identifying existing research gaps.

2.1 Theoretical literature

A range of economic theories put forward to explain link between public debt and inflation movements (Kaur, 2018; Kia, 2006). The question if public debt; either external or internal may cause inflation is at the center of interest of this study. Theories that link public debt to inflation are reviewed with an aimed to find out the channels through which public debt may cause inflation (Cagan, 1956; Kia, 2006). The first theory considered in this study is the Monetary Theory, which originates from the Quantity Theory of Money. The theory postulates that variations in money stock exert a direct effect on overall price levels within an economy. Friedman (1963) maintained that inflation is essentially driven by monetary factors, a position later reinforced by other scholars

(Ogunsakin & Olalere, 2017). As a result, monetary authorities are required to manage monetary expansion in line with the rate of economic growth. Inflationary tendencies may arise whenever growth in money stock persistently outpaces growth in real output. Another channel in monetary theory is the money market. The money market assumes money supply is exogenous while the demand directly derived from individual optimization. Money market is maintained at equilibrium, any deviation from the equilibrium at long run results to either excess demand or supply of money and goods, which in turn causes inflation (Khumalo,2013; Awe and Olalere,2012; Vieira,2000; Darrat,2010).

2.1.1 Fiscal Theory of Price Level

Linking fiscal policy to inflation is based non-Ricardian equivalence hypothesis which supports neoclassical theory of negative effect of fiscal debt on macroeconomic variables, inclusive of inflation (Kaur, 2018). The first channel is based on non-Ricardian hypothesis which advocate for running budget deficit and borrowing from domestic financial market result into a rise in interest rate. This crowd out private investor in accessing fund for capital investment causing low capital formation in the nation. In long run this reduces the supply of the tradable goods and services against a given demand (Ashra et al, 2004). If this situation persists it pushes the prices up causing demand-pull inflation. The deficit could be financed through borrowing from external financial markets. This affects inflation in three ways. First government spends a lot on project coupled with low tax increasing disposable income for the citizens, causing aggregate demand to shoot and push price up. This eventually causes rise in inflation rate. Second channel is based on the cost of borrowed fund which increase cost of imported capital, therefore increasing the production cost. This situation triggers price hikes, causing cost-push inflation. Third channel through which borrowing from external market causes inflation is during repayment of principal and interest rate. The repayment competes with local investment for the scarce savings and foreign earning from export. This is liquidity constraint view on how debt impact investment (Udofia, 2016). This reduces investment rate on capital which in short run affects negatively the amount of supply of goods and services against constant or increasing aggregate demand. This increasing disparity between aggregate supply and aggregate demand raises inflation rate (Keynesian perspective on causes of inflation). On the same note of repayment of foreign debt, the tax on capital output aimed to raise money for repayment of foreign debt. This reduces the benefit derived from capital investments hence reducing capital investment in the country. This high tax on capital can cause capital flight in the country as well as change in investment mix in favour of short run investment and export-oriented investments (Presbitero, 2005; udofia, 2016). The fourth channel is based on public deficit financing, which involves monetization of public budget deficit through seignorage. Keynesians called this a fiscal-monetary game. Fiscal policy dominance pushes monetary authority to seignorage to finance budget deficit. This situation increases monetary base and money supply, therefore disturbing the money market equilibrium resulting into excess supply of money that money demand, resulting into inflation (Edward and Tabellini,1991; Ashra, et al,2004; Darrat,2010)

The final transmission channel in this theory operates through the wealth effect of deficit financing. The effect arises when government decides to borrow rather than increasing tax. The public does not perceive the increase of future tax during repayment and therefore increase of wealth. The increase in wealth result into rise in aggregate demand which subsequently turn pushes up prices, causing inflation (Kaur, 2018; Inam,2014; Khumalo,2013). This study anchored the methodology on this theory.

2.1.2 Structural theory

The theory came into limelight in 1970 when most developing countries were faced with both increasing both unemployment rate and inflation rates. This was contrary to the theory of tradeoff between inflation and unemployment (stagflation). This made some empirical researchers conclude that famous Philips curve had collapsed and was not able to explain what was being experienced by some countries (Kia,2006; Khumalo,2013). Structural inflation is based on factors such as capital mobility that make risks to be priced and be shared, deterioration in the exchange rate and foreign interest rate fluctuation. Increased exchange rate results into high cost of imported capital hence pushing prices up. This contributes to cost-push inflation. Additionally, increasing foreign interest rate pushes up the cost of foreign and capital purchased using such funds. Therefore, production cost goes up which in turn rises the final products prices. This affects the supply side of market through increasing the cost of supplies, hence causing cost-push inflation (Bulawayo et al, 2018). Another factor is deteriorating terms of trade which means an increasing cost of imports affecting the supply side of the economy. Suppressed supply led to increasing prices a situation called import-inflation. Structural theory also points out that inflation could be due war and sanctions. These situations rise cost of imports hence causing inflation due to high cost and suppressed supplies. Structural theory is also based on Keynesian view of the causes of inflation as the imbalances between aggregate supply and aggregate demand (Kaur, 2018; Agba, 1994).

2.2 Empirical Literature

In their research, Ishaq and Mohsin (2015) examined the relationship linking fiscal deficits with inflation and emphasized the importance of accounting for the role played by monetary and financial institutions in addressing such macroeconomic issues. The analysis utilized panel data covering 11 Asian economies for the years 1981–2010 to evaluate the inflationary effects associated with fiscal imbalances. The association between fiscal deficits and inflation was found to be especially sensitive to institutional effectiveness, specifically the level of central bank autonomy and the level of financial sector development. The analysis was conducted using the System GMM method suitable for panel data. The result indicated that a budget deficit is inflationary and the inflationary pressure rises if the financial market is underdeveloped and central bank is not independent in implementing its objectives and targets effectively. The results supported the structural theory of inflation on institutional factors affecting inflationary behavior. This study differed with current study in methodology where, while the earlier study employed the GMMS method for analysis of panel data, the current study used ARDL methodology in data analysis. Also, the current study utilized time series data instead of panel data. The choice of variable in current study was wide including the exchange rate both external and internal debt while borrowing budget deficit as a variable.

To gain insights into the effect of externally financed fiscal deficits on economic growth in Kenya, Mweni et al. (2016) undertook a study using the non-Ricardian equivalence framework. The analysis utilized annual data covering the period between 1970 and 2013. The Johansen cointegration technique and a Vector Error Correction Model (VECM) were used to explore the relationships between the variables. The study considered several macroeconomic indicators, including inflation, real GDP growth, external debt, fiscal deficit, government expenditure, and domestic savings.

The study found that financing fiscal deficits through external borrowing was linked to a slowdown in economic growth in both the short and long run. The authors attributed this outcome to factors such as reduced domestic investment and rising debt-servicing commitments, which may limit the resources available for productive economic activities. Based on these findings, they argued that excessive dependence on foreign borrowing could hinder economic performance and recommended strengthening fiscal discipline while enhancing domestic resource mobilization as a more sustainable financing strategy.

Ochieng et al. (2016) examined the factors influencing inflation in Kenya using time-series data covering the period 1990 to 2014. Inflation was measured using the Consumer Price Index (CPI), while variables such as real GDP, money supply, government expenditure, exchange rates, fuel prices, interest rates, and lagged inflation were included in the analysis. The study found that economic growth contributed to lower inflation, suggesting that increased production can help ease price pressures. Oil price movements were identified as an important source of inflation, reflecting Kenya's exposure to developments in international energy markets. The results also pointed to the persistence of inflation over time, as past inflation was found to influence current price movements. Although money supply and government expenditure were included in the model, their effects were not consistent throughout the estimation period. The present study differs from Ochieng et al. (2016) in both scope and model specification. While the earlier study focused on a broader set of macroeconomic determinants, this research places particular emphasis on public debt and incorporates external debt, domestic debt, and fiscal deficit as main explanatory variables. The study also employs the ARDL framework to examine both short-run and long-run relationships among the variables.

Ogunsakin and Olalere (2017) investigated the link between fiscal deficits and inflation in Nigeria and the South Africa. The authors employed a Vector Error Correction Model (VECM) in conjunction with Granger causality tests to examine long-run relationships and causal interactions between variables. Their findings showed that fiscal deficit shocks were a source of increased inflation in both countries. The study also revealed that money supply growth is an important determinant of the movement of the general price level. Evidence from the causality analysis suggested a one-way causality from fiscal deficits to inflation in South Africa, whereas a two-way causal relationship was observed in Nigeria. Despite addressing a related issue, the current study differs from Ogunsakin and Olalere (2017) in several respects. First, it focuses exclusively on Kenya rather than undertaking a cross-country analysis. Second, it applies the ARDL methodology instead of the VECM approach. These differences make it possible to evaluate the debt–inflation relationship within the specific context of the Kenyan economy.

Bulawayo et al. (2018) investigated whether fiscal deficits contribute to inflation in Zambia using data for the period 1991–2016. The study employed the ARDL technique to capture both short-run and long-run relationships among the variables. Inflation was analysed alongside fiscal deficits, money supply, exchange rate movements, GDP growth, and interest rates. The results indicated that there was a positive relationship between the size of fiscal deficits and inflation in the short term, implying that an increase in fiscal deficits would lead to an increase in inflation. However, the study failed to find a significant long-run linkage between fiscal deficits and inflation. This suggests that although fiscal deficits may influence prices in the short term, their effect may not persist over an extended period. Compared with Bulawayo et al. (2018), the present study extends the analysis by incorporating both domestic and external debt as key variables and by focusing on the Kenyan economy.

Despite these differences, both studies rely on the ARDL framework to examine the relationships among the selected variables.

Nyoni (2018) examined inflation dynamics in Kenya and sought to forecast future inflation trends using time-series modelling techniques. The study utilized annual Consumer Price Index (CPI) data covering the period from 1960 to 2017. To analyse inflation behaviour, ARIMA (2,2,1), ARIMA (1,2,0), and AR (1)-GARCH (1,1) models were estimated. The most appropriate model was found by using Akaike Information Criterion (AIC) and Theil's U statistic. Diagnostic tests conducted by the author confirmed that the models satisfied the required conditions of stationarity and stability, indicating their suitability for forecasting inflation in Kenya. The current study employed the ARDL Model differing methodologically from Nyoni who employed ARIMA and GARCH frameworks. While Nyoni employed ARIMA and GARCH analyze inflation dynamics in Kenya, utilizing variables such as lagged inflation, volatility in past inflation and other macroeconomic indicators, the current study employed different variables like external debt, internal debt, annual budget deficit, annual money supply and exchange rate while retaining inflation as the primary variable of interest. Nyoni's study revealed that price level in Kenya is likely to persist, highlighting persistent inflationary pressures.

Okara & Mutuku (2019), in their study "Selected Macroeconomic Drivers of Inflation in Kenya", examined the factors of inflation using yearly statistics spanning from 2000 to 2016. The variables examined included rate of GDP growth, currency in circulation (M1), broad money supply (M2), unemployment rate and foreign currency rate. The analysis was based on the VECM approach to investigate transitory adjustment and long-term association between the variables. The study showed that inflation was sensitive to fluctuations in money stock, exchange rate, economic growth and unemployment in short term. In the long run, the influence of exchange rate changes and liquidity remained significant on price changes. The findings indicate that monetary conditions and exchange rates have been critical in determining inflationary trends. The present study differs from the above research in several respects. First, adopts the ARDL methodology to analyze short-run and long-run relationships between the variables. Second, while the earlier study focused on a different set of macroeconomic indicators, the current research places greater emphasis on public debt by incorporating domestic debt, external debt, and fiscal deficit alongside money supply, exchange rate, inflation and real GDP

2.3 Overview of literature view

Analysis of the available literature reveals that inflation is determined by fiscal, monetary and institutional factors. Some scholars have explored the effect of public debt, the budget deficit, the money supply, exchange rates and economic growth on price level changes and have obtained different results for different countries and periods.

To study the inflationary impact of budget deficits, Ishaq and Mohsin (2015) carried out an empirical analysis on 11 Asian countries over the period 1981–2010 and accounted for institutional effectiveness including the central bank independence and advanced financial markets. The study has been conducted using the GMM System for panel data to conclude that a budget deficit is a significant factor in causing inflation, especially in the presence of underdeveloped financial markets and non-independent central bank, which confirms the structural theory of inflation rate.

In his study, Mweni et al. (2016) analysed the effect of financing fiscal deficits with external debt in Kenya between 1970 and 2013 with VECM and Johansen cointegration. The observations showed that foreign debt has negative effect on the growth of the GDP, as it compels to shift investment resources from domestic projects and raises the debt burden for the debt servicing.

Using annual data from 1990 to 2014, Ochieng et al. (2016) measured the factors that affect inflation in Kenya using regression analysis. The study determined that the reduction of real GDP reduces the inflation, the fluctuation of oil prices increases inflation, the persistence of the inflationary rate is confirmed by the lagged inflation, and other variables are found to have no determining role.

Ogunsakin and Olalere (2017) applied the VECM and Granger causality between Nigeria and South Africa. The empirical findings indicated that fiscal deficits were found as one of the major inflationary pressures. The causality analysis also revealed that the causal relationship between the variables was unidirectional for South Africa, and bidirectional for Nigeria.

The study by Bulawayo et al. (2018) used ARDL method to analyse the Zambian data from 1991 to 2016. They found that fiscal deficits yield lower growth rates, higher rates of inflation, and a decrease in employment over the short-term horizon. The estimates found no evidence of a sustained association of the factors over time, however.

To assess the price behaviour in Kenya, Nyoni (2018) employed the modelling techniques of ARIMA and GARCH where price data was sourced from the period of 1960-2017. The study drew a positive trend on prices, and showed that there were some persistent and volatile movements in prices.

Using a VECM approach, the study period for the Kenyan data was from 2000 to 2016 as done by and Okara and Mutuku (2019). They found that monetary aggregate, foreign currency valuation, GDP growth and employment

status affect the inflation rate in the short term, while the FX rate and liquidity status have a significant impact in the long term. Data analysis techniques have different methods such as panel GMM, ARDL, VECM, regression, ARIMA and GARCH models, and variables such as GDP, CPI, employment, Lagged inflation, fiscal imbalances and debt, money supply, and exchange rates to oil prices, across these studies.

The present analysis is different in two ways: firstly, the ARDL methodology has been used and secondly, the variables have been expanded to include external debt, internal debt, budget deficits, money supply, exchange rates, GDP and inflation data, as these are all time-series data for Kenya. Overall, the studies emphasize the importance of both the macroeconomic fundamentals and institutional factors in shaping inflationary outcomes.

Furthermore, results indicate that debt and deficits, money supply, exchange rates and output growth are not only consistently found to be causing inflation dynamics, but also indicate the importance of policy measures which are aimed at institutional effectiveness and macroeconomic stability. The present research is an attempt to gain in-depth knowledge on immediate and long term dynamics of inflation in Kenya, with a more comprehensive set of variables explaining the inflation process, and applied the ARDL modeling approach to capture the co-integration relationships and error correcting mechanism.

III. METHODOLOGY

3.0 Introduction

An integrated discussion includes both theoretical and empirical estimation models. This section is the formulation and description of an empirical model used for the analysis, providing consistency of the conceptual framework and the purpose of the study. The interest was to complete the study goals and helped to offer the solutions to the problem identified. This chapter is about making estimates, conducting diagnostic testing, what data is and where it was found.

3.1 Research Design

A non-experimental longitudinal approach was used to investigate the relationship between public debt and inflation in Kenya over time. Observations over the years 1991–2023 were analysed. Domestic debt, external debt, monetary expansion, exchange rate movements and real output growth were among the topics of the investigation. The variables were confirmed to be time-series after which an ARDL specification with an error-correction term was estimated to determine short run adjustments and the long run relationships in the model.

3.2 Theoretical framework

Fiscal theory of inflation provides a framework for understanding how inflation and budget deficits are related. The model posits fiscal dominance, wherein the fiscal policymaker determines the magnitude of public budget deficits, subsequently delegating the responsibility to the monetary authority to issue bonds or print currency sufficient to finance said deficits. The model begins with a long-term government budget constraint defined by equation (3.1). Earlier research work of Oladipo and Akinbodola (2011), Kumar (2012), Khumalo (2013) and Solomon and Wet (2014) made use of this model.

$$\frac{B_{t-1}(t)}{P_t} = \sum_{j=0}^t \frac{1}{r^j} \left[R_{t+j} - G_{t+j} + \left(M_{t+j} - \frac{M_{t-1-j}}{P_{t+j}} \right) \right] \text{-----} (3.1)$$

Whereby;

$\frac{B_{t-1}(t)}{P_t}$ = outstanding public sector debt stock

r^j = the discount factor

R_{t+j} = total tax collections

G_{t+j} = total government spending

M_t = broad monetary aggregate

The relationship expressed in Equation 3.1 suggests that public debt can be interpreted as the present discounted value of future fiscal gaps combined with real seigniorage receipts over time. In short term, however, the concept of unpleasant monetarist arithmetic, which said that this kind of relationship is weak and would cause inflation to skyrocket in the future and which was introduced by Sargent and Wallace (1981). However, they also said that seigniorage was necessary to pay for the government's budget deficit in the short term. This is supported by equation 3.2

$$\frac{B_{t-1}(t)}{P_t} = R_t - G_t + \left[\frac{M_t - M_{t-1}}{P_t} \right] \text{-----} (3.2)$$

Equation 3.2 represents the government's budget constraint. It says that public debt can't grow at a certain time if the whole government budget deficit is paid for by seigniorage. If the government debt ($\frac{B_{t-1}(t)}{P_t}$) can't be rolled over, it has to be paid off when it comes due at time t. This scenario is expressed in equation 3.3.

$$\frac{B_{t-1}(t)}{P_t} - R_t + G_t = \left[\frac{M_t - M_{t-1}}{P_t} \right]$$

Re-arrange to emphasize the primary deficit (deficit = spending – revenue): This gives us equation 3.3

$$\frac{B_{t-1}(t)}{P_t} = R_t - G_t + \left[\frac{M_t - M_{t-1}}{P_t} \right] \dots \dots \dots 3.3$$

3.3 Estimation model specification

To ascertain the actual value of outstanding nominal debt, it is important to consider the aggregate of the primary shortfall and real seigniorage. According to FTPL logic, the price level, P_t , must change such that the real government debt value, $B(t-1)$, corresponds to the present value of future fiscal balances minus seigniorage. Deficits / accumulated debt and seigniorage basically affect price level. Take logs/differences to move from price level to inflation. Let $P_t = \ln P_t$ Inflation (continuously compounded approximation) is:

$$\pi_t \approx \Delta p_t = p_t - p_{t-1} \dots \dots \dots 3.4$$

π_t – Inflation., Δp_t – change in price, p_t – price level, p_{t-1} – last periods price level

From the identity $\frac{B_{t-1}(t)}{P_t} = \text{Deficit}_t + \left[\frac{\Delta M_t}{P_t} \right]$ equation 3.3, A compact way used in FTPL derivations is to take logs (or invert) and obtain an equilibrium relationship that links $P_t = \ln P_t$ to debt/deficits and money. We do not require a closed-form analytic inversion; rather, we propose a long-term relationship (cointegrating relation) that aligns with FTPL. The goal of estimating inflation in this study is to figure out how public debt affects inflation. So, external debt and internal debt are two important factors that should be in the estimation equation. To estimate inflation, two control variables are employed, which include the exchange rate and GDP. The exchange rate, amount of money in circulation, and the budget deficit constitute necessary determinants to be incorporated. This gives equation 3.4.

$$\ln P_t = \alpha_0 + \alpha_1 \text{ExtDebt}_t + \alpha_2 \text{DomDebt}_t + \alpha_3 \text{FiscalDeficit}_t + \alpha_4 \ln M_t + \alpha_5 \ln EXR_t + \alpha_6 \ln Y_t + u_t \dots \dots \dots 3.4$$

$\ln P_t$ = Represents the log of the aggregate price level

ExtDebt_t = external public debt / GDP (pct),

DomDebt_t = domestic public debt / GDP,

FiscalDeficit_t = (primary or overall) deficit / GDP,

M_t = money supply (M2),

EXR_t = nominal exchange rate (KES per USD),

Y_t = real GDP (control for demand).

u_t = Error term representing unobserved factors and random shocks not explained by the model.

$\ln P_t$ = represents the log of the aggregate price level.

First difference $\Delta \ln P_t$ corresponds to the inflation rate, which is why this model in equation 3.5 is appropriate for analyzing the linkage between debt, deficit, money supply, rate of exchange and output on inflation.

$$\begin{aligned} \Delta \ln P_t = & \beta_0 + \sum_{i=1}^{p-1} \psi_i \Delta \ln P_{t-i} + \sum_{j=0}^{q_1-1} \delta_{1j} \Delta \text{ExtDebt}_{t-j} + \sum_{j=0}^{q_2-1} \delta_{2j} \Delta \text{DomDebt}_{t-j} \\ & + \sum_{j=0}^{q_3-1} \delta_{3j} \Delta \text{FiscalDeficit}_{t-j} + \sum_{j=0}^{q_4-1} \delta_{4j} \Delta \ln M_{t-j} + \sum_{j=0}^{q_5-1} \delta_{5j} \Delta \ln EXR_{t-j} + \sum_{j=0}^{q_6-1} \delta_{6j} \Delta \ln Y_{t-j} \\ & + \lambda [\ln P_{t-1} - \theta_0 + \theta_1 \text{ExtDebt}_{t-1} + \theta_2 \text{DomDebt}_{t-1} + \theta_3 \text{FiscalDeficit}_{t-1} + \theta_4 \ln M_{t-1} \\ & + \theta_5 \ln EXR_{t-1} + \theta_6 \ln Y_{t-1} + \varepsilon_t] - \dots \dots \dots - 3.5 \end{aligned}$$

$\Delta \ln P_{t-i}$: lagged changes of the dependent variable capture inertia/adjustment.

$\Delta \text{ExtDebt}$, $\Delta \text{DomDebt}$, $\Delta \text{FiscalDeficit}$, $\Delta \ln M$, $\Delta \ln EXR$ and $\Delta \ln Y$ reflects short run adjustments, illustrating how changes in debt, fiscal positions, monetary aggregates, exchange rate developments and real output influence the price level within a limited time frame, which answers objective 2.

The quantity presented within square brackets [] corresponds to the Error Correction Term (ECT), which captures deviations from the equilibrium relationship and facilitates the adjustment process toward equilibrium. To get $\theta_0 - \theta_6$, which are long-run coefficients, you need to normalize the lagged level coefficients from the ARDL estimation. The speed of adjustment coefficient represented by the parameter λ , meets objective 1.

3.4 Variable Description and Measurement

Variable	Definition	Measurement
$\ln P_t$	Represents economy wide price movements and serves as a proxy for inflation dynamics	Computed as the natural logarithm of the Consumer Price Index (CPI) or GDP Deflator
External Debt	Government borrowing obtained from foreign creditors	External debt obligations as a share of Gross Domestic Product
Domestic Debt	Domestic public debt relative to national output	Domestic public debt relative to GDP
Fiscal Deficit	Government fiscal imbalance arising from excess expenditure over revenue	Overall fiscal deficit or primary deficit as a share of GDP
Money Supply	Total money stock available within the economy	M2 money supply, measured in billions of Kenya shillings or as annual growth rate
Exchange rate	Rate at which the Kenya Shilling trades against the US dollar	Kenya shillings (KES) per 1 US dollar (USD)
Real GDP	Real economic output used to control for aggregate demand effects	Real GDP measured at constant prices or annual real GDP growth rate

3.5 Data Diagnostic tests

A pre-estimation tests were done on a sample data set to find out more about the characteristics of the data set before estimation or regression is done. The tests displayed the kind of data set used for the research. These tests consist of descriptive statistics, correlation coefficient, causality test and stationarity test (unit root test).

3.5.1 Test of correlation

The correlation coefficient tells you how closely two variables are related. The coefficient tells you how strong and in what direction the relationship is. It's an easy way to find out how two random variables are related. The correlation coefficient is between -1 and 1, or $-1 \leq \text{corr} \leq 1$. When the correlation coefficient assumes the value of -1, the two variables exhibit a perfectly negatively association, indicating that the variables move opposite directions. Conversely, a coefficient of 1 signifies a positively association. A value of 0 implies that no linear correlation. The formula below is used to find the correlation between two variables (x, y);

$$\ell_{xy} = \frac{\text{cov}[x, y]}{\sqrt{\text{var}[x] \text{var}[y]}} \dots \dots \dots (3.5.1.0)$$

Where the formula for sample covariance and variance are stated below:

$$\text{cov}[x, y] = \frac{\sum [x - \bar{x}][y - \bar{y}]}{N - 1} \dots \dots \dots (3.5.1.1)$$

$$\sigma_x^2 = \frac{\sum [x - \bar{x}]^2}{N - 1} \text{ and } \sigma_y^2 = \frac{\sum [y - \bar{y}]^2}{N - 1} \dots \dots \dots (3.5.1.2)$$

3.5.2 Stationary test

Through subsequent to differentiation, non-stationary time series data are typically transformed to stationarity from their original state of non-stationarity. Time-series variables are often tested for being stationary using unit root tests. These procedures set the order of integration of variables and whether the differences in the series gradually return to their long-run equilibrium path. A multitude of methods exist for testing the stability features of time-series data and unit root procedures are some of the most commonly used methods. They provide information about the level at which the variable becomes stationary and whether its fluctuations over time are "convergent" or "divergent". Estimation without testing for stationarity may lead to spurious regression. Spurious regression yields biased estimators that are unreliable for forecasting the dependent variable. The data were subjected to unit root procedures before estimation of the model to find out the stationary characteristics of these data. The investigation applied the Augmented Dickey–Fuller (ADF), Dickey–Fuller Generalized Least Squares (DF-GLS), and KPSS tests to evaluate the stochastic properties and order of integration of the series.

3.5.3 Augmented Dickey-Fuller Test (ADF test)

ADF test for unit root test is commonly applied as compared to other tests because it performs well with country specific data. ADF test is an autoregressive regression equation of order which is specified as follows.

$$Y_t = \alpha + \phi Y_{t-1} + \varepsilon_t \dots\dots\dots (3.5.3.1)$$

The stochastic disturbance term, ε_t , represents factors omitted from the specified model. The error term is assumed to follow a normal distribution, with a mean of zero and a uniform variance (σ^2). The hypotheses subjected to empirical testing are specified below:

$$H_0 : |\phi| = 1$$

$$H_a : |\phi| < 0$$

The null hypothesis assumes that the variable (Y) contains a unit root and is therefore non-stationary, implying an integration order of I (1). In contrast, the alternative hypothesis suggests that the series is stationary and does not contain a unit root, which corresponds to integration at order I (0)

Depending on the behaviour of the observed series, the ADF framework can be estimated under three alternative specifications. These comprise a model without an intercept, a specification with a drift component, and a formulation that accounts for both drift and deterministic trend effects. The corresponding specifications are presented below;

$$\begin{aligned} Y_t &= +\phi Y_{t-1} + \varepsilon_t \\ Y_t &= \alpha + \phi Y_{t-1} + \varepsilon_t \dots\dots\dots (3.5.3.2) \\ Y_t &= \alpha + \phi t + \phi Y_{t-1} + \varepsilon_t \end{aligned}$$

3.5.4 Cointegration testing

Establishing the presence of a common stochastic trend among the variables is a prerequisite for evaluating their equilibrium relationships over time. The Johansen cointegration technique is applied to evaluate whether a group of variables shares common stochastic trends and stable equilibrium connections over time. The outcome of this analysis informs the choice of econometric model. If no cointegrating vectors are identified, estimation may proceed using a standard VAR framework. By contrast, evidence of cointegration warrants the use of a VECM specification, which integrates transitory movements with the correction process that guides the system back toward its equilibrium state. Since the Johansen methodology is derived from a VAR framework, equation 3.32, selecting the appropriate lag order is a prerequisite before performing the cointegration analysis.

$$V_t = \alpha + \sum_k^m \Theta_k V_{t-k} + \varepsilon_t \dots\dots\dots (3.5.4.1)$$

V_t denotes a four-dimensional vector containing the variables included in the study. Under consideration are the four variables anticipated to be integrated of order 1; one component is a constant i-vector, while, the other component is a iii-dimensional white-noise residual vector, assumed to have an expected value of zero and a variance that remains stable throughout the sample period. Π is the impact matrix of a 4*4 matrix made up of the four variables in the study, and k is the length of the lag.

3.5.5 Structural break test

A structural break is an unexpected change in the parameters of regression over time, either in level or slope. This can lead to errors in forecasting, which makes the model less reliable. Hendry and Clement (1998) contended that coefficient instability leads to forecast failure, necessitating regular testing for structural breaks. There exist various tests for structural breaks. To assess the stability of a coefficient in a regression the CUSUM test and the CUSUM squares test are mostly employed.

3.5.6 Autocorrelation

The Classical Linear Regression framework is founded on several assumptions, including the condition that the stochastic disturbance terms are uncorrelated across observations. The error terms ought to adhere to a stationary AR (1) process. It is also presumed that explanatory variables are mutually exclusive. This paper examined the issue of autocorrelation through the application of the Durbin-Watson statistic test and the Breusch-Godfrey test. Empirical literature indicated that these tests are conducted in tandem solely to validate each other's outcomes.

Durbin-Watson test

The error terms are extracted from estimated linear regression model, which is regressed against its lagged values.

$$\varepsilon_t = \rho\varepsilon_{t-1} + v_t \dots\dots\dots (3.5.6.1).$$

Where V_t = a white noise.

The ρ values should lie between negative one and positive one. This was calculated as follows.

$$\hat{\rho} = \frac{\sum_{t=2}^n (v_t - v_{t-1})^2}{\sum_{t=1}^n v_{t-1}^2} \dots\dots\dots (3.5.6.2)$$

The ρ lies between negative one and positive one.

Breach-Godfrey LM test

This is similar to DW test but uses the F statistic to find out if the coefficients of lagged values of error term (at least one) equals does not statistically equal to zero.

3.5.7 Homoskedasticity

A key property underlying classical regression estimation is homoskedasticity, whereby the stochastic disturbance term maintains a constant variance across the range of explanatory variables included in the model...

White Test for Heteroskedasticity

The White test for heteroskedasticity is used to check for homoskedasticity. The White test assumes that the error terms do not depend on the model's explanatory variables. The exogeneity assumption requires that the stochastic disturbance term remain orthogonal to the explanatory variables, implying the absence of any systematic relationship between them.

If the homoskedasticity assumption is broken in CLRM, the estimators would not be best linear unbiased (BLUE). This means that there is a better estimator than the one the model gave. Leaving out some variables could cause heteroskedasticity in the model.

3.5.8 Multicollinearity test

This is a case where independent variables are related to each other in some way. The issue arises from the erroneous application of dummy variables, the incorporation of a variable derived from other variables within the dataset, and the scenario where variables exhibit high correlation with one another. The issue of multicollinearity leads to unreliable inferences in partial regression, as coefficients may not be accurately estimated, resulting in high standard errors. Substantial variation in the estimated partial regression coefficients across different samples makes it difficult to determine the extent to which individual explanatory variables influence variations in the outcome variable. Furthermore, confidence intervals become wider and the associated test statistics tend to be smaller, thereby reducing the likelihood of rejecting the null hypothesis. The presence of multicollinearity is usually indicated by insignificant individual coefficient outcomes despite a significant overall outcome, as well as a drastic difference between the results of two parts of the sample data, signifying unstable coefficients. Finally, the presence of multicollinearity is indicated by significant changes in the model when a variable is added or removed, as these changes influence another independent variable. It is hard to explain the partial regression result using *ceteris paribus* because the independent variables change at the same time.

Variance Inflation Factor (VIF); Multicollinearity was assessed through the Variance Inflation Factor (VIF), a measure used to evaluate the extent of interdependence among explanatory variables incorporated in a regression equation. The Variance Inflation Factor is bounded by a lower limit of one but has no theoretical maximum. Values within the interval of 1 to 5 are usually regarded as indicating an acceptable level of association among the explanatory variables, with minimal concerns regarding multicollinearity. If the value is higher than 5, it means that there is multicollinearity and steps need to be taken to fix it.

3.5.9 Ramsey RESET test

This test is usually employed to examine functional misspecification in linear regression models. Ramsey made it in 1969. The test checks to see if the linear regression line fits the data. The linear regression model does not provide a better approximation of the population parameter. In this case, the nonlinear functional form might be right. The data analyst uses either the quadratic functional form or a higher order functional form.

3.5.10 Normality test

To check the normality of the data, it was subjected to normality test. This was crucial as many statistical procedures work better with normally distributed data/model residuals. In this study, the assessment was based on the residuals obtained after estimating the model, since residual behaviour provides useful information about the adequacy of the model.

Different tests can be used to evaluate normality, including the Kolmogorov–Smirnov, Shapiro–Wilk and Jarque–Bera tests. The Kolmogorov–Smirnov test compares the distribution of the sample data with a theoretical

distribution and is ideally suited for large samples and large numbers of observations. The Shapiro-Wilk test for normality is suitable for data sets with less than 50 observations ($n < 50$). The Shapiro-Wilk test checks to see if the given sample dataset comes from a normally distributed population.

To complement the analysis the Jarque-Bera was employed. The Jarque-Bera diagnostic is a formal statistical test to check the deviation from normality. The method is based on a test statistic with a chi-square distribution based on the sample skewness and kurtosis and provides evidence of whether the observed data have properties that are characteristic of a Gaussian distribution.

3.5.11 Stability test

The estimated model parameters are anticipated to remain stable throughout both the sample and forecasting periods. If that assumption is broken during or after the modeling process, the model becomes less useful. The stability test is a test of parameter that checks to see whether the estimated model coefficients are changing in a consistent way. The null hypothesis being tested posits that parameters remain stable. Two stability tests employed include the Cumulative Sum (CUSUM) test and the Cumulative Sum of Squares (CUSUMSQ) test. CUSUM test investigate if parameters are changing systematically while CUSUMSQ test if parameters are changing suddenly (Bhatti et al, 2006). The CUSUM statistics are computed through recursive estimation. The assumption for parameter stability is the CUSUM statistics are drawn from CUSUM distribution. If the CUSUM statistics are excessively large to be derived from the CUSUM distribution, the stability assumption is contravened.

3.5.12 Causality test

Granger causality analysis was undertaken to investigate potential directional linkages among economic growth, domestic debt, external debt, investment, and interest rates. Such analysis helps determine whether changes in one variable precede and help explain movements in another variable. The approach developed by Granger (1969) was employed to evaluate causal relationships among the variables.

3.6 Data Source

Annual secondary data sourced from the IMF database and various publications issued by the Kenya Bureau of Statistics was utilized in this study. The sample dataset covered the period from 1991 to 2023.

3.7 Data Analysis

The empirical investigation was carried out to evaluate the long-run association between public debt and inflation in Kenya. The analysis was informed by two specific research objectives aimed at evaluating different dimensions of this relationship. To examine the causal dynamics associated with this relationship, annual observations for the period 1991 to 2023 were analysed using Stata in conjunction with the Autoregressive Distributed Lag framework (ARDL). This approach is well suited to small sample sizes and can be applied to variables stationary at level, $I(0)$, as well as those that become stationary after first differencing, $I(1)$. The outcome variable is the logarithm of the aggregate price index ($\ln P$), measured using the Consumer Price Index (CPI), whereas the key explanatory variables comprise external debt (ExtDebt), domestic debt (DomDebt), and fiscal deficit (FiscalDeficit). Additional control variables include log money supply ($\ln M$), log exchange rate ($\ln EXR$), and log real GDP ($\ln Y$).

IV. EMPIRICAL FINDINGS

4.1 Introduction

This chapter reports the outcomes obtained from the empirical investigation and provides an interpretation of the results. It is therefore sectioned into sections based on the tests conducted. First, a summary of the variables is presented then the diagnostic test results, followed by correlation results, cointegration test results, ARDL results and finally bounds test result.

4.2 Descriptive Analysis

The summary statistics for the study variables are presented in Table 4.1. The table includes summary statistics such as the mean, standard deviation, minimum, and maximum values for each variable, as indicators of central tendency and variability.

Table 4.1: Descriptive Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation	33	8.351	5.167	.933	25.698
External Debt (%GDP)	33	24.179	10.186	14.411	45.589
Domestic Debt (%GDP)	33	24.764	7.21	16.504	48.72
Fiscal Deficit (%GDP)	33	-3.737	3.172	-8.58	.84

Money Supply (%GDP)	33	37.621	2.703	30.982	42.819
Exchange Rates	33	79.656	23.609	27.508	139.846
GDP Constant LCU	33	5.643e+12	2.207e+12	3.182e+12	1.042e+13

Table 4.1 shows that during the study period, inflation averaged 8.351, with a standard deviation of 5.167, and ranged between 0.933 and 25.698. External debt relative to GDP recorded a mean of 24.179 percent, with a dispersion measure of 10.186, indicating considerable variation around the mean. The minimum value for external debt was 14.411%, while the maximum was 45.589%. On average, domestic debt accounted for 24.764% of GDP, a dispersion of the series, as measured by the standard deviation was 7.21. The lowest and highest recorded values were 16.504% and 48.72% respectively. Additionally, the mean fiscal deficit (% of GDP) was -3.737%, with a standard deviation of 3.172, ranging between -8.58% and 0.84%. Further, the average money supply during the period was 37.621% of GDP, with a 2.703 variability. The minimum value was 30.982, while the maximum value was 42.819. Exchange rates during the period averaged 79.656, with high variability of 23.609, and ranged between 27.508 and 139.846. Finally, the findings indicated that the mean of GDP during the period was Ksh 5.643 trillion, with high variability of 2.207 trillion, and ranged between Ksh 3.182 trillion and Ksh 10.42 trillion.

4.3 Diagnostic Tests

As an initial step, the dataset was examined using appropriate statistical tests to establish whether the series possessed characteristics suitable for time-series analysis. Various diagnostic tests that were carried out, including the stationarity test, cointegration test, test for autocorrelation, homoscedasticity, multicollinearity and normality test. Additional tests performed comprised the Ramsey RESET specification test and causality analysis. The findings of these tests are presented and discussed in this section.

4.3.1 Stationary test

Unit root tests were performed to establish the order of integration of the study variables. The evaluation applied the ADF, DF-GLS, and KPSS tests, and the corresponding findings are reported in Table 4.2.

Table 4.2: Results of Stationarity Tests for the Study Variables

Variable	ADF Test Decision	DF-GLS Test Decision	KPSS Test Decision	Order of Integration
Log Inflation	Stationary	Stationary	Stationary	I(0)
External Debt (% of GDP)	Non-stationary	Stationary	Non-stationary	I(1)
Domestic Debt (% of GDP)	Stationary	Non-stationary	Stationary	Mixed I (0)/I (1)
Fiscal Deficit (% of GDP)	Non-stationary	Stationary	Non-stationary	I (1)
Log Money Supply	Non-stationary	Non-stationary	Stationary	I (1)
Log Exchange Rate	Non-stationary	Stationary	Stationary	I (1)
Log GDP	Non-stationary	Stationary	Non-stationary	I (1)

The findings reported in Table 4.2 show that log inflation satisfies the stationarity requirement in levels under all three testing procedures, implying an integration order of I (0). In contrast, external debt, fiscal deficit, and log GDP do not satisfy stationarity conditions in their level form but attain stationarity after first differencing, indicating I (1) behaviour. Results for domestic debt, money supply, and exchange rate vary across the ADF, DF-GLS, and KPSS procedures; nevertheless, the overall pattern suggests that first differencing is required before stationarity is achieved. Notably, no variable exhibits an integration order higher than one. The integration order of variables at both I(0) and I(1) is supportive of the existence of mixed integration orders, which makes the ARDL bounds testing framework suitable for analyzing both short-run adjustment and long-run association among variables.

4.3.2 Cointegration test

The Johansen's cointegration method was used to test for long-run association between the study variables. The results corresponding to this are reported in Table 4.3.

Table 4.3: Johansen Cointegration Analysis Results

Maximum Rank	Trace Statistic	5% Critical value
0	195.5010	124.24
1	128.2148	94.15
2	82.2012	68.52
3	49.6674	47.21
4	23.7612*	29.68
5	10.8646	15.41
6	1.3544	3.76

The results in Table 4.3 show that there were four (4) cointegrating equations based on a trace statistic, where $23.7652 < 29.68$ (was less than the 5% critical value). Consequently, the ARDL framework was considered appropriate since it facilitates the examination of long-run associations alongside short-run dynamics.

4.3.3 Autocorrelation Test

To examine whether the variables exhibited autocorrelation, the Durbin Watson and Breusch Pagan tests were performed. Table 4.4 displays the outcomes of these diagnostic tests.

Table 4.4: Autocorrelation Diagnostic Results

Durbin Watson d Statistic	Breusch-Godfrey LM test (Prob>Chi2)
1.731253	0.473

Based on the diagnostic tests, the model did not exhibit signs of autocorrelation. The Durbin-Watson statistic of 1.731253 suggested that the residuals were independently distributed. A probability statistic of 0.473 was obtained from the Breusch–Godfrey test. Since this value was above the specified significance criterion of 0.05, there was insufficient evidence to conclude that the residuals exhibited serial correlation. This suggests that the residual was free from autocorrelation, and therefore, further analysis could be conducted.

4.3.4 Homoskedasticity

To evaluate whether the variance of the disturbance term remained stable across observations, the White test was performed. The corresponding diagnostic statistics are reported in Table 4.5.

Table 4.5: Results of the White Heteroscedasticity Diagnostic Test

chi2	df	p
25.600	27	0.541
9.330	6	0.156
2.140	1	0.143
37.080	34	0.329

The assumption of constant error variance was examined using the White heteroscedasticity test. A chi-square value of 25.60 was obtained for 27 degrees of freedom with a probability of 0.5410. Since the probability value was greater than the significance level of 5%, the hypothesis of homoscedastic disturbances was not rejected. Results reveal that residuals were more or less homoscedastic, with the variance of the residuals being reasonably stable. This suggests that the estimated coefficients are dependable and can be used for interpretation with greater confidence. The result therefore provides additional support for the adequacy of the ARDL model used in the study.

4.3.5 Multicollinearity test

To determine whether a high degree of correlation existed among the explanatory variables, the Variance Inflation Factor (VIF) test was conducted. The outcome of the test is reported in Table 4.6.

Table 4.6: Multicollinearity Diagnostic Results

	VIF	1/VIF
Ln GDP	9.041	0.111
Ln Exchange Rate	6.576	0.152
External Debt (%GDP)	3.754	0.266
Fiscal Deficit (%GDP)	2.88	0.347
Ln Money Supply	1.508	0.663
Domestic Debt (%GDP)	1.276	0.783

Mean VIF

4.172

All the explanatory variables recorded VIF values that were below the acceptable limit of 10. This indicates that there was no evidence of serious multicollinearity among the variables included in the analysis.

4.3.6 Ramsey RESET Test

The Ramsey RESET test was carried out to verify the adequacy of the model specification. This test provided an indication of whether the chosen functional form was suitable for the analysis. The corresponding results are reported in Table 4.7.

Table 4.7: Model Specification Diagnostic Results

Statistic	value
F (3, 23)	2.36
Prob > F	0.0983

The results of the Ramsey RESET test did not reveal any problems with the model specification. With a p-value of 0.0983, which is above the 0.05 threshold, the model was considered suitable for the analysis. This provides confidence that the chosen functional form was capable of explaining the relationship among the variables included in the study.

4.3.7 Normality Test

Normality assumption was evaluated by examining the distributional characteristics of the variables using the Jarque–Bera diagnostic procedure. The corresponding findings are presented in Table 4.8.

Table 4.8: Results of the Normality Assessment

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj_chi2(2)	Prob>chi ²
Residue	33	0.008	0.069	8.720	0.013

The results indicated a deviation from normality at conventional significance levels, with the test statistic yielding a significance level of 0.013. Consequently, the assumption of a normal distribution was not supported by the data.

4.3.8 Assessment of Causal Relationships

The study assessed whether past values of one variable contained useful information for predicting another variable by applying Granger causality techniques. The associated results are reported in Table 4.9

Table 4.9: Wald Test for Granger Causality

Equation	Independent Variable	chi ²	df	Prob>Chi ²
Ln Inflation	External Debt (%GDP)	5.686	2	0.058
Ln Inflation	Domestic Debt (%GDP)	11.004	2	0.004
Ln Inflation	Fiscal Deficit (%GDP)	0.438	2	0.803
Ln Inflation	Ln Money Supply	13.159	2	0.001
Ln Inflation	Ln Exchange Rate	22.238	2	0.000
Ln Inflation	Ln GDP	7.205	2	0.027
Ln Inflation	ALL	55.889	12	0.000
External Debt (%GDP)	Ln Inflation	2.272	2	0.321
External Debt (%GDP)	Domestic Debt (%GDP)	10.481	2	0.005
External Debt (%GDP)	Fiscal Deficit (%GDP)	10.584	2	0.005
External Debt (%GDP)	Ln Money Supply	1.578	2	0.454
External Debt (%GDP)	Ln Exchange Rate	1.24	2	0.538
External Debt (%GDP)	Ln GDP	5.322	2	0.070
External Debt (%GDP)	ALL	130.5	12	0.000
Domestic Debt (%GDP)	Ln Inflation	0.834	2	0.659
Domestic Debt (%GDP)	External Debt (%GDP)	6.538	2	0.038
Domestic Debt (%GDP)	Fiscal Deficit (%GDP)	7.375	2	0.025
Domestic Debt (%GDP)	Ln Money Supply	3.429	2	0.180
Domestic Debt (%GDP)	Ln Exchange Rate	2.365	2	0.306
Domestic Debt (%GDP)	Ln GDP	2.324	2	0.313
Domestic Debt (%GDP)	ALL	30.227	12	0.003
Fiscal Deficit (%GDP)	Ln Inflation	1.33	2	0.514

Fiscal Deficit (%GDP)	External Debt (%GDP)	6.16	2	0.046
Fiscal Deficit (%GDP)	Domestic Debt (%GDP)	5.024	2	0.081
Fiscal Deficit (%GDP)	1 Ln Money Supply	3.664	2	0.160
Fiscal Deficit (%GDP)	Ln Exchange Rate	3.472	2	0.176
Fiscal Deficit (%GDP)	Ln GDP	2.904	2	0.234
Fiscal Deficit (%GDP) t	ALL	76.963	12	0.000
Ln Money Supply	Ln Inflation	1.158	2	0.560
Ln Money Supply	External Debt (%GDP)	1.411	2	0.494
Ln Money Supply	Domestic Debt (%GDP)	0.438	2	0.803
Ln Money Supply	Fiscal Deficit (%GDP)	11.612	2	0.003
Ln Money Supply	Ln Exchange Rate	1.653	2	0.438
Ln Money Supply	Ln GDP	3.801	2	0.149
Ln Money Supply	ALL	26.732	12	0.008
Ln Exchange Rate	Ln Inflation	0.642	2	0.725
Ln Exchange Rate	External Debt (%GDP)	5.619	2	0.060
Ln Exchange Rate	Domestic Debt (%GDP)	10.952	2	0.004
Ln Exchange Rate	Fiscal Deficit (%GDP)	5.707	2	0.058
Ln Exchange Rate	Ln Money Supply	0.724	2	0.696
Ln Exchange Rate	Ln GDP	5.599	2	0.061
Ln Exchange Rate	ALL	103.31	12	0.000
Ln GDP	Ln Inflation	6.117	2	0.047
Ln GDP	External Debt (%GDP)	10.091	2	0.006
Ln GDP	Domestic Debt (%GDP)	9.999	2	0.007
Ln GDP	Fiscal Deficit (%GDP)	5.489	2	0.064
Ln GDP	Ln Money Supply y	0.563	2	0.755
Ln GDP	Ln Exchange Rate	5.128	2	0.077
Ln GDP	ALL	24.423	12	0.018

According to the causality estimates presented in Table 4.9, changes in external debt, domestic debt, money supply, exchange rates, and real GDP precede and help explain variations in inflation. Their respective p-values were 0.058, 0.004, 0.001, 0.000, and 0.027. Furthermore, the explanatory variables were jointly significant in predicting inflation ($p = 0.000$). However, no evidence was found to support a causal influence of fiscal deficit on inflation since its p-value exceeded the conventional significance threshold ($p = 0.803$). This suggests that past values of external debt, domestic debt, money supply, exchange rates, GDP and the combined set of explanatory variables contain useful information for forecasting the present values of inflation.

In the equation with external debt (% of GDP) as the dependent variable, results showed that only domestic debt ($p=0.005$), fiscal deficit ($p=0.005$), and all variables combined ($p=0.00$) Granger cause external debt. This suggests that past values of domestic debt, fiscal deficit and all the variables combined can be utilized to forecast the current value of external debt.

For domestic debt as the dependent variable, the findings indicated that only external debt ($p=0.038$), fiscal deficit ($p=0.025$) and all variables combined ($p=0.003$) Granger cause domestic debt. This means that past values of external debt, fiscal deficit and all variables combined can be used to predict present values of domestic debt.

Further, the results revealed that only external debt ($p=0.046$) and all the variables combined ($p=0.000$) Granger cause fiscal deficit implying that only the past values of external debt and all variables combined can predict the present values of fiscal deficit. Additionally, only fiscal deficit ($p=0.003$) and the combination of all variables (0.008) were shown to Granger cause money supply meaning that past values of fiscal deficit and all variables combined can predict present values of money supply.

Furthermore, the results revealed that only domestic debt ($p=0.004$) and all variables combined ($p=0.000$) Granger cause exchange rates, hence past values of domestic debt and all variables combined can predict the present values of exchange rates. Finally, inflation ($p=0.047$), external debt ($p=0.006$), domestic debt ($p=0.007$),

and the combination of all variables ($p=0.018$) were found to Granger cause GDP. This implies that historical values of inflation, external debt, domestic debt, and the combination of all variables can predict the present values of GDP.

4.4 Correlation Analysis

An investigation of pairwise linear associations among the variables was undertaken using correlation coefficients. The estimates displayed in Table 4.10 provide insight into the strength and direction of these relationships.

Table 4.10: Correlation Matrix

Variables	(1) ln Inflation	(2) External Debt (%GDP)	(3) Domestic Debt (%GDP)	(4) Fiscal Deficit	(5) ln Money Supply	(6) ln Exchange Rate	(7) ln GDP
(1) ln Inflation	1.000						
(2) External Debt (%GDP)	0.426* (0.013)	1.000					
(3) Domestic Debt (%GDP)	-0.007 (0.970)	0.115 (0.525)	1.000				
(4) Fiscal Deficit	-0.210 (0.241)	-0.113 (0.531)	-0.290 (0.102)	1.000			
(5) ln Money Supply	-0.085 (0.637)	-0.101 (0.578)	0.206 (0.249)	-0.244 (0.172)	1.000		
(6) ln Exchange Rate	-0.439* (0.011)	-0.654* (0.000)	0.297 (0.093)	-0.203 (0.258)	0.491* (0.004)	1.000	
(7) ln GDP	-0.253 (0.155)	-0.636* (0.000)	0.335 (0.056)	-0.549* (0.001)	0.414* (0.017)	0.848* (0.000)	1.000

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

External debt exhibited a positive correlation with inflation ($r = 0.426$, $p = 0.000$), indicating that increased dependence on external borrowing is associated with rising price levels. By comparison, domestic debt ($r = -0.007$, $p = 0.970$), fiscal deficit ($r = -0.210$, $p = 0.241$), money supply ($r = -0.085$, $p = 0.637$), and GDP ($r = -0.253$, $p = 0.155$) showed weak relationships with inflation, none of which attained statistical significance. These results suggest the independent effect of all these factors on inflation is relatively small and might not lead to short-term changes in the overall price level. The correlation coefficient computed was -0.439 which was statistically significant at 5 percent level ($p = 0.011$), indicating that there is negative correlation between change in exchange rate and inflation. The results imply that movements in the exchange rate are closely related to movements in the general price level in Kenya, thus highlighting the role of external sector conditions in determining the inflationary trends.

The results offer some preliminary knowledge about the relationships between the studied variables. However, correlation analysis does not establish whether one variable causes change in another. This called for further econometric analysis to explore the causality and hence the long-run equilibrium relationship, along with short-run adjustments relating to public debt and inflation.

4.5 ARDL with Error Correction

ARDL with Error Correction the ARDL model was applied as a result of the presence of cointegration among the study variables. The estimation was targeted toward determining the impact of public debt on inflation, taking into consideration the short-run dynamics and considering the long-run equilibrium relationships. An error-correction mechanism was added to account for the adjustment dynamics after temporary shocks. Modelling this way allows for a better understanding of whether the effect of the explanatory variables is temporary or permanent in nature. The results of the estimation are summarized in Table 4.11.

Table 4.11: ARDL Results

D. ln Inflation	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
ADJ						
Ln Inflation						
L1.	-0.922	0.147	-6.28	0.000	-1.23	-0.613
LR						
External Debt (%GDP)	-0.077	0.024	-3.25	0.004	-0.127	-0.027
Domestic Debt (%GDP)	0.048	0.026	1.83	0.083	-0.007	0.102
Fiscal Deficit (%GDP)	0.125	0.101	1.23	0.235	-0.088	0.337

Ln Money Supply	5.12	2.111	2.43	0.026	0.685	9.556
Ln Exchange Rate	-5.333	1.128	-4.73	0	-7.702	-2.964
Ln GDP	5.497	1.416	3.88	0.001	2.522	8.472
SR						
External Debt (%GDP)						
D1.	0.063	0.058	1.08	0.296	-0.06	0.185
Domestic Debt (%GDP)						
D1.	-0.041	0.023	-1.79	0.091	-0.089	0.007
Fiscal Deficit (%GDP)						
D1.	0.185	0.115	1.6	0.127	-0.058	0.427
Ln Money Supply						
D1.	-5.285	1.595	-3.31	0.004	-8.635	-1.934
Ln Exchange Rate						
D1.	3.22	1.096	2.94	0.009	0.917	5.523
Ln GDP						
D1.	-15.464	5.304	-2.92	0.009	-26.608	-4.32
_cons	-140.989	30.886	-4.56	0	-205.878	-76.1
R squared	0.8000					

The performance of the estimated equation was satisfactory since its R^2 was 0.800. This implies that there are variables in the analysis, which together account for a significant share of the inflation process in the analysis period. The negative sign of the error-correction term (-0.922 , $p = 0.000$) suggests that any deviations from the equilibrium path are not permanent. Rather, the variables realign over time, and the estimated coefficient indicates that this realignment occurs relatively quickly, and that a significant portion of the disequilibrium is quickly eliminated during the next period. That is, 92.2% of any short run imbalance is corrected within a year.

The coefficient of external debt in the long run was negative and remained statistically significant ($\beta = -0.077$, $p = 0.004$). This discovery implies that the greater the external borrowing, over time, the lower the inflation. This could be due to the ability of the external financing to complement the internal financing to lessen inflationary pressure that comes from the limitation of local financing.

The domestic debt showed positive association with inflation in long term at 10 per cent level of significance ($\beta = 0.048$; $p = 0.083$) suggesting that prolonged domestic borrowing could lead to high inflation in the long term.

No statistically significant long-term effect of fiscal deficit on inflation was found ($\beta = 0.125$, $p = 0.235$). This suggests that overall fiscal imbalance, alone, was not a significant contributor to inflationary pressures during the study period, which is consistent with the conclusions of Bulawayo et al. that there was no statistically significant long run relationship between fiscal deficits and inflation. However, this positive coefficient indicates that the pattern of association observed is still as expected theoretically.

The coefficient of money supply for the long run was positive and was still statistically significant at 5 percent. The relationship between the monetary conditions index and the price index is significant ($\beta = 5.12$, $p = 0.026$), which highlights the influence of monetary conditions on the price changes and means that the further and further monetary conditions continue to grow, the greater the inflationary pressures in the economy will be. There was a significant relationship between inflation and the coefficient $\beta = 5.497$ ($p = 0.001$), which indicates that the rise in economic activity can create demand pressures because there is not a corresponding rise in productive capacity. This result is not in line with Ochieng et al. (2016), who reported that in the long-run, an increase in real GDP growth significantly lowers the inflation rate, which suggests that an increase in economic output helps to stabilize prices.

The sign and significance of the exchange-rate coefficient in the long-run were negative ($\beta = -5.333$) and statistically significant ($p = 0.000$), implying there is an inverse relationship between the exchange rate and inflation in the long run. This evidence confirms the importance of the currency fluctuations in the explanation of the long-term price behaviour, especially in the form of an impact on the prices of imported goods and services. The results are consistent with Okara & Mutuku (2019) who also concluded that exchange rates were one of the factors influencing inflation.

However, the pattern shown in the short run estimates was different. Despite the positive external debt coefficient, the relationship was not statistically different from zero ($\beta = 0.063$, $p = 0.296$), which can take a longer time for the impact of the external debt changes to be seen in domestic prices.

At the 10 percent significance level, there was a negative association between domestic debt and inflation in the short-term period for the mean period of 1990 to 2014 ($\beta = -0.041$, $p = 0.091$). This means that there was a negative relationship between domestic debt and inflation in the short-term period for the observation period of 1990 to 2014. There was no clear evidence that fiscal deficit had a statistically significant effect. The short-term estimation results are not significant ($\beta = 0.185$, $p = 0.127$), indicating that the fiscal balance changes within a short period of time did not directly result in inflationary pressures.

However, money supply was found to have a statistically significant short-term effect on inflation at the 5 per cent level ($\beta = 5.285$, $p = 0.004$) which indicates the importance of monetary developments in accounting for the short-term price movement.

Short-term movements of exchange rate also had a significant effect on inflation at 5 per cent level of significance, and had a positive effect ($\beta = 3.22$; $p = 0.009$). The fact that the estimation of the parameter is positive means that exchange rate variations are relatively rapidly passed on to the domestic price level, which reflects the importance of imported goods and production factors for inflation. The results are consistent with the results obtained by Okara and Mutuku (2019) who also obtained that in the short run, exchange-rate changes were statistically significant and had an impact on the inflation. Lastly, there was a statistically significant negative association for GDP with inflation over the short-term period at the 5 percent significance threshold ($\beta = -15.464$, $p = 0.009$), suggesting that increases in economic output may help ease inflationary pressures through an expansion in the availability of goods and services across the economy.

4.6 ARDL Bounds Assessment

The ARDL bounds approach was applied to assess whether a stable long-run equilibrium relationship existed among the study variables incorporated in the specification. The corresponding findings are reported in Table 4.12.

Table 4.12: Results of the ARDL Bounds Assessment

	10%		5%		1%		P value	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F statistic (8.790)	2.447	3.911	3.007	4.71	4.434	6.728	0	0.002
t statistic (-6.280)	-2.461	-3.933	-2.859	-4.43	-3.69	-5.477	0	0.003

Results obtained from the ARDL bounds assessment indicate a long-term equilibrium association between inflation and the explanatory variables, suggesting that these series converge towards equilibrium over time. Consequently, the ARDL error-correction framework was deemed suitable for examining both the long-term association and the short-term adjustments among the variables.

V. SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

In this chapter a summary of the main findings of the empirical results is given and conclusions are drawn from the analysis. It also sets out policy recommendations informed by the evidence obtained from the investigation. The study analyzed public debt and its relationship Kenya with inflation with annual data ranging from 1991 to 2023. Preliminary diagnostic assessments revealed a mix of level-stationary and first-differenced stationary variables, thereby rendering the ARDL framework suitable for estimation. Additional analysis revealed the presence of a stable long-run equilibrium relationship among the variables analyzed. The chapter concludes with policy recommendations and proposals for future study.

5.2 Synopsis of Key Findings

This study set to determining how public debt affects inflation in Kenya both in the short and long run. The main results are summarized below:

The short-term estimates indicated that the components of public debt had a different impact on inflation. Domestic borrowing showed negative and statistically significant relationship with inflation, suggesting that it may have a role to stabilize the inflation in the short term. The positive though not significant relation of the inflation was found in the external borrowing while the fiscal deficit did not show a statistically significant relationship during the time period.

The evidence also indicated that public debt is an important variable in explaining inflation in the long run. Positive and statistically significant effects were observed between domestic debt and inflation, indicating that an

upsurge in domestic debt has positive impact over time on inflation. External debt, in contrast, was negatively and statistically significantly related to inflation, implying that external borrowing could help alleviate the domestic financing pressure and help control the inflation rate over a long period. The empirical results thus suggest the existence of a long-term equilibrium association between public debt and inflation in Kenya.

5.3 Concluding Remarks

The analysis shows evidence of differential inflationary impacts of public debt in the short-run and the long-run. Domestic debt has played a stabilizing role in the near-term inflation in the current context, while external debt has not been found to have a significant impact on prices. This indicates that public borrowing is not the only factor to influence term inflation dynamics.

The long-term results reveal that public debt is an important determinant of inflation in Kenya. The positive impact of domestic debt suggests that excessive borrowing from domestic sources could lead to inflation. On the other hand, the negative relationship between external debt and inflation also implies that external borrowing may help to relieve the tensions on financial conditions within the economy. In general, the results indicate that the effect is heterogeneous between the structure of public debt and the time horizon used, thus emphasizing the importance of debt management to ensure macroeconomic stability and economic growth.

5.4 Policy Implications and Policy Inferences

The results imply that the effects of public debt on the inflation process are different in the short and long term. Public borrowing did not cause significant inflationary pressures in the short run, a fact that suggests that government borrowing to finance spending can help provide services without immediately raising the price level. The results of long-term analysis, however, indicated that domestic debt was also a pressure on prices, suggesting that heavy dependence on domestic borrowing can have a negative impact on price stability.

The results underscore the need for adopting a debt management policy that takes into account the financing requirements and the goals to ensure macroeconomic stability. Although public borrowing is a key source of finance of Development programmes and budgetary needs, too much accumulation of domestic debt could lead to the situation of rising prices in the long term.

The results further imply that debt composition is an important consideration in public debt management. Policymakers should therefore pay proper attention to both the level of public debt and the way in which it is financed, and its potential long-term implications for inflation. Sustainable borrowing and judicious use of borrowed funds are crucial to the economic stability and development in the long term.

In general, the results suggest that sound debt management policies should be included in a wider macroeconomic policy agenda for price stability, sustainable growth and fiscal sustainability.

5.5 Recommendations

Based on the evidence produced in this research, the government will have to strengthen public debt management mechanisms, while maintaining the level of debt within sustainable limits and not inducing inflationary pressure in the medium and long term. Cleaning up the excessive dependence on domestic borrowing was identified as a special attention area because over time, it was correlated with higher inflation.

The government should also channel funds for borrowing into activities that generate economic returns and provide for future repayment obligations. Project selection should focus on projects that can improve productivity, generate new jobs, and increase the productive capacity of the economy.

Moreover, the tendency of public borrowing should be taken into account with careful consideration of the inflationary consequences when formulating public finance policy. This would make it easier to make informed choices on the mix of domestic and external sources of finance.

Last but not least, the coordination of institutions and functions in debt management, budgetary policy and monetary policy needs to be improved to ensure macroeconomic stability. This coordination would help to ensure that the public debt is used to meet the goals of economic development without adversely affecting price stability.

5.6 Research Gaps and Suggestions for Further Research

Research gaps and suggestions for further research: The current study analysed the relationship between public debt and inflation using macroeconomic level public debt in Kenya. This made it impossible, therefore, to determine if there are different types of debt that have different impacts on inflation. Further research could be conducted looking at public debt by domestic and foreign borrowing, and short-term and long-term borrowing to provide more comprehensive knowledge of how they affect price fluctuations.

Annual data from 1991 to 2023 were used in the investigation. While this was suitable for looking at long-run trends, it was possible that annual observations would not adequately reflect short-run fluctuations in inflation and public borrowing. The short-run behaviour of these variables could be explored further using studies based on quarterly or monthly data.

The study also used linear ARDL model which assumes that over time there is stable relationship between the variables of public debt and inflation rate. The link between debt and inflation could actually be different at high levels of debt. Further research can thus be conducted to see if there are certain debt levels that can be reached at which inflationary pressures start to increase with the level of debt.

Further, the future research could include institutional and policy aspects that were not included in the current analysis. Indicators like fiscal discipline, debt administration practices, and effectiveness of monetary policy, might provide a more complete picture of the channels, through which public debt affects inflation in Kenya.

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