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Abstract

This study examined the relationship between public debt and private investment in Kenya, with a focus on the asymmetric effects of public debt. The study used both descriptive and empirical analysis, which was conducted using non-linear autoregressive distributed lag models and annual data covering the period 1967-2022. Three conclusions can be drawn from the descriptive analysis. First, debt spikes and troughs are explainable by a diversity of factors, including policy shifts and support to state-owned enterprises, with fiscal consolidation having a minimal role. Second, foreign-financed targeted and short-term projects, particularly towards the rural areas and low-income groups, have had a high success rate. Third, among comparator countries, Kenya ranks low in public investment efficiency scores, particularly in project selection and appraisal. The empirical results show evidence of asymmetric response of private investment to public debt with heterogeneity across various components of public debt. Specifically, the results show that rising public debt, external debt, and debt servicing are detrimental to private investment in the long run. The results also showed that the impact of an increase in debt on private investment is higher than the impact of a debt reduction, suggesting that an increase in debt may not be reversed by a similar reduction in debt. The results further show that declining domestic debt significantly decreases private investment, contradicting the crowding-out theory. The study makes five recommendations. First, the use of external debt should be strategic and targeted at sectors that bolster the private sector while minimizing reliance on commercial loans. Second, there is a need for further analysis to identify and focus policy on sectors that benefit from the complementary effects of domestic debt on private investment. Third, policy interventions on public debt should be heterogeneous across different components of debt. Fourth, efficiency gains from public investment would be enhanced by focusing policy priority on project selection and appraisal. Fifth, policymakers concerned with public debt management need to take into account the possible inability to reverse public debt increases with similar amounts of decreases.

Key Words: External Debt, Domestic Debt, Private Investment, Asymmetry

1.0. Introduction

Public debt policy debate, which had been dormant for over two decades, reemerged as a central topic in economic policy discussions following the global financial crisis in 2008-9 and the subsequent eurozone sovereign debt crisis in 2011. Recently, public debt levels in many developing countries reached new heights due to the COVID-19 pandemic, which necessitated substantial fiscal stimulus measures to mitigate the crisis and stimulate aggregate demand. The pandemic exacerbated public debt vulnerabilities, raising concerns about fiscal sustainability amid inadequate revenue mobilization. The concern was compounded by the global financial tightening in response to high inflation. This debate is particularly critical in African nations, where high public debt levels have not been accompanied by significant private investment and sustained economic growth.

In Kenya, public debt increased to 70.8 percent of GDP in June 2023 from 37.2 percent of GDP in June 2007. The public debt was mainly used to finance investment and infrastructure projects but has had minimal impact on private investment and sustainable economic growth (Kiriga et al., 2022). Over the past decade, Kenya's private investment as a percentage of GDP averaged 13 percent, falling short of the government target of 22 percent and lagging the Sub-Saharan Africa (SSA) average of 19 percent (GoK, 2008). Additionally, it underperformed when compared to countries within the same income group, such as Bangladesh, where private investment averaged 17.2 percent of GDP over the past four decades. During a similar timeframe, countries in the upper-middle-income group, which Kenya aims to join by 2030, have experienced significantly higher levels of private investment relative to GDP. For example, Malaysia and Thailand have registered average private investment rates of 20 percent and 20.8 percent, respectively. The persistent low private investment levels in Kenya, despite high public debt accumulation, raise questions about the relationship between public debt and private investment, the efficiency of debt financing of public investment in boosting private investment, and the cost-benefit outcomes of developmental projects funded by public debt.

The debt-investment nexus has been a subject of extensive theoretical debate, with several perspectives emerging from various economic schools of thought. These perspectives include Keynesian, classical, neo-classical, and Ricardian equivalence theories, as well as more recent theories that focus on non-linearity and asymmetric responses of private investment to public debt evolution.

Keynesian theory posits that rising public debt can stimulate productive public spending, complement private investment, and generate positive multiplier effects on the economy. According to this theory, public investment, particularly in infrastructure projects, such as power generation, roads, and education, increases the marginal product of capital and expected return on private investment by reducing the start-up cost facing private sector firms and creating an enabling environment for new private sector entrants (Greene and Villanueva, 1991). In contrast, classical theorists argue that public debt can impede growth through crowding out private investment and non-linear effects (Phelps, 2022; Sandow et al., 2022; Hilton, 2021; Salmon, 2021; Huang et al., 2018; Irina and Iulian, 2015). The classical theorists argue that public debt not only reduces the financial discipline of the budget process but also reduces the private sector's access to credit and hence deters private investment. Similarly, the neoclassicals contend that government borrowing through bond issuances increases wealth and lowers the trajectory of capital stock to the extent that economic agents cut back on consumption and investment in new company issues (Phelps, 2022).

The crowding-out hypothesis suggests that high levels of public debt and associated debt servicing obligations can impede private investments through at least three channels: drain the available investment funds that would otherwise be obtainable for new private sector bankable projects; debt servicing may involve future tax increases and reduce expected return to investment and it could dampen new capital formation since debt servicing create uncertainty to the private sector on debt repayment policies. On the other hand, the Ricardian equivalence theory suggests that the impact of public debt on private investment is neutral, as increases in public debt are matched by increases in future taxes (Barro, 1974; 1989).

Recent studies have explored theories of non-linear/asymmetric effects of public debt in the context of the determination of thresholds as well as the differentiated effects of negative and positive shocks of public debt on private investment, (Abille and Esin, 2023; Abubakar & Mamman, 2021; Lau et al., 2019; Reinhart and Rogoff, 2010).[1] Historical trends and country experience also show that fiscal stimulus and fiscal consolidation have different effects on investment and growth, particularly in countries where the associated public debt levels rapidly fluctuate (Jianhua, 2022; Lau, 2019). Moreover, there is evidence that failure to control for nonlinearity in such variables with asymmetric effects could lead to biased estimates and unreliable inference and forecasts (Shin et al., 2014).

Empirical studies on the debt-investment nexus have generated mixed results, with some corroborating the crowding-out effect (Were, 2001; King'wara, 2014; Lidiema, 2018) and others supporting the notion of non-linear relationships between public debt and private investment (Lau et al., 2019; Abubakar and Mamman, 2021; Penzin et al., 2022). More recent studies focusing on non-linear and asymmetric effects of public debt have found differing results across components of public debt, with some evidence of crowding-in effects at lower debt thresholds and crowding-out effects at higher debt thresholds for emerging economies (Lau et al., 2019; Abubakar and Mamman, 2021; Penzin et al., 2022).[2] These findings underscore the complexity of the relationship between public debt and private investment, and the need for further research to better understand the underlying dynamics.

The empirical literature on the public debt-investment relationship in Kenya has expanded in recent years, with several studies attempting to examine the link between these two variables. However, a common limitation in these studies is the assumption of linear relationships between public debt and private investment, overlooking the potential asymmetric effects of public debt on private investment. Moreover, the Kenyan economy is exposed to fiscal, external, and internal shocks, and the trends of public debt in Kenya have been fluctuating over time with periods of stimulus, financed by public debt, and debt-constrained periods; thus, an assumption of symmetric relationships may be misleading. Testing for asymmetry effects in public debt empirically is therefore critical, as they cannot be ruled out through a trend analysis.

In addition, existing studies tend to analyze the public debt-private investment relationship without specifically examining separately the asymmetric effects of total public debt, domestic debt, external debt, and debt servicing costs on private investment. By not distinguishing between these various components, the literature may miss crucial nuances in the relationship between public debt and private investment

[1] See details of studies on debt thresholds in Yusuf and Mohd, (2023) and Makhoba et al. (2022).
[2] See Table A5 in the Appendix 4 for the summary of empirical evidence on public debt-private investment relationship.

(Machagua, 2022; Mutunga, 2020; Kamundia et al., 2015; King'wara, 2014). Another gap in the literature concerns the micro-level aspects of debt on investment. Studies have yet to thoroughly investigate the impact of public debt-financed mega projects on expected investment outcomes, as outlined in government policy frameworks. This neglects an important aspect of the debt-investment nexus, which could provide valuable insights into the efficiency and effectiveness of public debt allocation.[3]

This paper seeks to fill these gaps by examining the impact of public debt on private investment in Kenya using a holistic approach that combines both a quantitative approach and a micro analysis on the efficiency of public investment. Specifically, we test for the existence of an asymmetric relationship between public debt and private investment, using the different components of debt. This enables us to establish if negative and positive shocks to public debt have uniform impacts on private investment in terms of direction, magnitude, and significance. Failure to account for non-linearities can blur the relationship between public debt and private investment and may lead to a loss of important policy insights. In addition, we integrate into the study, micro-level analysis of the efficiency of public investment based on existing indicators, including an evaluation of debt-financed mega projects. In addressing these objectives, the study uses descriptive analysis as well as quantitative methods based on non-linear autoregressive distributed lag (NARDL) approaches, which permit the testing of asymmetric relationships. Our analysis is based on annual data from 1967 to 2022.

The findings from this study will contribute to the setting of fiscal rules in Kenya, guiding investment decisions, and informing specific policy choices that promote efficient investment for economic growth. Furthermore, mapping of debt against expected outcomes engenders discourse on policy slippages that require correction or a re-strategizing of public debt decisions.

2.0 Stylized facts on dynamics of public debt and public investment efficiency

In this section, we provide the evolution of public debt and analyze the dynamics of public debt and its linkages to private investment. This includes isolating periods of debt spikes and fiscal consolidation, as well as identifying factors that explain debt fluctuations across time. Additionally, mapping of public debt to specific sectors and mega projects is reported, as well as an evaluation of the outcomes of selected publicly funded projects.

2.0.1. *Evolution of public debt in Kenya*

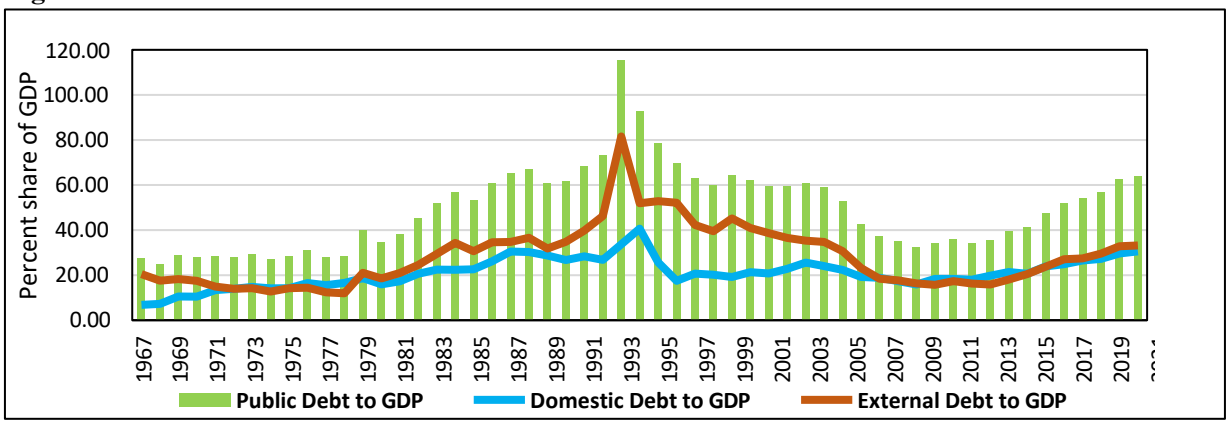
The evolution of public debt over the last four decades has been characterized by phases of spikes and troughs in the stock of debt, which is attributable to various factors, mainly policy changes, political regimes, and exogenous shocks (Fiebelkorn et al., 2021).[4] Public debt in Kenya rose from 27.3 percent of GDP in 1967 to a peak of 115.2 percent of GDP in 1993 (Figure 1). The increase in public debt reflected global and domestic macroeconomic developments during this period. The peak in the 1990's was attributed

[3] The efficiency of public investment affects the productivity of investment in the same manner as structural factors such as good governance (Straub, 2008).

[4] The evolution of fiscal deficits and measures on fiscal consolidation are provided in Appendix 1. Information on outstanding and guaranteed loans for key state corporations are provided in Appendix 2, based on a Fiebelkorn et al. (2021) and Harris (2020).

to the change in Kenya's exchange rate policy from a fixed to a flexible exchange rate, the opening of the capital and financial account as well as the lifting of foreign aid embargo imposed by donors in 1991 due to non-implementation of political and economic reforms, (Ndung'u, 2000; Ndung'u and Ngugi, 1999). In 1997, negative flows in external debt were experienced following another donor aid freeze due to poor economic governance (Brown, 2001).

Figure 1: Public debt as a share of GDP



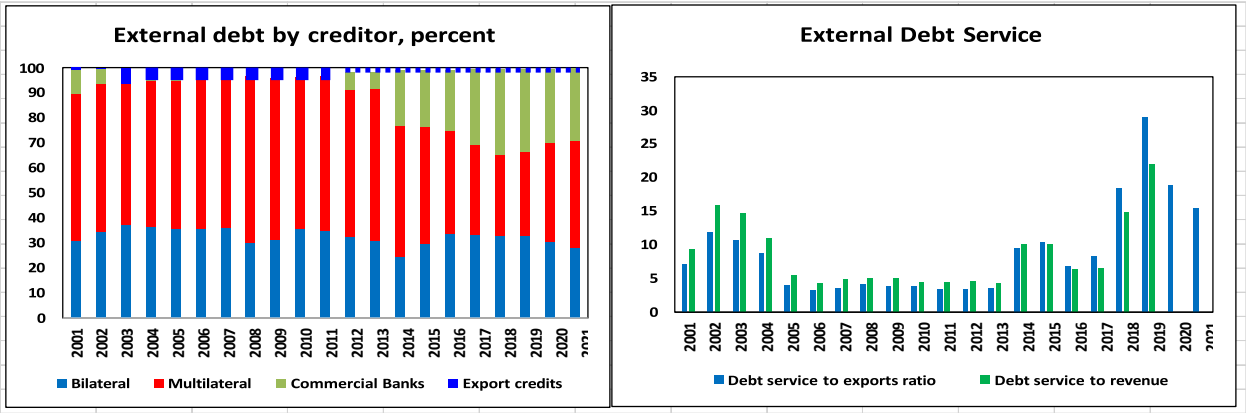
Source: Central Bank of Kenya

The trajectory of public debt as a share of GDP mirrored external debt evolution from 1993 to 2007, with sharp declines in external debt and modest increases in domestic debt. Public debt began to rise in 2009, increasing from 32.2 percent of GDP to 35.7 percent of GDP in 2013, and further to 56.4 percent of GDP in 2019. This continued with public debt reaching 67.3 percent of GDP in 2022, primarily due to the impact of the COVID-19 crisis (Figure 1).

A closer examination of public debt evolution in Kenya reveals that debt patterns over time can be linked to political regimes. Comparing the different political regimes since 2003, each lasting 10 years, reveals that public debt as a share of GDP averaged 52 percent during 2013-2022, compared to an average of 42 percent during 2003-2012. A significant proportion of loans contracted between 2013 and 2022 were from external creditors, notably commercial loans, a shift from the 2003-2012 phase, which largely relied on multilateral and bilateral creditors (Figure 2).

The share of commercial loans, which had remained minimal during 2003-2013, increased rapidly following the issuance of an international sovereign bond in 2014 and other subsequent issues. The sovereign bonds and other private external loans were mainly used to finance specific infrastructure projects, such as the Standard Gauge Railway (SGR) and the Lamu Port. The increase in commercial financing resulted in higher external debt servicing costs in 2019, with the share of external debt service to exports ratio and external debt service to revenues both rising above the IMF recommended sustainability thresholds of 15 percent and 18 percent, respectively (Figure 2). In addition, the implementation of the Constitution of Kenya, 2010, which established 47 new counties and corresponding political offices, amplified the financing and thereby increased borrowing needs.

Figure 2: External debt by creditor and debt service ratio



Source: Central Bank of Kenya

Kenya's domestic debt has also increased over time, and the composition has shifted from short-term treasury bills to longer-dated treasury bonds, with the ratio of treasury bills and treasury bonds as a share of total domestic debt at 25.1 percent and 75 percent, respectively, in 2020. This contrasts with 55.8 percent and 36.3 percent recorded in 2001. The longer-term domestic debt has mainly been used to finance government infrastructure projects. For example, the 30-year debut infrastructure bond in 2009 was specifically issued to finance Thika road construction. More than half of the domestic debt is held by commercial banks, while over 40 percent is held by non-banks, which include institutional investors such as pension funds and insurance companies (Figure A9, Appendix 7). Additionally, domestic debt servicing costs have increased steadily over the last five financial years (Figure A10, Appendix 7).[5]

An examination of government expenditure, in terms of development and recurrent spending, reveals that despite increasing budgetary allocation towards development expenditure from 17 percent in 2006 to 47 percent in 2013, it did not lead to a corresponding rise in private investment (Appendix 1, Figure A2). Consequently, it can be inferred that fiscal consolidation efforts, focusing on shifting the composition of government expenditure from recurrent to development spending, do not guarantee an increase in private investment. Moreover, it is important to highlight that over the past five years, many state corporations responsible for executing these projects have accrued significant arrears. This has led to the government providing guarantees and on-lending, which partially accounts for the surge in public debt (GoK, 2021).

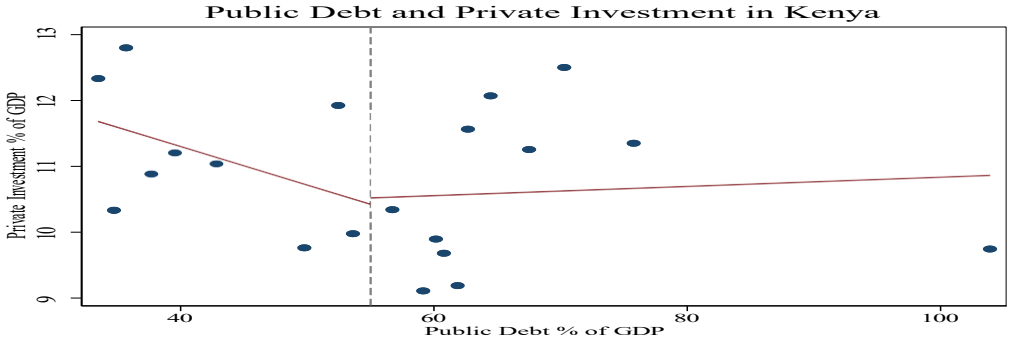
An analysis of the historical trends of public debt and private investment does not present a clear pattern. For instance, private investment relative to GDP was at its highest in 2006 when domestic debt was high. This share declined between 2016 and 2019 at a time when commercial loans reached their peak, most of which were used to finance major infrastructure projects, such as the Thika Superhighway and the SGR, implying the impacts on investment from different types of debt are not uniform. Interestingly, private investment as a share of GDP was relatively high between 2005 and 2012, at a time when external commercial loans were low, compared to the period between 2013 and 2020, during which commercial loans increased. The accumulation of commercial external debt in Kenya has not been matched with an

[5] The rise in debt service is partly explained by the depreciation of the exchange rate especially between 2022 and 2023 (See details in changes in exchange rate between the two periods in Appendix 8).

increase in private investment. Moreover, elevated levels of shorter-dated commercial loans expose the country to maturity mismatches, as these funds are often invested in long-term projects with revenue streams that take time to realize. Consequently, servicing external debt could become challenging, raising concerns about debt sustainability.

As shown in Figure 3, the relationship between public debt and private investment may also be non-linear, as it is negative when public debt to GDP is below 50 percent but becomes flat thereafter.[6]

Figure 3: Public debt and private investment in Kenya



Source: Central Bank of Kenya

2.0.2 Public Investment Efficiency in Kenya

The accumulation of public debt for investment, especially in infrastructure, is expected to lead to a scale-up of private investment in response to improved productivity. However, other factors could impede this outcome, such as bad governance and weak project management, that affect the efficiency of public investment. In this subsection, we provide an analysis of investment efficiency based on computed public investment management efficiency scores from previous work (Dabla-Norris, 2011). The index covers four broad areas of the investment management process, namely strategic guidance and project appraisal, project selection and budgeting, project implementation, and project evaluation and audit.

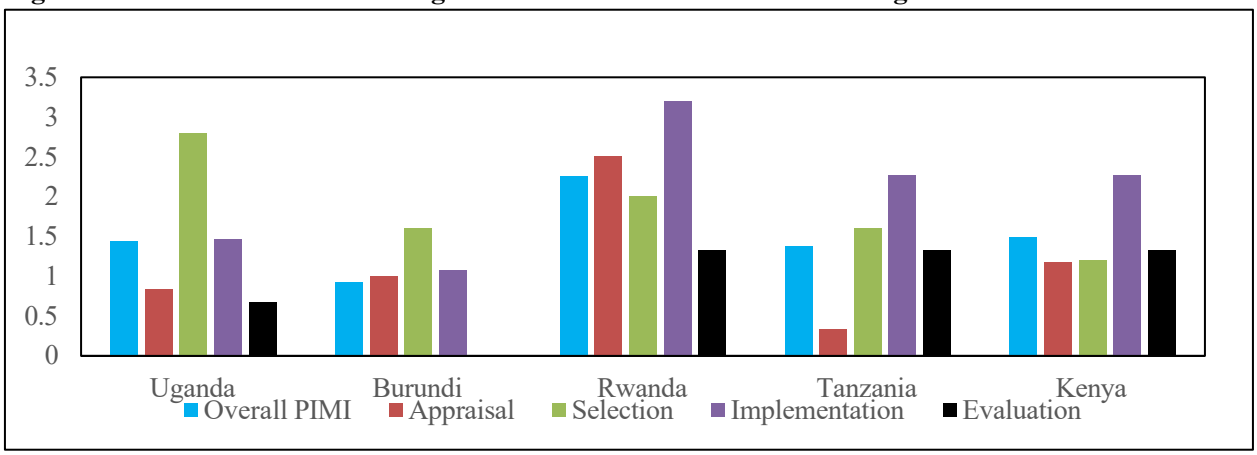
Additionally, we present an impact assessment of World Bank-funded projects, as data limitations restrict the assessment of other donor-financed projects. As shown in Figure A5a in Appendix 3, the Energy, Infrastructure, and ICT sectors receive the largest share of funds disbursed by donors in the form of loans and grants. Recent trends also highlight emerging sectors of interest, such as Environment, Water, and Natural Resources, which have experienced increased donor funding in the last three fiscal years. Analysis based on Table A2-A4 in Appendix 3 shows a high success rate of some of the foreign-financed projects, particularly in the energy sector.[7]

[6] The evidence of non-linearity is also observed in the differences in the relationship between components of debt and private investment as reported in Appendix 7.
[7] See details of assessment of outcomes of selected foreign financed sectoral projects in Appendix 3

2.0.2.1 Analysis of Public Investment Management Index (PIMI) scores

We utilize the PIMI scores developed by Dabla-Norris (2011) and efficiency scores by Gurara et al. (2021) to highlight some of the weaknesses that would be contributing to low private investment in spite of scaled-up public debt in Kenya. Based on Dabla-Norris (2011), Kenya performed poorly, particularly in the selection and appraisal of public projects in the EAC Region. In particular, small countries such as Rwanda performed much better not only in implementation but also in terms of selection and appraisal[8]. Thus, Rwanda, with an overall PIMI of 2.26, also has the highest score in the Region, compared to Kenya with a score of 1.49 (Figure 4).

Figure 4: Public Investment Management Index for the East African Region



Source: Dabla_Norris et al., 2011

Similarly, Kenya performed poorly in selection and appraisal compared to countries that are in the same income category (Lower Middle-Income Countries-LMIC) (Figure 5a). For Instance, Cote d'Ivoire, Lesotho, and Tunisia scored above 2 in appraisal against a score of 1.17 in Kenya. All the scores for Tunisia are above 2.5. The analysis of the investment efficiency overall score corroborates Kenya's poor performance in public investment efficiency, as it is below the average of comparator countries in Africa. Additionally, an analysis based on output efficiency scores by Gurara et al. (2021) shows consistency with the PIMI. Kenya, whose score is 0.46, is ranked as one of the countries in the low-efficiency score countries, while Tunisia, with a score of 0.64 out of a maximum of 0.80, is ranked under the high-efficiency countries category.[9]

[8]According to Dabla-Norris et al. (2011), an efficient outcome of public investment on private investment depends on high scores on all four stages of public investment management performance, with a score of 4 being the highest and 0 being the lowest. For details on the computation and elaboration on the overall PIMI and the components, see Dabla-Norris (2011). Analysis of the countries in our sample covered by Gurara et al. (2021) is available in Appendix 5, Figure A6.

[9] The low efficiency scores for Kenya are further reinforced based on the investment efficiency overall score, which shows that Kenya's scores are below the average of selected countries in Sub-Saharan Africa, as shown in Figure 5b

Figure 5a: Public Investment Management Index for selected African countries

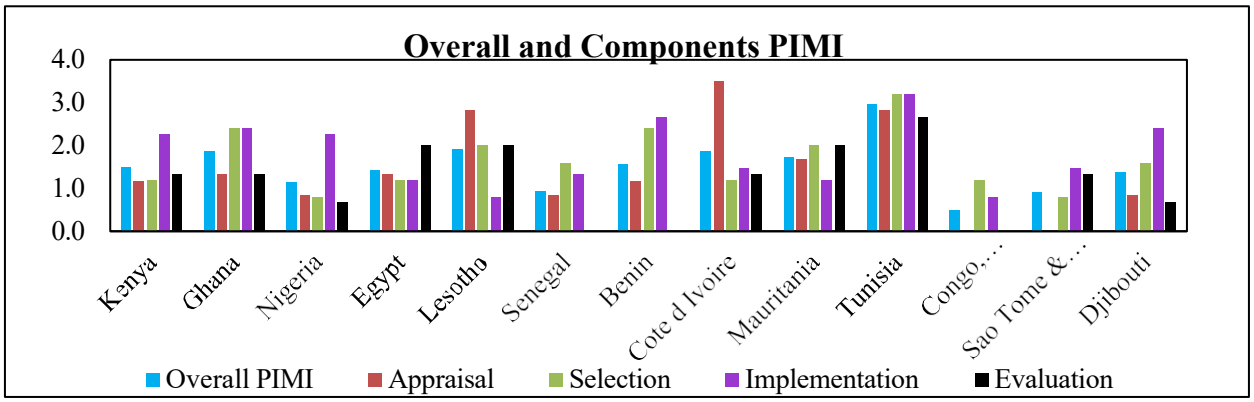
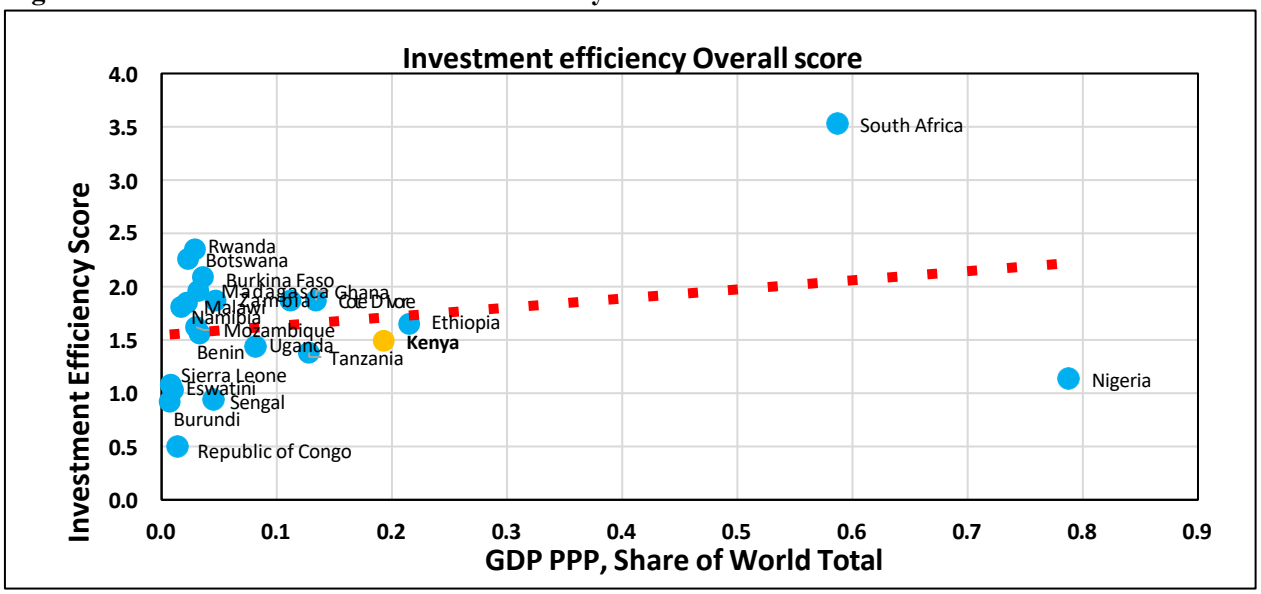


Figure 5b: Overall score of investment efficiency for selected African countries

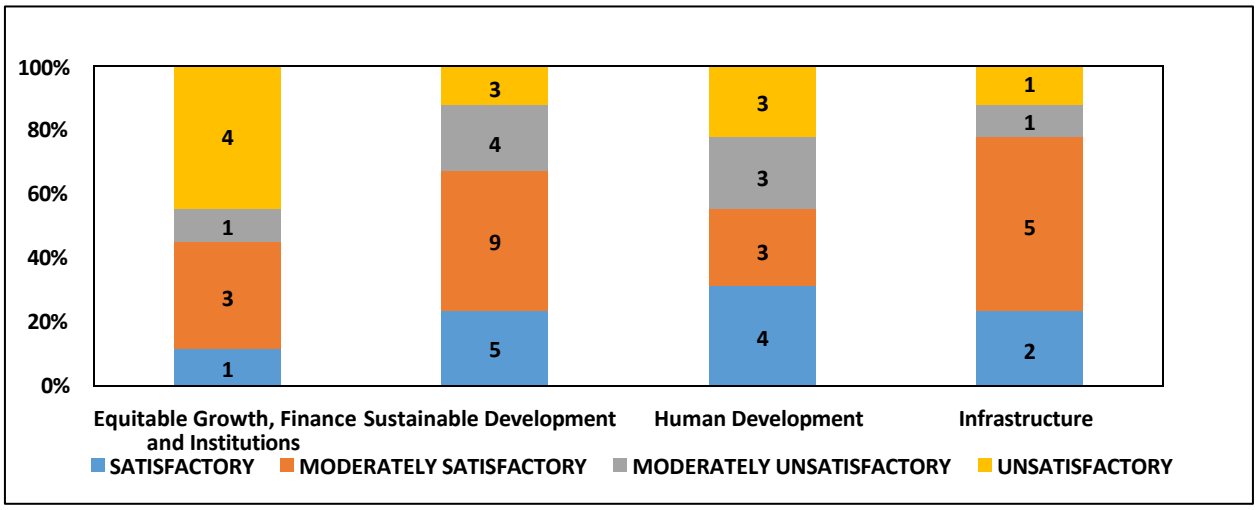


Source: Authors Computation based on Dabla_Norris et al., 2011

2.0.2.1. Outcome of World Bank Funded Projects in Kenya

World Bank-funded projects cut across four main groups, namely, equitable growth, finance and institutions, sustainable development, human development, and infrastructure. A total of 52 World Bank-funded projects were assessed during 2000-2021, with the outcome pointing to mixed performance (Figure 6). There were 21 projects assessed under sustainable development, specifically geared towards the environment, natural resources, and the blue economy, agriculture and food, provision of water, urban resilience, and land. The performance assessment ranked projects under provision for water and urban, resilience, and land as mostly satisfactorily and moderately satisfactorily, while the outcome of agriculture and food projects was ranked as unsatisfactory. Funded projects under human development revealed mixed performance, with social protection and jobs outcomes being satisfactory, health, nutrition, and population ranked as moderately satisfactory, while education outcomes were mostly unsatisfactory.

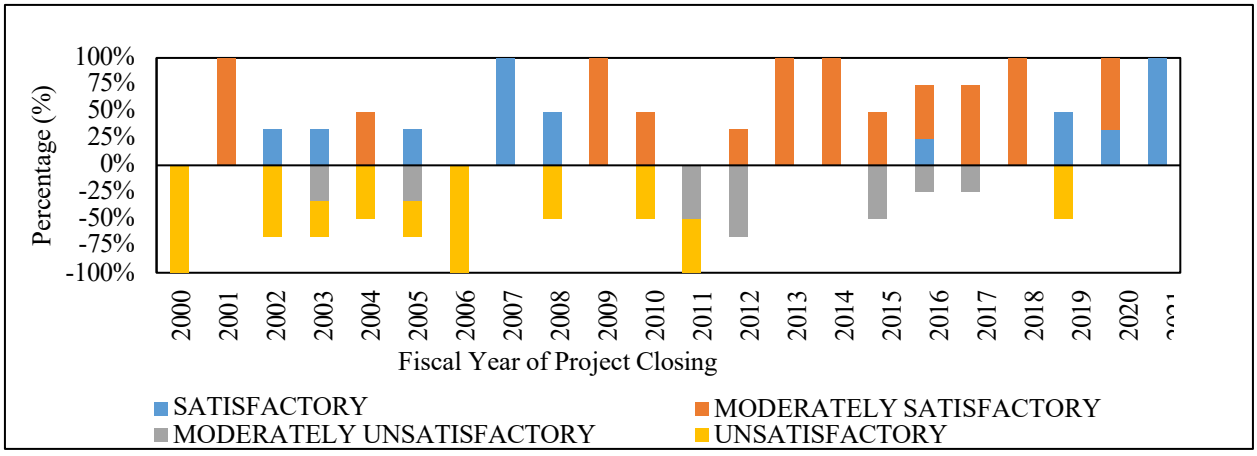
Figure 6: Assessment of World Bank Projects by Project in Kenya



Source: World Bank IEG Database

The overall assessment over time points to a general improvement in the outcome of World Bank projects (Figure 7). The outcome of the earlier projects was mostly unsatisfactory. The projects implemented between 2000-2006 were mostly equity, growth, finance and institutions, with specific projects on governance, finance, competitiveness and innovations all pointing to unsatisfactory outcomes. On the contrary, the World Bank infrastructure projects on transport, energy and extractives implemented between 2002-2005 had satisfactory outcome. The outcome of projects implemented between 2014-2020 were ranked as satisfactory and moderately satisfactory pointing to an improvement in project monitoring and evaluation.

Figure 7: Assessment of World Bank Projects, 2000-2021



Source: World Bank IEG Database

Kenya's performance ranking was consistent with that of Eastern and Southern Africa, which saw improvements in outcomes rating during 2018-2021. The outcome of 28 project ratings for 2021 showed that 50 percent of the projects had satisfactory outcomes, and were mainly related to sustainable development, equitable growth, and human development; 21 percent of the projects under sustainable development were ranked as moderate, and 21 percent under equitable growth and human development

were ranked as moderate to satisfactory. However, the transport project under infrastructure was ranked as moderately unsatisfactory (Figure A5c in Appendix 3).

3.0 Theoretical Framework and Methodology

Consistent with previous studies, the study uses Jorgenson's (1963) neo-classical investment theoretical framework that describes a process of capital stock adjustment to a desired or optimal level (Abubakar and Mamman, 2021; Lau et al., 2019). According to Jorgenson's theory, the capital stock also adjusts to changes in relative factor costs, and investment is affected by these changes in costs. The relative cost of capital is captured in Jorgenson's model by the user cost of capital (Baddeley, 2003). Under the Jorgenson investment model, the capital accumulation of firms could be achieved by maximizing profits at each period. Thus, the profit maximization function of a firm in a period can be presented as follows.

$$MMMMMMMM_{tt} = pp_{tt}Q_{tt} - (ww_{tt}LL_{tt} + rr_{tt}KK_{tt}) \quad (1)$$

Where r is the user cost of capital, π is profit, Q is the output, L and K are labour and capital, respectively, while p and w represent their respective prices. The profits being maximized represent the difference between the revenues of the firm and the cost of inputs. Consistent with previous studies, we assume a simple Cobb-Douglas production function of the form represented in Equation 2 below:

$$QQ_{tt}=AKK^{\alpha\alpha}_{tt}LL^{1-\alpha\alpha}_{tt} \quad (2)$$

From Equation 2, profit maximization under the assumption of perfectly competitive markets leads to Equations 3 and 4 below:

$$\frac{\partial\partial\Pi\Pi_{tt}}{\partial\partial KK_{tt}} = \alpha\frac{\rho\rho_{tt}\ AAKK^{\alpha\alpha}_{tt}\ LL^{1-\alpha\alpha}_{tt}}{KK_{tt}} - rr_{tt}= 0 \quad (3)$$

$$\alpha\alpha\frac{\rho\rho_{tt}AAKK^{\alpha\alpha}_{tt}LL^{1-\alpha\alpha}_{tt}}{KK_{tt}} = rr_{tt}\ MMaaaa\ MMaaaaaaaaaaaaaa\ YY\ aaaa\ aannaaaaaaMMnn\ nnaattppaatt = \rho\rho_{tt}\ AAKK^{\alpha\alpha}_{tt}LL^{1-\alpha\alpha}_{tt},$$

$$\text{Then, } r = \alpha\alpha\frac{YY_{tt}}{KK_{tt}} \quad (4)$$

Based on Equation 4, optimal capital stock is derived as represented in Equation 5 below

$$KK^{*}_{tt} = \alpha\alpha\frac{YY_{tt}}{rr_{tt}} \quad (5)$$

According to Kohli and Ryan (1985), Lau et al (2019), and Ang (2010), gross investment is the sum of net investment and replacement investment as shown in Equation 6 below:

$$II_{tt} = \sum_{ii=0}^{mm}\beta\beta_{ii}\Delta\left(\frac{YY_{tt-ii}}{rr_{tt-ii}}\right) + \alpha KK_{tt-1} \quad (6)$$

Net investment is then assumed to be the sum of the distributed lag on the past changes in the desired capital stock,

$$\sum_{ii=0}^{nn}\beta\beta_{ii}\Delta KK^{*}_{tt-1} = \sum_{ii=0}^{mm}\beta\beta_{ii}\Delta\left(\frac{YY_{tt-ii}}{rr_{tt-ii}}\right) \quad (7)$$

While replacement investment is the capital stock lagged one period KK_{tt-1} depreciating at a constant rate d.

Consistent with previous work, we assume that firms can only finance their investment from banks and that the available intermediated capital stock is a fraction (§) of savings lent out by banks to both private sector firms and the government, as depicted in Equation 8 below.

$$\S_{jj,tt}\, SS_{jj,tt} = kk_{jj,tt} + \emptyset_{jj,tt}\, GG_{tt} \quad (8)$$

Where kk_{jj} is the total quantity of resources loaned by bank j for investment and SS_{jj} is current savings deposited in bank j, G_t is the government budget financed by public debt, and $\emptyset_{jj,tt}\, GG_{tt}$ is a fraction of the public debt held by bank j and $KK_{tt} = \sum_{j}^{mm} kk_{jj,tt}$.

Therefore, the available capital stock to the private sector can be expressed as follows:

$$KK_{tt} = \sum_{jj=1}^{mm} \left(\S_{jj,tt}\, SS_{jj,tt} - \emptyset_{jj,tt}\, GG_{tt} \right) \quad (9)$$

Total public debt by banks can be expressed as $DDDDDDtt = \sum_{jj=1}^{mm} \emptyset_{jj,tt}\, GG_{tt}$ from Equation (9), which represents the capital stock available to the private sector and can also be written as:

$$KK_{tt} = \sum_{jj=1}^{mm} \left(\S_{jj,tt}\, SS_{jj,tt} - DDDDDDtt \right) \quad (10)$$

Equation (10) shows that public debt is a determinant of the available capital stock to the private sector. A linear representation of investment expressed as a function of output, user cost of capital, a fraction of savings, and public debt is derived based on the relationships expressed in Equations 4 to 10 and drawing from Lau et al. (2019) as represented in Equation 11 below.

$$II_{tt} = ff(YY_{tt,}\, rr_{tt}, \S_{tt}\, SS_{tt}, DDDDDDtt_{tt}) \quad (11)$$

3.3.1. Empirical Model

Equation 11 depicts a linear empirical relationship between public debt and private investment. However, an analysis of historical trends in Kenya reveals that the link between public debt and private investment is inconclusive, and a non-linear relationship cannot be ruled out. The evolution of debt in Kenya has not been uniform over time; historical trends, experiences, and policy commitments could have led to varying effects on private investment during periods of fiscal stimulus and fiscal consolidation. These distinct fiscal periods could have also resulted in differences in the cost of debt for both the private and public sectors across time, given imperfect markets and information in emerging markets, raising the question of whether private investment responses to public debt increases and decreases have been consistent over time.

It is therefore crucial to quantitatively distinguish the reactions of private investment to negative and positive changes in public debt. Hence, a non-linear autoregressive distributed lag model (NARDL) is employed to account for the possibility of asymmetric responses of private investment to fluctuations in public debt (Debt in Equation 11). The NARDL approach is selected because it permits identification of the presence of a nonlinear relationship between independent variables and the dependent variable and allows for testing cointegration in a single equation framework. In addition, unlike the ARDL, it enables

testing and detection of the positive and negative influences of the independent variables on the dependent variable in the long run and short run. The distributed lag variable exhibits asymmetric effects where positive changes have a different impact on the dependent variable than their negative counterparts. For instance, a positive shock in public debt may have a larger absolute effect in the short run, while a negative shock has a larger absolute effect in the long run and vice versa. It also includes an error correction process or a mechanism that considers asymmetries in long-run co-integration (Abbasi et al., 2022; Allen and McAleer, 2021; Khan et al., 2019; Shin et al., 2014). NARDL also performs better in determining cointegration relations in small samples, and most importantly, it can be applied irrespective of whether the regressors are stationary at the level or at the first difference (MEO, 2019; Khan et al., 2019; and Rocher, 2017). The NARDL approach also facilitates the detection of hidden cointegration. Hidden cointegration occurs when no cointegration is detected using conventional techniques, but it is found between positive and negative components of the series (Rocher, 2017; Granger and Yoon, 2002).

Based on Equation 11 and similar previous work, our long-run empirical model is specified as follows:

$$PPrraaPPII_{tt} = \alpha\alpha_0 + \alpha\alpha_1 DDDDDDtt_{tt} + \sum_{jj=2}^{nn} \alpha\alpha_{jj} XX_{jj,tt} + \varepsilon\varepsilon_{tt} \quad (12)$$

Where $PPrraaPPII_{tt}$ representing private investment is the indicator for I_t used in this study, $DDDDDDtt_{tt}$ represents the four measures (Total public debt, total external debt, total domestic debt, and debt service as a ratio of exports) of debt used in this study. XX_{tt} represents all the other variables considered in this study, mainly, credit to the private sector, interest rate, inflation, GDP, trade openness indicator, and public investment, while $\alpha\alpha_{jj}$ represents long-run parameters and $\varepsilon\varepsilon_{tt}$ is the error term. Control variables are included to capture characteristics akin to African countries consistent with previous studies (Nguyen, 2022; Misati et al., 2011; Muyambiri, 2010; Bazoumana, 2005; Mlambo and Oshikoya, 2001; Greene and Villanueva, 1991).
To account for possible asymmetric effects, Equation 12 is reformulated as depicted in Equation (13).

$$PPrraaPPII_{tt} = \alpha\alpha_0 + \underset{1}{\alpha\alpha^{+}} \underset{tt}{DDDDDDtt^{+}} + \underset{1}{\alpha\alpha^{-}} \underset{tt}{DDDDDDtt^{-}} + \sum_{jj=2}^{nn} \alpha\alpha_{jj} XX_{jj,tt} + \varepsilon\varepsilon_{tt} \quad (13)$$

According to Shin et al. (2014), who developed the NARDL model, from Equation (13) $DDDDDDtt^{+}$ represents the partial sum of positive changes in debt while $DDDDDDtt^{-}$ represents the partial sum of negative changes in debt in $DDDDDDtt_{tt}$ depicted in Equations 14 and 15, respectively.

$$\underset{tt}{DDDDDDtt^{+}} = \sum_{ii=1}^{tt} \underset{ii}{\Delta DDDDDDtt^{+}} = \sum_{ii=1}^{tt} \text{Max}\left(\Delta DDDDDDtt_{jj}, 0\right) \quad (14)$$

$$\underset{tt}{DDDDDDtt^{-}} = \sum_{ii=1}^{tt} \underset{ii}{\Delta DDDDDDtt^{-}} = \sum_{ii=1}^{tt} \text{Min}\left(\Delta DDDDDDtt_{jj}, 0\right) \quad (15)$$

From Equation (13), the long-run linkages between private investment and increases in public debt are captured by $\alpha\alpha^{+}$ while the relationship between private investment and decreases in public debt is represented by $\alpha\alpha^{-}$. The assumption is that negative and positive changes in public debt do not have the same effects in terms of magnitude and direction on private investment. Asymmetry arises from the fact that private investment responds differently to positive and negative changes in public debt in terms of magnitude.

Drawing from Equation (13) and under the assumption of cointegration, a combination of both the long run and short run representation is then specified in Equation (16) below.

$$\Delta\Delta PPrraaPPII_{tt} = \alpha\alpha_0 + \tau\tau_1 PPrraaPPII_{tt-1} + \alpha\alpha_1^{+} DDDDDDtt_{tt}^{+} + \alpha\alpha_1^{-} DDDDDDtt_{tt}^{-} + \sum_{jj=2}^{mm} \alpha\alpha_{jj} XX_{jj,tt} + \sum_{ii=0}^{tt} \partial\partial_{1,ii}^{+} \Delta DDDDDDtt_{tt-ii}^{+} + \partial\partial_{1,ii}^{-} \Delta DDDDDDtt_{tt-ii}^{-} + \sum_{jj=2}^{mm} \sum_{ii=0}^{tt} \partial\partial_{jj,ii} \Delta XX_{jj,tt-ii} + \varepsilon\varepsilon_{tt} \quad (16)$$

Where the n and t are the lag orders, while the long run coefficients are computed as follows: $\frac{-\alpha\alpha_1^{+}}{\tau\tau_1}$ and $\frac{-\alpha\alpha_1^{-}}{\tau\tau_1}$, which measure the long-run impacts of increases in public debt and decreases in public debt on private investment, respectively. The short-run coefficients, i.e., $\partial\partial_{ii}^{+}$ and $\partial\partial_{ii}^{-}$ measure the short-run effects of public debt increase and reduction on private investment, respectively. Thus, the null hypothesis for the long run asymmetry is tested by $\propto_1^{+} = \propto_1^{-}$ while the null hypothesis of the short run asymmetry was tested as follows, $\sum_{ii=0}^{tt} \partial\partial_{1,ii}^{+} = \sum_{ii=0}^{tt} \partial\partial_{1,ii}^{-}$.

3.3.2. Data sources

This study uses annual data covering the period 1967-2022. The description of variables, measurement, and sources is explained in Table 3.1 below.

Table 3.1. Variable definition, Measurement, and data sources

Variable Name	Definition	Measurement	Data Source
Credit to the private sector	Credit extended by depository corporations to the private sector	Credit to the private sector as a percent of GDP	Central Bank of Kenya
Public debt stock	Comprises domestic debt and external debt measured on a Gross basis	Public debt stock to GDP	Central Bank of Kenya
Domestic debt stock	Consists of government securities and government-guaranteed loans and advances from commercial banks.	Domestic debt stock to GDP	Central Bank of Kenya
External debt stock	Consists of public and publicly guaranteed external obligations of the general government, including the central government, central bank, and autonomous public bodies, and external obligations of private debtors that are guaranteed for repayment by a public entity	External debt stock to GDP	Central Bank of Kenya
Total External Debt Service	sum of principal and interest repayments paid to non-residents on obligations of public debtors and private obligations guaranteed by a public entity.	External debt service to exports	Central Bank of Kenya
Real GDP	Growth rate of gross domestic product at constant prices	Growth rate in Percent	World Development Indicators

Private investment	gross outlays by the private sector on additions to its fixed domestic assets	Gross fixed capital formation, private sector (% of GDP)	African Development Indicators IMF Staff report on Kenya
Public investment	stocks of fixed assets by government units and non-financial public enterprises.	Gross public investment (% of GDP)	African Development Indicators IMF Staff report on Kenya
Trade openness	Imports of goods and services Exports of goods and services	Sum of exports and imports as a share of GPD	World Development Indicators

4.0 Empirical results

In this section, we present unit root and cointegration test results in Tables 4.1 and 4.2, respectively. We then estimate four Equations using different measures of debt, that is, public debt, external debt, domestic debt, expressed as a share of GDP, and debt service as a share of exports. The other independent variables in the Equations include real GDP, public investment as a share of GDP, credit to the private sector as a share of GDP, trade openness indicator, lending interest rate, and inflation. Private investment as a share of GDP is our dependent variable in each of the Equations. The estimations are done using the NARDL approach.

Table 4.1 Unit Root Test Results

Variables	At levels		At First Difference		Order of integration
	t-stat.	P-value	t-stat.	P-value	I(d)
Augmented Dickey-Fuller (ADF)					
Credit to the private sector	-3.23	0.09	-8.03	0.0	I(1)
Public debt	-1.73	0.72	-7.15	0.0	I(1)
Domestic debt	-2.37	0.38	-7.00	0.0	I(1)
External debt	-2.01	0.58	-9.29	0.0	I(1)
Total debt service	-1.87	0.64	-6.51	0.0	I(1)
RGDP	-6.12	0.0	-	-	I(0)
Private investment	-4.16	0.0	-	-	I(0)
Public investment	-1.82	0.67	-6.76	0.0	I(1)
Phillips-Perron (PP)					
Credit to the private sector	-3.31	0.07	-8.03	0.0	I(1)
Public debt	-1.77	0.70	-7.15	0.0	I(1)
Domestic debt	-2.37	0.38	-6.52	0.0	I(1)
External debt	-1.92	0.63	-9.32	0.0	I(1)
Total debt service	-1.87	0.64	-6.49	0.0	I(1)
RGDP	-6.13	0.0	-	-	I(0)
Private investment	-3.77	0.02	-	-	I(0)
Public investment	-1.90	0.63	-6.75	0.0	I(1)

The unit root tests based on ADF and PP procedures show that all the variables are I (1) except RGDP and private investment, which are I(0). There is no variable that is I(2), thus permitting the use of the NARDL model. Results for cointegration based on bounds Wald Tests, F-statistics, and diagnostic tests are provided in Table 4.2. As shown in Table 4.2, a higher F-statistic is reported for the lower and upper bound critical values at 1 percent and 5 percent, for all the debt measures, indicating cointegration of all the variables considered in this study.

The diagnostic tests also show that the model errors are not autocorrelated, nor heteroscedastic, and are normal. Tests on structural breaks found one break in 1997 for the data on total public debt, likely attributed to a donor aid freeze to Kenya due to poor economic governance. The data on external debt, domestic debt, and debt service had no structural breaks. Inclusion of a dummy variable in the model to capture the break in the public debt data did not yield significantly different results from those without. Furthermore, the dummy variable was not significant.

Table 4.2: Bound Tests and Diagnostic Tests

	Public debt	External debt	Domestic debt	Debt service
Bound test				
F_Statistic	7.59***	3.81**	4.95***	7.51***
Diagnostic Test				
χ2 SC	3.59	0.03	3.91	3.23
χ2 HET	13.23	15.6	7.10	23.8
χ2 NOR	1.29	0.87	1.59	3.43

Notes: *, **, and *** denote significance at 10%, 5%, and 1% respectively. F_{test} indicates F_{test} for cointegration, and the critical values are obtained from Narayan (2005).[10] Case II for k = 6, n = 50: 1% (3.424, 4.880), 5% (2.550, 3.708), and 10% (2.170, 3.220). χ2 SC, χ2 HET, χ2 NOR

The results using different measures of debt are reported in Table 4.3. The debt measures used in Models 1, 3, 4, and 5 are public debt, external debt, domestic debt, and debt service, expressed as a share of GDP, respectively. In Model 2, the public investment variable is excluded from the list of explanatory variables. The long-run coefficients from the estimations are reported in Panel A, while the short-run coefficients are presented in Panel B of Table 4.3. The results for testing the presence of a non-linear relationship between private investment and debt, both in the long and short run, are reported in Panels C and D.[11]

Table 4.3: NARDL Estimation Results

	Public debt (Model 1)	Public Debt without public investment (Model 2	External debt (Model 3	Domestic debt (Model 4)	Debt service (Model 5)
Panel A: Long run Results					
$Priv_{t-1}$	-0.92(-6.67)***	-0.50(-4.37)***	-0.67(-4.91)***	-0.73(-5.19)***	-1.03(-6.40)***
$DDDDDD_{tt-1}^{+}$	-0.24(-2.08)**	0.12(1.49)	-0.05(-1.14)**	-0.20(-0.75)	-0.11(-1.84)*
$DDDDDD_{tt-1}^{-}$	-0.03(-0.49)	0.02(0.26)	-0.10(-2.26)**	0.24(1.99)**	0.04(0.83)

[10] For details on bound tests for large samples, see Pesaran et al. (2001) and Pesaran and Shin (1995).

[11] We also re-estimated all the models in Table 4.3 but excluded the GDP indicator in each of the models. We noted that the results do not alter our general conclusions of the results reported in Table 4.3. Nevertheless, we have provided the results without GDP in Appendix 6. We further conducted diagnostic tests including variable redundancy tests, which show that GDP growth is an important variable in explaining private investment. We also used GDP per capita as an alternative indicator to GDP growth and the results are not significantly different from what is reported in Appendix 6

GDP	1.93(3.50)***	0.03(1.65)*	0.90(1.32)		0.72(2.42)**
GDP_{t-1}				-0.11(-1.00)	
Pubinv			-0.30(-3.52)***		-0.30(-4.56)***
$Pubinv_{t-1}$	-0.64(-4.47)***			-0.31(-2.96)***	
Cred			0.49(1.82)		
$Cred_{t-1}$	0.94(2.94)***	0.25(2.40)**		0.22(1.65)*	-0.01(-1.26)
Inter		-0.04(-0.56)	0.01(1.40)		
$Inter_{t-1}$	0.009(1.33)			-0.08(-1.11)	
$Inter_{t-2}$					-0.009(-2.81)***
Infl		-0.003(-0.93)			-0.003(-1.67)*
$Infl_{t-1}$			0.005(1.29)	-0.003(-0.88)	
$Infl_{t-2}$	0.002(0.62)				
Trade		0.008(2.78)***			
$Trade_{t-1}$			0.004(0.86)	0.003(0.70)	
$Trade_{t-2}$	0.67(2.41)**				0.09(0.56)
Panel B: Short run Results					
$\Delta Priv_{t-1}$		0.21(1.71)*	0.226(1.94)*		0.35(2.74)***
ΔGDP	0.31(0.47)**			1.32(2.32)**	
ΔGDP_{t-1}					
ΔPubinv				-0.38(-2.46)***	
$\Delta Pubinv_{t-1}$	-0.37(-2.85)***				
ΔCred	0.73(3.27)***			0.88(2.94)***	0.01(1.232)
ΔInter	0.01(1.63)		0.002(0.39)	0.06(0.29)	
ΔInfl		0.001(0.27	0.001(0.19)	-0.004(-1.21)	
$\Delta Infl_{t-1}$	-8.97E-05(-0.02)				
ΔTrade[12]			0.001(0.19)	0.005(1.44)	
$\Delta Trade_{t-1}$	0.33(1.73)*				
$\Delta Debt^{+}$	-0.46(-1.67)*	-0.52(-2.14)**	-0.32(-2.02)**	-0.53(-1.76)*	0.15(1.71)*
$\Delta Debt^{-}$	0.73(1.76)*	0.34(0.76)	0.67(2.09)**	0.52(1.88)*	-0.06(-0.60)
$\Delta DDDDDD_{tt-1}^{tt+}$			0.21(1.16)		
$\Delta DDDDDD_{tt-1}^{tt-}$			-0.29(-1.38)		
$\Delta DDDDDD_{tt-2}^{tt+}$			-0.09(-0.54)		
$\Delta DDDDDD_{tt-2}^{tt-}$			0.60(2.51)***		
Panel C: Long run Asymmetries					
$DDDDDD_{tt-1}^{tt+}$	-0.26	0.240	-0.074	-0.273	-0.106
$DDDDDD_{tt-1}^{tt-}$	-0.03	0.040	-0.149	0.328	0.038
$Wald_{LR}$	4.64**	4.722**	3.721**	2.070	2.600*
Panel D: Short run Asymmetries					
$Wald_{SR}$	3.68**	2.111	4.824**	5.304**	1.665

$Wald_{LR}$ and $Wald_{SR}$ indicate the Wald F test for long-run asymmetry and short-run asymmetry, respectively. *, **, and *** denote significance at 10%, 5%, and 1% respectively.

The results show that private investment responds to changes in different components of debt, both in the short and long run in a non-linear manner. Positive ($DDDDDD_{tt-1}^{tt+}$) shocks to public debt and debt service in past periods, have negative causal effects on private investment whereas both positive and negative shocks ($DDDDDD_{tt-1}^{tt-}$) to external debt have positive and negative causal effects on private investment. These results are consistent with arguments on the need to consider customized interventions with regard to debt management. Moreover, the differences between the coefficients associated with the positive and negative

[12] According to the neoclassical analysis of welfare gains through exploitation of comparative advantage, a reduction in trade barriers increases trade and the level of productivity and capital formation. Thus, trade openness is expected to have a positive effect on private investment since it increases the rate of technological progress through expansion of market for outputs and inputs besides giving domestic producers access to a wider variety of capital goods, effectively enlarging the base of productive knowledge and capital formation, (Onifade et al., 2022; Misati et al., 2015). Inclusion of a variable to capture trade openness (Sum of exports and imports divided by GDP) improved the model specification. The coefficient of the trade openness indicator has the expected positive sign in all models but it is statistically significant only when total public debt is used as the debt indicator.

changes are statistically significant as depicted by the Wald F-test ($Wald_{LR}$) statistic (Panel C), except for Model 4 in which the domestic debt component is used. Hence, there is an asymmetric relationship between private investment and public debt, external debt, and debt service in the long run.

The long-run coefficients of debt presented in Panel A show that positive changes in public debt, external debt, and debt service are associated with a reduction in private investment. A one percentage point increase in public debt, external debt, and debt service is associated with a 0.26, 0.07, and 0.11 percentage point reduction in private investment, respectively. These results imply that increases in public debt, external debt, and debt servicing have an adverse impact on private investment in the long run, consistent with previous work (Abubakar and Mamman, 2021; Mabula and Mutasa, 2019; Lau et al., 2013). This is corroborated by the trend analysis on public debt, which shows an erratic pattern, as well as the bin-scatter plots that depict a negative relationship between private investment at lower levels of public debt, with a blurred or no relationship when public debt increases. Although not statistically significant, the long-run coefficient of debt is associated with a positive change ($DDDDDD_{tt-1}^{+}$). Model 4 indicates that a one percentage point increase in domestic debt is associated with a 0.27 percentage point increase in private investment.

The long-run coefficients associated with negative changes in debt ($DDDDDD_{tt-1}^{-}$) in Panel A shows that a one percentage point decrease in public debt is associated with an increase in private investment of 0.03 percentage points, which is lower than the impact of an increase in public debt on private investment at 0.26 percentage points. This implies that an increase in public debt reduces private investment by a larger amount while a decrease in public debt increases private investment by a smaller amount, raising concerns about the irreversibility of public debt increases. One would then conclude that an increase in public debt is not reversed by similar reductions in public debt. On the other hand, the results show that a one percentage point decrease in external debt is associated with an increase in private investment of 0.15 percentage points, which is higher than the impact of an increase in external debt on private investment at 0.07 percentage points. In this case, a small decrease in external debt has a higher positive impact on private investment. This finding would imply a possibility of Ponzi schemes where policy makers can increase external debt by higher amounts compared to decreases, particularly in the absence of enforceable fiscal rules. However, validation of such inferences requires further analysis in future research.

Contrastingly, a one percentage point decrease in domestic debt leads to a 0.33 percentage point reduction in private investment. This result lends some credence to the crowding in hypothesis and corroborates the observed historical trend that showed higher private investment levels during periods of relatively higher domestic debt. Public sector investment in infrastructure, particularly institutional reforms introduced from 2003 in the electricity and road sectors, may have contributed to some of the gains in investment observed in the results.[13] The results of the coefficient for domestic debt in Panels A and C on the long run analysis are reinforced by the short run findings reported in Panel B, where a one percentage decrease in total domestic debt leads to a decrease in private investment of 0.52 percentage points. The results are statistically significant.

[13] Details of performance of Kenya's infrastructure from 2001-2009 is available in Briceno-Garmendia and Shkaratan (2011). During this period and subsequent periods, successful public-private sector partnerships increased, the proportion of long-term date to total domestic debt also increased, issue of infrastructure bonds commenced and major road projects such as the Thika Superhighway were completed.

The short-run coefficients for the positive changes in debt ($DDDDDDtt_1^+$) in Panel B shows that increases in all components of debt are associated with a reduction in private investment in the short run. Specifically, a one percentage point increase in public debt, external debt, and domestic debt lowers private investment by 0.46, 0.32, and 0.53 percentage points, respectively. However, a one percentage point increase in debt service increases private investment by 0.15 percentage points in the short run. Negative changes in external debt have a statistically significant impact on private investment with strong lagged effects. A one percentage point decrease in external debt leads to a decrease of 0.67 and 0.60 percentage points in private investment, respectively, in the current and previous period. These results imply that external debt is beneficial to private investment in the short run. The asymmetric relationship between private investment and public debt, external and domestic debt in the short run is statistically significant as shown in Panel D.

Overall, the results show a stronger effect of external debt on private investment both in the short run and the long run, with an enhancing effect in the short run but a retarding effect in the long run. This implies that external debt is complementary to private investment in the short run. Foreign-financed projects are found to have a high success rate, as depicted by the descriptive analysis. The positive effects in the short term reflect the impact of immediate spending of the borrowed funds, while the relatively negative long-term effects corroborate the earlier analysis, which shows inefficiencies in public investment in Kenya. The long-run results lean more towards the classical theory. In Model 2, we re-estimated the first model, excluding the public investment variable to rule out the possibility of existence of a relationship between the two variables. The results in Models 1 and 2 show minor differences for some of the coefficients. We conducted further coefficient diagnostic tests to establish whether public investment is a redundant variable in Model 1. Our findings show that public investment is an important variable.

6.0. Conclusions and Policy Implications

Over the last three decades, Kenya has experienced a significant increase in public debt, yet this has not correspondingly boosted private investment. A shift in the domestic debt structure towards longer-term loans, primarily held by commercial banks, has raised concerns about potential crowding-out effects on the private sector. Additionally, the shift in external debt from concessional to commercial loans since the inaugural Eurobond issue in 2014 has further complicated the debt landscape. This study challenges the traditional assumption of homogenous private investment responses to changes in public debt, drawing on evidence from emerging and frontier economies that suggests possible asymmetric responses.

Our analysis of Kenya's historical debt trends reveals considerable fluctuations, with distinct periods of fiscal stimulus and consolidation, which likely influenced private investment differently. The country's exposure to various fiscal, external, and internal shocks over time suggests that private investment responses to changes in public debt might be non-uniform. This study aimed to empirically test for these potential asymmetries using a comprehensive approach encompassing both descriptive and empirical analyses.

The descriptive approach highlighted several key findings, that is, debt spikes and troughs were influenced by various factors, including policy shifts, political regimes, and donor embargoes, with minimal influence from fiscal consolidation. In addition, foreign-financed and targeted short-term projects exhibited high success rates. However, Kenya's public investment efficiency, particularly in project selection and appraisal, ranked low compared to similar countries.

The empirical analysis using non-linear autoregressive distributed lag models, covering the period 1967-2022, revealed nuanced and heterogeneous effects of public debt on private investment. Specifically, the study found that in the long run, external debt, public debt, and debt servicing are detrimental to private investment, particularly when these components are on the rise. Surprisingly, positive changes in domestic debt did not significantly affect private investment. In contrast, negative changes in domestic debt led to a decrease in private investment, contradicting the crowding-out theory.

In the short run, the results indicated a significant positive relationship between private investment and negative changes in external debt. This suggests that external debt is crucial for private investment but only in the short term, with decreases in external debt having a more detrimental effect on private investment than positive changes. The findings also showed that increases in public debt components generally have a more significant effect than decreases, except for domestic debt in the long run. Interestingly, in the short run, negative changes in external debt not only showed significance but also had larger effects on private investment compared to positive changes in the long run.

These empirical findings have several important policy implications. First, the divergent response of private investment to different debt components underscores the need for a more nuanced approach to public debt management. A generalized approach could be counterproductive. In addition, while debt accumulation is associated with a reduction in private investment, the impact on private investment of these increases in debt is not matched by similar decreases in debt. Debt management policies should be tailored to take into account this potential irreversibility. Second, the use of external debt should be strategic as it appears beneficial to private investment in the short term but detrimental in the long run. The deployment of external debt should therefore be targeted at sectors that bolster the private sector while minimizing reliance on commercial loans.

Third, the study shows that reductions in domestic debt adversely affect private investment. An in-depth analysis of domestic debt-financed expenditure is necessary for a deeper understanding of the components that could potentially crowd in private investment. Finally, enhancing the efficiency of public investment, prioritizing project selection, and appraisal could lead to better public investment outcomes, thereby potentially enhancing private investment. This study contributes to unravelling the complex relationship between public debt and private investment in Kenya. It highlights the need for policymakers to consider the nuanced effects of different debt components and their dynamic interactions with private investment. Such insights are vital for formulating fiscal policies that support sustainable economic growth.

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Appendix 1: Fiscal deficit and Fiscal consolidation measures in Kenya

Kenya's fiscal deficit has continued to widen over the years averaging 6.4 percent of GDP during 2013-2022 compared to a deficit of 3.0 percent of GDP during 2003-2012. The widening fiscal deficit is partly attributed to the increase in government expenditure which grew by 4.4 percentage points to 22.3 percent of GDP during 2013-2022 and the relatively lower revenues base averaging 15.9 percent of GDP over the same period (Figure A1). The share of recurrent expenditure to the national budget is more than 65 per cent, while county government transfers account 13.8 percent, implying that development expenditure allocation is less than 30 per cent of the total national budget. This is contrary to the Public Finance Management Act 2012 which stipulates that a minimum allocation of 30 per cent of the national budget should be for development expenditure (GoK, 2012). The persistent fiscal deficit has resulted in the continued rise in Kenya's public debt and debt servicing needs.

The Kenyan government has undertaken fiscal consolidation measures over the years aimed at reducing public debt to sustainable level and creating adequate fiscal space for development projects (GoK,, 2014; 2019). In the 2000's fiscal consolidation efforts focused on strengthening the budgeting processes by streamlining allocations towards infrastructure projects as opposed to recurrent expenditures. This resulted in a gradual increase in allocations for development expenditure from 11 percent in 2000 to 47 percent in 2013 and a decline in recurrent expenditures, with allocations for wages and salaries declining from 38 percent to 29 percent over the same period (Figure A2). During this time private investment also increased Annual GDP Growth rate also improved, reaching a peak of 8.1 percent in 2010 from 0.6 percent in 2000.

In 2013, the government initiated the devolved system of government, which saw the creation of 47 country governments besides the national government. The fiscal decentralization resulted in additional recurrent spending to the county government, mainly for setting up of administrative structures, country wage bill and other operational costs. These programs led to a decline in development spending to about 24 percent of total budgetary allocations and an increase in county allocations of about 14 percent. The revenue streams on the other hand remained relatively lower averaging 16 percent of GDP during 2013-2022 and this constrained the development of infrastructure projects.

This prompted the government to pursue revenue based fiscal consolidation measures to stabilize public debt (GoK, 2019;2022). Specifically, the government focus was on reducing the government fiscal deficit from a high of 8.7 percent of GDP during the fiscal year 2016/2017 to 3.1 percent of GDP during FY 2022/2023 and stabilize the growing public debt to sustainable level (GoK, 2019). The fiscal consolidation measures included a complete overhaul of the Income Tax Act, strengthening tax administration, expanding the tax base, while restricting the growth in recurrent spending and strengthening development expenditure. During the FY 2018/19, the government implemented several tax policy measures through the tax amendment law and the Finance Act 2018. These measures yielded a lower fiscal deficit of 6.7 percent of GDP in line with the 6.3 percent target for FY 2018/2019. However, the fiscal consolidation measures were short-lived, as government expenditure continued growing driven mainly by the recurrent expenditures, while the growth in revenues slowed down (Figure A3).

The outbreak of the Corona Virus Disease (COVID) 2019 also meant that the government had to put on-hold the fiscal consolidation measures, increase the government borrowing and widen the fiscal deficit to accommodate the recurrent health related expenditures and cash transfer programs. The fiscal consolidation path was upscaled by 2.5 percent of GDP to a deficit of 5.6 percent of GDP in FY 2022/23 (Figure A4). In April 2021, the IMF approved the multi-year fiscal consolidation programme for Kenya, anchored in the Extended Fund Facility (EFF)/ Extended Credit Facility (ECF) centered on raising tax revenues by broadening the tax net and reducing tax exemptions (including in VAT); and restraining recurrent expenditure through a gradual reduction in the wage bill and transfers to public sector entities; and improving the efficiency and effectiveness of government spending (IMF 2021).

Figure A1: Fiscal Deficit, Government Expenditures and Revenues in percent of GDP

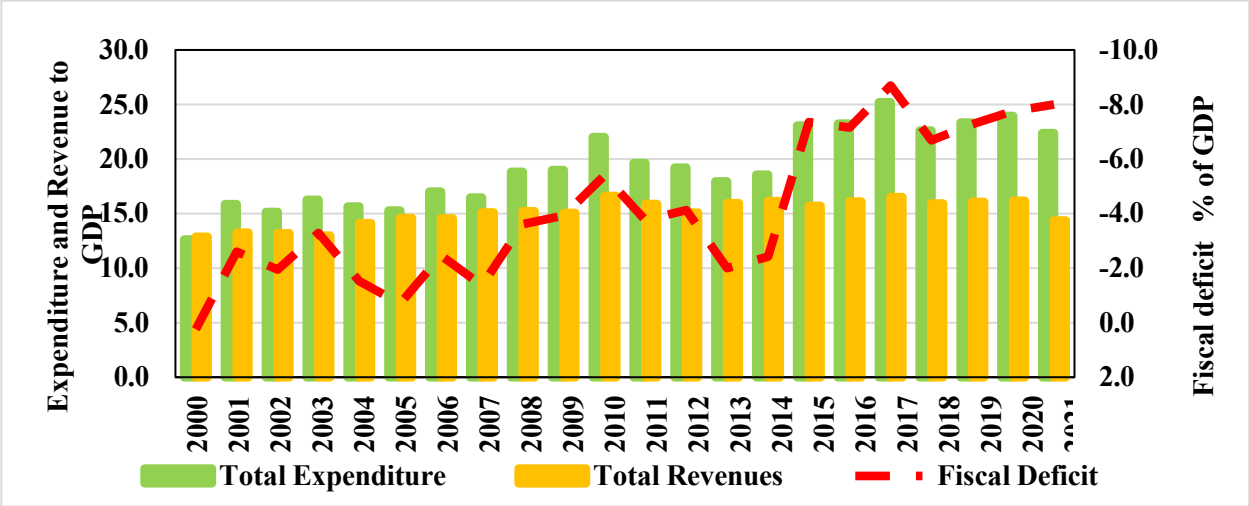
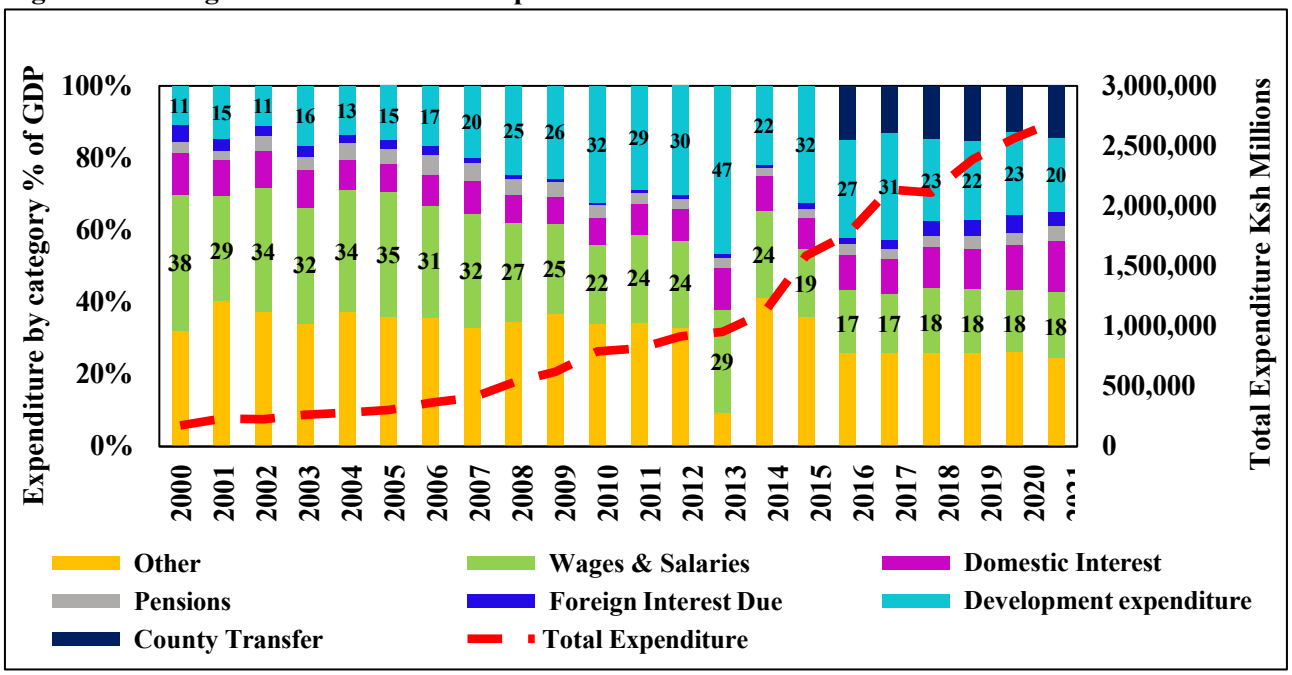


Figure A2: Categories of Government Expenditures



Source: Central Bank of Kenya, Statistical Bulletin

Figure A3: Categories of Government Revenues

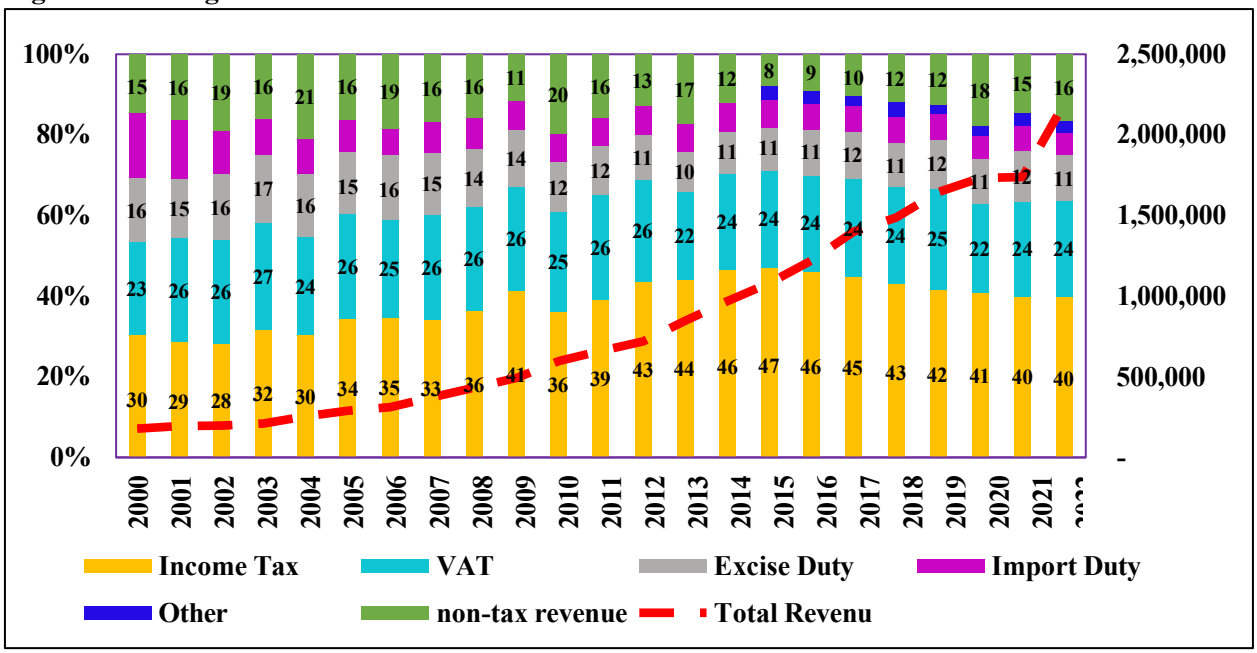
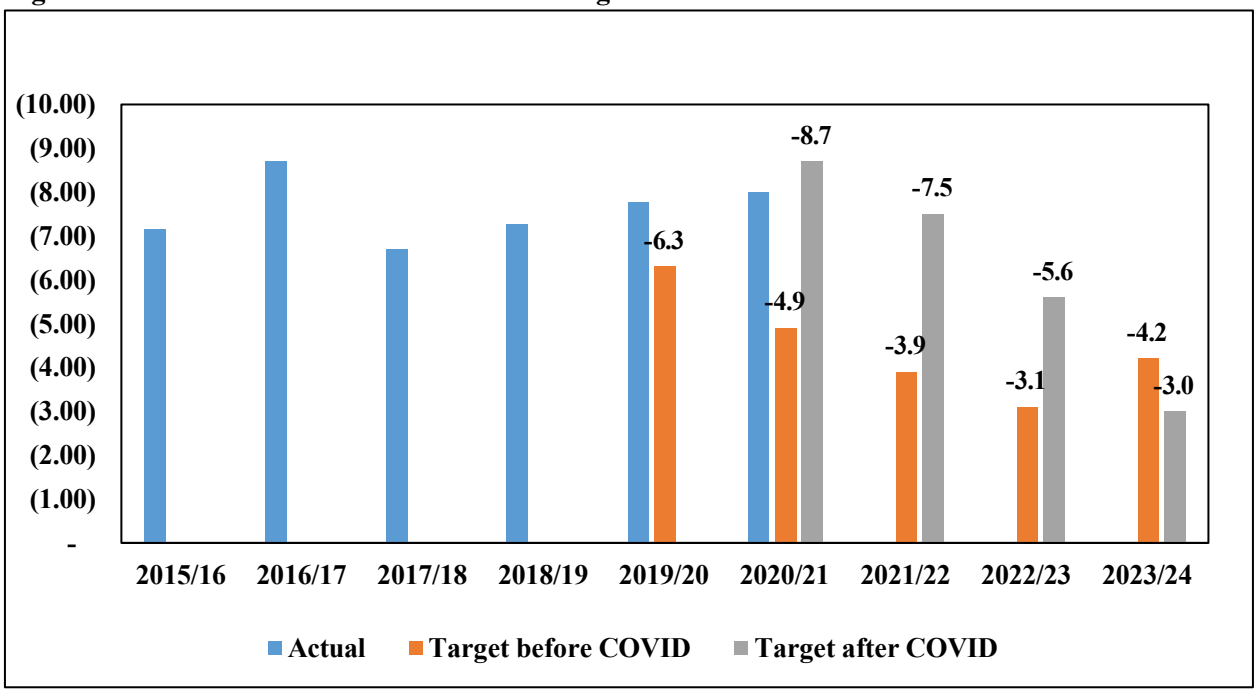


Figure A4: Fiscal Deficit and Consolidation Targets



Source: GoK, Budget Strategy Paper, 2022

Appendix 2: Roles of SOEs in public investment and debt accumulation

In Kenya, public corporations have benefited from government support in the form of on-lent and guaranteed loans based on Harris, (2020) and Fiebelkorn et al., (2021), with a number of the loans in arrears. Total government lending (direct and on-lent) amounted to 8.9 percent of GDP, debt guarantees to 1.5 percent of GDP, and non-guaranteed loans to 1.6 percent of GDP in FY2019/20. As per the Fiebelkorn et al., (2021), total outstanding government loans to state corporations, including both direct and on-lent loans constituted 8.86 percent of GDP in FY2019/20. As shown in Table A1 below and according to the National Treasury Press Statement, (2021), the sectors with highest government outstanding loans are in the transport (Kenya Railway Corporation for the Standard Gauge Railway) and the energy sector.

Table A1: Government of Kenya State Corporation Debtors, FY2019/20

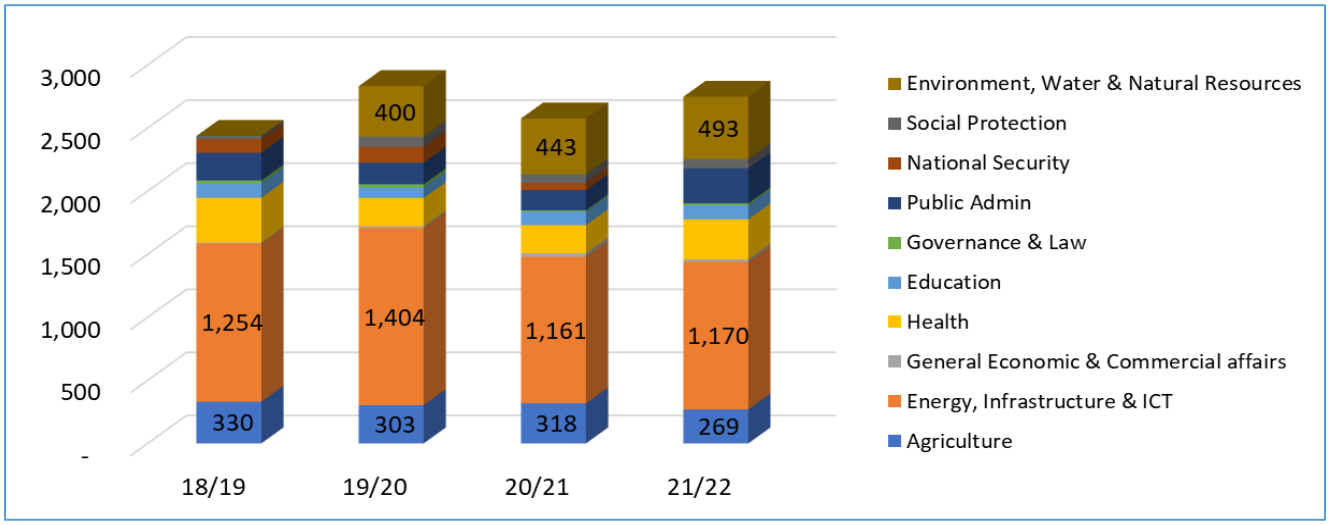
	State Corporations	Total Outstanding GoK loans	Guaranteed Debt	Net Income	Net Worth	Debt Asset Ratio (%)	Current ratio	Cost Recovery	Sector
1	KRC	539,270		- 24,178	634	99.9	0.27	5.52	Transport
2	KenGen	87,904	41,186	10,543	213,277	48.5	1.77	1.98	Energy
3	KBC	76,034		- 9,790	2	100	1.64	0.52	Communication
4	KPLC	49,238		- 2,983	52,683	84	0.35	2.99	Energy
5	Nzoia Sugar Compan	42,380		- 3,483	- 45,035	469	0.03	1.02	Agriculture
6	KPA	37,386	39,374	8,178	187,623	36	1.18	1.37	Transport

Notes: KRC= Kenya Railway Corporation, KBC- Kenya Broadcasting Corporation, KPLC-Kenya Power and Lighting Company, KPA= Kenya Ports Authority. Numbers in columns 2-5 are in KShs. Millions.

Appendix 3: Outcomes of debt financed projects in Kenya

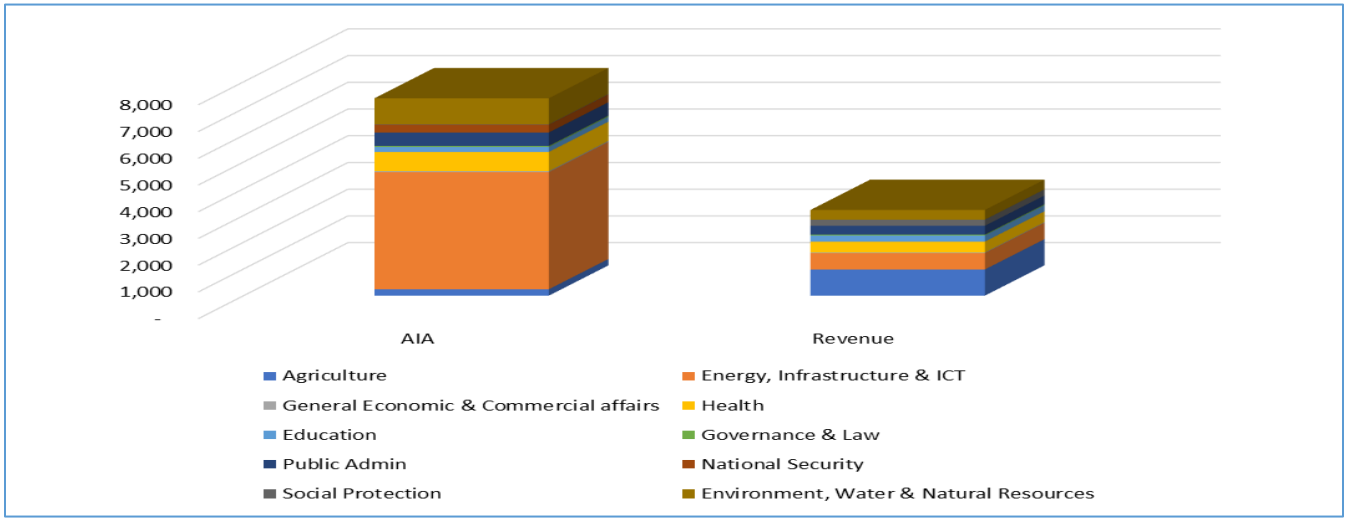
Figure A5a shows external estimates of funding under the Medium-Term Expenditure Framework (MTEF). Disbursements from external donors take the form of appropriations in aid with a much smaller component flowing in as revenue (Figure A5b). Revenue disbursements are in the form of cash and play a role of boosting the country's foreign exchange reserves.

Figure A5a: Sectoral external funding by Medium Term Expenditure Framework



Source: External Estimates

Figure A5b: Type of Disbursement by Sector (US $ Millions)



The main projects implemented during the period of analysis are in the infrastructure and energy sectors including: the Last Mile Connectivity Project (LMCP), Olkaria Geothermal project and the second phase of the Standard Gauge Railway (SGR). The main objective of the LMCP, which cost US$ 450 million, was to scale access to electricity to over 70 percent of the population in rural and peri-urban areas. The government provided a subsidy for grid extension thus enabling customers get electricity supply at an

affordable cost. The project was jointly funded by the Government of Kenya and development partners including the International Development Association, World Bank, the African Development Bank, the French Development Agency, the European Investment Bank, and the European Union (Kenya Power Annual Report, 2022) and has been under implementation since 2015 in three phases across all the 47 counties. A fourth phase of the project is jointly funded by the French Development Agency (AFD), European Union and European Investment Bank at a budget of US$ 220 million.

Table A2: Project performance indicators

Key Performance Indicators	Planned Targets			Achieved Targets		
	2018/19	2019/20	2020/21	2018/19	2019/20	2020/21
No. of annual New Customers Connected	800,000	800,000	500,000	440,822	500,397	714,510
No. of new Transformers installed	300	273	273	263	163	135
No. of public institutions connected to electricity	250	587	600	223	281	160

Source: MTEF Sector Report

Analysis based on Table A2 shows that more than half of the planned targets for nearly all the key performance indicators of the LMCP were achieved. For instance, a total of 741,510 customers were connected to the grid under the project hence increasing electricity access to over 70 percent of the population by 2020/21. In the rural areas access to electricity increased from 25 percent of the rural population in 2014 just before the launch of the LMCP in 2015 to 62.6 percent in 2020/21 fiscal year. Availability of supporting infrastructure has been cited as the main reason for the underperformance in transformer installation and connectivity to public institutions.

Table A3: Project performance indicators

Key output	Key Performance Indicators	Planned Targets			Achieved Targets		
		2018/19	2019/20	2020/21	2018/19	2019/20	2020/21
Power generation capacity	MW of electric power generated from 165.4 MW of Olkaria V	82.7	82.7	-	82.7	82.7	-
	% completion of 83.3MW Olkaria 1 Unit 6 Power Plant	45	62	90	45	62	87

Source: MTEF Sector Report

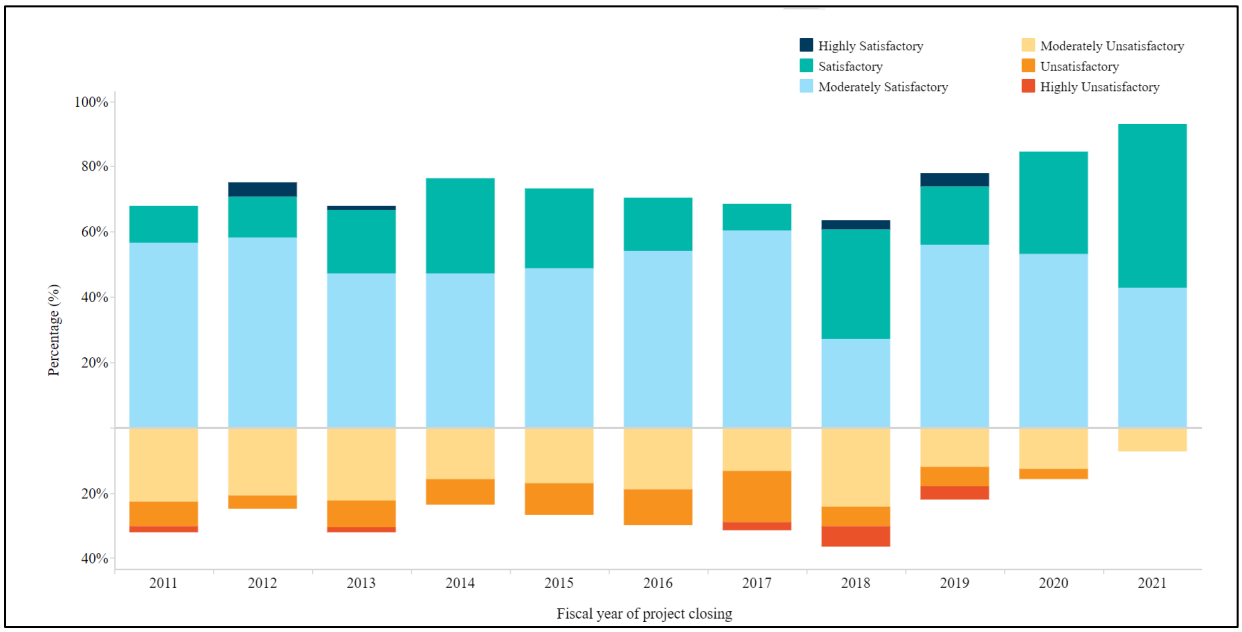
In terms of electricity generation, the Third Medium Term Plan (MTP III) of 2018 to 2022 envisaged additional 913MW from geothermal power projects. This sector received external funding with the aim of increasing electricity generation through investments in cheaper renewable energy sources. Unit 1 and Unit 2 of the Olkaria V power station started interim commercial operations at the end of 2019 bringing on board 82.7 MW. The 83.3MW Olkaria I Unit 6 was commissioned in 2022 (Table A3).

The SGR project was co-financed by the Government of Kenya (GOK) 10 percent and Export Import (EXIM) Bank of China 90 percent. The GOK counterpart funding is drawn from the Railway Development Fund (RDF) sourced through 1.5 percent levy on all imports effective 5th July 2013. The SGR was designed to enhance the rail transport and was expected to move up to 22 million tonnes of cargo per year at a speed of 80 to 100km per hour for the cargo trains.

Table A4: SGR Performance indicators and achieved targets

Key output	Key Performance Indicators	Planned Targets			Achieved Targets		
		2016/17	2017/18	2018/19	2016/17	2017/18	2018/19
Standard Gauge Railway Line	Km of standard gauge railway constructed in Phase 2A (Nairobi to Naivasha)	-	44	33	-	74	46
	Million tonnes of freight transported	-	1.5	1.5	-	2	4.6

Figure A5c: Assessment of World Bank funded projects in Eastern and Southern Africa



Source: World Bank IEG Database

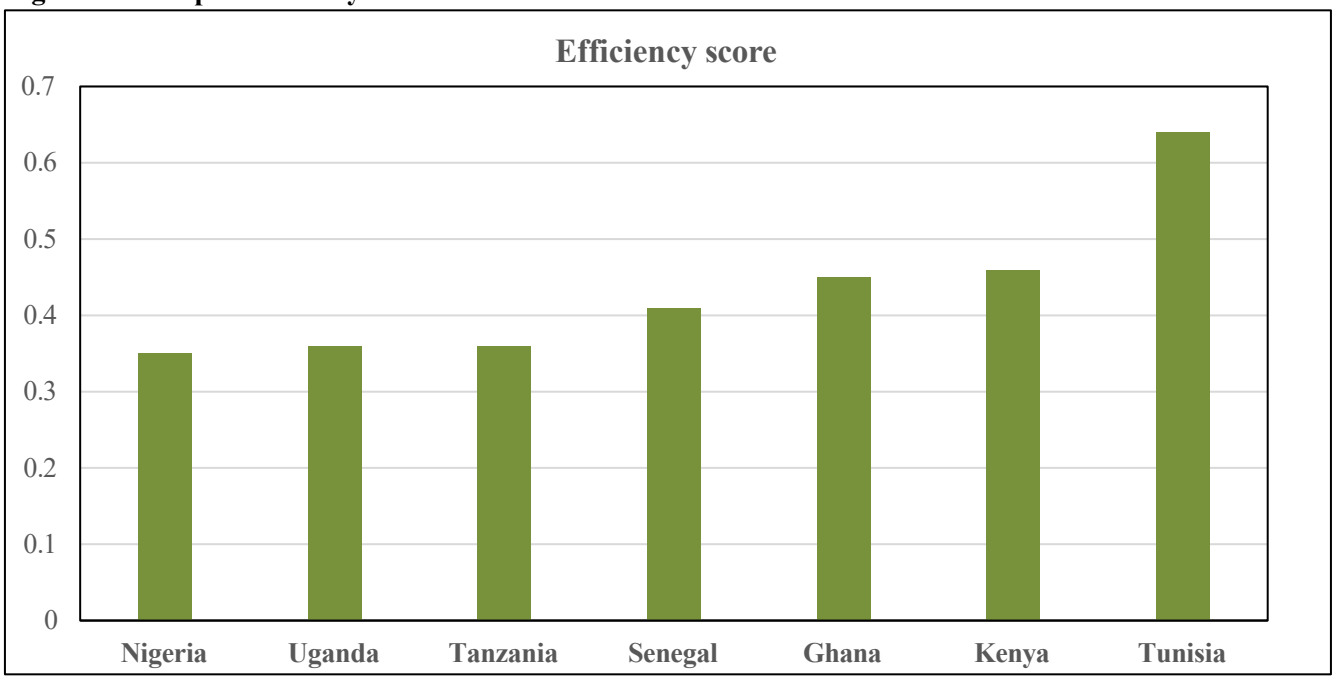
Appendix 4: Empirical evidence of the impact of debt in private investment

Table A5: Summary of empirical evidence on public debt-private investment relationship

Year	Author	Country	Data	Method	Findings
2022	Penzin et al	Emerging and advanced economies	1990-2020	Panel Threshold regression	Establishes a non-linear relationship and finds evidence of crowding in of private investment up certain thresholds
2021	Zhou	South Africa		Fully Modified Ordinary Least Squares approach	External debt crowds in private investment
2021	Abubakar and Mamman	Nigeria	1981-2018	ARDL and NARDL	Only domestic debt has asymmetric effects on private investment while total debt, external debt, debt service has negative and symmetric effects.
2020	Mutunga	Kenya	1980-2019	ARDL	Domestic debt negatively affects private investment in the short run while external debt crowds out private investment in the long run and debt service negatively affects private investment both in the short run and in the long run
2019	Mabula and Mutasa	Tanzania	1970-2016	ARDL	Public debt has a negative effect on private investment
2019	Lau et al	Malaysia	1980-2016	Non-Linear autoregressive distributed lags estimation (NARDL)	Evidence of asymmetric effect in public debt-private investment nexus in both the short and long run
2018	Lidiema	Kenya	1975-2014	ARDL	Negative effect of domestic debt on private investment
2014	King'wara	Kenya	1967-2007	OLS	Negative effect of domestic debt on private investment
2013	Kamundia et al.,	Kenya	1980-2013	OLS Granger causality	-Unidirectional effect from public debt to private investment Negative effect of public debt on private investment

Appendix 5: Efficiency score

Figure A6: Output efficiency score



Source: Gurara et al., (2021)

Appendix 6: NARDL Estimation Results without GDP

	Public debt (Model 1)	Public Debt without public investment (Model 2	External debt (Model 3	Domestic debt (Model 4)	Debt service (Model 5)
Panel A: Long run Results					
$Priv_{t-1}$	-0.62(-4.46)***	-0.52(-4.47)***	-0.88(-5.75)***	-0.79(-4.86)***	-0.92(-6.04)***
$DDDDDDtt^{+}_{t-1}$	-0.33(-2.22)**	0.08(1.47)	-0.31(-2.19)**	0.04(0.11)	-0.10(-1.77)*
$DDDDDDtt^{-}_{t-1}$	0.27(1.40)	-0.02-0.32)	0.11(0.77)	0.37(2.29)**	0.09(1.43)
Pubinv					-0.34(-4.77)***
$Pubinv_{t-1}$	-0.04(-3.10)***		-0.34(-3.41)***	-0.22(-1.91)*	
Cred			0.22(1.21)		
$Cred_{t-1}$	0.05(0.23)	0.25(2.60)***			1.23(3.51)***
$Cred_{t-2}$				-0.04(-0.31)	
Inter	0.33(1.18)				
$Inter_{t-1}$		0.24(1.38)	0.13(1.53)	-0.07(-0.58)	
$Inter_{t-2}$					-0.01(-3.23)***
Infl	-0.009(-1.80)*	-0.007(-1.90)*			-0.004(-2.05)**
$Infl_{t-1}$			0.002(1.50)	-0.008(-1.65)*	
$Infl_{t-2}$					
Trade		0.007(3.12)***	-0.0002(-0.06)		-0.004(-1.20)
$Trade_{t-1}$				0.01(2.41)**	
$Trade_{t-2}$	0.002(0.52)				
Panel B: Short run Results					
$\Delta Priv_{t-1}$		0.26(2.05)**	0.46(3.54)***		0.38(2.85)***
ΔPubinv	-0.04(-1.80)*		-0.22(-2.12)**	-0.08(-0.56)	
$\Delta Pubinv_{t-1}$			0.19(1.67)*		
ΔCred	0.63(2.14)**				0.73(2.99)***
$\Delta Cred_{t-1}$				0.58(1.86)*	
ΔInter				-0.07(-0.33)	
$\Delta Inter_{t-1}$	0.08(0.41)				
ΔInfl				-0.006(-1.58)	
$\Delta Infl_{t-1}$	-0.004(-1.39)	-0.001(-0.61)			
ΔTrade				0.006(1.66)*	0.007(2.01)**
$\Delta Trade_{t-1}$					
$\Delta Debt^{+}$	-0.64(-2.02)**	-0.55(-2.23)**	-0.41(-2.32)**	-0.40(-1.12)	0.15(1.93)*
$\Delta Debt^{-}$	0.59(1.23)	0.13(0.29)	0.35(1.45)	0.82(2.23)**	0.01(0.13)
$\Delta DDDDDDtt^{+}_{t-1}$			0.23(1.33)		
$\Delta DDDDDDtt^{-}_{t-1}$			-0.43(-1.69)*		
$\Delta DDDDDDtt^{+}_{t-2}$			-0.05(-0.35)		
$\Delta DDDDDDtt^{-}_{t-2}$			0.47(2.05)**		
Panel C: Long run Asymmetries					
$DDDDDDtt^{+}_{t-1}$	-0.532	0.153	-0.352	0.050	-0.108
$DDDDDDtt^{-}_{t-1}$	0.435	-0.038	0.125	0.468	0.097
$Wald_{LR}$	3.693**	4.740***	2.745*	0.501	3.603**
Panel D: Short run Asymmetries					
$Wald_{SR}$	2.984*	1.335	1.612	3.852**	0.876

$Wald_{LR}$ and $Wald_{SR}$ indicate Wald F test for long run asymmetry and short run asymmetry respectively. *, **, and *** denote significance at 10%, 5%, and 1% respectively.

Appendix 7: Additional Charts on public debt and private investment

Figure A7: Positive relationship between domestic debt and private investment

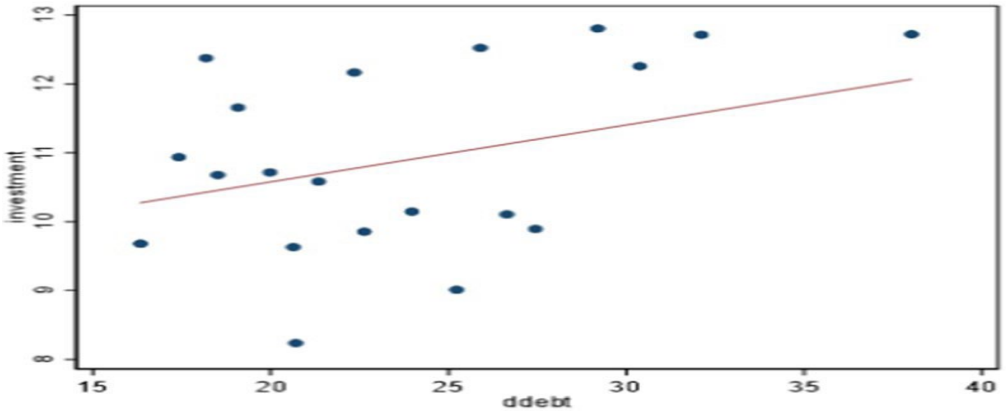


Figure A8: Negative relationship between external debt and private investment

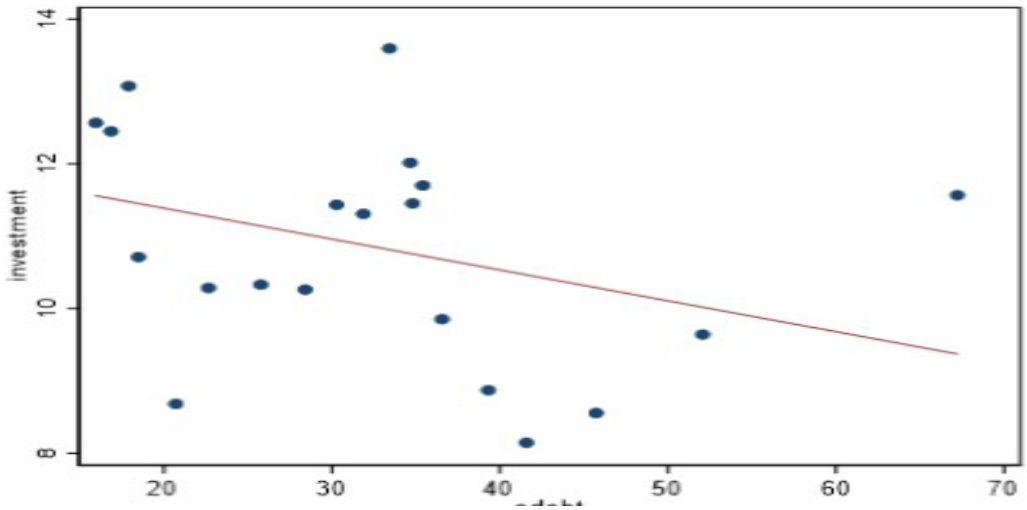
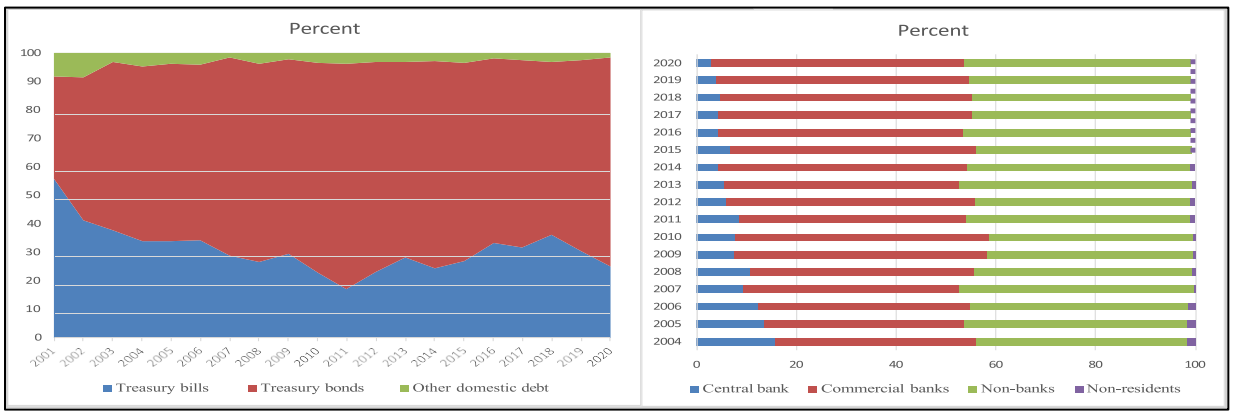
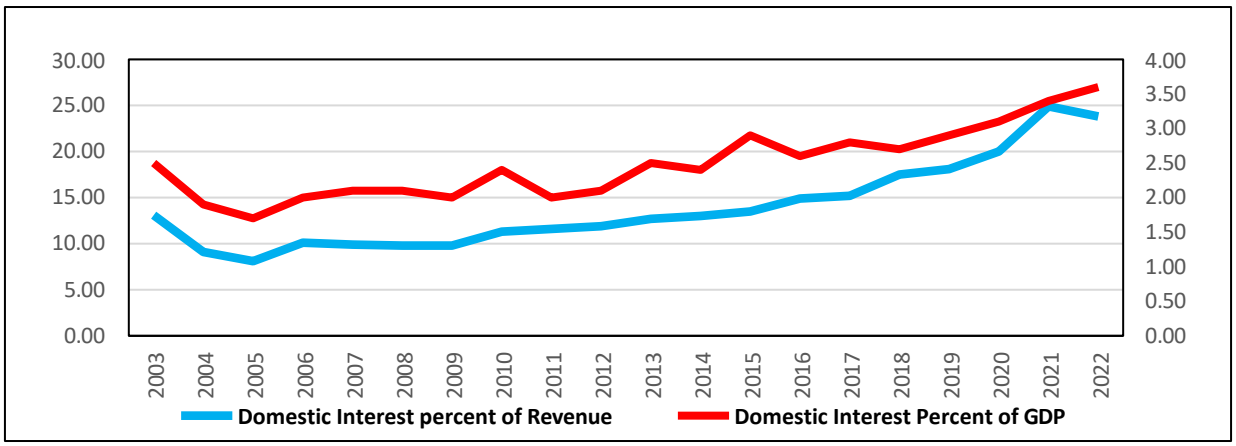


Figure A9: Domestic debt composition and holders



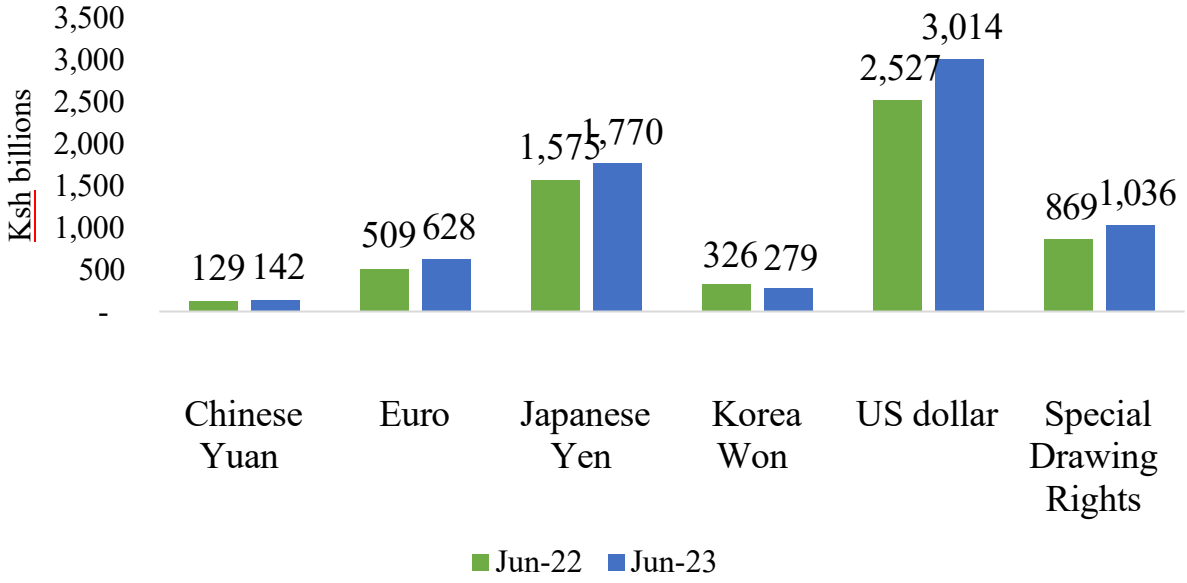
Source: Central Bank of Kenya

Figure A10: Interest payments on domestic debt



Source: Central Bank of Kenya

Appendix 8: Exchange rate effects on public debt



Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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