

Analysing the relationship between deficit bias and fiscal sustainability: systemic interdependencies in Kenya

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Abstract. *The study examines the existence and implications of deficit bias on fiscal sustainability in Kenya. Deficit bias being the persistent deviation of actual fiscal deficits from budgeted estimates is a critical concern for many Sub-Saharan African (SSA) countries, where fiscal frameworks are often undermined by weak institutional anchors, political pressures and macroeconomic shocks. Using annual data from 2003 to 2024, the study applied a Paired Samples T-test to confirm the presence of a significant deficit bias in Kenya. A Three Stage Least Squares (3SLS) estimation was then employed to explore systemic interdependencies between deficit bias, fiscal sustainability (proxied by primary balance), inflation, exchange rates, and debt composition. Findings show that Kenya has had a consistent deficit bias averaging Ksh. 31.9 billion. The 3SLS model reveals a negative relationship between deficit bias and fiscal sustainability, both domestic and external debt significantly increase deficit bias with external borrowing having the greater effect. Inflation is also found to be positively related with deficit bias, highlighting the inflationary effects of Kenya's deficit financing. Systemic mapping reveals four key feedback loops; a debt spiral loop, fiscal discipline loop, debt substitution loop, and inflationary pressure loop. These loops demonstrate the dynamic and interconnected nature of Kenya's macro-fiscal environment. Policy recommendations include prioritizing primary surpluses to stabilize public debt, implementing a prudent debt management strategy to balance domestic and external borrowing, and enhancing coordination between fiscal and monetary authorities. The study underscores the need for structural reforms targeting revenue enhancement and expenditure efficiency. Additionally, an Autoregressive Integrated Moving Average (ARIMA) forecast suggests an improving deficit bias from 2025 to 2028, indicating some progress in fiscal consolidation efforts. Overall, reducing deficit bias is vital for ensuring long-term macroeconomic stability and sustainable public finance in Kenya.*

Keywords: *Deficit bias, Fiscal sustainability, Systemic interdependence*

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1. Introduction

Fiscal policy has become an integral part of the economic process in developing and developed nations to scale up gross domestic product (GDP) growth and economic development (Wondimhunegn, 2020). To attain macroeconomic strength and stability, governments in both developed and developing countries depend on deficit financing because of their incapability to generate adequate revenue (Arif & Arif, 2023). In the context of Sub-Saharan Africa (SSA), fiscal policy often leans towards budget deficits prompted by government involvement in economic activity and the need to fund public infrastructures (Abanikanda et al., 2023). The challenge for many SSA countries lies in finding measures to address debt vulnerabilities and ensuring sustainability, while satisfying elevated spending pressures for public services, and facing political resistance to tax increases (IMF, 2024).

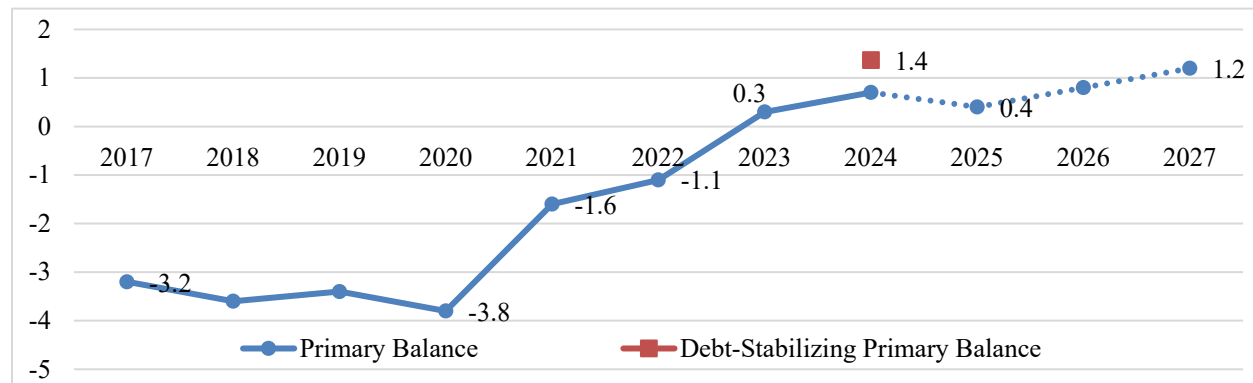
Debt vulnerabilities and sustainability may be harmful to welfare, for instance, debt-GDP-ratio is negatively related with long run fiscal sustainability and may also increase the volatility of inflation, therefore affecting the living standards for future generations (Jayid et al., 2011). Further, as noted by Arif and Arif (2023) and Agnello and Sousa (2009), the vulnerabilities can constrain private sector growth through the crowding out effect.

1.1 Kenya's macroeconomic and fiscal outlook

SSA is projected to record a growth of 4.1 percent and 4.3 percent in 2025 and 2026 respectively, as financial conditions ease together with decline in inflation. However, the growth trajectory is expected to be unevenly distributed among SSA economies (World Bank, 2025). In Kenya, GDP growth is projected to outweigh the SSA region growth over the medium term, with a projection of 5.1 percent in the financial year (FY) 2025/26, 5.2 percent in FY 2026/27 and 5.2 percent in FY 2027/28 mainly supported by growth in the services (Parliamentary Budget Office, 2025).

Limited fiscal space, due to high debt levels and increased borrowing costs, continue to weigh on government spending across the SSA region (World Bank, 2025). In Kenya, fiscal consolidation from the expenditure side has helped reduce fiscal deficit from 8.4 percent of GDP in FY 2020/21 to 5.2 percent of GDP in FY 2023/24 and the government expects the fiscal deficit to further reduce to 4.3% of GDP in the FY 2025/26, as it intensifies its fiscal consolidation efforts (Parliamentary Budget Office, 2025). However, over the years, Kenya has experienced revenue collection underperformance with limited spending cuts. This trend is likely to continue raising debt and eventually undermine long-term fiscal sustainability. For instance, the debt-stabilizing primary balance target of 1.4 percent of GDP as in Figure 1 is far higher by 1% than the projected 2025 primary balance needed to stabilize the debt-to-GDP ratio in 2025 (Parliamentary Budget Office, 2025).

Figure 1. Debt-stabilizing primary balance



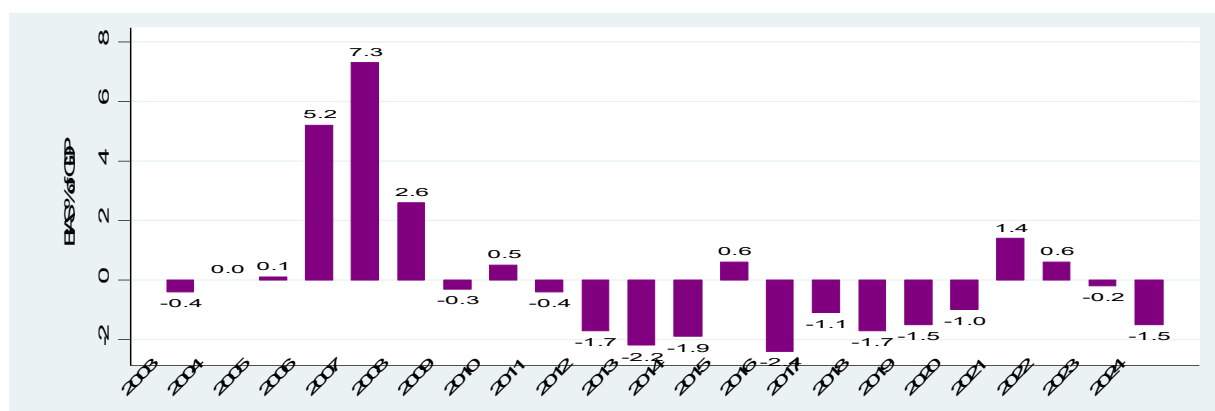
Source: Parliamentary Budget Office, 2025.

1.2 Deficit bias in Kenya

Deficit bias (DB) is the government's tendency to allow deficit and public debt levels to increase over time (Irish Fiscal Council, 2012). Deficit bias according to Jílek and Lacina (2011) comes about as a result of numerous factors which include the fiscal illusion of voters, the political budgetary cycle and use of the deficit as a competitive tool by political parties amongst others. Kenya, like other SSA countries, has been hit by a series of shocks from 2019 that is, COVID-19 pandemic, Russia's invasion of Ukraine, and increasingly frequent weather events worsening fiscal vulnerabilities where the country's fiscal sustainability is projected to continue worsening in the next five years, if significant fiscal reforms are not undertaken (Comelli et al., 2023). Although fiscal rules and medium-term budget frameworks are present in Kenya, their capability to guide fiscal policy remains limited.

As noted by Comelli et al. (2023), evidence suggests that fiscal policy in Kenya lacks an effective anchor with much focus being on short-term goals where there are frequent breaches of fiscal deficit ceilings. For instance, in the last 9 years, the country has recorded a deficit bias of at least 0.2% of GDP as in Figure 2, except 2021 and 2022. This is an indication that, despite the ongoing fiscal consolidation efforts, Kenya continues to face a persistent trend of the actual deficits at the end of the FY exceeding the deficits proposed in the budget estimates. This deficit bias, exacerbated by external shocks such as the COVID-19 and global economic disruptions, raises concerns about the country's long-term fiscal sustainability.

Figure 2. Deficit bias in Kenya as a percent of GDP



Source: Authors' computation.

1.3 The problem and central issue in Kenya

Kenya's primary balance has steadily improved as in Figure 1, from a low of -3.8 percent of GDP in 2020 to a projected 1.2 percent by 2027. Despite a modest improvement in the primary balance, the continued appetite for higher debt levels continues to undermine fiscal discipline and sustainability. The problem addressed in the study revolves around Kenya's fiscal policy, specifically the issue of deficit bias and its impact on fiscal sustainability. There is a noticeable gap in empirical literature linking deficit bias and fiscal sustainability in SSA countries, including Kenya. Kenya's trajectory - characterized by frequent budget deficits, growing public debt and susceptibility to external shocks such as currency depreciation, geopolitical and interest risks - highlights the urgent need to analyze the interlinkages influencing fiscal outcomes. Addressing this gap requires a systemic approach that captures these interdependencies to better understand how deficit bias undermines fiscal sustainability.

The study's main objective was therefore to analyze the systemic interdependencies between deficit bias and fiscal sustainability in Kenya, exploring how fiscal policy decisions interact with macroeconomic variables such as exchange rates, external loans, domestic loans and inflation. The central issue was understanding whether Kenya is experiencing a significant deficit bias, and if so, what is the relationship with fiscal sustainability. The results of this analysis are crucial in addressing the underlying fiscal

challenges and providing policy recommendations for improving Kenya's fiscal discipline and sustainability.

2. Literature review

2.1 Economic and political dimensions of budget balances

As noted by Tevdovski et al. (2021), the budget balance is approached from two fronts: economic and political. From the economic front, fiscal policy is expected to be countercyclical, where budget deficits are allowed during recessions and budget surpluses in booms, with an aim of stabilizing productivity and employment. This aligns with Keynesian's proposition on adopting expansionary fiscal policies during recessions and contractionary policies during booms. However, in many developing countries including Kenya, fiscal policies tend to be pro-cyclical as a result of institutional and political weaknesses. That is, governments cut down on spending/raising taxation during recessions and increase spending/cut down on taxes during booms often worsening the business cycles. Tevdovski et al. (2021) also argue that politically weaker governments, especially those with short tenures and weak political power, are prone to incurring larger budget deficits due to their limited capacity to enforce fiscal discipline.

From a politico-institutional perspective, Alesina and Perotti (1995), in their survey on fiscal behaviour of OECD countries, concluded that political pressures often lead to violations of fiscal rules. In democratic settings, governments tend to run persistent deficits driven by fiscal illusions. That is a condition where voters underestimate tax burden while overestimating the benefits of current government spending. This is usually exploited by opportunistic politicians seeking re-election, as they take advantage of the confusion by raising spending or cutting taxes to please the electorate at the expense of long-term sustainability.

This dynamic is particularly visible in Kenya, where the structure of government expenditure heavily favours recurrent spending which has been increasing (Controller of Budget, 2022). For instance, as noted by Nzuma and Espiritu (2024), employee compensations, pensions, and maintenance, consumed over 81% of the total government budget. Further, the Controller of budget indicated that Kenya spends nearly five times more on consumption related expenditures than development (Mburu, 2022). This highlights a deeply embedded structural deficit bias. This tendency reflects not just technical inefficiencies, but deep-rooted political incentives that prioritize short-term consumption heavy policies over long-term investment oriented fiscal planning.

2.2 Macroeconomic vulnerabilities and institutional determinants of budget deficits

Empirical studies corroborate the argument that both macroeconomic and institutional variables significantly influence fiscal deficits. Arif and Arif (2023), in their study involving a panel of 66 countries, found that GDP per capita, inflation rates, trade openness and population growth rate impacted the budget deficit positively. These results were affirmed by Arjomand et al. (2016) for growth and inflation, particularly in the context of MENA countries. In contrast, factors related to institutional quality such as, lower corruption, stronger democratic accountability, the rule of law and higher labor productivity were negatively associated with budget deficit in the long run. Arif and Hussain (2018), in their panel study on Asia and ASEAN countries affirmed these findings by emphasizing that corruption and political instability are major contributors to budget deficits and recommended improving institutional setup and quality for purposes of stabilizing fiscal outcomes.

In Sub-Saharan Africa, Abanikanda et al. (2023) noted that besides economic factors, institutional and political factors are significant drivers of fiscal deficit. That is, per capita income, trade openness, population and religious tension raise fiscal deficit while bureaucracy quality, government stability, law and order, and military in politics reduce fiscal deficit. Further, in their study Abubakar et al. (2025) observed that debt relief initiatives improve fiscal sustainability, but paradoxically, the imposition of fiscal rules may threaten debt sustainability in the SSA region if not tailored to the local context.

In the case of Kenya, institutional responses to deficit have proven fragile, with recent events illustrating this vulnerability. The withdrawal of planned tax hikes as had been proposed in the Finance Bill 2024, following mass protests, compromised the fiscal consolidation agenda. This led to immediate downgrade in Kenya's sovereign credit rating from B to B- by Fitch, while Moody's cut Kenya's sovereign rating deeper into junk territory at Caa1, citing increased fiscal and financial risks (Fitch Ratings, 2024; Reuters, 2024). As noted by Miriri (2025), Kenya also failed to meet key conditions under the IMF's Extended Credit Facility, resulting in the suspension of USD 800 million tranche. These developments underscore how political resistance to revenue reforms and an embedded tolerance for deficits can trigger real financial costs through higher borrowing rates and limited access to concessional funds.

The long-term implications of sustained budget deficits often manifest through rising levels of public debt and associated inflationary pressures. Taghavi (2000), in testing the hypothesis that debt matters in the EU, concluded that high debt levels tend to fuel inflation over time. Similarly, Yaya (2023), investigating the West African economies, identified that weak institutions, high government spending, and external shocks coupled with ineffective revenue mobilization escalate debt burdens leading to persistent inflation, rising borrowing costs and sluggish economic growth. Brandao-Marques et al. (2023) further argued that high public debt levels can undermine inflation control efforts, particularly in emerging market economies where debt is often dollarized and monetary policy frameworks are weaker. Therefore, the debt-driven expectations create a feedback loop that complicates macroeconomic management.

A study by Odoom et al. (2025) on Ghana underscores the interconnectedness of public debt and macroeconomic indicators, revealing a correlation between exchange rate volatility and public debt accumulation. This corroborates Kugler (1998) view that persistent budget deficits and increasing government debt levels contribute to currency depreciation complicating macroeconomic management.

Comelli et al. (2023) described Kenya's fiscal trajectory as one lacking a credible fiscal anchor, with repeated breaches of deficit ceilings. The persistent deficit bias in Kenya is compounded by over-optimistic revenue projections, delays in donor disbursements, and reliance on costlier domestic and external borrowing raising concerns on the sustainability of fiscal policy in Kenya (Chemnyongoi, 2023). Shikumo and Irungu (2024) found that Kenya's fiscal response is often influenced more by past fiscal imbalances than current debt sustainability metrics, suggesting a path dependent and reactive approach to fiscal management. Furthermore, the IMF and World Bank's debt sustainability framework also points to rising debt servicing costs especially in relation to exports as a key vulnerability, despite debt-to-GDP remaining within theoretical thresholds (World Bank, 2022).

The effectiveness of Kenya's fiscal framework also depends on the strength of institutional systems such as the Treasury Single Account (TSA) and the Integrated Financial Management Information System (IFMIS). Systems have been identified as critical tools for reducing inefficiencies and enhancing fiscal discipline (Kokogho et al., 2024; The Public Financial Management Reform Secretariat, 2025). However, the functionality of these systems remains constrained by inconsistent political support, undermining their potential to anchor credible fiscal management.

From the reviews, it is quite evident that while numerous studies have explored the determinants and effects of fiscal deficits globally and in Sub-Saharan Africa, very few have addressed the concept of deficit bias directly, particularly in the context of systemic interdependencies. Most focus on the correlations without accounting for complex feedback loops between deficit bias, debt structure, inflation, exchange rates and fiscal sustainability. This study seeks to fill the gap by applying a simultaneous equation modeling (3SLS) approach, mapping out systemic fiscal dynamics in Kenya and offering a holistic view of the policy implications.

3. Methodology

The study focused on annual time series data for a period of 22 years, from 2003 to 2024. Quantitative analysis was employed involving paired samples t-test, independent samples t-test and Three Stage Least Squares (3SLS) estimator technique. Paired samples t-test aided in establishing whether indeed

there exists a significant deficit bias in Kenya. Independent samples t-test established the mean difference for ordinary revenue performance and underperformance over the study period. OLS was also employed to examine the effect of ordinary revenue (OR) underperformance on deficit bias while 3SLS based on the system of simultaneous equations model (1) examined the joint and systemic dependencies between fiscal bias and fiscal sustainability in Kenya. The analysis also included the key macroeconomic variables of Exchange rate (EX), external loans (EL), domestic loans (DL) and inflation (INF) in the 3SLS method, where all independent variables in each equation were treated as exogenous variables.

The 3SLS technique was adopted based on its power to combine the strengths of Two Stage Least Squares (2SLS) and Seemingly Unrelated Regression (SUR). That is, it addresses the endogeneity issues in each equation and improves efficiency by accounting for correlations of error terms across equations.

$$DB_t = \alpha_{10} + \alpha_{11}PB_t + \alpha_{12}DL_t + \alpha_{13}EL_t + \alpha_{14}INF_t + \alpha_{15}EX_t + \mu_{1t}$$

$$PB_t = \alpha_{20} + \alpha_{21}DB_t + \alpha_{22}INF_t + \alpha_{23}DL_t + \alpha_{24}EL_t + \alpha_{25}EX_t + \mu_{2t}$$

$$EL_t = \alpha_{30} + \alpha_{31}DB_t + \alpha_{32}DL_t + \alpha_{34}EX_t + \alpha_{34}PB_t + \mu_{3t} \quad (1)$$

$$EX_t = \alpha_{40} + \alpha_{41}DB_t + \alpha_{42}DL_t + \alpha_{43}PB_t + \alpha_{44}EL_t + \mu_{4t}$$

$$DL_t = \alpha_{50} + \alpha_{51}DB_t + \alpha_{52}EX_t + \alpha_{53}PB_t + \alpha_{54}EL_t + \mu_{5t}$$

$$INF_t = \alpha_{60} + \alpha_{61}DB_t + \alpha_{62}EX_t + \alpha_{63}PB_t + \alpha_{64}EL_t + \alpha_{64}DL_t + \mu_{6t}$$

Where:

DB_t - Deficit bias, measured by the GDP ratio of difference between budget estimates (BE) deficit and Actual (AC) deficit at the end of a given financial year, as in equation (2).

$$DB_t = \frac{AC_t - BE_t}{GDP_t} \quad (2)$$

PB_t - Fiscal sustainability (proxy, primary balance as a percentage of GDP). Measured as the difference between government revenue (T) and primary spending (a net difference between government expenditure (G) and interest spending (I)) divided by GDP, as in equation (3).

$$PB_t = \frac{T_t - (G_t - I_t)}{GDP_t} \quad (3)$$

EX_t - Exchange rate measured based on the appreciation/depreciation rate of the official exchange rate (Local currency per) United States dollar), as in equation (4).

$$EX_t = \frac{EX_t - EX_{t-1}}{EX_{t-1}} \quad (4)$$

EL_t - Total foreign financing in a given year as a ratio of GDP.

DL_t - Total domestic financing in a given year as a ratio of GDP.

INF_t - Annual inflation rate.

Table 4. Simultaneous analysis results

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
BIAS_GDP	22	5	1.840438	0.3631	45.27	0.0000
PB_GDP_AC	22	5	1.260083	0.5369	88.50	0.0000
Ext_Debt_A~P	22	4	1.01591	0.6034	92.20	0.0000
EX	22	4	6.173517	0.0668	14.11	0.0070
D_Debt_AC_~P	22	4	1.377895	0.3181	35.49	0.0000
INF	22	5	4.257665	0.1909	12.37	0.0300

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
BIAS_GDP					
PB_GDP_AC	-.8885741	.2939609	-3.02	0.003	-1.464727 - .3124214
D_Debt_AC_GDP	.7855392	.2468779	3.18	0.001	.3016674 1.269411
Ext_Debt_AC_GDP	1.152369	.3257039	3.54	0.000	.5140013 1.790737
INF	.194877	.0628381	3.10	0.002	.0717166 .3180373
EX	-.0488416	.0610258	-0.80	0.424	-.16845 .0707667
_cons	.7955682	1.052895	0.76	0.450	-1.268068 2.859205
PB_GDP_AC					
BIAS_GDP	-.3716481	.1259361	-2.95	0.003	-.6184783 -.124818
INF	-.0018538	.0359733	-0.05	0.959	-.0723602 .0686527
D_Debt_AC_GDP	.5788595	.1618506	3.58	0.000	.2616382 .8960808
Ext_Debt_AC_GDP	1.119694	.1456453	7.69	0.000	.8342347 1.405154
EX	-.1015372	.0384887	-2.64	0.008	-.1769737 -.0261007
_cons	1.337372	.6693994	2.00	0.046	.0253729 2.64937
Ext_Debt_AC_GDP					
BIAS_GDP	.3355673	.0920958	3.64	0.000	.1550628 .5160717
D_Debt_AC_GDP	-.3410246	.1477508	-2.31	0.021	-.6306108 -.0514384
EX	.0771071	.0316911	2.43	0.015	.0149938 .1392205
PB_GDP_AC	.7635887	.0994985	7.67	0.000	.5685753 .9586022
_cons	-.9854544	.4742905	-2.08	0.038	-1.915047 -.0558621
EX					
BIAS_GDP	-.7843281	.6846811	-1.15	0.252	-2.126279 .5576223
D_Debt_AC_GDP	2.49395	.9037299	2.76	0.006	.7226721 4.265228
PB_GDP_AC	-2.753386	1.041539	-2.64	0.008	-4.794764 -.7120075
Ext_Debt_AC_GDP	3.06421	1.259392	2.43	0.015	.5958466 5.532573
_cons	4.499835	3.122662	1.44	0.150	-1.62047 10.62014
D_Debt_AC_GDP					
BIAS_GDP	.4435319	.1300177	3.41	0.001	.188702 .6983619
EX	.117295	.0425041	2.76	0.006	.0339886 .2006015
PB_GDP_AC	.7370119	.2066152	3.57	0.000	.3320537 1.14197
Ext_Debt_AC_GDP	-.6373846	.2761503	-2.31	0.021	-1.178629 -.0961399
_cons	-2.304529	.4920565	-4.68	0.000	-3.268942 -1.340116
INF					
BIAS_GDP	1.385099	.4652931	2.98	0.003	.4731414 2.297057
EX	-.081308	.1523083	-0.53	0.593	-.3798269 .2172108
PB_GDP_AC	.3462818	.7901534	0.44	0.661	-1.20239 1.894954
Ext_Debt_AC_GDP	-.3625982	.9489446	-0.38	0.702	-2.222495 1.497299
D_Debt_AC_GDP	-.0967261	.6957266	-0.14	0.889	-1.460325 1.266873
_cons	8.286817	2.25702	3.67	0.000	3.86314 12.71049

Endogenous variables:

Exogenous variables: BIAS_GDP PB_GDP_AC D_Debt_AC_GDP Ext_Debt_AC_GDP INF
 EX

Source: authors' computations.

Table 5. First single equation coefficients Interpretation (deficit bias as a ratio of GDP-dependent variable)

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
Primary balance (PB)	-0.889	$z = -3.02, p < 0.05$	1% increase in primary balance as a ratio of GDP (fiscal sustainability) decreases deficit bias by 0.89%	Increasing fiscal sustainability via primary surpluses reduces the likelihood of persistent deficits hence the government of Kenya should focus on improving fiscal balance to stabilize debt levels
Domestic financing (DL)	0.786	$z = 3.18, p < 0.05$	1% increase in domestic debt as a ratio of GDP increases deficit bias by 0.79%	Excessive domestic borrowing tends to be harmful and therefore the Kenyan government needs to balance domestic debt levels to avoid fiscal stress.
External financing (EL)	1.152	$z = 3.54, p < 0.05$	1% increase in external debt as a ratio of GDP increases deficit bias by 1.15%	External debt can also lead to higher deficit bias due to higher borrowing costs or debt servicing pressure. Therefore, the Kenyan government needs to carefully manage external borrowing in order to avoid fiscal instability
Inflation (INF)	0.195	$z = 3.10, p < 0.05$	1% increase in inflation increases deficit bias by 0.20%	Higher inflation erodes government revenues and can increase expenditure pressures. Therefore, the government of Kenya should aim for price stability through monetary policy.
Exchange rate (EX)	-0.049	$z = -0.8, p > 0.05$	Currency appreciation/depreciation does not affect deficit bias	-

Source: authors' computations.

Table 6. Second single equation coefficients interpretation (primary balance as a ratio of GDP-dependent variable)

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
Deficit Bias (DB)	-0.372	$z = -2.95, p < 0.05$	1% increase in deficit bias as a ratio of GDP decreases deficit bias by 0.37%	Running of higher deficits by the Kenyan government may make it harder to maintain fiscal discipline. The government should aim at lowering deficit bias for long-term fiscal stability.
Inflation (INF)	-0.002	$z = -0.05, p > 0.05$	Inflation does not significantly affect primary balance	Since inflation does not significantly influence the primary balance, more

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
				emphasis should be placed on expenditure rationalization and revenue mobilization strategies to improve fiscal sustainability.
Domestic financing (DL)	0.579	$z = 3.58, p < 0.05$	1% increase in domestic debt as a ratio of GDP increases primary balance by 0.58%	Excessive domestic borrowing tends to be harmful and therefore the Kenyan government needs to balance domestic debt levels to avoid fiscal stress.
External financing (EL)	1.120	$z = 7.69, p < 0.05$	1% increase in external debt as a ratio of GDP increases primary balance by 1.12%	External debt can also lead to higher deficit bias due to higher borrowing costs or debt servicing pressure. Therefore, the Kenyan government needs to carefully manage external borrowing in order to avoid fiscal instability.
Exchange rate (EX)	-0.102	$z = -2.64, p < 0.05$	1% depreciation of the exchange rate reduces primary balance by 1.10%	Exchange rate depreciation can worsen fiscal balances due to increased debt servicing costs. Thus, policy makers need to monitor the exchange rate to avoid increased fiscal pressures.
Constant	1.337	$z = 2.00, p < 0.05$	With all factors being zero the primary balance is equals 1.34% of GDP	The baseline level of primary balance or debt stabilizing primary balance in Kenya is approximately 1.34%.

Source: authors' computations.

Table 7. Third single equation coefficients interpretation (external debt as a percent of GDP-dependent variable)

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
Deficit Bias (DB)	0.336	$z = 3.64, p < 0.05$	1% increase in deficit bias as a ratio of GDP decreases deficit bias by 0.34%	Running of higher deficits by the Kenyan government may make it harder to maintain fiscal discipline. The government should aim at lowering deficit bias for long-term fiscal stability.
Domestic financing (DL)	-0.341	$z = -2.31, p < 0.05$	1% increase in domestic debt as a ratio of GDP increases primary balance by 0.58%	Due to debt substitution effect and depending on costs, risks and availability of external debt. The Kenyan government may switch to borrowing enough from the domestic markets to avoid exchange rate and

				geopolitical risks hence reducing external debt.
Exchange rate (EX)	0.077	$z = 2.43, p < 0.05$	1% depreciation of the exchange rate increase external debt by 0.08%	Exchange rate depreciation can worsen fiscal balances due to increased debt servicing costs. Thus, policy makers need to monitor the exchange rate to avoid increased fiscal pressures.
Primary balance (PB)	0.764	$z = 7.67, p < 0.05$	1% increase in primary balance as a ratio of GDP (fiscal sustainability) decreases deficit bias by 0.76%	Increasing fiscal sustainability via primary surpluses reduces the likelihood of persistent deficits hence the government of Kenya should focus on improving fiscal balance to stabilize debt levels.
Constant	-0.985	$z = -2.08, p < 0.05$	With all factors being zero, the external debt is 0.99% of GDP	The baseline external deficit in Kenya projected at approximately 1% of GDP.

Source: authors' computations.

Table 8. Fourth single equation coefficients interpretation (exchange rate-dependent variable)

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
Deficit Bias (DB)	-0.784	$z = -1.15, p > 0.05$	No statistically significant effect on exchange rate.	-
Domestic financing (DL)	2.494	$z = 2.76, p < 0.05$	1% increase in domestic debt as a ratio of GDP depreciates the exchange rate by 2.49%.	Excessive domestic borrowing tends to be harmful and therefore the Kenyan government needs to balance domestic debt levels to avoid fiscal stress.
Primary balance (PB)	-2.753	$z = 2.64, p < 0.05$	1% increase in primary balance as a ratio of GDP appreciates the exchange rate by 2.75%.	Increasing fiscal sustainability via primary surpluses reduces the likelihood of persistent deficits hence the government of Kenya should focus on improving fiscal balance to stabilize debt levels
External financing (EL)	3.064	$z = 2.43, p < 0.05$	1% increase in external debt as a ratio of GDP depreciates the exchange rate by 3.06%.	External debt increases exchange rate volatility in Kenya with currency markets responding to higher debt servicing pressures. The Kenyan government should therefore aim for a diversified financing base to reduce foreign exchange risks.

Source: authors' computations.

Table 9. Fifth single equation coefficients interpretation (domestic debt as a percent of GDP -dependent variable)

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
Deficit Bias (DB)	0.444	$z = 3.41, p < 0.05$	1% increase in deficit bias as a ratio of GDP decreases domestic borrowing by 0.44%.	Higher deficit bias leads to higher domestic borrowing. Reducing deficit bias needs to be prioritized in Kenya in order to reduce reliance on domestic debt and ensure long-term fiscal sustainability.
Exchange rate (EX)	0.112	$z = 2.76, p < 0.05$	1% depreciation of the exchange rate increase domestic debt by 0.11%	Exchange rate depreciation can worsen fiscal balances due to increased debt servicing costs. Thus, policy makers need to monitor the exchange rate to avoid increased fiscal pressures.
Primary balance (PB)	0.737	$z = 3.57, p < 0.05$	1% increase in primary balance as a ratio of GDP increases domestic debt by 0.74%.	Increasing fiscal sustainability via primary surpluses reduces the likelihood of persistent deficits hence the government of Kenya should focus on improving fiscal balance to stabilize domestic debt levels.
External financing (EL)	-0.637	$z = -2.31, p < 0.05$	1% increase in external debt as a ratio of GDP decreases domestic debt by 0.64%.	Excessive external borrowing tends to be harmful based on costs, risks and availability. Due to the debt substitution effect, cheaper external debt increases the Kenyan government's preference for external debt hence reducing domestic debt.
Constant	-2.305	$z = -4.68, p < 0.05$	With 0% change in all factors, the domestic debt is maintained at 2.31% of GDP	The baseline domestic deficit in Kenya needs to be projected at approximately 2.3% of GDP.

Source: authors' computations.

Table 10. Sixth single equation coefficients interpretation (inflation -dependent variable)

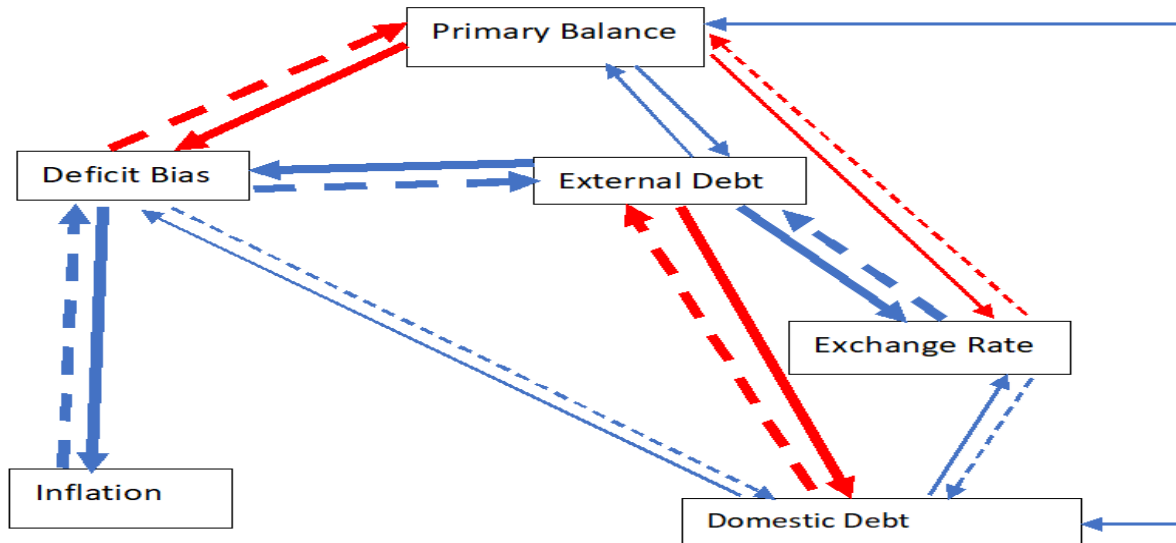
Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
Deficit Bias (DB)	1.385	$z = 2.98, p < 0.05$	1% increase in deficit bias as a ratio of GDP increases inflation by 1.39%.	Deficit financing in Kenya seems to be inflationary, therefore, the Kenyan government needs to maintain fiscal discipline to control inflation.
Exchange rate (EX)	-0.081	$z = -0.53, p > 0.05$	No significant effect	-
Primary balance (PB)	0.346	$z = 0.44, p > 0.05$	No significant effect	-

Variable	Coefficient	P-value	Interpretation (ceteris paribus)	Policy Implication
External financing (EL)	-0.363	$z = -0.38, p > 0.05$	No significant effect	-
Domestic financing (DL)	-0.097	$z = -0.14, p > 0.05$	No significant effect	-
Constant	8.287	$z = 3.67, p < 0.05$	With all other variables at zero, inflation is predicted at 8.29%.	The baseline inflationary pressure in the absence of fiscal effects is 8.29%.

Source: authors' computations.

A systemic map/causal loop diagram based on the simultaneous equations results was then plotted to represent the complex relationships and feedback loops (situation where part of the system's output is fed back into the system as an input creating a cycle of cause and effect) between different elements in the system. This was helpful in identification of positive feedback/reinforcing loops (where a change in one direction leads to more change in the same direction causing the system to spiral unless there is intervention) and negative feedback/balancing loops (where a change in one direction leads to a corrective force in the opposite direction stabilizing the system back to equilibrium).

Figure 3. Systemic map of Kenya's fiscal and debt dynamics



Note: Red arrow-negative effect; Blue arrow-positive effect, bold arrow- at least 1% effect, dashed arrow-less than 1% effect
 Source: authors' concept.

The study established 4 key feedback loops that can be categorized as debt spiral loop, fiscal discipline loop, debt substitution loop and inflationary pressure loop.

Loop 1-Debt spiral loop: This is a positive feedback loop represented by:

$$Deficit_Bias \uparrow \rightarrow External_Debt \uparrow \rightarrow Exchange_Rate \uparrow \rightarrow External_Debt \uparrow \rightarrow Deficit_Bias \uparrow$$

The loop shows how a persistent deficit pushes Kenya to borrow more externally. External borrowing then increases pressure on the exchange rate (due to foreign exchange demand) worsening debt

servicing costs which creates more fiscal pressure leading to further deficits. Kenya needs to break this loop by improving its primary balance and managing external debt sustainability. Maybe also diversifying sources and improving export competitiveness can help.

Loop 2-Fiscal discipline loop: This is a negative feedback or balancing loop represented by:

$$\text{Primary_Balance}\hat{\uparrow} \rightarrow \text{Deficit_Bias}\downarrow \rightarrow \text{Primary_Balance}\hat{\uparrow}$$

The loop shows that an increase in primary balance (running surpluses) in Kenya reduces the deficit bias. This causes lower fiscal pressure that allows further improvement in the primary balance hence a stabilizing loop. Kenya needs to reinforce this loop by institutional reforms like fiscal rules, budget transparency, and tax collection enhancement. Improving primary balance positively affects the whole system.

Loop 3-Debt substitution loop

$$\text{External_Debt}\hat{\uparrow} \rightarrow \text{Domestic_Debt}\downarrow, \text{ and vice versa.}$$

The loop shows that Kenya may substitute between domestic and external debts which may be determined by factors like market access, costs, or geopolitical risks. It is important to note that overreliance on either carries risks. For instance, external debt has forex and geopolitical risks while domestic has crowding out and high interest risks. The government of Kenya should adopt a debt management strategy that optimizes cost-risk trade-offs and reduces overexposure to any single source.

Loop 4-Inflationary pressure loop

$$\text{Deficit_Bias}\hat{\uparrow} \rightarrow \text{Inflation}\hat{\uparrow} \rightarrow \text{Deficit_Bias}\hat{\uparrow}$$

The loop shows that financing deficits in Kenya especially through domestic borrowing can lead to inflation. Inflation may raise the cost of public services and wages fueling fiscal pressure hence more deficits. There is need for fiscal and monetary authorities in Kenya to coordinate closely to anchor inflation expectations. Avoiding excessive deficit financing through monetary expansion is crucial.

4.3 ARIMA deficit bias forecasting

The study forecasted the deficit bias in Kenya from 2025 to 2028 by use of an ARIMA (1,1,1) model. This was chosen based on integration order 1 for deficit bias, as in Table 11, and Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) having 1 lags each for moving average (MA) and autoregressive (AR) exceeding the 95% confidence bands, as in Figures 4 and 5. Results in Figure 6 showed that the deficit bias is projected at 1% of GDP in 2025, 0.7% of GDP in 2026, 0.5% of GDP in 2027 and 0.3% in 2028. The downward trajectory shows commitment to fiscal discipline in Kenya whereby the country is aiming to control borrowing, reduce public debt and hence improve long-term macroeconomic stability.

Table 11: Stationarity test for Deficit Bias

```
. dfuller BIAS_GDP
```

Dickey-Fuller test for unit root		Interpolated Dickey-Fuller		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-2.099	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.2449

```
. dfuller d.BIAS_GDP
```

Dickey-Fuller test for unit root		Interpolated Dickey-Fuller		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-4.062	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0011

Source: authors' computations.

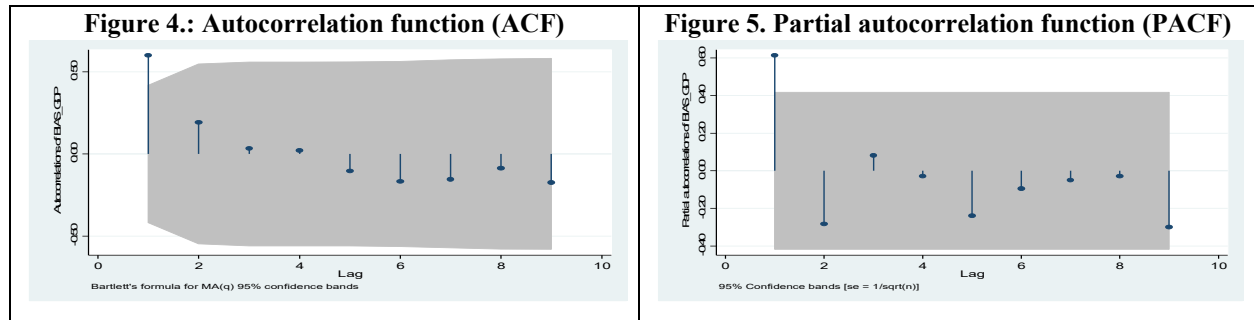
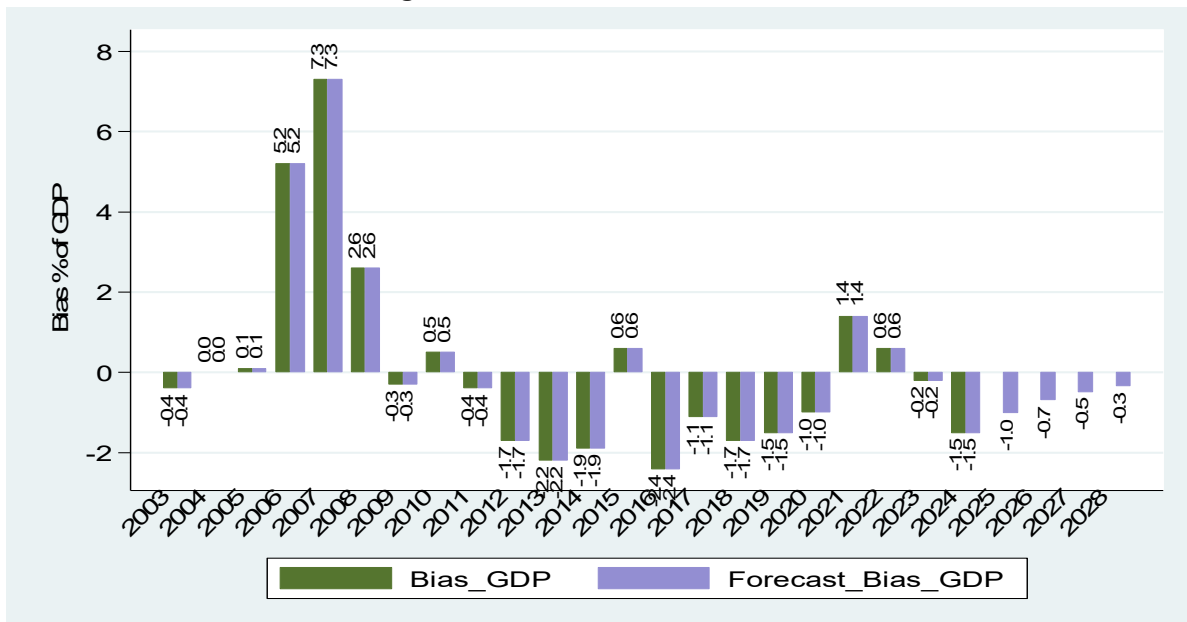


Figure 6. Forecasted deficit bias results



Source: authors' computations.

5. Conclusion

The purpose of this study was to analyse the systemic interdependencies between deficit bias and fiscal sustainability in Kenya. It was established that Kenya's macro-fiscal system demonstrates feedback loops, where fiscal discipline, debt structure, and macro stability (inflation, exchange rates) are deeply intertwined. A focus on reducing deficit bias through improved primary balances, coupled with prudent debt and exchange rate management is essential for ensuring long-term fiscal and economic sustainability.

The 3SLS key conclusions policy insights are:

1. Deficit bias is central and reactive to fiscal indicators:
 - a) Primary balance significantly reduces deficit bias: fiscal discipline, reflected in higher primary surpluses, leads to reduced reliance on deficit financing. This implies a need for Kenya to focus on fiscal consolidation.
 - b) Both domestic and external debt increases deficit bias, which signals the fiscal stress imposed by excessive borrowing. External debt, however, has a larger impact, likely due to exchange rate risk and higher servicing costs.
 - c) Inflation is positively associated with deficit bias, confirming the inflationary nature of deficit financing in Kenya.

Policy implication: The government must enhance primary balances and manage both domestic and external debt, carefully to mitigate long-term fiscal pressures and control inflation.

2. Debt composition is influenced by fiscal health and exchange rate movements:
 - a) External debt responds negatively to domestic debt levels indicating debt substitution, but increases with primary balance. This implies that when fiscal space is created, external borrowing seems to be favored maybe due to its relative affordability.
 - b) Exchange rate depreciation increases both external and domestic burdens compounding fiscal risks.

Policy implication: A prudent debt management strategy is needed, balancing external and domestic sources while managing currency risk. Fiscal prudence also reduces pressure on the exchange rate.

3. Inflation and exchange rate are affected by fiscal factors:
 - a) Inflation is driven by deficit bias, confirming the inflationary effects of expansionary fiscal policies.
 - b) The exchange rate depreciates with rising domestic and external debt but appreciates with improvements in primary balance, reinforcing the need for sustainable fiscal policies.

Policy implication: Coordinated fiscal and monetary policy is critical. Fiscal discipline can anchor inflation expectations and exchange rate stability.

The systemic dependency, on the other hand, led to a conclusion that fiscal challenges in Kenya aren't just technical but structural and dynamic. Policy must target the structure of the system and not just the symptoms. Strengthening balancing loops, like improving the primary balance while disrupting reinforcing loops like debt spirals, is the key to achieving fiscal sustainability in Kenya. The established feedback loops can guide policy in Kenya, as explained in Table 12.

Table 12. Feedback loop policy guide

Policy	Desired Action	Justification
Fiscal consolidation	Prioritize primary surpluses.	Stabilizes the system by reinforcing the negative or balancing loop.
Debt Management	Diversify and optimize debt mix.	Prevents reinforcing (positive) loops from spiraling, reducing exposure to shocks.
Exchange rate monitoring	Manage volatility and limit foreign exchange exposure.	Disrupts the exchange rate –debt servicing loop.
Inflation control	Coordinate fiscal and monetary policy.	Prevents inflation-deficit reinforcing loops from triggering runaway price levels.

Policy	Desired Action	Justification
Structural reforms	Enhance revenue efficiency and control expenditure.	Strengthens the fiscal discipline loop and reduces reliance on debt.

Source: authors' concept.

Limitations and potential research avenues

This study, while comprehensive, has several limitations. It relies on historical data that may suffer from measurement errors and excludes important institutional and political factors influencing fiscal outcomes. The linear 3SLS model, though effective for capturing systemic dependencies, may not fully reflect nonlinear relationships in fiscal behaviour. Additionally, the ARIMA forecast assumes stability in future trends, which may not hold in a volatile economic environment. Future research could address these limitations by incorporating political economy variables, applying nonlinear models, conducting comparative studies across countries, and using advanced forecasting or simulation tools. Such expansions would deepen understanding of deficit dynamics and support more robust, evidence based fiscal policy making in Kenya and similar contexts.

Authors' contribution: Introduction: Masinde, M.M.; Literature review: Luvisi, M.A.; Methodology and data: Kiganda, E.O.; Research results and comments: Kiganda, E.O. & Masinde, M.M.; Conclusion: All

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