

PHD DISSERTATION

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ESSAYS ON FISCAL POLICY: EMPIRICAL EVIDENCE FROM SSA COUNTRIES

PHD DISSERTATION

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DEDICATION

I dedicate this thesis to the besieged people of Tigray who were the victims of direct killings, tortured, and dead due to lack of health care in the war on Tigray. In particular, this thesis is dedicated to the Tigrayan mothers and girls who were suffered from the humanitarian blockade, rape and other sexual violence.

LIST OF PUBLICATIONS

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1. **Woldu, G. T.**, 2023. The asymmetric effect of fiscal policy on private consumption and investment over a business cycle: evidence from Sub-Saharan African countries. *Regional Science, Policy and Practice*: <https://doi.org/10.1111/rsp3.12614>
2. Somayeh Sedighi, Samaneh Raiss Shaghghi & **Gabriel Temesgen Woldu**, 2021. Macroeconomic effects of fiscal policy shocks: Panel VAR evidence from MENA countries, *Macroeconomics and Finance in Emerging Market Economies*, 14 (3): <https://doi.org/10.1080/17520843.2021.1995248>
3. Woldu, Gabriel. 2021. Impact of Urbanization and Globalization on Environmental Quality in Mozambique: An ARDL Bound Testing Approach. *The International Journal of Climate Change: Impacts and Responses* 13 (2): 147-161. <http://doi:10.18848/1835-7156/CGP/v13i02/147-161>
4. Teka, A.M., **Woldu, G.T.** and Fre, Z., 2019. Status and determinants of poverty and income inequality in pastoral and agro-pastoral communities: Household-based evidence from Afar Regional State, Ethiopia. *World Development Perspectives*, p.100123. <https://doi.org/10.1016/j.wdp.2019.100123>
5. Gebresilassie, Y.H. and **Woldu, G.T.**, 2020. Determinants of Ethiopia's Livestock Exports: Analysis of Gravity Model of Trade. *Abyssinia Journal of Business and Social Sciences*, 5(1), pp.1-9. <https://doi.org/10.20372/ajbs.2020.5.1.124>

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1. **Woldu, G.T.**, 2021. Is the twin deficit hypothesis applicable in SSA countries? In: Proceedings of the 38th International Business Information Management Association (IBIMA): Innovation management and sustainable economic development in the era of global pandemic. Proceedings of the IBIMA conference. IBIMA Publishing, Sevilla, pp. 27- 34.(2021) ISBN 9780999855171. <https://ibima.org/accepted-paper/is-the-twin-deficit-hypothesis-applicable-in-ssa-countries/>

2. Fre, Z., **Woldu, G. T.**, Negash, N., Araya, S. T., Tsegay, B., M. Teka, A. M., Weldesilassie, B., Kenton, and Livingstone, J. (2022). Social protection for inclusive development in the Afar region of Ethiopia: Findings from the participatory rural appraisal. In *Social Protection, Pastoralism and Resilience in Ethiopia: Lessons for Sub-Saharan Africa*, Routledge. <https://doi.org/10.4324/9781003203513-3>
3. Fre, Z., **Woldu, G. T.**, and Livingstone, J. (2022). Social protection design and implementation in Ethiopia. In *Social Protection, Pastoralism and Resilience in Ethiopia: Lessons for Sub-Saharan Africa*, Routledge. <https://doi.org/10.4324/9781003203513-9>

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3. **Woldu, Gabriel.** 2021 (virtual). Searching for non-linear effects of fiscal policy on consumption and investment evidence from Sub-Saharan Africa (SSA) countries. In the 12th Annual Financial Market Liquidity Conference **Budapest, Hungary**, 11th-12th November 2021. [https://www.uni-corvinus.hu/contents/uploads/2021/11/book_of_abstracts%20\(1\).f33.pdf](https://www.uni-corvinus.hu/contents/uploads/2021/11/book_of_abstracts%20(1).f33.pdf)
4. **Woldu, Gabriel.** 2021 (virtual). Impact of Urbanization and Globalization on Environmental Quality in Mozambique: An ARDL Bound Testing Approach. The 2021 Annual Conference of Development Studies Association Ireland (DSAI), November 11th-12th, **Ireland, UK.** <https://www.dsaireland.org/assets/files/pdf/1636712634864914151.pdf>
5. **Woldu, Gabriel.** 2021 (virtual). Do fiscal regimes matter for fiscal sustainability in South Africa?: A Markov-switching approach. EMNES ANNUAL CONFERENCE 2021. **Barcelona, Spain.** <https://conference2021.emnes.org/>

6. **Woldu, Gabriel.** 2019. Determinant factors of Biogas Technology Adoption for Household Energy Use and Its Challenges: Evidence from Eastern Zone of Tigray, Ethiopia. In: Kaya, M. Veysel; Chodnicka-Jaworska, Patrycja (eds.) 15th RSEP International Conference on Economics, Finance & Social Sciences Conference Proceedings Book of Abstracts. Roma, **Rome, Italy**: Review of Socio-Economic Perspectives, (2019) p. 16. <https://rsepconferences.com/wp-content/uploads/2019/12/Rome-Book-of-Abstract-Completed.pdf>

ABSTRACT

Fiscal policy tools have piqued the interest of many governments and academics worldwide due to their ability to respond to aggregate demand shocks. Therefore, the thesis aims to identify the determinant factors of fiscal multipliers; examine the threshold level of the public debt that makes the fiscal policy sustainable, and identify the conditions under which countries undertake fiscal consolidation measures and the effects of fiscal consolidation on economic activity. In addition, this thesis deals with the connection between fiscal policy shocks, long-run fiscal sustainability, and contractionary fiscal policy, which most existing studies have largely failed to consider.

Chapter two presents the definitions and concepts of expansionary and contractionary fiscal policy. In addition, this section reviews the terminologies, concepts, and debates surrounding the macroeconomic effects of fiscal policy on economic activity. Finally, chapter three discusses the overview of the trends in fiscal policy and economic performance of SSA countries from 2000-2019. It also highlights the effect of the COVID-19 pandemic on the economic performance and fiscal conditions of SSA countries.

The thesis comprises three empirical chapters that are not mutually exclusive, yielding several novel and exciting results. The three chapters employ econometric panel techniques using annual data from 40 countries in SSA spanning from 2000 to 2019. The first study estimates the asymmetric effects of fiscal policy on output; the second assesses the tipping point of public debt to GD ratio that makes fiscal policy sustainable; and the third examines whether contractionary austerity works for SSA countries.

Chapter four explores the output response to discretionary fiscal policy is a crucial aspect of examining various theories and findings of empirical studies and delivering guidance to policymakers. This study analyzes the output response to unanticipated fiscal spending shocks under several structural economic characteristic factors, including business cycle states, debt burden, the openness of the economy, exchange rate regimes, and institutional quality, using annual data from 40 countries in SSA spanning from 2000 to 2019 in a panel threshold vector autoregression model. The findings indicate that fiscal spending multipliers have sizable effects on output during recession periods; in economies operating under lower trade openness, a fixed exchange rate, a low debt burden, and a democratic governance regime. Based on the results, this

chapter corroborates the Keynesian perspective on fiscal spending shocks, as it consistently finds the responses of the structural characteristics of the economies to the announcements of fiscal policy in SSA countries. In addition, fiscal multipliers in SSA countries vary based on the transient and structural characteristics of the economies.

Chapter five analyzes the Bohn (2007) sustainability test, allowing for a quadratic fiscal reaction function to public debt levels over the period 2000–2019 for 40 countries in sub-Saharan Africa. This chapter employs a dynamic panel threshold model and other alternative estimation methods to investigate the reaction of fiscal policy and Dumitrescu–Hurlin Granger causality to identify potential causality linkages between government spending and revenue. The findings of this chapter indicate that at a low to moderate level of the public debt ratio, fiscal policy follows a debt-stabilizing rule; however, fiscal responsiveness weakens when the public debt to GDP ratio exceeds 55%, indicating that SSA countries generate unsustainable debt burden as debt mounts and fiscal consolidation becomes highly sensitive in the long run. The Dumitrescu–Hurlin result suggests a unidirectional flow from expenditure to revenue in SSA countries, implying that governments correct fiscal revenue to match budgetary expenditure. Governments in SSA countries should guarantee that public debt management strategies align with the public debt threshold that maximizes growth. The conclusions of this analysis rule out the policy option of relying too much on public debt to achieve fiscal sustainability.

Chapter six explores the impact of fiscal consolidation on economic activity in 40 Sub-Saharan African countries from 2000 to 2019. The study applies the cyclically adjusted primary balance to GDP ratio (CAPB-to-GDP) to identify fiscal consolidation episodes and estimates the impulse response function using the local projection method proposed by Jordà (2005). In the short run, fiscal consolidation reduces real GDP and private demand. In addition, the current account balance responds positively to a shock in fiscal consolidation, whereas the real effective exchange rate responds negatively. Moreover, compared with revenue-based consolidations, spending-based consolidations lead to more minor losses in output. Our finding also reveals that fiscal consolidations depend on economic cycles, with a lower output loss during an economic boom. Finally, this chapter supports the traditional Keynesian approach where contractionary fiscal policy slowdown real GDP and private demand.

The last chapter presents the fiscal policy implications emanating from this thesis to earn sizable, persistent, and long-lasting effects on economic activity and fiscal sustainability. It also presents the thesis's contribution to SSA countries' fiscal policy and raises directions for future research.

KEYWORDS: Sub-Saharan Africa (SSA); fiscal spending shocks; fiscal sustainability; fiscal consolidation; panel TVAR; panel threshold model; local projection method

JEL CLASSIFICATIONS: C23; E62; H30; H60; N17

Acronyms and Abbreviations

BFI	Blanchard Fiscal Impulse
CAPB	Cyclically adjusted primary balance
CD	Cross-sectional dependence
DSGE	Dynamic stochastic general equilibrium
FE	Fixed effects
GFC	global financial crisis
HIPC	Heavily Indebted Poor Countries
IMF	International Monetary Fund
LCU	Local currency units
LIC	Low-income countries
MDRI	Multilateral Debt Relief Initiative
RBC	Reaal Business Cycle
RE	Random Effects
SSA	Sub-Saharan Africa
SVAR	Structural vector auto-regressions
TVAR	Threshold Vector auto-regression
WB	World Bank

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1. Introduction

This dissertation aims to examine the effects of discretionary fiscal policy, dynamics of fiscal sustainability and fiscal consolidation measures in SSA countries using various econometrics methods. This study aims to fill the gap in the literature that did not have a definite conclusion regarding a discretionary fiscal policy while adding to the little systematic analysis in the literature considering the nonlinearity nature of the data-generating process. In sum, this paper attempts to connect the macroeconomic effects of fiscal policy shocks and the long-term effects of fiscal sustainability with consolidation measures.

1.1. Background of the study

Amid the global financial crisis (GFC), fiscal spending shocks, fiscal sustainability, and fiscal consolidation have become hot topics in the policy discourse of Sub-Saharan African (SSA) countries. In response to the GFC, fiscal authorities in SSA countries have introduced large-scale fiscal stimulus packages to revive the economic slowdown. However, the expansionary fiscal strategy is accompanied by a deterioration in fiscal sustainability. Again, as the GFC began, the fiscal balance deteriorated, and most SSA countries' public debt ratios rose sharply. Consequently, the gap between expenditures and revenues has grown, leading to a widening budget deficit and a barrier that restrains economic growth.

Consequently, SSA nations are compelled to take action to put their fiscal policies on a sustainable course by adjusting their fiscal stances and expanding their fiscal buffer to deal with potential future economic downturns. Nevertheless, the effects of discretionary fiscal policy and fiscal sustainability, considering the specific features of SSA countries, have received little attention in the empirical literature. In this context, accurately measuring the effects of discretionary fiscal policy was essential for macroeconomic stability and prudent fiscal policy.

Furthermore, the COVID-19-led recession poses new challenges to the region's fiscal imbalances. On one side, most governments increased fiscal stimulus to mitigate the economic crisis caused by the pandemic. On the other side, the pandemic significantly impacts the countries' public revenue, primarily through a drop in commodity export prices and volumes and a reduction in tax

revenue due to the lockdown. Consequently, fiscal deficits widen as revenues fall, prompting policymakers, governments, and academia to investigate the post-COVID-19 exit strategy.

Interestingly, countries use fiscal policy instruments to either ensure public finances' sustainability or respond to economic shocks. In any circumstance, it is essential to precisely assess the impact of fiscal policy instruments on economic activity. This study is significant for SSA due to soaring public debts and fiscal imbalances that necessitate fiscal adjustment during extended periods of fiscal instability. In addition, this paper attempts to establish a connection between the macroeconomic effects of fiscal policy shocks and the long-term effects of fiscal sustainability with consolidation measures. As a result, it is timely to ask the following research questions: to what extent does the size of fiscal multipliers vary with the structural and transient factors of SSA economies? Given the possibility of increased government spending to stimulate the economy and the risk of increasing the public debt-to-GDP ratio, what level of public debt would ensure public finance sustainability? To what extent does fiscal policy constrain economic growth? Answering these three research questions helps us understand the impact of fiscal policy instruments and prescribe desirable policy tools.

1.2. Statement of the problem

In pursuit of macroeconomic stability, SSA's economy had prolonged periods of instability by relying on monetary policy instruments rather than fiscal policy instruments (Phiri, 2019). However, monetary-based policies failed to achieve macroeconomic stability for the economies. Consequently, there is a growing consensus regarding implementing fiscal instruments as a critical policy to achieve a steady-state sustainable budget. Furthermore, the GFC has unequivocally illuminated the importance of fiscal policy to economic crises. Several studies contend that expansionary fiscal policy can stimulate economic growth, whereas other studies contend that contractionary fiscal policy can stimulate economic growth in the short term. Moreover, the magnitude, persistence, and identification of contemporaneous fiscal shocks have become a global policy priority. Moreover, the literature on the effects of fiscal policy in SSA economies is inconclusive and systematic investigation is lacking.

There is a long-standing debate about the contemporaneous effects of fiscal policy and its transmission mechanisms both in theory and practice. In addition, the literature on the size and

persistence of fiscal multipliers in developing countries, whether larger or smaller than those in other developed and emerging economies, remains unclear. As discussed by the IMF (2014) and Honda et al. (2020), developing countries have a lower monetary response to output; lower automatic stabilizers; and a higher rate of unemployment, which may result in larger fiscal multipliers. On the other hand, low precautionary savings, economic openness, and a more volatile environment may dampen fiscal effects.

In addition, due to unstable access to capital markets and these countries' inability to borrow, sustainable public finance is crucial for countries such as those SSA. These issues can be an essential incentive to avoid a considerable accumulation of public debt (Mendoza and Ostry, 2008). However, increasing debt accumulation due to fiscal stimulus is associated with a greater likelihood of default and a drag on economic growth, significantly when it exceeds a certain threshold (Mahdavi and Westerlund, 2011; Baharumshah et al., 2017). Consequently, the sustainable level of public debt has sparked renewed interest in threshold analysis as a means of assessing the sustainability of fiscal stances in recent studies, despite little being known about the fiscal sustainability of SSA countries.

Expansive fiscal policy could result in enormous public deficits, pressure interest rates, and discourage private investment, which is likely to result in unsustainable public finances. Therefore, governments may engage in restrictive fiscal policy via fiscal consolidations. In contrast, a reduction in public expenditures would likely result in a decline in consumption, output, and employment. The solution to this debate depends on answering the research questions that are not mutually exclusive: to what extent does expansionary fiscal policy stimulate economic growth? Considering an increase in government spending to stimulate the economy and the risk of a rise in the public debt-to-GDP ratio, what level of public debt would ensure the sustainability of public finances? How much does contractionary fiscal policy retard economic expansion?

In sum, the sharp increase in fiscal spending implemented at the onset of the GFC accompanied a long-term worsening of budget deficits and public debt accumulations. Moreover, plans for fiscal consolidation must be evaluated based on their potential short-term impact on economic activity. These issues have become a source of debate in the empirical literature, and there is little consensus on the effect of fiscal spending shocks, fiscal sustainability, and fiscal consolidation. On top of

these, most cited papers have ignored the experience of SSA countries. In light of the preceding discussions, this study will shed light on the interactions between fiscal spending shocks, fiscal sustainability, and fiscal consolidation in the SSA region. By examining these, this study will contribute new insights to the literature on fiscal policy instruments and guide the future by outlining potential approaches to addressing issues about macroeconomic stability and the sustainability of public finances.

Despite the abundance of literature on fiscal policy effects related to the study, the majority of studies have largely neglected to address the following issues:

- a) In fiscal policy analysis, the studies focusing on developed nations failed to account for characteristics of SSA economies, such as dependence on foreign aid, sensitivity to external and domestic shocks, commodity trade shocks, political instability, weak policies and institutions, procyclical fiscal policy, widespread poverty, high unemployment, and sizable informal labor markets. Thus, it is vital to conduct empirical studies focusing on the specific region rather than treating it as an outlier or dummy variable in studies comprising a large panel of advanced and developing countries.
- b) SSA countries' economies differ from the developed world because of their excessive use of external debt to finance fiscal deficits, massive infrastructural needs, and limited fiscal space to finance public spending. Due to the region's unique characteristics, studies focusing on those characteristics are required.
- c) Little is known about the asymmetric effects of discretionary fiscal policy shocks under different economic conditions. Moreover, the sign and size of fiscal impulses vary over structural economic features, requiring a non-linear approach to better estimate the actual magnitude of the fiscal multipliers. However, the empirical studies documented in SSA countries do not entail a non-linear pattern of fiscal policy.
- d) Most previous studies in SSA countries evaluate fiscal sustainability using the methods outlined by Trehan and Walsh (1988, 1991) while ignoring the nonlinear fiscal reaction function. Considering the asymmetric response of fiscal policy to the increasing debt hypothesis, this chapter applies a non-linear approach to generate correct inferences from the model specification techniques.

- e) The literature on the impact of fiscal consolidation on economic activity in SSA countries is thin, and the existing studies focused only on the impact of fiscal consolidation on output and neglected its effects on private demand and unemployment. In addition, the studies neglect the state-dependent effects of fiscal consolidation on output and the heterogeneity effect of the fiscal instrument on output.

The value addition of this study is numerous. First, this study investigates three sequential fiscal policy-related research questions and provides detail evidence on the effects of fiscal policy with a broader sample of SSA countries. Notably, the study's findings can assist policymakers in determining whether contemporaneous fiscal policy is essential for fostering economic growth under various economic conditions. In line with this, this study, to the researchers' best knowledge, is the first study that examines the asymmetric effects of fiscal policy using a panel threshold model. Moreover, this paper estimates the effect of political regimes on fiscal policy, which is lacking in the literature. Second, this paper advises policymakers to use the public debt ceiling to rule out an excessive reliance on higher debt to stimulate economic growth in SSA countries and to identify the factors that determine fiscal sustainability. Third, using an appropriate methodology, this paper suggests the macroeconomic effects of fiscal consolidation on economic output, unemployment, consumption, private investment, REER, and current account balance. Finally, it provides future researchers with a deeper understanding of SSA fiscal policy. Researchers and policymakers interested in how fiscal spending shocks affect economic growth, the dynamics of fiscal sustainability in the region, and the effects of contractionary fiscal policy on economic activity should find the results of this study proper. This thesis also aims to contribute to the existing literature on discretionary fiscal policy.

1.3. Objectives of the study

Fiscal policy tools have piqued the interest of many governments and academics worldwide due to their ability to respond to aggregate demand shocks. As a result, this thesis empirically assesses the effect of discretionary fiscal policy and fiscal sustainability for SSA countries.

This thesis addresses three specific objectives that figure centrally in fiscal policy.

- ✓ To investigate the determinants and magnitude of fiscal innovations under SSA countries' key economic features
- ✓ To identify determinant factors of fiscal sustainability
- ✓ To identify the determinant factors of fiscal consolidation and assess its effect on economic activity

1.4. Research questions

This thesis addresses three research questions:

- (1) To what extent does the fiscal multipliers' size vary with the structural and transitory factors of SSA economies?
- (2) Considering an increase in government spending to stimulate the economy and the risk of a rise in the public debt-to-GDP ratio, what level of public debt would ensure the sustainability of public finances in SSA countries?
- (3) How much does contractionary fiscal policy retard economic activity in SSA countries?

1.5. The hypothesis of the study

Accordingly, we proposed the following hypotheses:

H_1 : Expansionary fiscal policy does not significantly affect output in the short-to-medium term in SSA countries.

H_2 : Primary balance and public debt have a linear relationship in SSA countries.

H_3 : Contractionary fiscal policy does not significantly affect economic activity in the short run in SSA countries.

1.6. Significance of the study

This thesis contributes not only to current macroeconomic policy by providing vital information but also to the maintenance of sustained economic growth through fiscal sustainability. SSA economies are distinguished by their excessive reliance on external debt to finance fiscal deficits and enormous infrastructure requirements. This thesis aims to suggest improved methods for

addressing fiscal imbalances and economic distortions of countries caused by excessive debt accumulation and to elevate the fiscal sustainability issue to the top of the policy agenda.

Therefore, the results demonstrated in this thesis are expected to serve as a basis for researchers and policymakers interested in how fiscal spending shocks affect economic growth, the dynamics of fiscal sustainability in the region, and the effects of contractionary fiscal policy on economic activity. Moreover, this thesis aims to add to the growing literature on discretionary fiscal policy in SSA countries.

1.7. Scope of the study

This study's data range from 2000 to 2019. We chose this period to capture the resurgence of discretionary fiscal policy as a cornerstone of most SSA countries on the one hand and the consistent availability of balanced panel data from the same source on the other hand. Data are gathered from 40 SSA countries. Furthermore, this study covers 40 SSA countries out of the total 45 SSA countries, depending on the availability of long comparable time series data in those countries. It also employs a robust technique that guards against panel estimation problems such as cross-sectional dependence, autocorrelation, and endogeneity.

1.8. Organization of the thesis

The thesis is organized as follows. **Chapter two** presents the concepts of fiscal policy shocks, fiscal sustainability, and consolidation and how they have been measured in the literature. **Chapter three** deals with the overview trends in SSA countries' macroeconomic and fiscal performances of SSA countries over the period 2000-2019. **Chapter four** deals with the first empirical study addressing research objective I. This chapter estimates the determinants of fiscal multipliers, focusing on a nonlinearity assumption using a panel TVAR model. The estimation process overcomes problems associated with panel estimation, such as cross-sectional dependence, stability test, autocorrelation, and endogeneity.

Chapter five provides the empirical finding to address objective II employing a dynamic panel threshold model and other alternative estimation methods to investigate the reaction of fiscal policy and Dumitrescu–Hurlin Granger causality to identify potential causality linkages between

government spending and revenue. **Chapter six** presents the empirical results to respond to specific objective III, identifying the fiscal consolidation using the cyclically adjusted primary balance to GDP ratio (CAPB-to-GDP) and estimating the impulse response function of economic activity using the local projection (LP) method proposed by Jordà (2005). Lastly, **chapter seven** sets the summary, concluding remarks, and policy options.

2. Definitions and Concepts of Fiscal Policy

This chapter covers the main concepts of fiscal policy debated in the literature. It deals with the concepts and definitions of fiscal spending shocks, fiscal sustainability, and fiscal consolidation effects.

Fiscal policy uses instruments such as government spending, taxation, and borrowing to influence a country's economy through its expansionary or contractionary policy, depending on the state of the economy. An expansionary fiscal policy entails increasing government spending and transfer payments while decreasing tax levels, whereas a contractionary fiscal policy is an opposite. The primary fiscal policy goals in modern economies are three. First, fiscal policy aims to allocate public goods and services efficiently. Second, it uses to redistribute income and wealth. Third, fiscal policy stimulates economic activity, maintains price stability, and reduces unemployment in the short term while achieving long-term fiscal sustainability. Furthermore, regardless of income level, all countries use government spending as an essential policy tool, particularly in developing countries such as SSA countries, where public spending can share the macroeconomy to stimulate economic growth, and its relevance increases (Shen et al., 2018).

2.1 Fiscal spending shocks

Fiscal multipliers measure the effect of fiscal policy on economic activity. It can immediately impact the economy by increasing government spending, or it can indirectly impact by increasing private consumption, private investment, and net trade. According to economic theories, structural and conjunctive factors potentially influence fiscal multipliers' magnitude and persistence. For example, the size of multipliers will vary depending on the following factors: the persistence of the fiscal changes, type of fiscal instrument changed, source of finance of the fiscal instruments, anticipation rate, share of the hand-to-mouth population and liquidity-constrained firms, how monetary policy is accommodated, business cycle of the economy when the fiscal shock is implemented, and other main structural features of the economy, such as level of development, automatic stabilizers, public debt, exchange rate regime, and trade openness (Ramey, 2019).

The effect of fiscal spending shocks has been the subject of a long-standing debate in the theoretical and empirical literature. The empirical literature on the effect of discretionary fiscal

policy on output falls within two schools of thought—The Keynesian preposition and the classical preposition. The Keynesian preposition assumes aggregate demand determines output, price is stable, and the economy has excess capacity. Thus, fiscal expansion, especially during a recession, through its fiscal multipliers on aggregate demand, increases employment, profits, and private investment. It also spurs economic growth. Contrary to Keynes’ theory, the Mundell–Fleming model assumes fiscal expansion in an open economy will crowd out private investment by increasing interest rates and exchange rates and drag in consumption and leisure.

Theoretically, the effects of the fiscal multiplier variation of Keynesian and neoclassical models come from the private consumption response. The Keynesian models predict that fiscal expansions will increase private consumption due to price rigidity and the inseparability of consumption and leisure. According to this model, labor supply rises, real wages increase, and non-Ricardian (rule-of-thumb) households’ consumption responds positively. As a result, the fiscal multipliers contribute to an increase in labor income and employment and an expansion in output. In contrast, the neoclassical theory asserts that fiscal expansion can harm the wealth of Ricardian households who anticipate future tax increases. This results in a decrease in consumption and leisure and an increase in labor supply, which lowers the wage rate and increases output (Galí et al., 2007).

2.2 Fiscal sustainability

A function of prior debt stocks, the difference between interest and growth rates, and the primary balance can be used to express fiscal sustainability. Fiscal sustainability presupposes that there is a no-Ponzi scheme where the government can never pay off its debt. It is possible to approach fiscal sustainability historically and proactively (Tanner and Samake, 2008). Research questions like “To what extent do the existing policies have to continue to make public finance sustainable?” are addressed through retrospective analysis, which uses historical data. Or do policy changes need to be made? The prospective approach, however, uses anticipated data and provides answers. What policies should be developed today to prevent the need for additional changes to make the public finances sustainable in the future?

Two lines of research on measuring fiscal sustainability exist following the theoretical arguments: the fiscal sustainability indicator (Buiter, 1985; Blanchard, 1990) and the intertemporal budget constraint (IBC) (Hamilton and Flavin, 1985). The Fiscal Sustainability Indicator argues that for

fiscal policy to be sustainable, there must be a positive difference between interest rates and growth rates. As a result, the debt-to-GNP ratio eventually reaches its initial level (Buitier, 1985; Blanchard, 1990; Gramlich, 1990; Chouraqqii et al., 1990; Burnside, 2003; Croce and Juan-Ramon, 2003). Due to the method's ease of application, readability, and comparability of results across nations and historical periods, many academics prefer it. Furthermore, the method ignores conditions unique to a particular nation.

Meanwhile, the IBC (Hamilton and Flavin, 1985) refers to the goal of keeping initial debt equal to the present value of future fiscal surpluses. Hamilton and Flavin (1985) investigated the stationarity of the discounted debt under the assumption of a constant real interest rate. Wilcox (1989) builds on Hamilton and Flavin's (1985) IBC by introducing structural breaks in the processes. According to Wilcox (1989), the debt process should not grow faster than an economy's economic growth, and the sufficiency condition necessitates the integration of the deficit process. In addition, (Trehan and Walsh, 1988, 1991; Hakkio and Rush, 1991; Haug, 1991; Smith and Zin, 1991) extend the IBC model by requiring the cointegration of public revenues and spending. The IBC has policy ramifications. First, the approach does not rule out either large primary deficits or high debt as long as the present value of future primary surpluses meets the PVBC. Second, the model considers the process sustainable if (i) the deficit process is high in all periods and (ii) the debt growth rate is slower than the interest rate if and only if the transversality condition is met (Chalk and Hemming, 2000).

In the empirical literature, fiscal sustainability is measured mainly through three approaches.

2.2.1. Unit root test approach

In the empirical literature, it is customary for the present value borrowing constraint to satisfy public debt stationarity and revenue and expenditure requirements (Hamilton and Flavin, 1986; Wilcox, 1989; Trehan and Walsh, 1991; Afonso, 2005).

The empirical model can be tested as follows:

- I. The current debt level must be equal to the sum of future primary surpluses:

$$b_{t-1} = \sum_{i=0}^{\infty} (1+r)^{-(i+1)} (x_{t+i} + \sigma_{t+i}) \quad (2.1)$$

II. The transversality condition:

$$\lim_{j \rightarrow \infty} (1 + r)^{-(j+1)} b_{t+j} = 0 \quad (2.2)$$

Equation (2.2) rules out that the accumulated public debt and that interest cannot be paid by issuing new debts, known as the no-Ponzi game condition. In the long run, public debts cannot grow higher than the interest rate.

2.2.2. Cointegration tests approach

The long-run relationship between public revenue and spending as a sufficiency condition and the debt as a necessary condition should not increase faster than the interest rate (Elliot and Kearney, 1988; Hakkio and Rush, 1991; Haug, 1991; Ahmed and Rogers, 1995; Payne, 1997; Afonso, 2005).

Cointegration regression testing is conducted during the process:

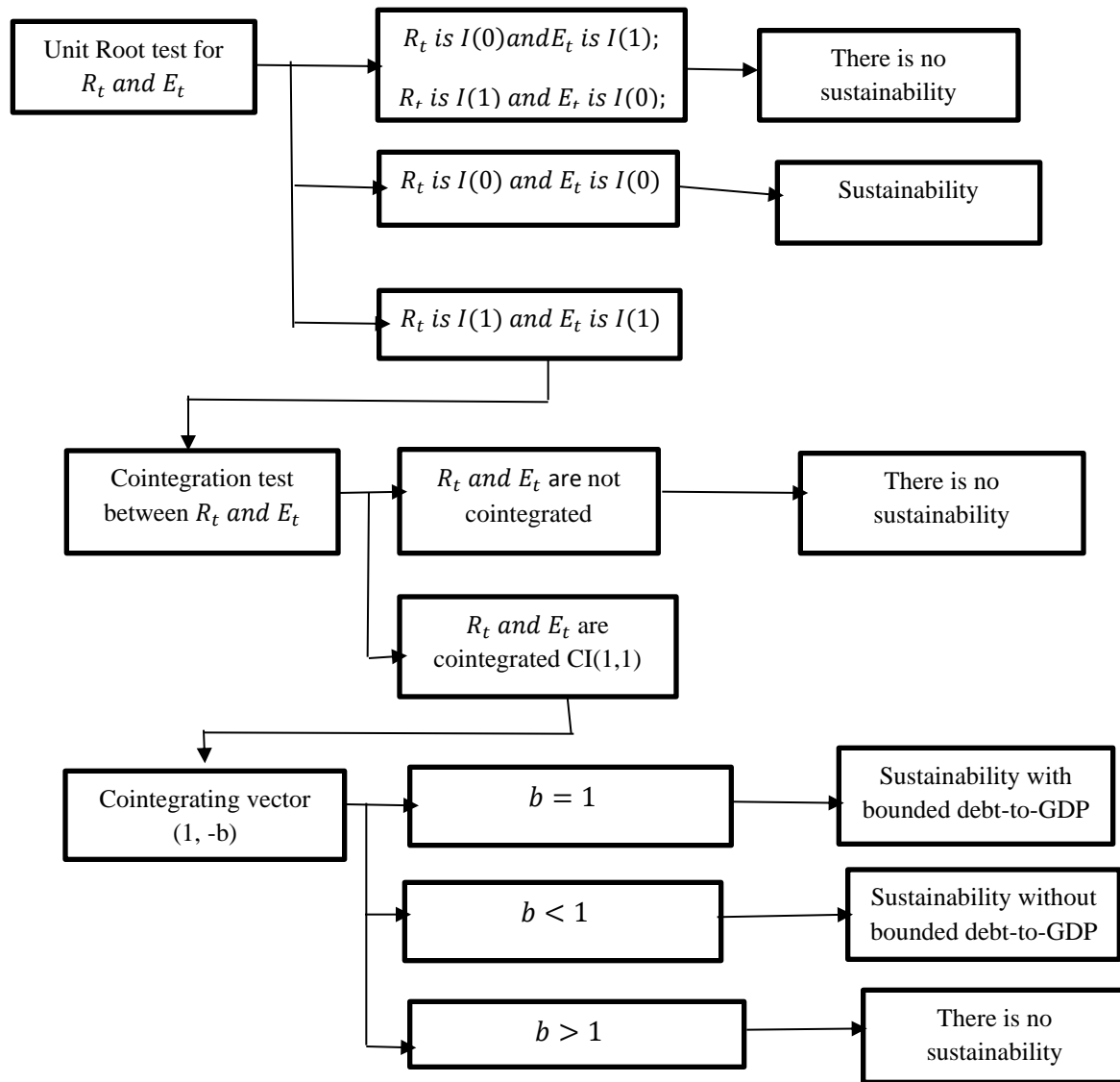
$$R_t = \alpha + \beta E_t + \mu_t \quad (2.3)$$

According to Quintos (1995), strong sustainability happens when $\beta = 1$ and the μ_t is $I(0)$. Second, there is a weak sustainability if $0 < \beta < 1$. Third, if $\beta \leq 0$, the fiscal condition is unsustainability. Lastly, when $\beta > 1$, the IBC is violated, implying indefinite growing surpluses and therefore is not consistent with the IBC solvency condition.

However, according to Bohn (2007), unit root and cointegration tests cannot rule out sustainability, either because they reject low-order difference-stationarity or because revenues and spending do not need to be cointegrated.

Diagrammatically, the scenarios can be represented in Figure 3.1:

Figure 2.1: Unit-root and cointegration tests fiscal sustainability criteria



Source: Adopted from Afonso (2005)¹.

The classical approach to assessing fiscal sustainability is to examine the public debt stationarity process and the cointegration between revenues and spending. Figure 2.1 depicts if public revenue (R_t) and spending (E_t) have a different level of stationarity level, then the fiscal policy is unsustainable. If both series are $I(0)$, then the fiscal policy is sustainable. However, if both series are nonstationary at level but stationary at the first difference, we will assess the cointegration

¹ The diagram is taken from Afonso (2005, p. 25).

vector of the two variables. If there is no cointegration between the variables implies a non-sustainable fiscal policy. If public revenue and government spending are $I(1)$ and their cointegration vector is one, then there is strong fiscal sustainability; if the cointegrating vector is between $0 < b < 1$, the fiscal policy is sustainability without bounded debt-to-GDP; and lastly if the cointegrating vector is greater than one, the fiscal policy is not sustainable.

2.2.3. The fiscal reaction function approach

Bohn (2007) responds to the limitations of such tests by rejecting sustainability. First, the no-Ponzi game condition can be satisfied in an infinite sample of debt series and revenue and spending at arbitrarily higher order of integration. The cointegration of government expenditure and revenue is not required to achieve fiscal solvency. Furthermore, these methods suffer from omitted variable bias because they fail to account for the cyclical components of primary surplus in unit root testing (Bohn, 1998).

To address the omitted variable bias and econometric limitations of the unit root and cointegration tests, Bohn (1995, 1998) proposes a model with a no-Ponzi game condition, dubbed model-based sustainability, and proposes guaranteed public finance sustainability if the primary surplus rises in proportion to rising levels of past debt accumulation. The plausible economic intuition is that an increase in past public debt accumulation should be accompanied by an increase in the primary surplus, allowing governments to initiate corrective policy responses in the future and maintain the IBC.

Recent research on fiscal sustainability has shifted toward nonlinear fiscal reaction functions. These extensions either consider fiscal reaction functions as polynomial functions of debt to primary balance (Gosh et al., 2013) or fiscal rules as time-varying and described by structural breaks (Legrenzi et al., 2013; Fournier and Fall, 2017; Aldama and Creel, 2020). The latter contends that governments cannot adhere to Bohn's sustainability condition because nonlinearities arise from periodic fiscal policy violations in recurring and future episodes (Aldama and Creel, 2020). In contrast, the former contends that a primary balance reacts to lagged debt in the form of an S-shape, with a threshold level at which the primary surplus cannot increase as quickly as interest payments amid rising debt. Furthermore, the S-shaped fiscal rule implies that fiscal fatigue sets in when a government reaches its debt limit and the government defaults (Gosh et al., 2013).

2.3. Fiscal consolidation

Fiscal consolidation is commonly defined as reducing spending or increasing taxes to reduce public debt. However, the macroeconomic effects of fiscal consolidation are a matter of contention. Following Giavazzi and Pagano (1990), the empirical literature on the response of real GDP and private demand to contractionary fiscal policy is divided into two strands, expansionary austerity (non-Keynesian effects of fiscal policy) and contractionary austerity.

A standard implication of Keynesian models is that spending cuts or tax increases reduce short-term aggregate demand. In contrast, non-Keynesian effects contend that short-term fiscal adjustments can stimulate private consumption and investment via the demand side (wealth effects and interest rate channels) or the supply side (the labor market and tax decisions channel).

In tandem, countries with a stable macroeconomic environment pursue an expansionary fiscal policy, whereas countries with limited fiscal space or high levels of debt tighten their fiscal policies in the short term. Numerous studies have been conducted worldwide on the three sequential topics, but the literature on SSA economies is thin.

2.4 Sustainable development

After the Brundtland Report (1987) and the Rio Conference (UN 1992), sustainable development as a discourse has attracted different disciplines and spread out to encompass economic, environmental, and social dimensions. However, Báger (2022) argues that the existing sustainable development framework is insufficient for recent development issues and new related challenges. Accordingly, Báger (2022) suggests multiple sustainable development pillars, such as finance, culture, and territory, to support the sustainable development dimensions in the Future House of Sustainability.

Of the new sustainable development domains, the finance domain is the main interest of this study. Báger (2022) identifies eight dimensions in the financial sustainability domain: the Banking System; Finances of Households; Corporate Finances; Corporate Finances; Public Finances; Stability of Macrofinances; Digital Financial Services; Electronic Payment Services, and Green Finance (Báger, 2022). The importance of the financial sustainability pillar increases following the GFC due to the financial crisis and its escalated effects into a broader economic and social

slump. The crisis not only affected the macroeconomic aspect of the nations but also disrupted the finance of households and companies.

Public finance sustainability requires maintaining the public debt ratio below the threshold level and demands a comprehensive policy response that considers the residual maturity of the debt and public debt structure. Moreover, it should also be complemented by pension and healthcare expenses arising from population aging. Therefore, this thesis examines the fiscal sustainability of SSA countries using the concept of the optimal quantity of debt.

2.5 Chapter summary

Fiscal policy involves the manipulation of government spending, taxation, and borrowing to influence the level of economic activities and stabilize the economy. Fiscal multipliers measure the response of real GDP changes to a unit shock in the fiscal stances. Fiscal policy has a direct as well as an indirect effect on output. Countries with stable macroeconomic run expansionary fiscal policies, while those without fiscal space or highly indebted countries tighten their fiscal policies in the short term. In sum, this chapter introduces the concepts and measurements of fiscal spending shocks, fiscal sustainability, and consolidation from the existing literature. The next chapter provides an overview of SSA countries' fiscal and economic performance.

3. Overview and pattern of SSA countries' fiscal policy and economic performance

This chapter presents the pattern of SSA countries' fiscal policy and economic performance variables. This chapter's main aim is to briefly introduce how SSA countries' fiscal and economic performance over the period 2000-2019. It also highlights the effect of the COVID-19 pandemic on SSA economies.

3.1. Description of SSA countries

The SSA is made up of 45 countries from the Africa continent (Table 3.1). SSA is composed of low, lower-middle, upper-middle, and high-income countries. Of the 45 SSA countries, 22 countries are either fragile or conflict-affected.

Table 3.1: List of SSA countries

Angola	Central African Republic	Eritrea	Guinea-Bissau	Mauritius	Senegal	Uganda
Benin	Chad	Eswatini	Kenya	Mozambique	Seychelles	Zambia
Botswana	Comoros	Ethiopia	Lesotho	Namibia	Sierra Leone	Zimbabwe
Burkina Faso	Democratic Republic of Congo	Gabon	Liberia	Niger	South Africa	
Burundi	Republic of Congo	The Gambia	Madagascar	Nigeria	South Sudan	
Cameroon	Côte d'Ivoire	Ghana	Malawi	Rwanda	Tanzania	
Cape Verde	Equatorial Guinea	Guinea	Mali	Sao Tome and Principe	Togo	

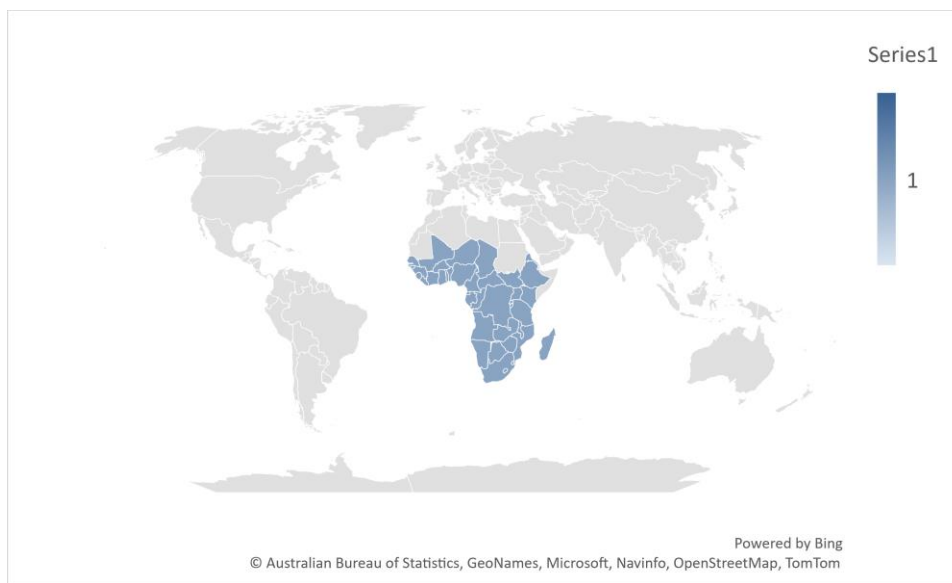
Source:

More than a billion people live in the SSA region with a relatively rapid population growth, which may negatively impact the current budget deficit and effective macroeconomic management (Figure 1). Similarly, the region may eventually face an intertemporal budget deficit due to the

old-age dependency ratio, congestion, pollution, and slum settlements. This realization has prompted the continent's fiscal authorities to implement fiscal sustainability as a critical policy to achieve a sustainable budget over the steady-state.

In 2021, the SSA countries' GDP per capita was \$1,645, with a 5.33% inflation rate and a 7.66% unemployment rate. Moreover, the IMF report in 2019 indicates that Africa accounted for 4.4% of intraregional trade and 2.8% of global trade. Because Africa relies on primary commodities, its exports are vulnerable to various shocks. Despite good economic performance over the last two decades, poverty in the region is more widespread and profound than in the rest of the world. Furthermore, the benefits of economic growth have not been widely distributed, resulting in persistent regional economic inequalities.

Figure 3.1: Map of SSA countries



Source: own computation

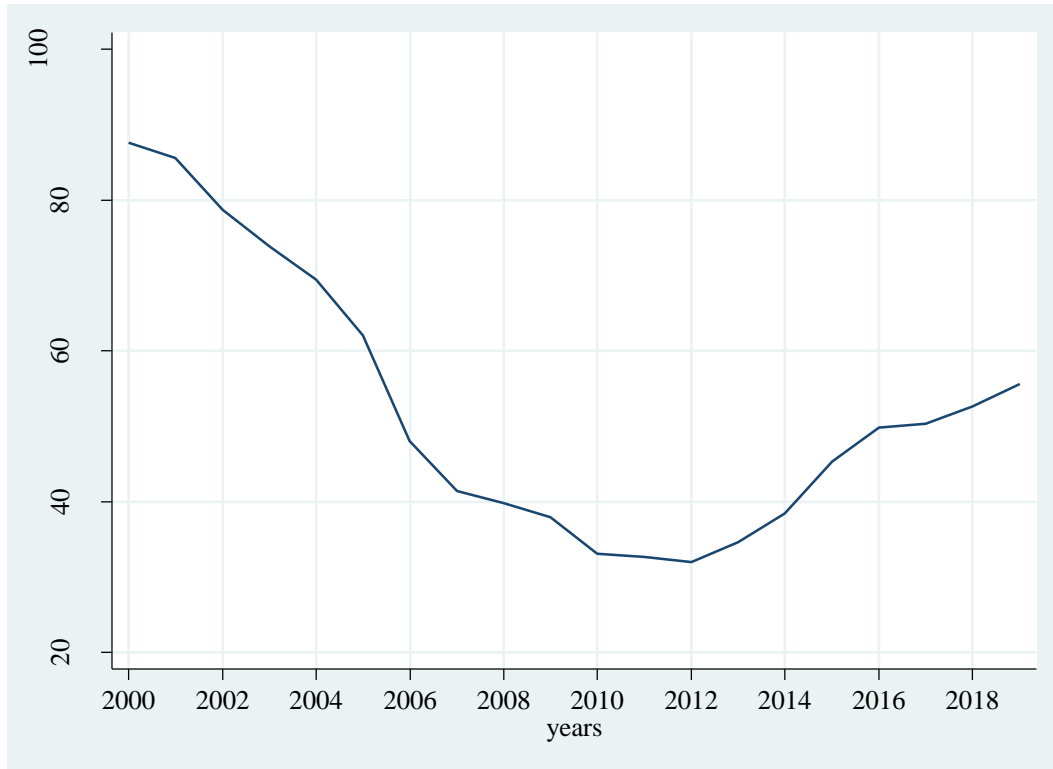
The SSA economies are distinguished by their reliance on undiversified primary export commodities as a source of foreign exchange earnings leading the countries in danger because their revenues can no longer cover their comparatively high total spending due to unanticipated shocks to the limited export products. Moreover, future uncertainties make it difficult to plan for the economy, contributing to the countries' slow growth. Furthermore, the prevalence of corruption and political polarization made macroeconomic management in the countries more

difficult. Additionally, the governments' consumption responses are procyclical. Thus, fiscal indicators can significantly improve these notable challenges in economies with highly uncertain fiscal revenues and their impact on the budget deficit.

3.2. Overview of SSA countries' public debt

As shown in Figure 3.2, the average public debt level decreased sharply from 87.6% of GDP in 2000 to 32% of GDP in 2012 due to significant debt forgiveness for heavily indebted emerging countries. However, over the past decade, the average public debt of SSA countries increased from 32% to 55.6% of GDP, resulting in a rapid increase in the region's debt stock. Fiscal expansion contributed to this increase. The key contributors to the accumulation of debt vary from country to country. However, they include commodity price volatility, poor fiscal management and corruption, significant infrastructure needs, rapidly growing populations, increased public spending, exchange rate depreciations, and a shifting proportion of commercial to concessional loans. In addition, the government's response to the GFC and the terms-of-trade shock also contributed to debt accumulation. Following this, the crisis negatively impacted the economic activities of the countries, resulting in a decline in government revenue. Consequently, the increasing accumulation of debt complicates nations' macroeconomic management by diminishing governments' credibility, restricting access to international financial markets, and stifling private investment due to over-reliance on domestic borrowing.

Figure 3.2: The trend of average public debt level in SSA countries



Source: authors' computation

Fiscal sustainability is critical to an economy's long-term economic growth. Though debt accumulation in SSA countries is not as severe as in the eurozone, fiscal policy is characterized by a lack of fiscal discipline (Phiri, 2019). As shown in Figure 2, the average debt-to-GDP ratio for 40 SSA countries in 2019 was 55.6%. The International Monetary Fund (IMF) report suggested that the debt-to-GDP benchmark for African countries should not exceed 35%, 55%, and 70% of GDP based on the performance of the countries as weak, medium, and strong, respectively (IMF, 2018). Thus, many SSA countries have approached or exceeded the threshold, which may pose a problem for fiscal sustainability and the overall macroeconomic system's stability.

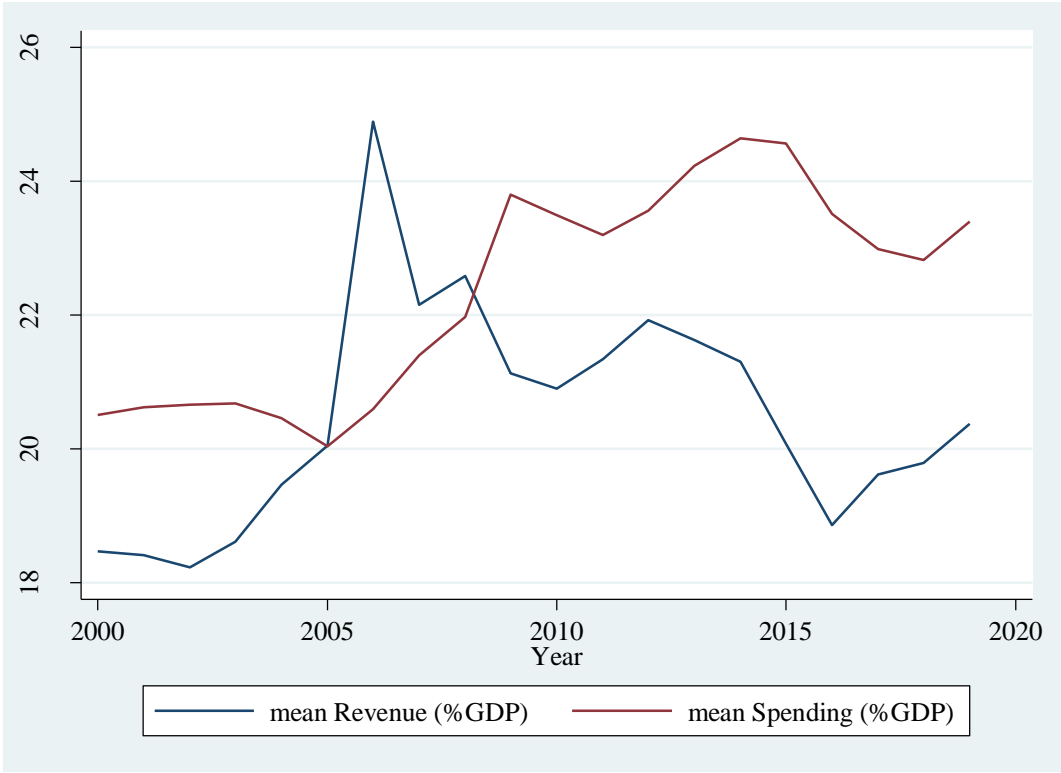
3.3. Overview of SSA countries' public spending (%GDP) and public revenue (%GDP)

Figure 3.3 depicts the average public spending and revenue as a percentage of GDP for SSA countries from 2000 to 2019. The public revenue to GDP ratio trend shows a significant increase from 18.5% in 2000 to 24.9% in 2006. A possible explanation for the budget balance improvement

is commodity price booms in the 2000s, particularly in oil-exporting nations (Cespedes - Velasco, 2014; Calderon - Nguyen, 2016). In 2016, the revenue-to-GDP ratio reached its lowest point, 18.9%. After 2016, a third rising trend occurred in 2019, with a value of 20.4% of GDP. Narrow and volatile revenue sources, relatively shallow private capital inflows, underdeveloped financial markets, and reliance on aid and foreign borrowings to cover government expenses are the primary reasons for the fluctuating decline in public revenues.

In contrast, fiscal spending was 20.5% of GDP in 2000 and remained stable until 2006, with a spending-to-GDP ratio of 20.5%. Following 2006, average fiscal expenditures began to rise gradually, reaching a peak of 24.6% of GDP in 2014. The increase in public spending responds to economic shocks and massive regional development requirements. Since 2014, the ratio of public spending to GDP has decreased, reaching 23.4% in 2019.

Figure 3.3: The trend in public spending–GDP ratio and public revenue GDP ratio for SSA countries



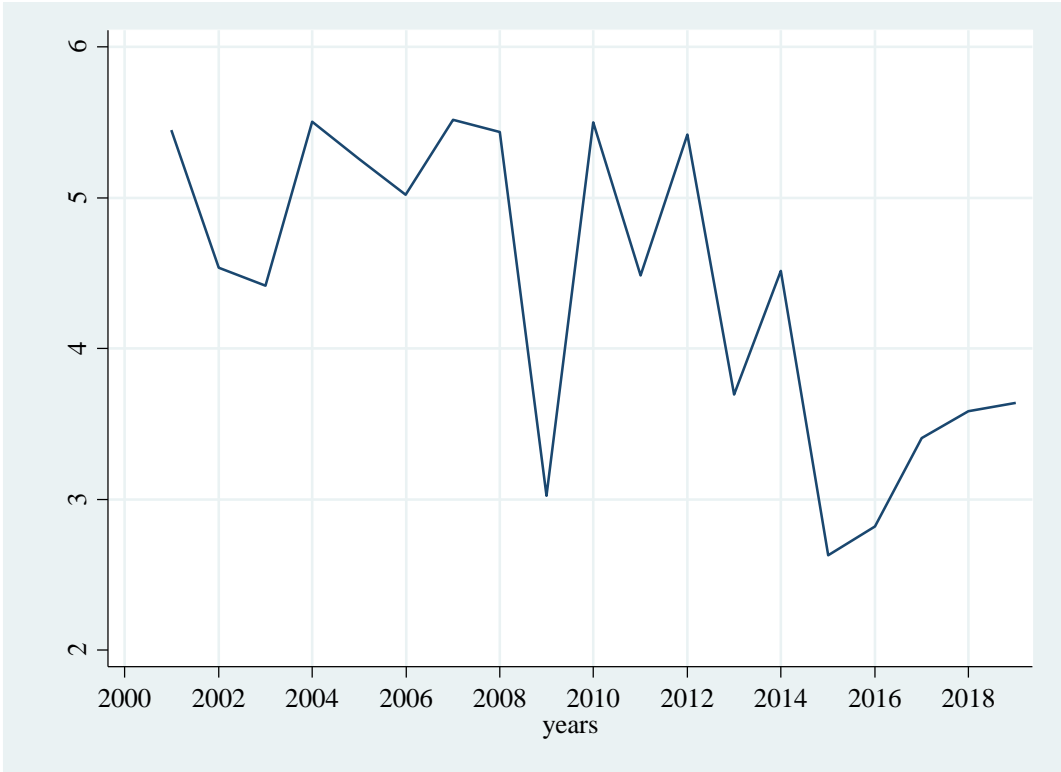
Source: Authors’ computation

From a fiscal perspective, the primary criterion for a prudent macroeconomic environment is maintaining a stable long-term cointegration between expenditures and revenues. The study also seeks to determine whether fiscal imbalances threaten the fiscal sustainability of SSA countries and their propensity for insolvency.

3.4. Overview of SSA countries' economic growth

Figure 3.4 depicts the trend in SSA countries' economic growth rates and fiscal balance-to-GDP ratios from 2000 to 2019. Although no negative economic growth rates were recorded in the region, economic growth fluctuated upward and downward during the review period. In 2001, economic growth was 5.4%. Following a series of fluctuations, the economic growth decreased in 2009 to 3% and experienced the lowest level of economic growth at 2.6% in 2015. This suggests that, although SSA countries' economic integration into the global economy is limited, their economies are vulnerable to shocks outside the continent. As illustrated in Figure 2, the 2009 GFC and the drop in oil prices in 2015 had significant repercussions on SSA economies.

Figure 3.4: The trend in economic growth rate and primary balance of SSA countries

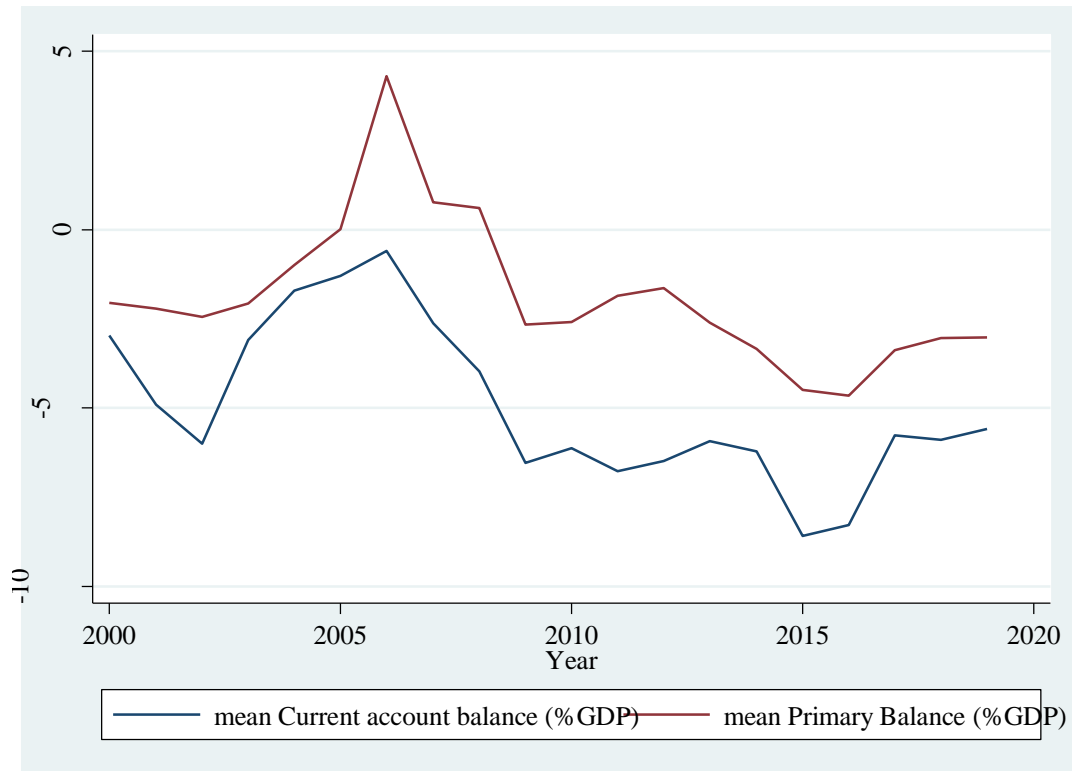


Source: Authors' computation

3.5. Overview of trends of the current account balance to GDP and primary balance to GDP

The literature has long debated the relative merits of fiscal and current account deficits. The twin deficit hypothesis holds that an economy's current account deficit and budget deficit move in the same direction, meaning that changes in the current account balance are directly correlated with changes in the budget balance. However, a persistently large current account deficit is problematic because it transfers wealth to foreigners and burdens future generations. In addition, persistent fiscal deficits may make the economy more vulnerable to inflationary pressures, burden the sovereign debt more, and discourage private investors from putting resources into the economy. Figure 3.5 shows the average trend of the current account balance-to-GDP ratio. In SSA countries, the current account balance to GDP ratio fell from -3% in 2000 to -6% in 2002 before recovering and peaking at -0.6% in 2016. However, the current account balance-to-GDP ratio for SSA countries dropped again from -0.6% in 2006 to -8.6% in 2015. As a percentage of GDP in 2019, the current account balance was -5.6% (see figure 3.5).

Figure 3.5: The trend in the current account balance-to-GDP ratio of SSA countries



Source: Authors' computation

The primary balance reached its lowest levels during the GFC and oil price shock (Figure 3.5). The trend in the primary balance indicates that it was -2% of GDP in the year 2000 and that the trend began on a positive note with an increase and peaked at 4.3% of GDP in the year 2006. With the onset of the 2009 GFC, the primary balance widened and decreased to -2.7% of GDP. Following the fall in oil prices, SSA countries' primary balance-to-GDP ratio reached its lowest point of -4.5% in 2015 and began to recover, reaching -3% in 2019 (Figure 3.5). The main reason behind this deficit is that these countries fund a larger proportion of their budgets with external borrowings, indicating that the deficit accumulates to the countries' existing debt levels. In addition, the data series on the budget deficit to GDP ratio indicates high volatility for most countries, complicating economic planning and macroeconomic stability.

3.6. Overview of trends of trade openness to GDP, export and import to GDP

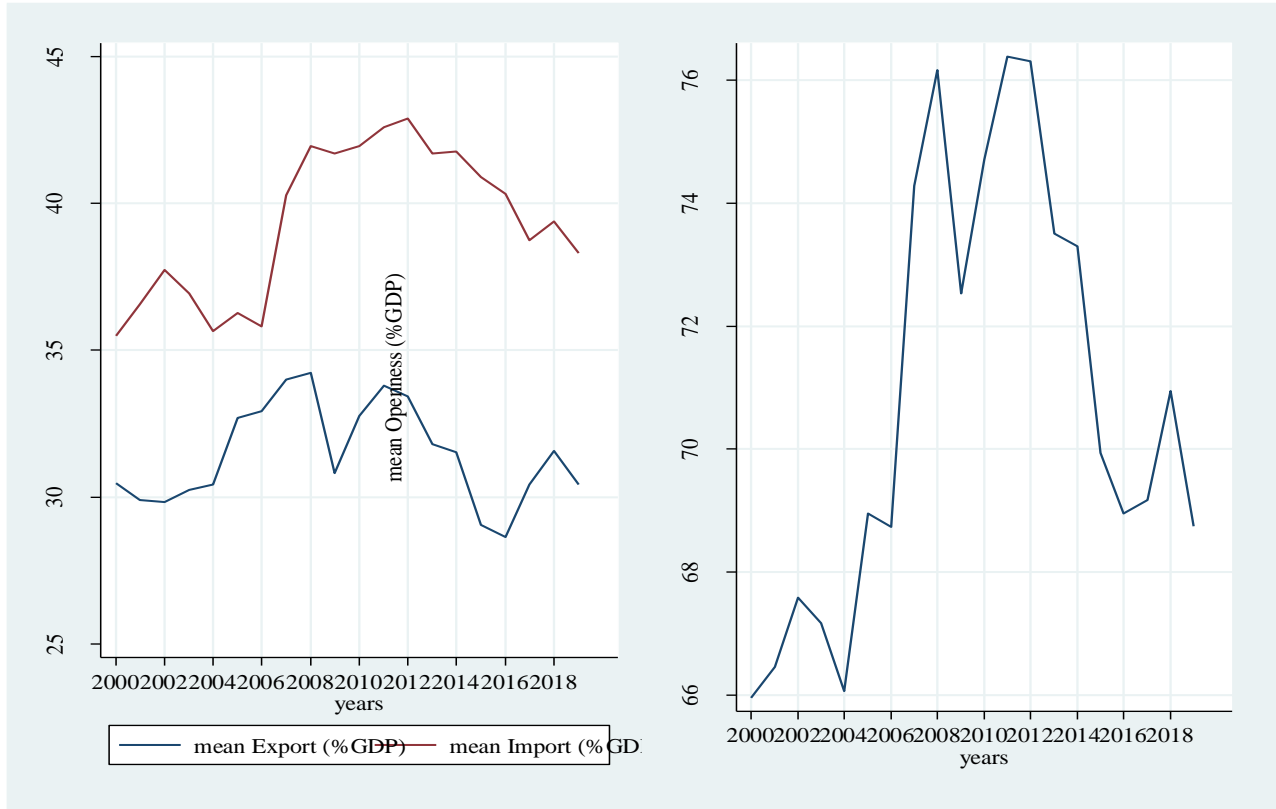
Trade deficits can cause macroeconomic imbalances that harm a country's long-term economic growth trend. Furthermore, trade balances influence fiscal policy transmissions. The size of fiscal

multipliers decreases as trade openness increases. According to Keynesian models, the effect of fiscal policy on aggregate demand is expected to diminish in open economies due to the leakage of imported goods. Most SSA economies have trade deficits due to their participation in international trade. Figure 3.6a depicts the SSA's share of imports to GDP and the share of exports to GDP from 2000 to 2019, whereas Figure 3.6b depicts the economies' average trade openness as a percentage of GDP.

SSA Openness increased from 66% in 2004 to 76.2% in 2008 and declined to 72.5% in 2009 following the GFC. However, SSA trade openings fell dramatically between 2012 and 2016. This could be because SSA countries export a limited amount of primary goods, making them particularly vulnerable to fluctuations in trade terms. These shocks have a significant impact on the countries' net exports.

Figure 6a depicts the export-to-GDP and import-to-GDP ratios. The average export level in 2000 was 30.5% of the GDP, which increased to 34.2% in 2008. Export appears to have declined to 30.8% of GDP following the GFC. Furthermore, following the 2014 oil price shock, exports fell to their lowest point, reaching 28.6% of GDP in 2016. The share of exports to GDP increased to 30.4% in 2017, and it fluctuated and remained at 30.4% in 2019. In contrast, imports as a percentage of GDP were 35.5% in 2000 and 37.7% in 2002. The region's import level increased from 37% of GDP in 2003 to 43.3% in 2012. Moreover, the SSA countries' import-to-GDP ratio has decreased, reaching 38.3% in 2019.

Figure 3.6: (a) Trends in export and import to GDP ratio (b) Trend in the trade openness to GDP ratio of SSA countries



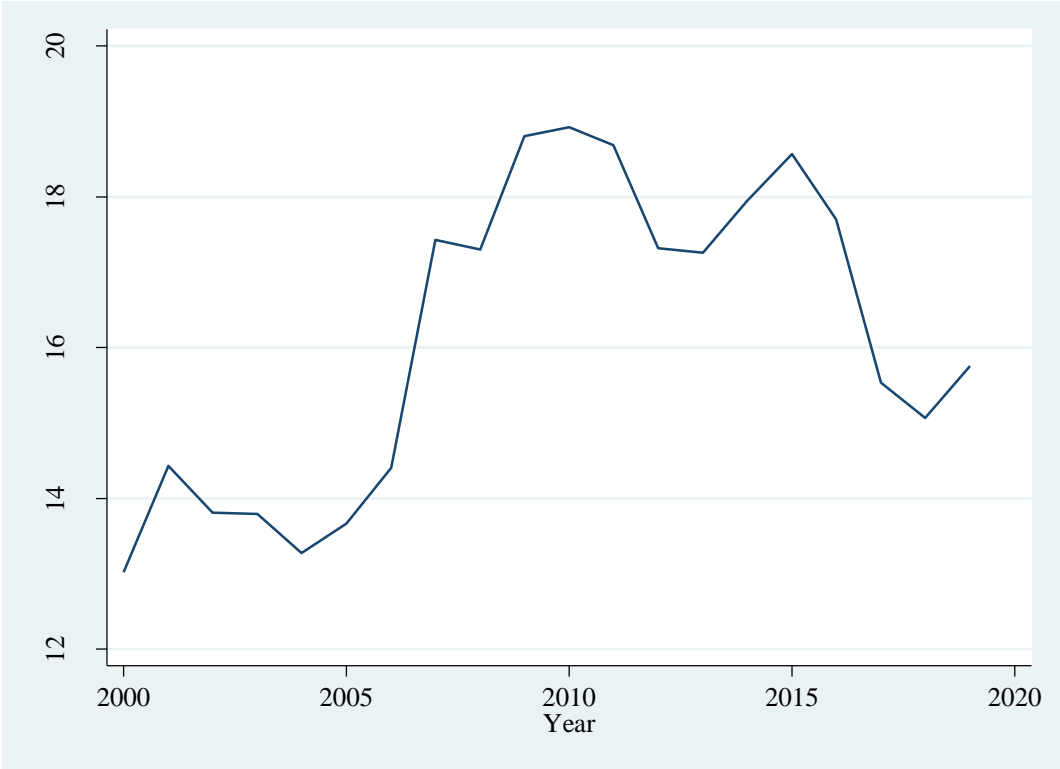
Source: Authors' computation

3.7. Overview of private consumption to GDP and private investment to GDP in SSA countries

The literature on the effects of expansionary fiscal policy on private consumption and investment is based on the Real Business Cycle (RBC) model and the new Keynesian model. The typical Real Business Cycle model by Baxter and King (1993) predicts that a government spending shock (financed by lump-sum taxes) will increase employment and the return on capital, increasing private investment and reducing private consumption. In the meantime, the new Keynesian analysis predicts that a government spending shock financed by future lump-sum taxes will generate a positive consumption response from agents who consume their after-tax disposable income each period (Perotti, 2008). However, private investment in the standard new Keynesian model may be hampered by households' smooth consumption, which could cause the interest rate to rise (Tagkalakis, 2008; Ilizetzi et al., 2013; Koh, 2016; Sedighi et al., 2021).

The year 2000 marked the lowest level of private investment as a percentage of GDP at 13%, and since 2004 private investment has been on the rise (Figure 3.7). As a result, the average ratio of private investment to gross domestic product increased from 13.3% in 2004 to 18.9% in 2010. However, the oil price shock slowed credit growth, and spillovers from slower growth in countries such as Angola, Nigeria, and South Africa have led to a decline in private investment since 2015. As a result, the 2019 private investment rate for SSA countries is 15.8% of GDP.

Figure 3.7: The trend in the private investment to GDP ratio of SSA countries



Source: Authors’ computation

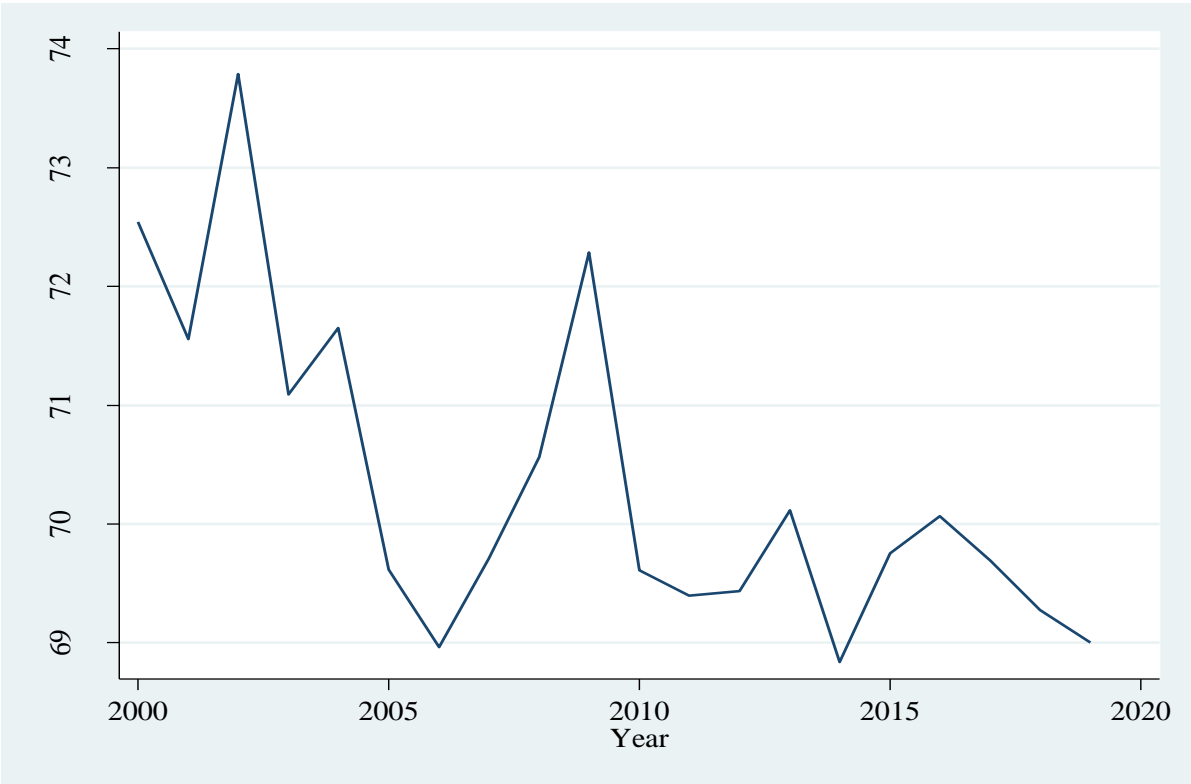
The effects of fiscal policy announcements on private consumption have been the subject of a protracted policy debate mainly because most economic activity is accounted for by private consumption. The empirical results demonstrate that the debate on how private investment and consumption react to fiscal spending shocks is still open. The Keynesian growth model contends that fiscal policy causes households to increase consumption levels because expansionary fiscal policy raises worker income, enabling them to spend more, and as a result, both output and private

consumption expand. The neoclassical growth model contends that fiscal policy has a negative consumption multiplier because of the negative wealth effect. The trends in the SSA countries' private consumption to GDP ratio from 2000 to 2019 are shown in Figure 3.7.

Theoretical predictions of the elasticity of consumer response to an expansionary fiscal policy are the basis for the macroeconomic implications of fiscal expansions. For example, agents who exhibit Ricardian behavior anticipate that the shock to government spending will finance future lump-sum taxes, lower private consumption, and raise savings rates. Contrarily, if agents follow the general rule, an increase in fiscal spending results in a boost to private consumption, improving the effectiveness of discretionary fiscal policy (Correa et al., 2014).

Private consumption as a percentage of GDP varies from year to year across all periods (Figure 3.8). Private consumption-to-GDP in SSA economies was 72.5% in 2000, 71.6% in 2001, 73.8% in 2002, and a sharp decline from 2003 to 2006, rising to 69%. In 2009, private consumption increased to 72.3% of GDP. Since then, it has fluctuated, dropping to 69% in 2019. Between 2006 and 2014, private consumption as a percentage of GDP reached its lowest point for SSA nations.

Figure 3.8: The trend in the private consumption to GDP ratio of SSA countries



Source: authors' computation

3.8. Effect of COVID-19 pandemic on macroeconomic and fiscal conditions in SSA

Following the GFC, SSA countries experienced average GDP growth of 6% and low inflation but increasing debt accumulation. However, the onset of the COVID-19 pandemic harms the macroeconomic situation of SSA countries. In 2020, the IMF forecasts SSA economic growth to be the lowest on record, at -1.6%. Similarly, World Bank (2020) confirmed the region's sharp decline in economic growth from 2.4% in 2019 to -2.1% to -5.1% in 2020. However, the IMF (2022) reported an improvement in the growth of SSA countries, estimating economic growth of 3.7% to 4.5% in the second half of 2021. In addition, IMF (2022) confirmed that Ukraine's conflict adversely affected the external and fiscal balances of SSA countries mainly due to the spike in oil and food prices that jeopardized the food security concerns of the countries. Consequently, it expects the growth projection of the region to decline in the year 2022.

In addition, the pandemic hit hard the countries' fiscal position via losses in revenue associated with an economic slowdown and declining commodity export revenues. Furthermore, donor aid flows were reduced, which impacted most SSA countries because aid funds account for a sizable portion of their budgets.

SSA countries' response to the pandemic was impeded by limited domestic saving rates, low and volatile resource mobilization, significant illicit financial outflows, capital flight, commodity price shocks, persistent fiscal imbalances, and stagnating official development assistance (Zeidy, 2020). Meanwhile, given the brutal hit of the pandemic, most governments faced high pressure on their spending due to increasing poverty levels, currency depreciation, increasing interest rates, and falling commodity prices. These factors forced most SSA governments to respond to the shock by increasing external debts that might affect public finance sustainability due to increased fiscal deficits. This thesis, at last, suggests that future researchers should incorporate these global shocks into their studies to have a broader analysis better.

3.9. Chapter Summary

This chapter summarizes the trends in fiscal policy instruments and economic growth from 2000-2019. Over the last decade, the average public debt of SSA countries increased from 32% to 55.6% of GDP, causing the region's debt stock to grow rapidly, partly due to expansionary fiscal policy responses. Fiscal imbalances characterize SSA economies. The primary balance has deteriorated to its lowest point since the GFC, owing to a drop in oil prices. Following a series of fluctuations in economic growth, SSA economies' growth decreased in 2009 to 3% and has since experienced the lowest level of economic growth at 2.6% in 2015, indicating SSA economies' vulnerability to shocks from outside the continent.

Furthermore, when the COVID-19 pandemic began, SSA countries' macroeconomic situation suffered. Furthermore, the pandemic harmed countries' fiscal positions by causing revenue losses associated with an economic slowdown and declining commodity export revenues. Furthermore, donor aid flows were reduced, which impacted most SSA countries because aid funds account for a sizable portion of their budgets.

The following chapter offers empirical evidence on the transmission mechanism of fiscal spending shocks over a structural and transient feature of the economies.

4. Fiscal Multipliers and Structural Economic Characteristics: Evidence from Countries in Sub-Saharan Africa

This chapter presents the debate on the asymmetric effects of fiscal policy on output, shedding light on the size and determinants affecting transmissions, such as economic cycle positions, debt burden, trade openness, exchange rate regimes, and political regime using a panel TVAR model covering recent sample period and broader countries from SSA economies.

4.1. Introduction

As a result of the global financial turmoil in 2008/09, fiscal policy tools sparked the attention of many governments and scholars worldwide for their role in mitigating the negative impacts of crises on economic growth. The financial turmoil turned the initial interest of policymakers to focus on fiscal stimulus packages rather than monetary transmission mechanisms because monetary policy shocks could not offset the massive contraction in demand, with many countries' interest rates reaching a lower bound of nearly zero (Spilimbergo et al., 2008). However, despite its classic theme in macroeconomic policy, the effect of discretionary fiscal spending shocks has become a source of debate among economists, mainly due to the endogeneity nature of the fiscal policy. Furthermore, determinants and magnitude of fiscal innovations under countries' structural characteristics are debated in the literature, and little consensus has been reached.

Several studies distinguish the asymmetric response of output² to the discretionary fiscal policy under various key economic factors (e.g., Baum et al., 2012; Auerbach - Gorodnichenko, 2013a; Auerbach - Gorodnichenko, 2013b; Ilzetzi et al., 2013; Koh, 2016; Ramey and Zubairy, 2018; Honda et al., 2020). In general, the results of these papers reveal that the response of output to discretionary fiscal policy varies with economic development levels, economies' business cycles, debt burdens, exchange rate regimes, levels of economic openness, political regime, and monetary accommodation. However, the empirical studies documented in SSA countries do not entail the non-linear patterns of fiscal policy. Moreover, as Blanchard - Leigh (2013) documents, inaccurate estimation of fiscal multipliers can lead to significant growth forecast errors, which have important consequences in the design of macroeconomic policies; for instance, in setting unrealistic fiscal

² In this thesis "GDP and "output" are used interchangeably.

targets on fiscal balance and public debt. Therefore, estimating fiscal impulses using panel TVAR is pivotal to comparing the differences between the multipliers in economic characteristics.

Despite many policymakers and scholars agreeing on the interdependence among fiscal policy, real output, and macroeconomic variables, a consensus has not yet been reached regarding the magnitude and persistence of fiscal impulses on output in developing countries. For example, in reference to developing countries, panel studies using different quantitative models predict heterogeneous size values of multipliers, that is, -0.03 percent (Ilzetzki et al., 2013), 0.17 percent (Estevão - Samaké, 2013), 0.48 percent (Kraay, 2014), 0.39 percent (Contreras - Battelle, 2014), 0.63 percent (Koh, 2016), 0.2 percent (Furceri - Li, 2017), 0.7 percent (Shen et al., 2018), 0.7 percent (Arizala et al., 2020), 0.1 percent (Honda et al., 2020) and 0.81 percent (Sheremirov - Spirovska, 2022), all demonstrating considerable heterogeneity and persistent fiscal impulses (see Table 4.1).

Table 4.1: Summary of the empirical literature on determinants and magnitude of fiscal innovations in developing countries

<i>Authors</i>	<i>Countries and data frequency</i>	<i>Methodology</i>	<i>Fiscal multiplier³</i>
Ilzetzki et al. (2013)	44 countries (quarterly: 1960:1–2007: 4)	SVAR	-0.03
Estevão and Samaké (2013)	77 countries (annual: 1973–2011)	SVECM	0.17
Kraay (2014)	102 developing countries (annual: 1970–2010)	Loans from official creditors	0.48
Contreras and Battelle (2014)	55 countries (quarterly: 1988:1–2010:4)	SVAR	0.39

³ The fiscal multiplier here only regards developing countries, excluding advanced and emerging economies.

Chian Koh (2016)	120 countries (annual: 1960–2014)	SVAR with sign restrictions	0.63
Furceri and Li (2017);	79 emerging market and low-income countries	Local projection method using forecast error	0.2
Shen et al. (2018);	27 LICs in Sub-Saharan Africa (SSA) (annual: 2000–2015)	DSGE	0.7
Arizala et al. (2020)	44 Sub-Saharan African countries (annual: 1990–2016)	Local projection method using forecast error	0.7
Honda et al. (2020)	42 LICs (annual: 1995–2017)	Local projection method using forecast error	0.1
Sheremirov - Spirovska (2022)	129 countries (1988–2013)	Local projections method (Jordà, 2005) with an IV approach	0.81

Source: Authors' construction

Moreover, there is a long-standing debate about the contemporaneous effects of fiscal policy and its transmission mechanisms both in theory and practice. In addition, the empirical literature on the size and persistence of fiscal multipliers in developing countries remains unclear, whether larger or smaller than those in other developed and emerging economies. As discussed by the IMF (2014) and Honda et al. (2020), developing countries have a lower monetary response to output; lower automatic stabilizers; and a higher rate of unemployment, which may result in larger fiscal multipliers. On the other hand, developing countries have low precautionary savings, economic openness, and a more volatile environment that may dampen fiscal effects.

It is essential to investigate fiscal spending innovations in SSA countries, irrespective of the voluminous literature on fiscal policy effects in the developed world and cross-country studies in

developing countries. As Shen et al. (2018) asserted, low-income countries (LICs) differ from developed countries based on three primary features affecting fiscal financing effects of high reliance on external financing, low spending efficiency, and high import intensity in public capital spending, called “*low degree of home bias.*” Moreover, Honda et al. (2020) highlighted the main characteristics of LICs that policymakers must systematically explore. These include widespread poverty, soaring unemployment, considerable social needs, severe indebtedness, sizeable informal labor markets, and the asymmetric effects of discretionary fiscal policy shocks are relatively unexplored. This demands research to establish an accurate forecast of fiscal policy in stimulating real GDP, which this study is intended for.

In addition to adding to the limited studies attempting to explore output response to discretionary fiscal policy in SSA countries (Arizala et al., 2020) and LICs (Honda et al., 2020), the value added of this study is threefold. First, the methodology differs in that the other papers identify fiscal shocks differently (using forecasting errors) and use the local projection method that offers less bias but with increased variance (Li et al., 2022). In contrast, this study uses a panel threshold vector auto-regression (TVAR) method, which is scarce in the SSA literature. Second, this study extends the scope of previous research by estimating the fiscal multipliers under various structural and transient factors using a broad set of SSA countries and a recent dataset. Third, this study focused on the specific characteristics of SSA economies and analyzed the asymmetric effects of discretionary fiscal policy shocks.

The study addresses five research questions. First, to what extent does the size of the fiscal multipliers vary over fluctuations in the economic cycle? Second, does debt burden determine fiscal multipliers’ sign, size, and persistence? Third, is trade openness a factor in the output response to discretionary fiscal policy? Fourth, does the size of fiscal innovations vary under fixed and floating exchange rate regimes? Finally, does political regime determine fiscal multipliers’ sign, size, and persistence? We address the research questions by estimating determinants of fiscal multipliers, focusing on a nonlinearity assumption using a panel TVAR model. The results suggest that economies with a lower propensity to trade during downturns, low debt burden, fixed exchange rates, and democratic governance are related to larger and more persistent impulse responses.

4.2. Literature review

Theoretical predictions regarding fiscal spending shocks are one of the most widely debated topics in macroeconomic policy discussions due to the variation in the size of fiscal multipliers, which mainly depends on the school of thought based. Two schools of theoretical thought prevail Keynesian and neoclassical models, with different predictions on output response to discretionary fiscal policy, particularly related to the response of private consumption. The former explains the effects through the demand side, whereas the latter describes fiscal impulses through supply-side effects. Neoclassical models argue that a discretionary fiscal policy that is matched by a rise in taxes in the future results in the loss of households' wealth. This leads to reductions in consumption and leisure activities and an increase in labor supply, driving down the wage rate, which leads to an output rise. Conversely, the Keynesian theory predicts that due to sticky nominal wages and prices, private consumption increases with an expansionary fiscal policy (Galí et al., 2007); thus, fiscal expansion financed by lump-sum taxes raises labor supply, leading to an increase in real wages. Subsequently, the consumption of non-Ricardian consumers will increase because of the positive response to labor income, leading to increased aggregate demand and further growth in GDP and employment.

Exogenous fiscal shocks in the literature are primarily identified using five approaches. The first approach is Blanchard and Perotti's (2002) structural vector auto-regressions (SVARs) model, which assumes that fiscal innovations do not respond to macroeconomic shocks to the economy in the same period or quarter. Mountford - Uhlig (2009) uses an alternative approach to SVAR in which the sign restrictions address the parametric identification problems by imposing signs on the variables. The second approach is the narrative approach, relying on military buildups as an identification strategy, as military expenditure is orthogonal to output fluctuations (Ramey, 2011; Barro - Redlick, 2011; Ramey, 2016). However, this approach is much more problematic for small open economies, as such countries generally have a small military buildup. In addition, the possible existence of other fiscal shocks can simultaneously affect the exogeneity of fiscal shocks. The third fiscal shock identification strategy was developed by Kraay (2012; 2014) and used loans from official creditors as orthogonal and unanticipated drivers of fiscal spending shocks. The fourth method uses forecast errors to assess exogenous fiscal policy shocks to address the fiscal foresight problem and the likely counter loop from the current economic state (Auerbach and

Gorodnichenko, 2013a). The fifth shock identification strategy is dynamic stochastic general equilibrium approach that assesses the Keynesian predictions for simulating fiscal policy impact on growth. DSGE models have been subject to various challenges, including the difficulty of modeling fiscal policy and incorporating nonlinearity (Cogan et al., 2010; Smets - Wouters, 2007).

The determinants and size of fiscal impulses depend on countries' structural characteristics. Below are explained the factors, theoretical predictions, and empirical justifications.

1. Economic cycle fluctuations: The effects of a discretionary fiscal policy on real GDP are larger in downturns than in expansions (e.g., Ilzetki et al., 2013; Koh, 2016; Honda et al., 2020). In times of recession, the availability of excess capacity in the economy raises the effectiveness of fiscal policy due to the decreased likelihood of crowding-out private spending. Furthermore, agents with binding liquidity constraints can borrow to smooth (maintain) consumption and production, thus increasing output.
2. Exchange rate regimes: Fiscal shocks exert sizable fiscal impulses under fixed exchange regimes compared to floating exchange regimes because leakage through currency appreciation is minimal (Ilzetki et al., 2013).
3. The degree of indebtedness: Highly indebted economies experience lower multipliers (Ilzetki et al., 2013) because of the anticipation of forward-looking agents paying higher taxes sooner, possibly reducing the effect of increased government spending to magnify adverse wealth effects.
4. Degree of openness to trade: The more an economy is open, the higher the demand leakage when government spending increases; hence, openness has a lower output response to fiscal expansion (Ilzetki et al., 2013).
5. Political regimes: In an environment of democratic regime governance, fiscal multipliers can potentially have a higher impact on output because superior institutional quality could maintain stability in the macroeconomic environment (Rodrik, 2008), and economies with better democratic governments leverage physical and human capital resources more efficiently to ensure that fiscal expansion responds positively to output (Acemoglu et al., 2001).

In sum, the empirical literature reveals that the size of the fiscal impulses varies over structural economic features, and a non-linear approach is an appropriate method to compare the differences between the multipliers in economic characteristics.

4.3. Materials and Methods

This study's dataset was constructed annually, spanning from 2000 to 2019, for 40 SSA countries, namely, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Eswatini, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles Sierra Leone, South Africa, Tanzania, Togo, Uganda, and Zambia. Our dataset primarily relies upon World Economic Outlook, World Development, the Polity IV database, Darvas (2020), and Ilzetzki et al. (2019; 2021) as data sources (Table 4.2).

Table 4.2: Data source and data definition

<i>Variable</i>	<i>Definition of variables</i>	<i>Data source</i>
Fiscal spending	General government expenditure divided by a GDP deflator.	World Economic Outlook- IMF
Fiscal/ government revenue	General government revenue deflated by a GDP deflator.	World Economic Outlook- IMF
Real output	GDP in local currency divided by a GDP deflator.	World Economic Outlook- IMF
Output deflator	GDP deflator expressed by the base year of each country's national accounts.	World Economic Outlook- IMF
REER	Real effective exchange rate (CPI-based) data for 171 trading partners' countries.	Data generated from http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database
Output Gap	Upturns and economic slacks are calculated based on the difference of GDP from the Hodrick–Prescott trend using the standard smoothing parameter of 100.	Authors' calculation

Exchange rate regimes	Based on fine classification constructed referencing Ilzetzki et al.'s (2013) classification. Fixed exchange rate regime: fine classification 1–8 Flexible/floating exchange rate regime: fine classification 9–15	Ilzetzki et al. (2019; 2021)
Government Debt as %age of GDP	General government gross debt as %age of GDP constructed following Ilzetzki et al.'s (2013) classification. Low indebted countries: $\leq 60\%$ of Debt % GDP High indebted countries: $> 60\%$ of Debt % GDP	World Economic Outlook- IMF
Trade openness	Trade (% of GDP) constructed following Ilzetzki et al.'s (2013) classification. Open economy: Trade % GDP $> 60\%$ Closed economy: Trade % GDP $\leq 60\%$	WDI, World development indicators, World Bank
Political regime	Polity2: Democracy and autocracy indicators (from –10 to 10). The median of the distribution is used as a cutoff point for low and high-quality institutions.	Polity IV database

Source: Authors' construction

4.3.1 Methodology

In this study, we use a panel TVAR approach, allowing for the asymmetric responses of fiscal spending shocks using Blanchard and Perotti's (2002) structural identification procedure. The panel TVAR model is preferred for two main reasons. First, the model captures the non-linear reactions easily to accommodate a non-linear specification of fiscal policy. Second, the model is advantageous in that the regime variable can itself be an endogenous variable and helps to switch the regime variable following the shock (Baum - Koester, G, 2011; Ferraresi et al., 2015; Shaheen – Turner, 2020; Afonso et al. 2018; Dime et al., 2021; Hlaváček et al., 2021).

We apply a panel TVAR model varying deterministic conditioning to the structural characteristics of the countries, which is specified as follows:

$$y_{it} = \alpha_1 y_{it} + \beta_1(L)y_{i,t-1} + [\alpha_2 y_{it} + \beta_2(L)y_{i,t-1}] * I(S_{t-d} > \gamma) + \omega_i + \varepsilon_{i,t} \quad (4.1)$$

where y_{it} is a five-dimensional vector of the endogenous variables [government spending, government revenue,⁴ output, current account deficit to GDP fraction, and real effective exchange rate (REER)]. All the endogenous variables are in real and logarithmic values, except for the current account deficit to GDP fraction. (L) is a lagged polynomial matrix and ω_i is a time-invariant common linear trend introduced to control unobserved heterogeneity. I is the threshold variable that takes the value of 1 if, from the structural and transient factors are higher than the threshold value γ , and 0 otherwise. $\alpha_1 y_{it}$ and $\alpha_2 y_{it}$ are the contemporaneous terms. ε_{it} is the vector of uncorrelated structural shocks. The structural characteristics of the economies are treated as the threshold variables. To consider the features of an open economy, the ratio of current account deficit to GDP fraction and REER are included in our study. Second, all the variables are used as first differences to interpret the impulse responses as elasticities. Furthermore, the whole data is divided into two subsamples corresponding to the thresholds based on the structural and transient factors.

This study uses annual data to assess fiscal spending shocks for various reasons. First, noninterpolated long series quarterly data are unavailable for SSA countries. Second, fiscal policy

⁴ Tax revenue is proxied by government revenue, since non-interpolated long term annual data on tax revenue for SSA countries is unavailable.

decisions are made annually, therefore raising the likelihood of predicting actual shocks. Third, the probable response of fiscal policy to existing economic conditions is unlikely to be anticipated by agents after one year (Ramey, 2011; Koh, 2016). Fourth, it has the advantage of minimizing the risks associated with seasonal changes. Last but not least, a plethora of studies postulated that spending shocks using annual data of recursive identification restrictions VAR model produces plausible results in comparison to those of noninterpolated quarterly fiscal data applying for different countries (e.g., Beetsma et al., 2006; Beetsma et al., 2009; Beetsma and Giuliadori, 2011; Koh, 2016).

Fiscal shocks are identified by a recursive identification of a Cholesky decomposition with the ordering $[\Delta spending, \Delta revenue, \Delta gdp, \Delta CAB_{GDP}, \Delta reer]$. The impact multiplier is expressed as the response of real GDP changes to a unit shock in the fiscal stances. The fiscal multiplier is then calculated as follows:

$$Impact\ multiplier = \frac{\frac{\Delta \ln Y_t}{\Delta \ln G_t}}{\widetilde{g/y}} \quad (4.2)$$

The cumulative fiscal impulses represent the cumulative change in real GDP over h horizons relative to the cumulative effects of an exogenous discretionary fiscal spending change during a given period.

$$Cumulative\ multiplier = \frac{\sum_{j=0}^N \Delta \ln Y(t+j)}{\sum_{j=0}^N \Delta \ln G(t+j)} / (\widetilde{g/y}) \quad (4.3)$$

4.4. Results and Discussion

4.4.1. Summary statistics

Table 4.3 shows the summary statistics of the endogenous variables used in the paper for 2000–2019. Over the study period, the average real government spending of the 40 countries for the period 2000–2019 is 2191.84 in local currency units (LCUs), with the lowest value of 1,661.05 in LCUs and the highest value of 2617.99 in LCUs. The real GDP value for the sampled countries over the study period is an average of 2349.25 in LCUs, and the mean value of real government revenue is 2181.16 LCUs. The average current account deficit–GDP ratio is –4.97, with a standard

deviation of 9.54 for the study period. The REER has an average value of 462.53 for the sampled period, with a standard deviation of 16.76.

Table 4.3: Summary statistics

Variables	Obs	Mean	Std. Dev.	Min.	Max.
Log (spending)	800	2191.84	215.37	1661.05	2617.99
Log (GDP)	800	2349.25	232.31	1766.65	2787.72
Log (revenue)	800	2181.16	216.13	1675.86	2592.07
Log (REER)	800	462.53	16.76	392.47	583.04
CAB–GDP ratio	800	-4.97	9.54	-84.11	24.01

Source: Authors' computations

4.4.2. Cross-sectional dependence test

Panel data can be subject to pervasive cross-sectional dependence in the errors, which may arise because of the presence of common global shocks that affect all individual countries (albeit to different degrees), wherein economic agents' decisions are interdependent among economic agents, market integrations, and global financial crises (De Hoyos - Sarafidis, 2006). If the observations reveal relationships across countries, then unit root tests considering cross-sectional units are appropriate.

First, the Pesaran (2004) cross-sectional dependence test (CD) test is used to examine if there are unobserved components that ultimately become part of the error term. This model tests the dependency within a variable by taking a series for a particular country i (or the residuals of a country i from the estimated equation) and tests the correlation factor for the other $N-1$ country series (or residual). The model tests for all sampled countries and ends up with $N(N-1)$ correlation coefficients.

Mathematically, the Pesaran *CD* statistic can be derived as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^N P_{ij} \right) \quad (4.4)$$

Where $N = 1, \dots, N$ denotes for cross-sectional unit and $T = 1, \dots, T$ denotes time. P_{ij} denotes the average pairwise correlation of the variable series (or residuals). *CD* is distributed normally with $N(0,1)$ for sufficiently large T and $N \rightarrow \infty$.

In addition to the Pesaran (2004) *CD* (Cross-section Dependence) test, this thesis applies the Friedman (1937) *FR* test and Frees (1995, 2004) *FREE* test statistics to verify the robustness of the results. Friedman's (1937) *FR* test statistic is a nonparametric test applying a Spearman's rank correlation where the coefficient is derived from the normal product-moment correlation coefficient. The test statistic is expressed as:

$$FR_{test} = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^N r_{ij} \quad (4.5)$$

Where r_{ij} is the rank correlation coefficient of the residuals

$$r_{ij} = r_{ji} = \frac{\sum_{i=1}^T \{r_{ij} - (T + 1/2)\} \{r_{ji} - (T + 1/2)\}}{\sum_{i=1}^T \{r_{ij} - (T + 1/2)\}^2} \quad (4.6)$$

According to the test, if FR_{test} or r_{ij} is large means there is a presence of nonzero cross-sectional correlations (De Hoyos- Sarafidis, 2006).

The Frees (1995) *FREE* test statistic works on the sum of the squared rank correlation coefficients. However, in the cases where the correlation coefficient alternates in sign, and there is a possibility of canceling each other out, causing the test to be unable to detect cross-sectional dependence, the Frees' test is advantageous over the other two tests.

$$FREE_{test} = N \{ FREE_{test}^2 - (t-1)^{-1} \} \xrightarrow{d} Q = \alpha(T) \{ X_{1,T-i}^2 - (T-1) \} + \beta(T) X_{2,T(T-3)/2}^2 T(T-3)/2 \} \quad (4.7)$$

Where $FREE_{test} = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \tilde{r}_{ij}^2$ $X_{1,T-i}^2$ and $X_{2,T(T-3)/2}^2$ are independent of X^2 random variables with $T - i$ and $T(T - 3)/2$ degrees of freedom respectively. Thus, the null hypothesis is rejected if $FREE_{test} > (t - 1)^{-1} + Q_q/N$, where Q_q is the appropriate quantile of the Q distribution (De Hoyos- Sarafidis, 2006).

This paper employs the Pesaran (2004) cross-sectional dependence test (CD) test to assess cross-sectional independence. The null hypothesis of cross-sectional independence is not accepted in our study for individual and group variables. As revealed in the results, the *abs* option, Frees' and Friedman's CD tests, the null hypothesis for both the individual variables and the group rejects the cross-sectional independence (Table 4.4).

As expected, the coefficient and the probabilities obtained from Frees' and Friedman's tests reject the null of cross-sectional independence among the variables. The probability of FR_{test} is 0.000 and rejects the null hypothesis of cross-sectional independence at 1%. Moreover, the $FREE_{test}$ 3.91 rejects the null hypothesis of cross-sectional independence at 1%, referring to the α values of 1%, 5%, and 10% obtained from the Q distribution where $T \leq 30$.

Table 4.4: Cross-sectional dependence test

Variable	CD test	p-value	Corr	abs(Corr)
Log (spending)	46.76	0.000	0.674	0.679
Log (GDP)	66.11	0.000	0.953	0.953
Log (revenue)	39.62	0.000	0.571	0.612
CAB–GDP ratio	5.13	0.000	0.074	0.284
Log (REER)	6.76	0.000	0.097	0.460
CD test values			p-value	
Pesaran's test of cross-sectional independence = 16.84				Pr = 0.0000

Friedman's test of cross-sectional independence = 114.78 Pr = 0.0001

Frees' test of cross-sectional independence = 3.91 Critical values from Frees' Q distribution

alpha = 0.10: 0.14

alpha = 0.05: 0.19

alpha = 0.01: 0.26

Source: Authors' computations

4.4.3 Unit root test

Owing to the acceptance of cross-sectional dependence in the data, we ran the Pesaran (2007) cross-sectionally augmented (CIPS) stationarity test and Hadri LM test. Table 4 presents the unit root test results with CIPS values. The results indicate that the model rejects the null hypothesis for real public spending, real fiscal revenue, current account deficit to GDP ratio, and real effective exchange rate, revealing that these variables are I(0). In contrast, the real GDP is stationary after the first difference (Table 4.5).

Table 4.5: Second-generation unit root test

Pesaran (2007) CIPS Panel Unit Root Test Result				
Variables	Level (intercepts only)			First Difference (intercepts only)
	Critical values			CIPS
		10%	5%	1%
		-2.11	-2.2	-2.36
Log (spending)	-2.24**			-
Log (GDP)	-1.43			-3.69***

Log (revenue)	-2.30**	-
CAB–GDP ratio	-2.179*	-
Log (REER)	-2.34**	-

Notes: *, **, and *** indicate 1%, 5%, and 10% critical values, respectively. Critical values are reported at 1%, 5%, and 10%.

Source: Authors' computations

The optimal lag selection criteria test was performed with standard information criteria. Table 4.6 presents the lag order selection based on the lowest values of MBIC, MAIC, and MQIC. Hence, following the MBIC, MAIC, and MQIC criteria, one lag is selected in this study.

Table 4.6: Optimal lag order selection

Lag	CD	J	J p-value	MBIC	MAIC	MQIC
1	0.65	110.68	0.004	-363.91	-39.32	-166.06
2	0.73	90.75	0.0003	-225.65	-9.25	-93.75
3	0.61	39.93	0.03	-118.26	-10.06	-52.31

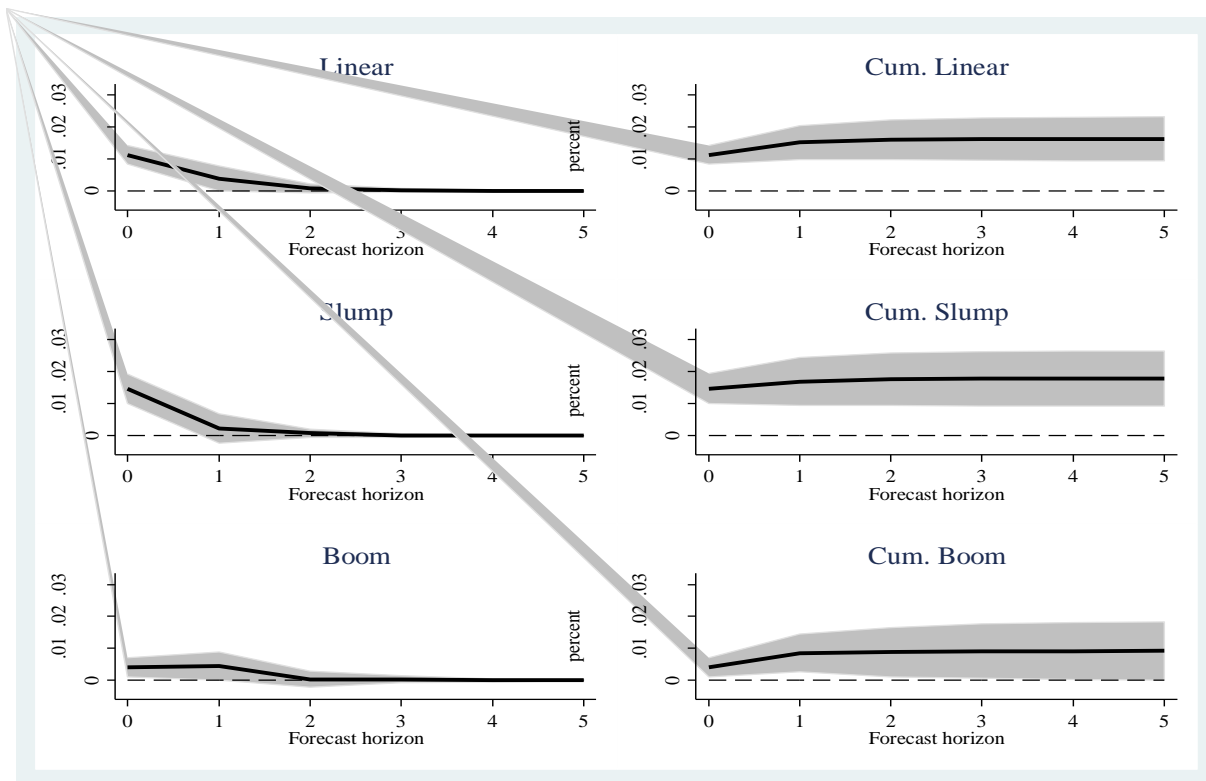
Source: Authors' computations

4.3.4 Fiscal spending shocks over a business cycle of an economy

Fiscal multipliers have asymmetric effects over an economy's business cycle. In this study, the business cycle is obtained based on the short-run fluctuations of actual and potential output from the Hodrick–Prescott trend. Figure 4.1 presents the response of an output to a unit shock of fiscal spending over a business cycle fluctuation. We multiply the impulse responses with the mean GDP-Spending ratio to obtain the fiscal multipliers. As depicted in Figure 4.1, a 1% increase in an unanticipated fiscal spending shock in the year of implementation raises output by 0.07% without considering the business cycle. However, the fiscal multipliers, on impact, exhibit a larger impact multiplier in slumps of 0.09% and tapers off following the shock period. However, its effect on

impact is 0.024% in a boom, and the fiscal multiplier tapers off two years after the shock period. The findings support the arguments of traditional Keynesian models, asserting that a discretionary fiscal policy is a sounder in times of a negative output gap in which there are excess capacities available in an economy that are likely to have less crowding-out effects from private investment. Second, because of the high share of the ‘hand-to-mouth’ population and binding liquidity constraints for credit-constrained agents in SSA countries, a fiscal shock would loosen these constraints, leading to households’ increasing marginal propensity to consume in recession periods. Our estimates are consistent with the signs and persistence of fiscal multipliers in the studies of Koh (2016), Gechert – Rannenberg (2018), Alichì et al. (2019), Honda et al. (2020), Sheremirov - Spirovska (2022) despite the size of estimates varies from study to study. The application of variation in estimation methodologies, specific country characteristics, difference in sampling of countries & time period, and identification of fiscal shocks can mainly explain the variation in the size of the estimates.

Figure 4.1: Fiscal multiplier over business cycle fluctuations



Notes: The solid line displays percentage response, and the shaded areas represent 95% CI by 1,000 Monte Carlo simulations.

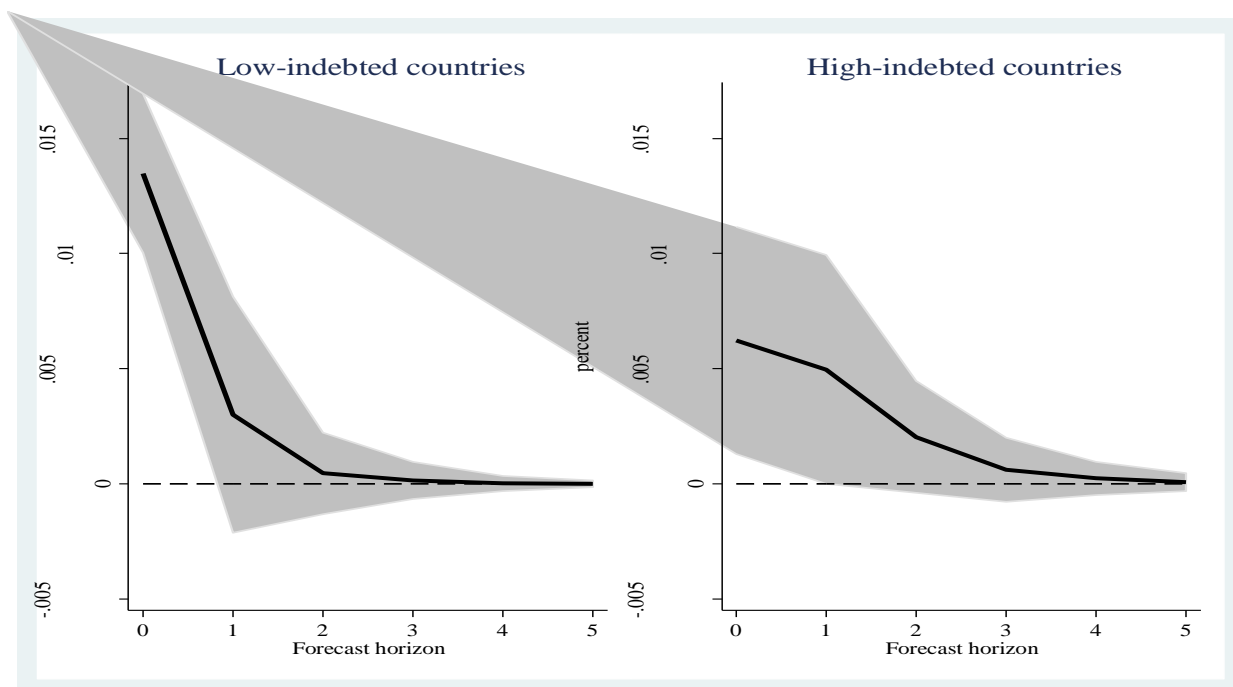
Source: Authors' computations

To complement the short-to-medium term multipliers, we compute cumulative multipliers realizing the lags in GDP response, and fiscal stimulus packages are built over time. Figure 4.1 displays the cumulative multiplier of fiscal spending shocks in a linear and state-dependent setting. On average, the cumulative impulse response of the fiscal innovations in linear, recession, and expansion equals 0.011%, 0.015%, and 0.004%, respectively, for the 5-year horizon (Figure 4.1). The result reveals that the exogenous cumulative government spending shock effect on output is gauged more sizable in downturns than in upturns. In addition, following the spending shock, output increased in both states during the recession and expansion, except there was a higher crowding-out of private demand in the expansion periods at each horizon.

4.3.5 Fiscal multipliers and debt burden

The fiscal multipliers for high-debt countries and low-debt countries are estimated separately. To examine the effect of debt burden on the multiplier size, we split the sample into high-debt countries and low-debt countries, based on 60 percent of public debt to GDP ratio following the prominent papers of (Ilzetzki et al., 2013; Koh, 2017). The output response to a discretionary fiscal spending shock varies with countries' debt burden. Figure 4.2 reveals that, on impact, the elasticity of fiscal policy shocks to output for low-indebted countries is 0.08%, and the impact response dissipated two years after the shock period. For highly indebted countries, the largest effect at the shock period is 0.04%, and tapers off three years after the shock year, though, are not statistically significant except the shock period implying that a large part of the efficacious of fiscal policy is realized within the shock period.

Figure 4.2: Fiscal multipliers and debt burden



Notes: The solid line displays percentage response, and the shaded areas represent 95% CI by 1,000 Monte Carlo simulations.

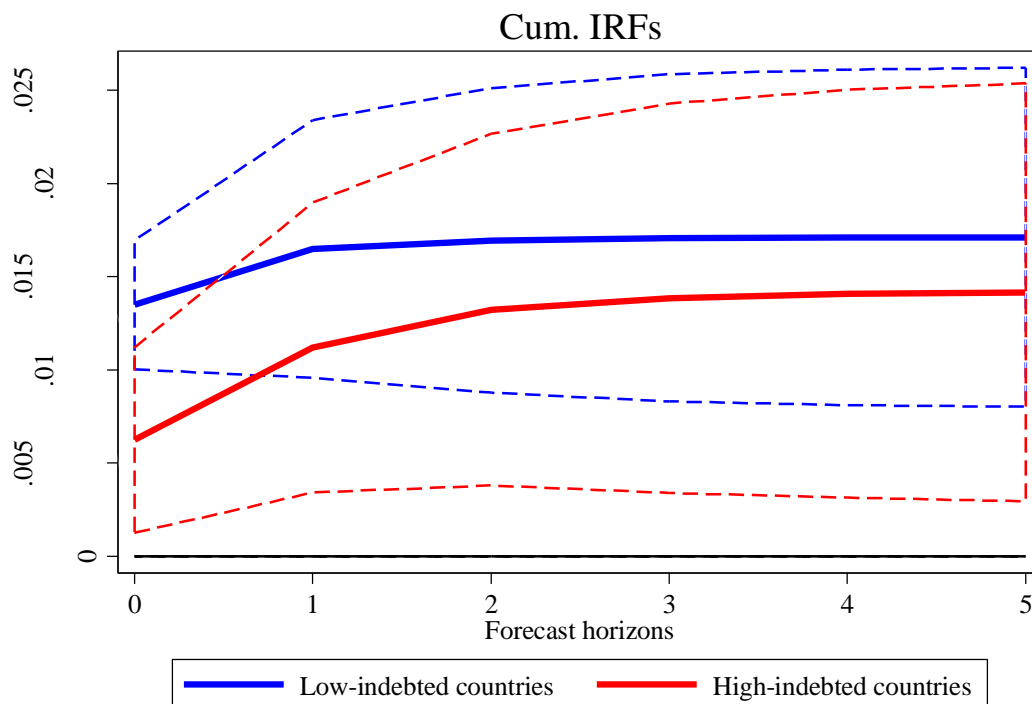
Source: Author's computations

Our findings indicate that highly indebted countries tend to have smaller fiscal multipliers. Three reasons could justify this finding. First, because of the anticipation of forward-looking agents paying higher taxes in the future, possibly reducing the effect of increased government spending to magnify adverse wealth effects. Second, the resources used for injecting new spending in highly indebted countries can deter domestic borrowing, mainly if domestic banks absorb the holdings of the public debt. Third, increasing public debt to finance deficit spending leads to increase interest rates and crowd-out private investment. On the other hand, increased interest rates lower asset values and have a negative wealth effect of discouraging private consumption. Our estimates are consistent with those estimates documented by (Ilzetzi et al. 2013; Furceri - Li, 2017; Koh, 2017; Alichii et al. 2019).

Furthermore, the cumulative fiscal multiplier of low-indebted countries is sizable and more persistent than that of highly-indebted countries (figure 4.3). Figure 4.3 also shows evidence that an increase in government spending shocks, in the long run, tends to have a larger multiplier in

low-indebted countries than in highly indebted countries, and the difference is statistically significant for the five forecast horizons.

Figure 4.3: Cumulative IRFs under high and low debt economies



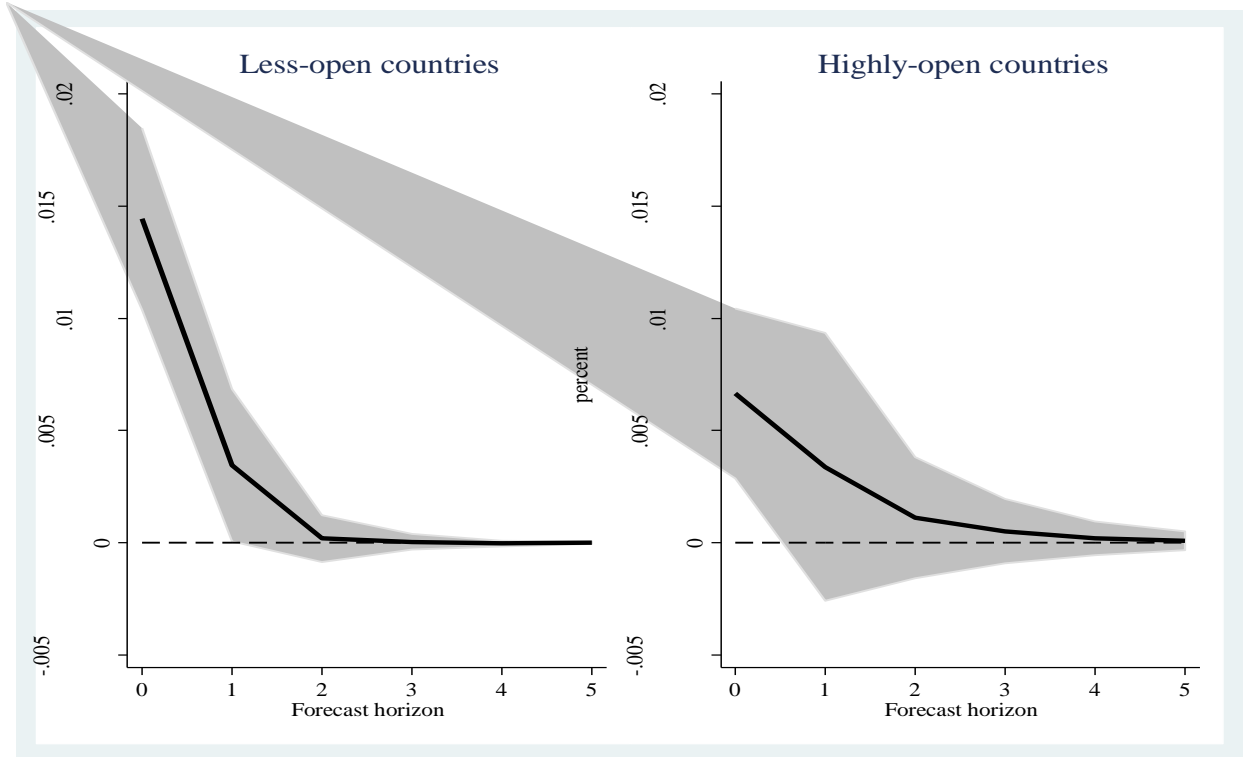
Source: Author's computations

4.3.6. Fiscal spending shocks and economic openness

In this study, following the prominent papers of Ilzetki et al. (2013), an open economy is defined if the average share of total trade (exports plus imports) to GDP is greater than 60 percent, whereas closed (less open) economy if the share is below or equal to 60 percent of GDP. Fiscal impulse multipliers vary with the openness of economies. Figure 4.4 presents the fiscal impulses obtained under economies with a lower propensity to import and openness to trade. The output response to structural fiscal spending shocks under a closed economy is 0.09%, whereas it is 0.04% under those open to trade. The finding suggests that fiscal policy expansions have a demand leakage that is more pronounced by imports to open economies as part of the increment in government spending. Moreover, an injection in government spending in an open economy appreciates the

domestic currency and reduces the current account balance. The results support the Keynesian model and are congruent with conclusions reached by Iizetzi et al. (2013), Koh (2017), Furceri - Li (2017), Shen et al. (2018), Sheremirov - Spirovska (2019), and others.

Figure 4.4: Fiscal multipliers and economic openness

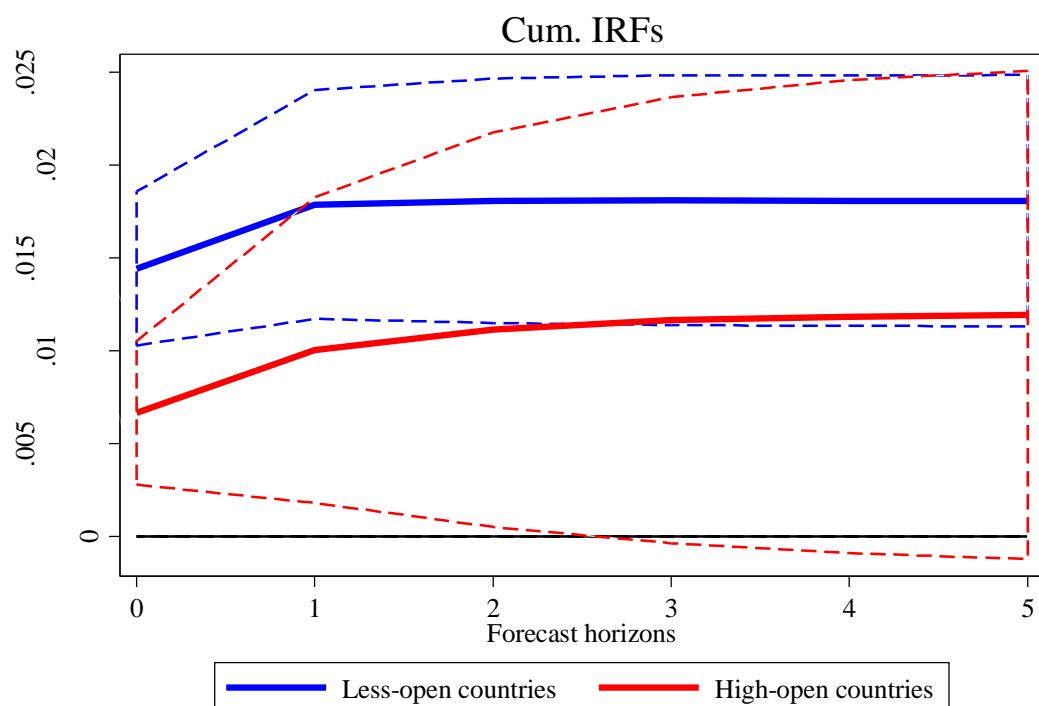


Source: Authors' computations

Notes: The solid line displays percentage response, and the shaded areas represent 95% CI by 1,000 Monte Carlo simulations.

Figure 4.5 depicts the long-run multiplier suggesting that economic openness is the primary determinant of fiscal multipliers, with sizable cumulative impulse responses under economies with a lower propensity to import than those open to trade. The result is statistically significant for the 5-year forecast horizon.

Figure 4.5: Cumulative IRFs under closed and open economies



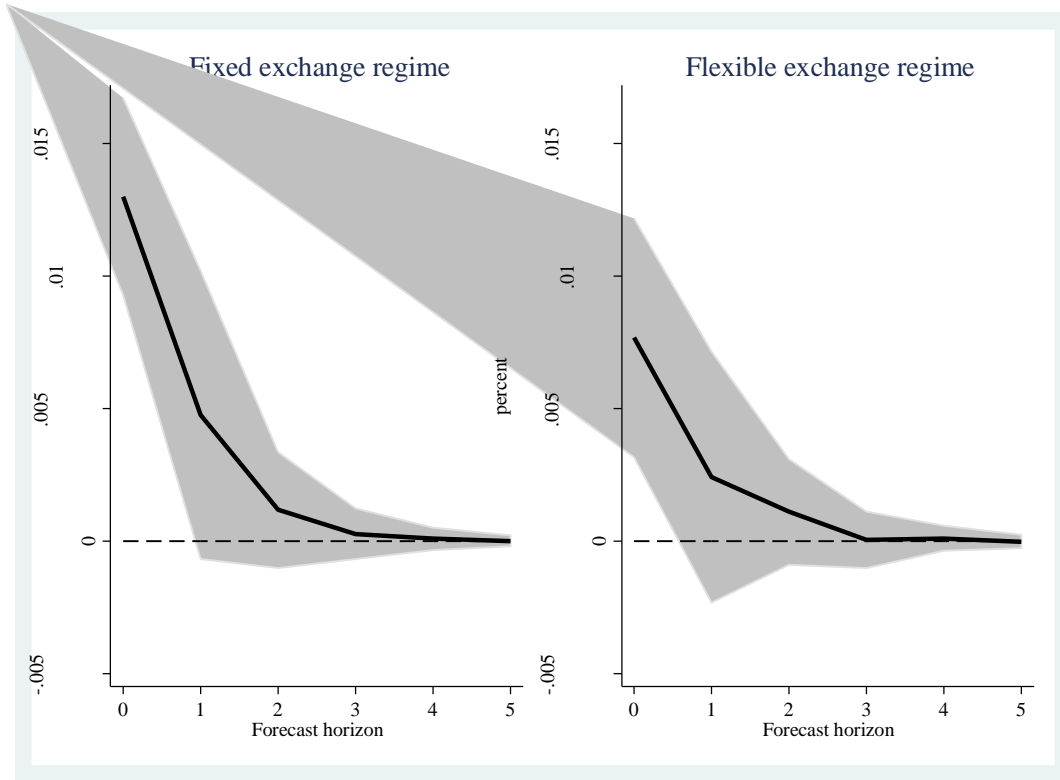
Source: Authors' computations

4.3.7 Fiscal multipliers and exchange rate regimes

The exchange regime variable is obtained based on the fine classification of Ilzetzi et al. (2019, 2021). The variable takes values from 1 to 15, where above eight values correspond to the flexible exchange rate regime and below or equal to eight corresponds to the fixed exchange rate regime. In our sample, the elasticity of fiscal multipliers differs with exchange rate regimes and is more potent under the peg exchange rate regimes. For example, a 1% increase in fiscal spending under a floating exchange rate regime increases the response in output by 0.05%. On the other hand, the output response to an exogenous fiscal policy under fixed exchange rate regimes is large at all horizons, with a 0.08% impact multiplier (Figure 4.6). This can be explained in an open economy with free capital movement; under a flexible exchange rate regime, the interest rate increases, and the domestic currency appreciates reducing the effect of fiscal expansion. Conversely, under a fixed exchange rate regime, the central bank follows an expansionary monetary policy to maintain currency appreciation, leading to a relatively strong output response. (Ilzetzi et al., 2013; Furceri

- Li, 2017). Our estimates agree with the conclusions (Ilzetzi et al., 2013; Furceri - Li, 2017; Sheremirov - Spirovska, 2019).

Figure 4.6: Fiscal multiplier under different exchange rate regimes

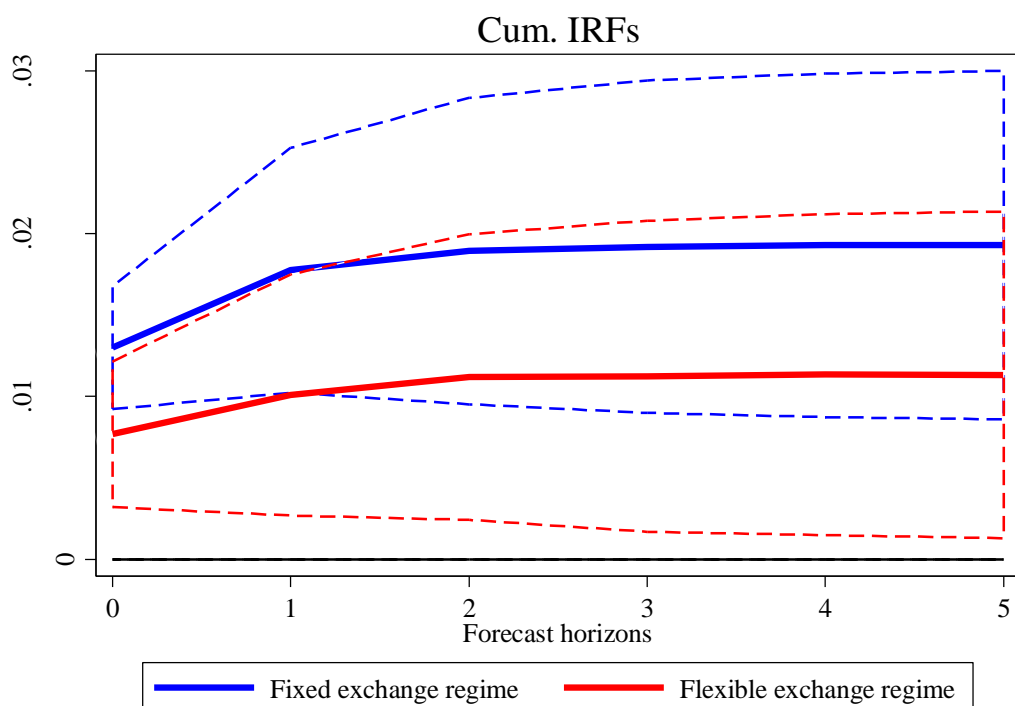


Notes: The solid line displays percentage response, and the shaded areas represent 95% CI by 1,000 Monte Carlo simulations.

Source: Authors' computations

Out cumulative multipliers evidenced that fixed exchange rate regimes tend to induce larger multipliers than floating exchange rate regimes in SSA countries (figure 4.7). In the long run, under a fixed exchange regime, the study provides evidence that, on average, a 1% increase in government spending induces output to increase by 0.013%, whereas, under a floating exchange rate regime, it leads to an increase by 0.008%.

Figure 4.7: Cumulative IRFs under fixed and floating exchange rate regimes

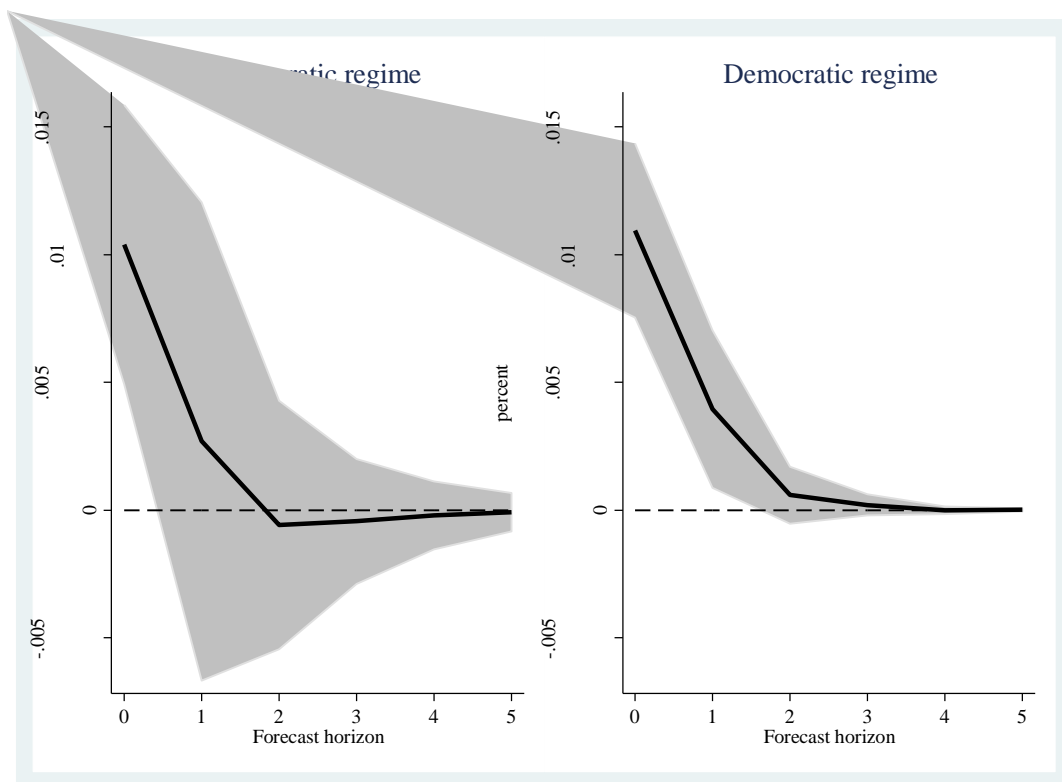


Source: Authors' computations

4.3.8 Fiscal spending shocks and political regimes

This study uses the Polity 2 dataset to split the political regime into democracy versus autocracy. The data ranges from +10 (full democracy) to -10 (full autocracy), and this study codes the negative score to an authoritarian regime and the positive score to a democratic regime. The fiscal transmission mechanism reveals sizable differences across political regimes (Figure 4.8). This paper also shows evidence that, under a democratic regime, a \$1 in LCU increase in government spending shocks, on impact, tends to increase output by \$0.064 in LCU, whereas, under an authoritarian regime, it increases output by \$0.061 in LCU. Autocratic regimes, compared to democratic regimes, reduce the effect of fiscal multipliers. The possible explanation could be that under democratic governance, voters and pressure groups can influence politicians to redistribute public resources to social welfare programs to the people. As a result, political institutions have electoral incentives to spend the government resources in public programs, which increases the fiscal multiplier. Last but not least, the prolonged civil wars in SSA necessitate immediate military expenditure to respond to close multipliers in both regimes' shock periods.

Figure 4.8: Fiscal multipliers and institutional quality

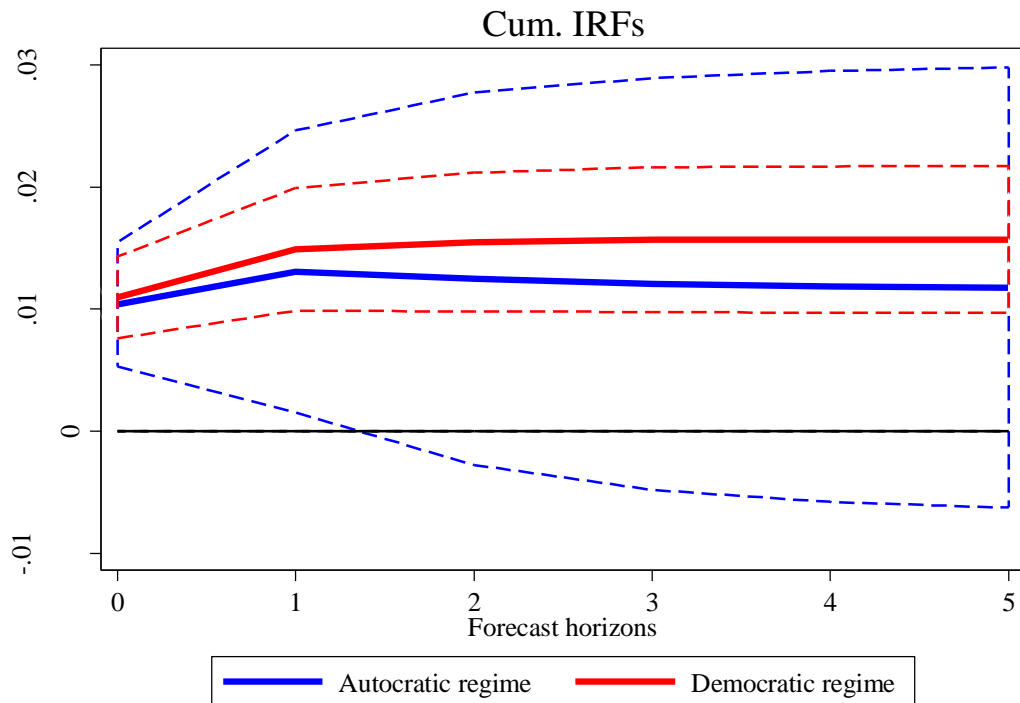


Notes: The solid line displays percentage response, and the shaded areas represent 95% CI by 1,000 Monte Carlo simulations.

Source: Authors' computations

Figure 4.9 demonstrates that the cumulative output response under democratic governance has a larger multiplier in the long run than in autocratic governance countries. The results suggest that the effects of unanticipated fiscal policy innovations would be sizable and more persistent in the long run when the political regime is democratic.

Figure 4.9: Cumulative IRFs under low- and high-quality institutions



Source: Authors' computations

In tandem, the findings of this chapter lend theoretical and empirical justifications of previous studies on advanced economies and minimal studies on developing countries regarding the business cycle of an economy; trade openness; debt burden; exchange regime, and governance regime with smaller multiplier effects. The reasons can be summarized as follows. First, the variations in the multipliers' size can mainly be rooted in implementing various methodologies and using different identification strategies. Moreover, it can also be related to the specific characteristics of SSA economies where there are sizeable informal labor markets, higher precautionary saving because of instability, inefficient fiscal administration, and small but more open economies. Last but not least, violent armed conflicts can potentially divert public spending towards defense to reduce the multiplier effects (IMF, 2019; Okwoche - Iheonu, 2021).

4.4 Robustness checks

Various robustness checks, including per capita and GDP percentage values, do not substantially alter the signs and size of the results (Figure A1). Furthermore, cyclically adjusted government

revenue was also considered to represent an unadjusted government revenue, confirming that the estimated impulse multipliers are not reverted and do not lead to substantially varied impulse responses (Figure A2). Furthermore, altering the order of the endogenous variables does not substantially alter the results. Therefore, the robustness checks confirm that the identification of spending shocks seems appropriate (Figure A3). In addition, for the robustness check, the cumulative IRFs are reported. Finally, all the panel TVAR estimated models in this paper were assessed for stability, and the eigenvalues of the roots of the companion matrix lie inside the unit circle, confirming the stability condition.

4.5 Chapter Summary

This chapter addresses the contemporaneous effects of discretionary fiscal policy shocks using a panel TVAR model. This chapter finds evidence that government spending has a nonlinear effect on output based on the structural and transient characteristics of the economies. The findings reveal that the size of fiscal (spending) multipliers in SSA countries depends on various factors, including business cycle states, the health of public finances measured by the public debt to GDP ratio, exchange rate regimes, degree of openness, and political regime, among others.

The next chapter discusses the sustainability of public debt using a non-linear fiscal reaction function. Moreover, the chapter also looks into causality linkages between government revenue and government expenditure.

5. Fiscal sustainability in sub-Saharan African countries: A dynamic panel threshold model

The chapter mainly focuses on the concept and definition of public finance sustainability and presents the theoretical and empirical perspectives of public finance sustainability, followed by the threshold level for fiscal sustainability for SSA countries. Next, it details the underlying theoretical framework and model specification, followed by empirical results and a chapter summary.

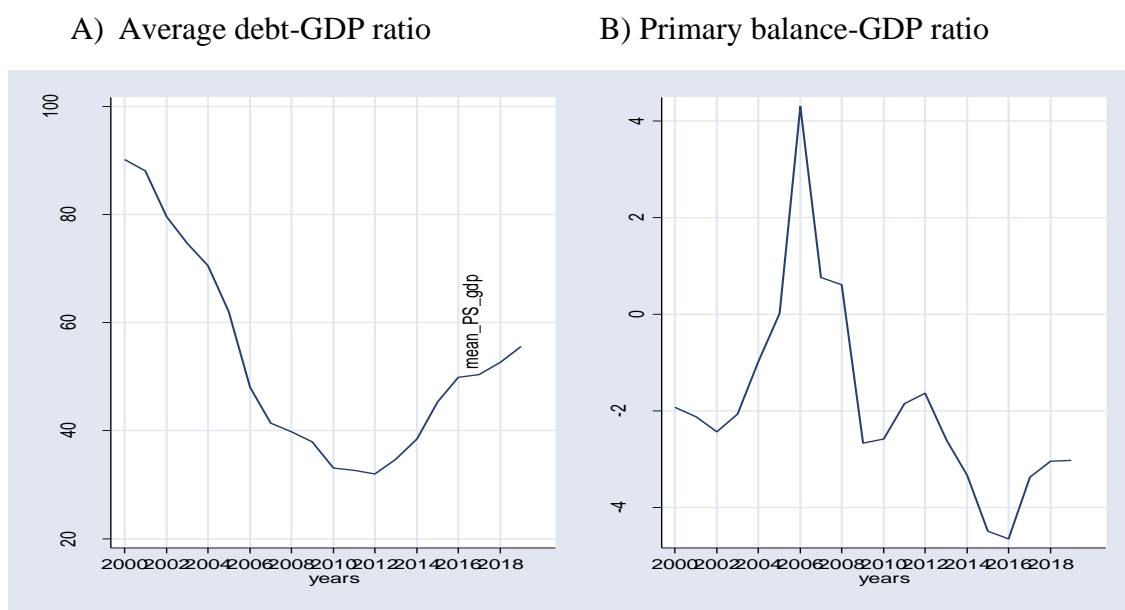
5.1 Introduction

The fiscal policy approach is deemed sustainable when a government can service its outstanding debt in the future while remaining intertemporally solvent (Abbas, 2004). Sustainable public finance is essential for developing countries, which have unstable access to capital markets, and the markets do not allow these countries to borrow, which is a significant incentive to avoid the existing stock of debt (Mendoza - Ostry, 2008). However, as Beddies et al. (2009) describe, sub-Saharan African (SSA) countries also have specific economic characteristics. These economies are predominantly characterized by higher sensitivity to external and domestic shocks. They are susceptible to trade shocks related to the production and export of a few raw products, climate shocks, volatile aid flow, political instability, weak policies and institutions, higher levels of external indebtedness, higher reliance on official external creditors, governments accounting for the largest share of foreign indebtedness, and public debt that is based on concessional loans and problems related to moral hazards (Beddies et al., 2009).

The average debt ratio of most SSA countries fell sharply following the Multilateral Debt Relief Initiative (MDRI) programs granted for heavily indebted poor countries (HIPC), from 90.2% in 2000 to 32% in 2012 (Fig. 5.1a). However, sovereign debt soared to 55.6% in 2019. If this condition persists for an extended period, it can generate an excess accumulation of public debt, threatening macroeconomic stability and fiscal sustainability. This suggests that repeated rounds of debt relief are not a panacea to help SSA countries escape debt crises. Congruently, SSA economies' primary balance began to fall in 2006, and the countries faced increased fiscal challenges (see Fig. 5.1b). In this context, it is worth investigating SSA countries' fiscal

sustainability while controlling the mounting debt levels to investigate the extent of countries' fiscal space.

Figure 5.1: (a) Average debt-GDP ratio of SSA countries (b) Primary balance-GDP ratio of SSA countries



Source: Authors' computations

As depicted in Figure (5.1a), in less than a decade since HIPC debt relief, the pace of the debt buildup in SSA countries has rapidly risen. As a result, many SSA countries that benefited from HIPC debt relief are falling into a high risk of debt distress (IMF, 2021). This might lead SSA countries to lose traction in servicing outstanding debts, as the debt levels are on an explosive trajectory and necessitate higher government fiscal sacrifices; hence, urgent reconsideration and renewed strategies are needed regarding public finance responses to public debt.

It is worth pointing out that, at moderate debt levels, the expected discounted sum of primary surplus positively responds to offset the increasing public debt level to hold a no-Ponzi game condition. However, when debt levels increase rapidly to a higher range, governments cannot finance existing obligations, and the public debt may not converge to a finite level, leading to insolvency (Ostry et al., 2010). Moreover, in recent studies, identifying the sustainable level of

public debt has triggered renewed interest in threshold analysis to investigate fiscal policy sustainability for designing prudent fiscal policy and avoiding excessive debt.

From an empirical point of view, many studies use a polynomial function of debt to primary balance to examine fiscal sustainability, notably for investigating US and European cases (e.g., Adedeji - Williams, 2007; Mendoza - Ostry, 2008; Gosh et al., 2013; Fournier - Fall, 2017; Checherita-Westphal - Źdarek, 2015; D'Erasmus et al., 2015; Berti et al., 2016; Everaert - Jansen, 2017; Everaert - Jansen, 2018). However, such investigations have largely failed to consider SSA countries. In addition, despite the importance of a polynomial function of debt to primary balance, most previous studies in SSA countries failed to consider the asymmetric response of fiscal policy to public debt ratios. For instance, Fincke - Greiner (2010) assesses fiscal sustainability by relying on stationarity and cointegration tests, finding mixed results. Fedelino - Kudina (2003) estimates a fiscal reaction function for 12 SSA countries from 1991 to 2002, revealing an unsustainable fiscal path. Mackiewicz (2021) analyzes the fiscal sustainability of nine southern African countries using a time-varying Kalman filter method and provides mixed results.

Building on SSA countries, Okwoche - Iheonu (2021) and Mupunga - Ngundu (2020) consider the possibility of a nonlinear fiscal reaction function based on squaring the debt element, demonstrating the possibility of a sustainable fiscal policy; however, these studies have two critical methodical drawbacks in analyzing nonlinear models. First, the threshold impact is not determined endogenously but is exogenously set on a priori restriction, and multicollinearity or collinearity problems could arise. Second, the model does not consider the endogeneity of primary balance. Such drawbacks can be adjusted in a threshold model. This chapter uses a dynamic panel threshold model to address the potential endogeneity problem, simultaneity for the threshold variable and regressors, and unobserved individual heterogeneity (Seo - Shin, 2016).

The findings of this chapter are fourfold. (i) The fiscal data in SSA countries can be better explained by an inverted U-shape fiscal reaction function. (ii) The sustainability criteria elicited using unit root, and cointegration tests indicate weak fiscal sustainability for SSA countries. (iii) There is an estimated debt threshold effect at 55% of GDP. (iv) There is a unidirectional flow from expenditure to revenue in SSA countries implying that governments correct fiscal revenue to match budgetary expenditures.

The contributions of this paper are twofold. First, the primary novelty of the study is its coverage of a wide range of SSA countries and examination of a nonlinear fiscal reaction function for SSA countries that only a few studies have engaged. Second, adding to the minimal research on SSA countries using a nonlinear fiscal reaction function, as existing studies tend to use the general method of moments (GMM) and overestimate the threshold level (Okwoche - Iheonu, 2021 and Mupunga - Ngundu, 2020). This study overcomes the limitations of the methodological backdrop and employs a dynamic panel threshold model that controls the problem of endogeneity with a first-differenced estimator GMM.

5.2 Literature review

The literature on assessing public finance sustainability methods has widely adopted the intertemporal budget constraint (IBC) approach, referring to the requirement that the expected discounted sum of primary surplus must be equivalent to past debt accumulations. Hamilton-Flavin's (1985) IBC tests the stationarity of the discounted debt stock, allowing for fixed real interest rates to satisfy the transversality condition. Wilcox (1989) extends the work of Hamilton and Flavin's IBC by allowing for flexible real interest rates and the presence of structural breaks in the budget balance process (i.e., the debt process must expand less rapidly than the average interest rate to be sustainable, whereas revenue and expenditure cointegration is the sufficiency criterion). Consequently, the government budget balance cycle can be integrated or even moderately explosive, and the fiscal policy stance will still satisfy the no-Ponzi game condition, provided that past debt accumulation does not outpace economic growth. Multiple authors (e.g., Haug, 1991; Hakkio - Rush, 1991; Trehan - Walsh, 1988; Quintos, 1995) further develop a cointegration framework between revenue and expenditure, including interest rate payments, to satisfy the sustainability hypothesis.

Bohn (2007) counters regarding the limitation of such tests on rejecting sustainability. First, the no-Ponzi game condition can be satisfied at an arbitrarily higher order of integration in an infinite sample of debt series and/or revenue and spending. Achieving fiscal solvency does not necessitate the cointegration of government expenditure and revenue. In addition, these methods have a problem of omitted variable bias, as they neglect consideration of the cyclical components of primary surplus in unit root testing (Bohn, 1998).

To address the omitted variable bias and econometric limitations of the unit root and cointegration tests, Bohn (1995, 1998) proposes a model that holds a no-Ponzi game condition, dubbing it model-based sustainability and proposing guaranteed public finance sustainability if the primary surplus increases with the rising levels of past debt accumulation. The plausible economic intuition is that an increase in past public debt buildup should be accompanied by a rise in primary surplus, allowing governments to initiate corrective policy responses in the future and hold the IBC.

Recent literature on fiscal sustainability has moved toward nonlinear forms of fiscal reaction function. These extensions either consider fiscal reaction functions as polynomial functions of debt to primary balance (Gosh et al., 2013) or fiscal rules as time-varying and described by structural breaks (Legrenzi et al., 2013; Fournier - Fall, 2017; Aldama - Creel, 2020). The latter argues that governments cannot follow Bohn's sustainability condition, as nonlinearities arise from periodic violations of fiscal policy in recurrent and future episodes (Aldama - Creel, 2020). In contrast, the former argues that a primary balance reacts to lagged debt, resembling an S-shape, wherein a threshold level exists at which the primary surplus cannot increase as fast as interest payments amid a rising debt level. In addition, the S-shaped fiscal rule implies that once a government reaches the debt limit, fiscal fatigue kicks in, and the government will default (Gosh et al., 2013). This chapter adopts the former argument to examine the nonlinear form of fiscal reaction function.

Table 5.1: List of panel studies on fiscal sustainability in SSA

Studies	Countries and samples covered	Methodology	Sustainability
Mackiewicz (2021)	Nine southern African countries (annual: 1960–2016)	Time-varying analysis of fiscal sustainability using the Kalman filter	Mixed
Okwoche - Iheonu (2021)	41 SSA countries (annual: 1990–2019)	Two-step GMM model	Weakly sustainable
Mupunga - Ngundu (2020)	40 SSA countries (annual: 2000–2016)	Two-step GMM model	Weakly sustainable
Fincke - Greiner (2010)	Developing countries from Africa and Latin America with low and middle income (annual: 1970–2005)	Stationarity and cointegration tests	Mixed
Zhan - York (2009)	Oil-producing sub-Saharan African countries (annual: 2005–2008)	Fiscal rule (constant real expenditure)	Mixed
Fedelino - Kudina (2003)	12 SSA countries (annual: 1991–2002)	Primary balance framework based on simulations	Unsustainable

Source: Authors' compilation based on SSA studies

In Table 5.1, we present the panel studies focusing on SSA countries. Mackiewicz (2021) examined the fiscal sustainability among nine southern African countries using a Kalman filter method from 1960 to 2016. The study finds mixed results in Namibia and Zimbabwe that violate the transversality condition, whereas Angola, Botswana, and Malawi support the no-Ponzi game condition. Conversely, Eswatini, Lesotho, South Africa, and Zambia had inconclusive results

regarding fiscal sustainability in these countries. Okwoche - Iheonu (2021) examine the determinants of fiscal policy stances in 41 SSA countries addressing the role of conflict within the framework of fiscal reaction functions. The study uses a GMM model, finding conflict to affect fiscal policy stances adversely in SSA and proposing a nonlinear fiscal reaction function in SSA. Mupunga - Ngundu (2020) investigate the fiscal sustainability of 40 SSA countries using the GMM model to explain panel fiscal reaction functions from 2000 to 2016. They determine that governments' reactions to increasing debt levels exceeding 90% of GDP have a deleterious effect on fiscal solvency. Zhan - York (2021) seek to assess the impact of fluctuating global oil prices on eight oil-producing SSA countries over 2005–2008, finding Cameroon and Côte d'Ivoire to be sustainable. In contrast, Angola, Chad, Gabon, Equatorial Guinea, Nigeria, and the Republic of Congo are found to have unsustainable fiscal policies. This study concluded that given the volatility of world oil prices, a sustained consolidation would help reduce the probability of a return to debt distress should oil prices trend downward. Fedelino - Kudina (2003) examined public finance sustainability among 12 SSA countries participating in MDRI programs granted for HIPC countries from 1991 to 2002. The study concludes that SSA countries will remain unsustainable even after the HIPC initiative application. Fincke - Greiner (2010) investigated public debt sustainability with samples from Africa and Latin America with low- and middle-income countries employing stationarity and cointegration tests to demonstrate the no-Ponzi game condition in the countries. The findings show that some of the countries have sustainable fiscal policies.

On the other hand, the research on fiscal sustainability in a few SSA countries has primarily adopted time series tools, mainly using unit root and cointegration tests. For instance, Phiri (2019), Ganyaupfu - Robinson (2019), Kavase - Phiri (2018), Jooste et al. (2013), and Baharumshah et al. (2016) estimate country-specific fiscal sustainability for South Africa; Nganga et al. (2018) and Mutuku (2015) examine Kenya; Alhaji Jibrilla (2016) studies Nigeria; and Amankwah et al. (2018) assess Ghana. These studies explain various mixed sustainability conditions for the countries, and no definitive conclusions can be drawn for SSA countries. Despite its significance in current policy debates, SSA countries' nonlinear fiscal reaction function remained relatively unexplored, particularly from a dynamic panel threshold perspective.

5.3 Data, theoretical model, and method

5.3.1 Data

A dataset of 40 SSA countries, including Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, the Democratic Republic of the Congo, Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Eswatini, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles Sierra Leone, South Africa, Tanzania, Togo, Uganda and Zambia from 2000 to 2019 is used in this paper to examine Bohn's model-based sustainability framework allowing for nonlinearity in the debt feedback to primary surplus. Annual data, including total government expenditure, total government revenue, current account balance (%GDP), and gross public debt, were sourced from the International Monetary Fund's World Economic Outlook, October 2021. The election dummy was sourced from every country's electoral commission to control for countries' political stability. To control for the cyclical effects, the output gap (YGAP) of a business cycle and the expenditure gap (GVAR) of temporary public primary expenditure were used. The debt relief of HIPC countries was constructed as a dummy variable sourced from the IMF's History of Lending Arrangements (www.imf.org).

5.3.2 Theoretical model

We adopted the intertemporal budget constraint (IBC) approach, wherein the future expected discounted sum of the maximum primary surplus can service the outstanding public debt and payments associated with the interest rates of current fiscal deficits. Henceforth, if the present value of the IBC holds, fiscal policy stances are considered sustainable.

Algebraically, the theoretical framework is expressed by the present value of government borrowing constraint (PVBC) at time t :

$$G_t + (1 + r) B_{t-1} = R_t + \sigma_t + B_t \quad (5.1)$$

where B_t is the outstanding public debt at the end of period t , r is the real interest rate, G_t is government spending, R_t is government revenue, and σ_t is seigniorage revenue. The PVBC can

be explained as a fraction of Y_t , the nominal GDP [$Y_t = (1 + g)Y_{t-1}$]. In addition, to keep the algebra simple, we combine the seigniorage to the government revenue to express the IBC as:

$$\frac{B_t}{Y_t} = (1 + r_t) \frac{B_{t-1}}{Y_{t-1}} \frac{Y_{t-1}}{Y_t} + \frac{PS_t}{Y_t} \quad (5.2)$$

$$b_t = \frac{(1 + r_t)}{(1 + g_t)} b_{t-1} - ps_t \quad (5.3)$$

where b_t is the real value of debt stock at the end of period t , ps_t ($exp_t - rev_t$) denotes the real primary surplus indexed to nominal GDP, and g is the nominal GDP growth rate. If the interest rate surpasses the growth rate ($r_t > g_t$), the primary surplus has positive feedback to the outstanding debt.

Denoting $\gamma_t = \frac{(1+r_t)}{(1+g_t)}$ and rearranging Eq. (5.3):

$$b_{t-1} = (1 + \gamma)^{-1} b_t + (1 + \gamma)^{-1} (ps_t) \quad (5.4)$$

Equation (5.3) can be updated to period t and expressed as:

$$b_t = (1 + \gamma)^{-1} b_{t+1} + (1 + \gamma)^{-1} (ps_{t+1}) \quad (5.5)$$

Substituting Eq. (5.3) on the right-hand side of b_t gives:

$$b_{t-1} = (1 + \gamma)^{-2} b_{t+1} + (1 + \gamma)^{-1} (ps_{t+1}) + (1 + \gamma)^{-2} (ps_{t+1}) \quad (5.6)$$

Substituting b_{t+1} on the right-hand side of Eq. (5.6) and for b_{t+2} through recursive substitution gives:

$$b_{t-1} = (1 + \gamma)^{-(j+1)} b_{t+j} + \sum_{i=0}^j (1 + \gamma)^{-(i+1)} (ps_{t+i}) \quad (5.7)$$

Equation (5.7) expresses the link between the total government debt at two periods -1 and $t + j$. That is, the total amount of outstanding debt at period $t + j$ is a function of the starting debt at $t - 1$ plus the future expected discounted sum of the primary surplus future.

At the infinity period, the present value of public debt must approach zero:

$$\lim_{j \rightarrow \infty} (1 + \gamma)^{-(j+1)} b_{t+j} = 0 \quad (5.8)$$

Equation (5.8) refers to a transversality (or no-Ponzi game) condition for fiscal sustainability. So then, the IBC becomes:

$$b_{t-1} = \sum_{i=0}^j (1 + \gamma)^{-(i+1)} (ps_{t+1}) \quad (5.9)$$

By implication, the government applies its initial debt by equating the future primary surpluses in the present value to its past debt accumulations.

To obtain an appropriate specification to test empirically and normalizing $\frac{(1+r_t)}{(1+g_t)} \approx 1 + r - g$,

Eq. (5.9) can be written as:

$$b_t = (1_r + r - g) b_{t-1} - ps_t \quad (5.10)$$

rearranging Eq. (5.10) as:

$$\Delta b_t = (r - g) b_{t-1} - ps_t \quad (5.11)$$

If $(r > g)$, then the primary balance must respond positively to keep the lagged values of debt to GDP ratio bounded. This is considered the basic fiscal reaction function.

$$ps_t = \gamma b_{t-1} \quad (5.12)$$

where, at the debt-stabilizing level, the current value of primary surplus must exactly pay for the previous debt obligations.

$$ps_t = \gamma b_{t-1} + \Delta b_t \quad (5.13)$$

For the estimate, the Δb_t can be affected by temporary variations in government outlays based on Barro's (1979, 1981, 1986) tax-smoothing model. According to the model, the primary surplus has two main fluctuating components: fluctuations in business cycle and government spending. This can be represented as $\Delta b_t = \vartheta Z_t + \mu_t$, where Z_t is a set of covariates and $\mu_t \sim i. i. d(0, \delta^2)$.

The Bohn (1998) extended model, including the omitted variables, can be written as:

$$ps_t = \alpha_0 + \gamma b_{t-1} + \beta_t GVAR_t + \delta_t YGAP_t + \rho_t CAB_t + \sigma_t IMF_t + \varphi_t elec_t + \varepsilon_t \quad (5.14)$$

where *GVAR* denotes fluctuations of government spending and is included in the model to control cyclical government spending. The output gap (*YGAP*) is used to control the effects of economic cycle fluctuation. *CAB* denotes the current account balance (%GDP) and is included to control for the “twin deficits” hypothesis and cross-country spillovers. The *elec* dummy is included to capture possible political pressure on fiscal spending in election periods. The *IMF* dummy is included to investigate the impact of international financial institutions.

The nonlinear panel FRF is expressed as follows:

$$PS_{i,t} = \alpha + PS_{i,t-1} + \beta Debt_{i,t-1} + \gamma Debt_{i,t-1}^2 + \delta X_{i,t} + \theta_i + \vartheta_t + \varepsilon_{i,t} \quad (5.15)$$

where $PS_{i,t}$ is a primary surplus (%GDP), $PS_{i,t-1}$ is a lagged primary surplus (%GDP), $\beta Debt_{i,t-1}$ is a lagged value of gross government debt (%GDP) at time $t - 1$, $\gamma Debt_{i,t-1}^2$ is a lagged value of the square of gross government debt (%GDP) at time $t - 1$, $\delta X_{i,t}$ is a set of covariates, θ_i is a country-fixed effect, ϑ_t is a time-fixed effect, and $\varepsilon_{i,t}$ is a random error and $\varepsilon_{i,t} \sim N(0, \delta_{i,t}^2)$.

5.3.3. Stationarity test

Despite Bohn’s (2007) criticisms, fiscal sustainability can be assessed through government cointegration of revenue and expenditure or through the stationarity process of the fiscal variables and the public debt series.

Based on the IBC and assuming a constant real interest rate, with mean γ is stationary if $E_t = G_t + (r_t - r)B_{t-1}$ and $GG_t = G_t - r_t B_{t-1}$, then intertemporal budget constraint becomes:

$$GG_t - R_t = \sum_{s=0}^{\infty} \frac{1}{(1+r)^{s-1}} (\Delta R_{t+s} - \Delta E_{t+s}) + \lim_{s \rightarrow \infty} \frac{B_{t+s}}{(1+r)^{s+1}} \quad (5.16)$$

and with the solvency condition, both (GG_t) and (R_t) must be at a stationary of order one and cointegrated variables; therefore, the IBC would be satisfied with cointegrating relationship regressions $R_t = \alpha + \beta GG_t + \varepsilon_t$,

where R_t is government revenue and GG_t is government expenditure in units of local currency, ε_t is a random error, and $\varepsilon_{i,t} \sim N(0, \delta_{i,t}^2)$.

Following Quintos (1995), if no cointegration is rejected and $\beta = 1$, this implies that the fiscal policy stance is strongly sustainable; however, if $0 < \beta < 1$, it is “weakly” sustainable.

5.3.4. Dynamic panel threshold model

The study applies the dynamic panel threshold model developed by Seo and Shin (2016) and protracted by Seo et al. (2019). The model is built with a first-differenced estimator GMM principle to avoid endogeneity problems, simultaneity for the threshold variable and regressors, and unobserved individual heterogeneity.

The model is specified as follows:

$$PS_{j,t} = \beta_1 PS_{j,t-1} + \sum_{i=1,2}^n \beta_n X_{j,i,t} + (\delta_0 + \delta_1 PS_{i,t-1} + \sum_{i=1,2}^n \delta_i X_{j,i,t}) I_{qj,t > \gamma} + \mu_j + \varepsilon_{i,t} \quad (5.17)$$

where j represents countries, t represents the time variable, and i represents regressors. $PS_{i,t}$ is a primary surplus (%GDP); $PS_{i,t-1}$ is a lagged primary balance (%GDP); $X_{j,i,t}$ denotes a set of covariates; $I_{qj,t > \gamma} + \mu_j$ is a binary variable, with a value of one if the threshold occurs and zero otherwise; μ_j is a country-fixed effect; $\varepsilon_{i,t}$ is the serially uncorrelated idiosyncratic error and $\varepsilon_{i,t} \sim N(0, \delta_{i,t}^2)$.

5.3.5. Panel causality based on the Dumitrescu–Hurlin test

Uncovering causality linkages between government revenue and government expenditure could reveal important insights regarding how these economies can accurately manage fiscal imbalances in the future. Notably, causal direction does not have consequences for the solvency condition; instead, we use it only for the budget adjustment dynamics process.

The direction of causation can derive from (i) government spending to government revenue (Barro, 1979), (ii) government revenue to government spending (Friedman, 1978), (iii) bidirectional causality (Musgrave, 1966), and (iv) no causality (Hoover - Sheffrin, 1992). This study uses Dumitrescu - Hurlin’s (2012) Granger causality test for panel modeling developed as an extension

of Granger (1967). The technique is adopted because it accounts for possible individual unit fixed effects in the data and adds cross-sectional dependence.

The model assumes the two variables to be stationary and balanced and is specified as follows:

$$y_{i,t} = \delta_{1i} + \sum_{k=1}^k \beta_{1,i}^k x_{i,t-k} + \varepsilon_{1i,t} \quad (5.18)$$

$$x_{i,t} = \delta_{2i} + \sum_{k=1}^k \alpha_{2,i}^k y_{i,t-k} + \varepsilon_{2i,t} \quad (5.19)$$

Where i represents countries, t represents the time variable, δ_i is a dimensional vector representing constant time individual unit fixed effects, K is the lag length, $\alpha_{2,i}^k$ and $\beta_{1,i}^k$ are set to change across groups but fixed in time, $\varepsilon_{i,t}$ is a random error, and $\varepsilon_{i,t} \sim N(0, \delta_{i,t}^2)$.

5.4 Discussion and analysis

5.4.1 Summary Statistics

Table 5.2 presents the summary statistics for the variables in this study. The average panel value for primary surplus (% of GDP) is -0.019 for the period 2000-2019 for 40 SSA countries. The average gross government debt for the 40 SSA countries is 53 (% of GDP), with the lowest range of 5 (% of GDP) and the highest at 261 (% of GDP) from 2000- 2019. SSA countries' mean current account balance (%GDP) is -0.002. The average fiscal revenue is 20 (% of GDP) among the 40 SSA countries, while the average government spending is 22 (% of GDP). The mean of output and spending gaps are close to zero from the negative side for SSA countries.

Table 5.2: Summary statistics

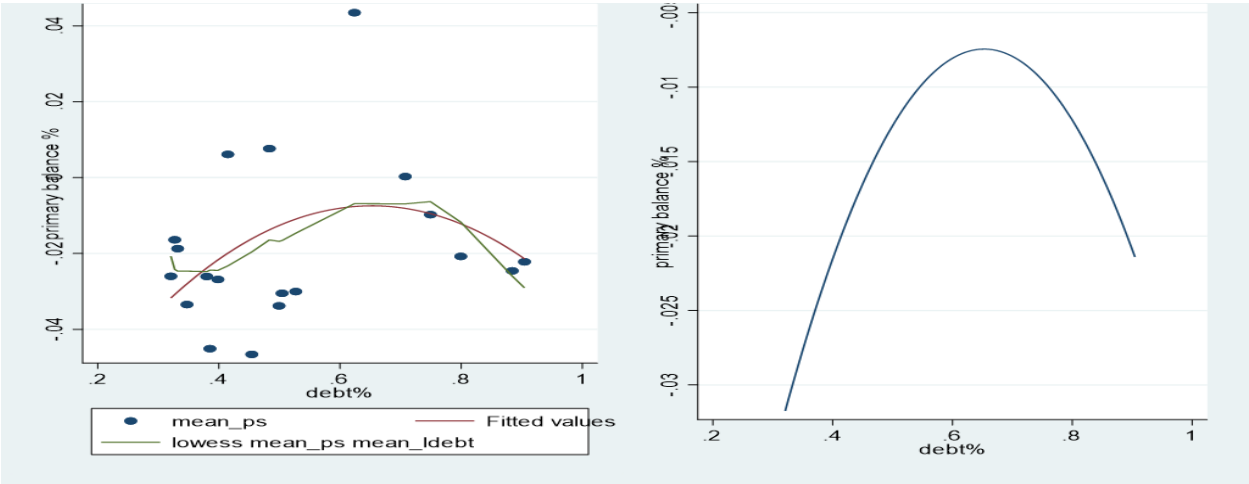
Variable	Obs	Mean	Std. dev.	Min	Max
Primary surplus (%GDP)	800	-0.019	0.05	-0.18	0.31
Debt (%GDP)	800	0.53	0.39	0.005	2.61

Current account balance (%GDP)	800	-0.002	0.009	-0.08	0.03
Output gap (YGAP)	800	-4.3E-13	0.77	0.73	0.40
Spending gap (GVAR)	800	-4.4E-13	0.12	-0.58	0.59
Spending-GDP ratio	800	0.22	0.96	0.025	0.65
Revenue-GDP ratio	800	0.20	0.99	0.006	0.62

Source: Authors' computations

Examining trends in the scatterplots (Figs. 5.2 a & b) reveals that the relationship between primary surplus (%GDP) and lagged debt (%GDP) follows an inverted U-shaped curve, in contrast to the S shape proposed by Ghosh et al. (2013). Specifically, the fiscal policy stances for SSA countries can be explained by a quadratic function wherein the primary surplus remains on track with low to moderate debt levels, eventually decreasing as public debt is bound to climb higher. This indicates that a maximum debt level has a deleterious effect on the fiscal policy of SSA countries. The graph also reveals the concave aspect of the larger S-shaped curve proposed by Ghosh et al. (2013). In contrast to S-shaped, the reasons for an inverted U shaped debt dynamics could be related to unstable access to capital markets, as the markets do not allow these countries to borrow excessive amounts.

Figure 5.2: Debt Dynamics with nonlinear FRFs (a and b)



Source: Authors' computations

5.4.2 Cross-sectional dependence test

In this study, the Pesaran (2004) CD (Cross-section Dependence) test is used to test the existence of cross-sectional dependency in the individual variables. Table 5.3 presents the CD test proposed by Pesaran (2004). As demonstrated in Table 5.3, CD is sufficiently large enough to reject the null hypothesis for all panel time series and individual variables to indicate a relationship across the countries. Moreover, Frees' and Friedman's tests reject the null hypothesis of non-cross-sectional dependence among the variables.

As expected, the coefficient and the probabilities obtained from Frees' and Friedman's tests reject the null of cross-sectional independence among the variables. The probability of FR_{test} is 0.026 and rejects the null hypothesis of cross-sectional independence at 5%. Moreover, the $FREE_{test}$ rejects the null hypothesis of cross-sectional independence at 1%, the α values of 1%, 5%, and 10% are obtained from the Q distribution where $T \leq 30$.

Table 5.3: Cross-sectional dependence tests

Variable	CD test	p-value	corr	abs(corr)
Primary balance (%GDP)	19.91	0.000	0.16	0.32
Lagged debt (%GDP)	80.33	0.000	0.66	0.75
Output gap	16.00	0.000	0.13	0.30
Spending gap	10.37	0.000	0.09	0.27
Current account balance (%GDP)	12.94	0.000	0.104	0.31
CD test values			p-value	

Pesaran's test of cross-sectional independence = 10.461	Pr = 0.000
Friedman's test of cross-sectional independence = 57.933	Pr = 0.026
Frees' test of cross-sectional independence = 2.25	Critical values from Frees' Q distribution
	alpha = 0.10 : 0.14
	alpha = 0.05 : 0.18
	alpha = 0.01 : 0.26

Source: Authors' computations

5.4.3 Panel unit root tests

We examine potential stationarity using a second-generation CIPS unit root test (Pesaran, 2007). Table 5.4 presents the results of the panel unit root tests, demonstrating that all the variables included in this study strongly rejected the null hypothesis of non-stationarity at level.

Table 5.4: Panel unit root test

Variables	Level (intercepts only)			
	CIPS	Critical values		
		1%	5%	10%
		-2.11	-2.2	-2.36
Primary balance (%GDP)	-3.09***			
Debt (%GDP)	-2.111*			
Output gap (YGAP)	-2.47***			
Spending gap (GVAR)	-3.56***			
Current account balance (%GDP)	-2.179*			
Spending (%GDP)	-2.362***			
Revenue (%GDP)	-2.46***			
Log (spending)	-2.24**			
Log (revenue)	-2.30**			

Note: Critical values are reported at 1%, 5%, and 10%. *** p < 0.01, ** p < 0.05, * p < 0.1.

Source: Authors' computations

5.4.4 Estimates of long-run relationship (fixed effects approach)

three tests are applied to select the best model. First, the $F - test$ failed to accept the null hypothesis of no fixed effect in the panel at a 1% significance level. Second, the results of the Breusch–Pagan (1979) Lagrange multiplier test recommend that the RE model is recommended rather than pooled ordinary least squares (POLS) by rejecting the null hypothesis of no random effects in the panel. Third, comparing the random effects (RE) model with the FE model, the FE model is more efficient using the Hausman test statistic. Table 5.5 illustrates the outcomes of the fixed effects (FE) method.

The study examines whether the cointegration factor is $0 < b < 1$ to obey the fiscal policy and satisfy the budget constraint. As a result, the estimated coefficient of the FE model for government expenditure was 0.88, implying that governments' revenue climbs by less than 1% for every 1% increase in public expenditure (see Table 5.5). This finding has important implications, suggesting weak fiscal sustainability of SSA countries over the period 2000–2019.

Table 5.5: Estimates of a long-run relationship

Log (revenue)	Coefficient
Log (spending)	0.88*** (53.06)
Constant	2.49*** (6.82)
Observations	800
Number of id	40
R-squared	0.788

Note: t-statistics are in parentheses *** $p < 0.01$

Source: Authors' computations

5.4.5 Fiscal sustainability using a dynamic panel threshold model

Applying a dynamic panel threshold model, Table 5.6 strongly rejects a linearity hypothesis, confirming the presence of a tipping point at which public debt potentially triggers unsustainable public finance. The results indicate that fiscal responsiveness weakens when the public debt-to-

GDP ratio exceeds 55%, suggesting that SSA countries will continue to face unsustainable debt burdens as debt mounts and fiscal consolidation becomes highly sensitive in the long run. Below the threshold, the lag of primary surplus is positive and significant, confirming the dynamism of primary balance and the persistence of governments' fiscal reaction to past debt accumulations. Previous findings corroborate this result (Mendoza - Ostry, 2008; Ghosh et al., 2013; Fournier - Fall, 2017; Berti et al., 2016; Okwoche - Iheonu, 2021; Mupunga - Ngundu, 2020).

Lagged debt has both statistically significant and positive effects at the 10% level; however, above the threshold, the debt value is insignificant, although it exhibits a negative sign. This indicates the government's fiscal reaction to satisfy the IBC below the public debt threshold. Current account balance (%GDP) has both statistically significant and positive effects in the lower regime, supporting the twin deficit hypothesis for SSA countries. On the other hand, the coefficient of the spending gap is negative and significant, only below the threshold. The estimates of debt relief exhibit a positive sign in the lower regime and a negative in the upper regime. This can be justified as HIPC benefited countries below the threshold, helping to reduce foreign debt and improve primary surplus; however, as countries' borrowing increases and surpasses the threshold, it jeopardizes countries' budget balance.

Table 5.6: Dynamic panel threshold model

Dependent variable = primary balance	Coefficient	
	Lower regime	Upper regime
Lagged primary surplus (%GDP)	0.39*** (4.87)	0.36 (0.78)
Lagged debt (%GDP)	0.06* (1.5)	-0.097 (-0.69)
Current account balance (%GDP)	5.33*** (3.46)	5.39 (0.60)
Output gap	0.09 (1.29)	-0.86 (-1.37)
Spending gap (GVAR)	-0.198*** (-3.96)	-0.53 (-1.43)
Election year (dummy)	0.006 (1.20)	0.03 (0.43)

IMF arrangement (dummy)	0.04*** (4.00)	-0.36** (-2.40)
Constant	0.09* (1.50)	
Threshold:	0.55** (2.04)	
Bootstrap p-value for linearity test:	0.0000	

Note: Values in parentheses denote *t* – statistics. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Authors’ computations

5.5 Robustness checks

We test a nonlinear quadratic reaction in the debt (%GDP) specification to validate our results using alternative estimation methods. In addition, the lagged primary surplus is added as an exogenous variable in our model to consider the sluggish response of a government to changes in public debt.

However, including a lagged dependent variable as an explanatory variable may generate an endogeneity problem from the so-called Nickell bias (1981). Furthermore, potentially endogenous variables can arise from the reverse causality of the output gap with fiscal policy. Finally, due to the twin deficit hypothesis, endogeneity may potentially arise from the current account balance (%GDP). Thus, to address these problems, this chapter uses various estimation methods to avoid these issues, such as the two-step GMM, Prais–Winsten regression, bias-corrected FE, regression with Driscoll–Kraay standard errors, and FE (within) regression with AR(1) disturbances. Table 5.7 presents the results of these alternative estimation methods.

Table 5.7: Nonlinear regression results

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Two-step GMM	FE-IV	Prais- Winsten regression	Bias- corrected FE	FE with AR(1)	Driscoll– Kraay standard

						errors
Lagged primary balance (%GDP)	0.20** (2.5)	0.34*** (5.66)	0.27*** (3.86)	0.36*** (12.00)	0.28*** (9.33)	0.32*** (4.00)
Lagged debt (%GDP)	0.17*** (3.40)	0.05*** (5.01)	0.05*** (5.01)	0.03** (3.01)	0.05*** (5.00)	0.04** (4.01)
Lagged debt square (%GDP)	-0.06*** (-2.86)	-0.02*** (-2.93)	-0.02*** (-2.91)	-0.01*** (-2.63)	-0.02*** (-3.41)	-0.01** (-2.57)
Current account balance (%GDP)	1.13* (1.85)	0.38 (1.08)	0.94*** (4.27)	0.75*** (2.88)	0.94*** (3.91)	0.80*** (3.80)

Table 5.8: Nonlinear regression results

Output gap	0.18*** (5.09)	0.12*** (2.95)	0.17*** (6.51)	0.16*** (7.72)	0.18*** (8.4)	0.16*** (0.04)
GVAR	-0.14*** (-5.42)	-0.13*** (-7.87)	-0.14*** (-11.47)	-0.14*** (-9.72)	-0.14*** (-11.20)	-0.14*** (-10.52)
Election dummy	0.00 (0.16)	-0.00 (-0.68)	-0.00 (-0.69)	-0.00 (-0.40)	-0.00 (-0.54)	-0.00 (-0.49)

IMF arrangement (dummy)	-0.00 (-0.02)	-0.01*** (-2.90)	-0.01* (-1.91)	-0.01* (-1.84)	-0.01** (-2.02)	-0.01*** (-3.98)
Constant	-0.06*** (-3.14)		-0.03** (-2.20)		-0.04*** (-5.03)	-0.01** (-2.09)
Observations	760	720	760	760	720	760
R-squared		0.482	0.578			
Number of groups	40	40	40	40	40	
Country FE	No	No	No	Yes	No	No
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
AR (2) (p-val)	0.34					
Hansen J-test (p-value)	0.116	0.1076				
Kleibergen–Paap rk LM statistic		0.0000				

Note: Values in parentheses denote t – statistics. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Time and country fixed effects are not provided.

Source: Authors’ computations

Using a two-step system GMM specification, Column (1) of Table 5.7 demonstrates that the results do not change the signs of the public debt and the control variables. The average slope of primary surplus (%GDP) is 0.208 and is significant at 5%, demonstrating the persistence of primary surplus to rising public debt. This is primarily because government budgeting is highly politicized, making it difficult to respond quickly to debt changes and other economic conditions. These results are congruent with Mendoza - Ostry (2008), Ostry et al. (2010), Ghosh et al. (2013), Fournier - Fall (2017), Berti et al. (2016), Okwoche - Iheonu (2021), and Mupunga - Ngundu (2020).

The coefficient of lagged debt (%GDP) exhibits a positive sign, indicating countries’ responsiveness to satisfy the solvency condition at low to moderate levels of debt. This confirms

the governments' reaction by tightening their budget to the increasing debt; however, when the debt ratio reaches a sufficiently high level, the primary balance slowly responds to the increasing debt level to satisfy government solvency constraints. The result of the lagged debt coefficients is consistent with previous empirical studies (Okwoche - Iheonu, 2021; Mupunga - Ngundu, 2020).

The output gap has both statistical significance and positive effects on primary surplus, indicating that the fiscal policy is countercyclical. Consequently, the coefficient of the current account–GDP ratio is positive and significant in all models, indicating the “twin deficits” hypothesis effects between external and fiscal deficits; however, the coefficient of cyclical government spending is negative and significant, indicating its adversity to government budget balance (see Column (1), Table 8).

Finally, Columns (2)–(6) of Table 5.7 present alternative estimation approaches, suggesting that these alternative approaches produced robust results. The results in Table 5.7, Columns (2)–(6) are unchanged, except for the case of HIPC countries' debt relief demonstrating an adverse effect on fiscal stances. This could be justified as the HIPCs benefiting countries resulted in public debt buildup and deteriorated fiscal balance. In addition, it indicates the countries' willingness to assume more debt based on expectations of additional new debt relief, in the belief that if the country faces difficulties in servicing its obligations, it will be forgiven, which generates disincentives for the implementation of debt-reducing policies. The findings are consistent with IMF - IDA (2003).

Note that due to the countries' dynamic specification and cross-sectional dependence, the time-fixed effects are allowed to enter to control for common shocks hitting all. Finally, the Sargan test of autocorrelation, over-identifying restrictions via the Hansen tests, and the weak instruments test via the Kleibergen–Paap LM test also demonstrate that the instruments are valid. The AR(2) test also indicates the robustness of the instruments.

5.6 Panel causality test

Table 5.8 presents the Dumitrescu–Hurlin Granger causality test (2012). Table 5.8 confirm a unidirectional flow from expenditure to revenue in SSA countries, implying that governments correct fiscal revenue to match the budgetary expenditure.

Table 5.9: Panel causality test

	Lag=1	Lags=2	Lags=3
	F-Stat.	F-Stat.	F-Stat.
Fiscal revenue does not Granger-cause government expenditure	0.87 (0.39)	1.015 (0.30)	0.39 (0.68)
Government expenditure does not Granger-cause fiscal revenue	3.61*** (0.00)	7.07*** (0.00)	4.41*** (0.00)

Notes: Values in parenthesis denote p-value. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' computations

5.7 Chapter Summary

This chapter addresses the sustainability of public debt using various approaches, such as unit root, cointegration tests, and fiscal reaction function. This chapter mainly uses Bohn's fiscal reaction function, allowing for a quadratic fiscal reaction function to investigate fiscal policy reaction to the rising public debt and examine the existence of long-run public finance sustainability in SSA countries. In this chapter, the result following the unit root and cointegration tests indicates that the fiscal stance of SSA economies is sustainable. Moreover, using the panel threshold model, the study finds the fiscal policy is sustainable till the threshold level of 55% maximum outstanding debt-GDP ratio. The findings of the study also indicate that fiscal policy is countercyclical, evidence for the "twin deficits" hypotheses, and a negative effect from temporary increases in government outlays. Furthermore, there is a unidirectional flow from expenditure to revenue in SSA countries, implying that the government corrects fiscal revenue to match the budget expenditure.

The next chapter offers evidence on the determinants of fiscal consolidation and the effects of fiscal measures in sub-Saharan countries on economic output, unemployment, consumption, private investment, REER, and current account balance. Additionally, the paper looks into two additional dimensions of fiscal consolidation: an economy's business cycle and the composition of fiscal consolidation.

6. Macroeconomic effects of fiscal consolidation on economic activity in SSA countries

The thesis chapter deals with the determinants and effects of fiscal consolidation on SSA countries. The section first briefly introduces the background and justification of the problem, followed by a review of related literature on the definition, measurement, composition of consolidations, determinants, and effect of fiscal consolidation. It also presents the data source and method of data analysis, followed by the results focusing on fiscal consolidation. Finally, this section delivers a chapter summary.

6.1 Introduction

Over the last two to three decades, fiscal policy has gained a resurgence in global discourse. However, a coherent understanding of fiscal consolidation is scant and inconclusive. Fiscal consolidation is inevitable in times of high public debt and worsening fiscal position. For instance, in SSA countries, the mean debt-to-GDP ratio leveled off at 58% in 2019 and has an increasing trend (Ndung'u et al., 2021). Moreover, among the SSA countries that benefited from the Heavily Indebted Poor Countries (HIPC) initiative, most are either in debt stress or have a high risk of debt stress (Coulibaly et al., 2019). The region's tax-to-GDP ratio is 16.6%, the lowest compared with other regions worldwide (Revenue Statistics in Africa, 2021). Overall, despite improvements in revenue mobilization in SSA countries in the last two decades, their fiscal position has worsened from year to year, leading to a rapid upward trend in their sovereign debt. As these deficits widen, fiscal retrenchment is inevitable in stabilizing and possibly reversing the increasing trend of the public debt-to-GDP ratio. However, it appears that this issue has been under-explored in the literature.

The empirical validity surrounding fiscal adjustment is not yet fully settled. The first debt stems from the ambiguous effects of fiscal consolidations where one strand of literature supports the view of expansionary effects on GDP (Giavazzi - Pagano, 1990; 1996; Perotti, 1999; Alesina et al., 2015; Alesina et al., 2019; Afonso - Leal, 2020) while the other strand of literature rejects the expansionary fiscal retrenchments (Hjelm, 2002; Schclarek, 2003; Yabré - Semedo, 2021; Arizala et al., 2021; Afonso et al., 2022). The second strand of literature in which a coherent understanding

of fiscal consolidation does not exist is about the economic effects of fiscal adjustments over the business cycle of an economy. A plethora of studies confirms that compared with those preceded by an economic boom, fiscal adjustments preceded by a recession are more contractionary (Jordà - Taylor, 2016; Alesina et al., 2018), suggesting the effectiveness of fiscal consolidation depends on the initial period of the economic cycle. However, Ramey - Zubairy (2018) did not detect significant differences over a business cycle.

The third strand of literature provides less mixed evidence that compared with revenue-based consolidations, spending-based adjustments are less contractionary (Zaghini, 2001; Guichard et al., 2007; Alesina - Ardagna, 2010; Brady, 2015; Alesina et al., 2015; Arizala et al., 2021), whereas others have argued that both spending- and revenue-based adjustments reduce private consumption and GDP (Barrell et al., 2012; Guajardo et al., 2014).

Aside from these mixed results, little is known about its effect in Sub-Saharan African (SSA) countries. This study focuses on SSA countries' fiscal policy, where there is a lack of empirical studies for policy guidance. The economies are predominantly characterized by dependence on foreign aid, sensitivity to external and domestic shocks, commodity trade shocks, political instability, weak policies and institutions, higher levels of external indebtedness, procyclical fiscal policy, and natural resource rent (Beddies et al., 2009; Lledo - Poplawski-Ribeiro, 2013; Yabré - Semedo, 2021). Due to the peculiar characteristics of the region, our study mainly focuses on the response of economic activity to the changes in cyclically adjusted primary balance (CAPB) in SSA economies.

The literature on SSA economies that focuses on fiscal adjustment is largely inconclusive, and only a few studies have been conducted. For instance, Yabré - Semedo (2021) investigated the effect of political stability on changes in fiscal consolidation in SSA countries. The study found that stable governments are positively associated with fiscal consolidation. Arizala et al. (2021) unveiled the short-run response of output to a percentage change in fiscal consolidation in SSA countries. They concluded that fiscal consolidations lead to a slowdown in economic activities in SSA economies. The contribution of this study is as follows. First, our study adds to the paper of Arizala et al. (2021) and extends it empirically by offering evidence on the determinants of fiscal consolidation and its effects on economic activity in sub-Saharan countries. Notably, this chapter

investigates the effect of fiscal consolidation on economic output, unemployment, consumption, private investment, REER, and current account balance. Additionally, the paper looks into two additional dimensions of fiscal consolidation: an economy's business cycle and the composition of fiscal consolidation.

The findings of the study are twofold. First, the paper finds that the initial conditions of output growth, output gap, current account balance, financial crisis, public debt, and official development assistance (ODA) received are positively associated with the likelihood of fiscal consolidation implementation. In contrast, the initial budget balance decreases the likelihood of tight fiscal policy decisions. Second, based on the local projection method (LPM) estimation, our study rejects the expansionary austerity hypothesis and supports its recessionary effect on output and the crowding-out effect on private demand. Moreover, we find that revenue-based consolidations lead to more output loss than spending-based consolidations. Furthermore, our findings support the claim that consolidation episodes initiated in boom periods have lower contractionary effects than those initiated in recession periods. The robustness of the findings of this study is tested by using an alternative definition of fiscal consolidation and various econometric methodologies.

6.2. Literature review

Fiscal consolidation is experienced when a government cuts its spending and/or increases its tax to minimize the CAPB and debt level. Many countries implement fiscal consolidation measures after fiscal expansions to reduce the increasing levels of public debt. Theoretically, fiscal adjustments positively impact the private sector by decreasing interest rates, leading to crowding-in effects on private investment and increasing the wealth effect through future expectations of substantial tax cuts. In addition, fiscal adjustment decisions indicate policymakers' commitment to macroeconomic stability and fiscal sustainability. In the empirical literature, various authors have different views about when fiscal adjustment should be launched. Guichard et al. (2007) and Barrios et al. (2010) claimed that fiscal adjustments should be launched when governments face high fiscal imbalance. However, von Hagen - Strauch (2001) and Molnar (2013) argued that fiscal adjustments are mostly introduced when the home economy is growing well, whereas Romer - Romer (2010) and Alesina - Ardagna (2013) indicated that past economic performance rather than current economic cycles lead to a greater motivation to implement fiscal adjustments. Giavazzi -

Pagano (1996) discussed the initial condition of the economy and found that the magnitude and persistence of the consolidation episodes are the main determining factors when implementing fiscal consolidation.

Following the paper by Giavazzi - Pagano (1990), the empirical literature on the response of real GDP and private demand to contractionary fiscal policy falls within two strands—expansionary austerity (non-Keynesian effects of fiscal policy) (Giavazzi - Pagano, 1990, 1996; Alesina - Perotti, 1997; Alesina - Ardagna, 1998; Perotti, 1999; Ardagna, 2004; von Hagen - Strauch, 2001; van Aarle - Garretsen, 2003; Giudice et al., 2007; Alesina et al., 2015; Jordà - Taylor, 2016; Alesina et al., 2019; Afonso - Leal, 2020; Afonso et al., 2022) and contractionary austerity (Hjelm, 2002b; van Aarle - Garretsen, 2003; Schclarek, 2007; Guajardo et al., 2014; Arizala et al., 2021; Yabré - Semedo, 2021).

The first school of thought, contractionary austerity, supports the Keynesian proposition and argues that spending cuts or tax increases reduce aggregate demand in the short term. This school of thought assumes that the economy has an excess capacity and that there are also liquidity-constrained individuals in the economy. Therefore, fiscal policy can stimulate aggregate demand through private consumption, which can induce the labor market and activate private investment to respond quickly to fiscal shocks (Brinca et al., 2016; Afonso - Leal, 2022). However, fiscal adjustments are expected to reduce aggregate demand and, thus, output.

Conversely, the second school of thought argues that fiscal adjustments in the short term can induce private consumption and investment either through the demand side (the wealth effects and interest rate channels) or the supply side (the labor market and tax decisions channel). For instance, on the demand side, a little tax hike can help to avoid major, potentially disruptive consolidations in the future. This will raise households' confidence, as they would expect higher permanent income in the future because of the significant tax cuts. Similarly, the confidence of investors will increase and thus stimulate private investment. The second channel arises from the credibility effects on interest rates (Alesina - Perotti, 1997). Fiscal adjustment decisions stimulate private investments and consumption by reducing interest rates. As a result, adjustment decisions reduce government spending, and fiscal deficit reduces households' concerns about future risks related to public debt. This reduces the interest rate and risk premium, stimulating investors' market

confidence, which then increases private investment and consumption (McDermott - Wescott, 1996). As Alesina et al. (1989) discussed, the public confidence effect has a visible impact on the output response. Thus, for high-debt countries, if the public perceives that the government will fail to pay its sovereign debt in the future, individuals will hold foreign assets instead of buying debt. The third channel arises from the real exchange rate depreciation, which can help the countries improve their competitiveness and increase net exports.

Expansionary fiscal austerity can also arise from the supply side, that is, through the labor market. This is known as the private sector wage depressing effect. If government spending cuts are implemented through public wage cuts, it will depress the wage in the private sector, can have a spillover effect, and may improve the competitiveness and productivity of the private sector. The second channel works through the substitution effects between consumption and leisure (Alesina - Perotti, 1997). Assuming that both leisure and consumption are normal goods, spending cuts and tax hikes would affect the private sector labor costs in opposite directions. Finally, the third channel works through the tax effects. Reducing government spending indicates that future taxes would reduce. This motivates the private sector to employ more labor and increase productivity.

However, as Arizala et al. (2021) stated, due to narrow financial systems and large informal sectors in the SSA economies, fiscal consolidation in developing countries can drag private investment by increasing the interest rates on domestic borrowing by the government and can lower its effect on output. Thus, against this backdrop, assessing whether SSA fiscal consolidation supports the expansionary austerity or contractionary austerity is mandatory.

6.2.1. definitions of fiscal consolidation

In the literature, based on the size, duration, and persistence of the change in CAPB, there are differences in defining and setting the cutoff of the consolidation episodes. Table 6.1 presents the definitions of fiscal consolidation episodes.

Table 6.1: Definitions of fiscal consolidation episode

Papers	Criteria
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Alesina - Perotti (1995)	The Blanchard Fiscal Impulse (BFI) is below -1.5% of the GDP
Giavazzi - Pagano (1996)	3% or greater improvement in the change in CAPB-to-GDP ratio (henceforth CAPB-to-GDP) in a year and consecutive two, three, and four years if the cumulative improvement in CAPB-to-GDP is 3, 4, and 5%, respectively
McDermott - Wescott (1996)	1.5% of GDP or greater positive change in the CAPB in two years with increment in every year
Alesina - Ardagna (1998)	2% or more improvement in the CAPB-to-GDP in a year or 1.5% improvement in the CAPB-to-GDP in two consecutive years
Giavazzi et al. (2000)	In a year, if the increment in the change in full employment surplus to potential GDP ratio is 1.5%
Alesina - Ardagna (2010)	1.5% improvement in the change in CAPB-to-GDP in a year
Afonso (2010)	The change in CAPB is at least 1.5% of GDP multiplied by the standard deviation in a year or at least one times the standard deviation in two years
Alesina - Ardagna (2013)	In two years, on average if the change in CAPB increases by a cumulative 2% of GDP

	or by at least 3% of GDP in three or more years
Afonso (2021)	0.5 percentage points improvement in the change in CAPB-to-GDP for two successive years

Source: Authors' compilation

According to Alesina - Perotti (1995), fiscal consolidation episodes are determined in a year when the BFI is below -1.5% of GDP. Giavazzi - Pagano (1996) defined consolidation periods as when there is a 3% or greater improvement in the change in CAPB-to-GDP in a year and in two, three, and four successive years if the cumulative change in CAPB-to-GDP is 3, 4, and 5%, respectively. McDermott - Wescott (1996) defined a consolidation period as when the improvement in the change in CAPB is 1.5% of GDP in two successive years without declining every year. According to Alesina - Ardagna (1998), fiscal consolidation episodes are determined when there is a 2% or more improvement in the CAPB-to-GDP in a year or a 1.5% improvement in the CAPB-to-GDP in two consecutive years.

Giavazzi et al. (2000) defined consolidation episodes as when in a year, the increment in the change in total employment surplus to potential GDP ratio is 1.5%. Alesina - Ardagna (2010) defined consolidation periods as when the improvement in the change in CAPB-to-GDP is 1.5% or greater in a year. According to Afonso (2010), consolidation episodes occur when the change in CAPB is at least 1.5% of GDP multiplied by the standard deviation in a year or at least one times the standard deviation in two years. Alesina - Ardagna (2013) defined consolidation episodes as when in two years, on average, the change in CAPB-to-GDP increases by a cumulative 2% or by at least 3% in three or more years. According to Afonso (2021), consolidation episodes are defined as when there is a 0.5 percentage points improvement in the change in CAPB-to-GDP for two successive years. Among the alternative consolidation definitions, this study adopts Alesina - Ardagna's (2010) definition of fiscal episodes to account for both the multiyear and the "stop and go" episodes and consider a real change in the policy stance and not driven by the business cycle. On the other hand, to account for small and gradual changes in the fiscal stance, we run a robustness test using the definition of Afonso (2021).

In sum, the existing literature does not agree on whether the fiscal consolidation effects support the traditional view of fiscal policy and/ or the theory of expansionary austerity in SSA economies. Furthermore, empirical studies about SSA economies are few, and they do not answer the following research questions: What are the determining factors of fiscal consolidation decisions? Does the expansionary austerity hypothesis hold for SSA countries? To what extent is the decrease in economic activities associated with fiscal consolidations? Compared with revenue-based consolidation, is spending-based consolidation less recessive to growth? Should fiscal consolidation be preceded by recession or expansion? Hence, this study aims at contributing to the empirical literature by answering these questions.

6.3. Data and methodology

6.3.1. Data

We constructed a balanced panel dataset for 40 SSA economies from 2000 to 2019; the data are drawn from various sources. Table 6.2 describes the variables and their data sources. To identify exogenous fiscal consolidation shocks, we follow Blanchard (1993), with a threshold of 1.5% as improvements on the cyclically adjusted primary balance to the previous year. To collect data about public spending (%GDP), public revenue (%GDP), real GDP, Current account balance (%GDP), and public debt (%GDP), we rely on the World Economic Outlook of IMF. We also gather data from World Development Indicators of the WB, such as private consumption (%GDP), private investment (%GDP), Net ODA received, and unemployment rate.

Table 6.2: Definition of variables and source of data

Variables	Definition	source
Ratio of government spending to GDP	General government total expenditure (Percentage of GDP)	WEO-IMF (October 2021)
Ratio of government revenue to GDP	General government total revenue (Percentage of GDP)	WEO-IMF (October 2021)

Real GDP in logarithmic form	Real GDP in a local currency unit	WEO-IMF (October 2021)
CAPB	Cyclical adjustment based on the BFI approach	Authors' compilation
Real private investment in logarithmic form	Real private investment in a local currency unit	WDI (2022)
Real private consumption in logarithmic form	Real private consumption in a local currency unit	WDI (2022)
Current account balance (% GDP)	Current account balance to GDP ratio	WEO-IMF (October 2021)
Debt (%GDP)	General government gross debt (Percentage of GDP)	WEO-IMF (October 2021)
Unemployment rate	Unemployment rate (Percentage of the total labor force)	WDI (2022)
Real effective exchange rate (REER) in logarithmic form	REER (CPI-based) data for 171 trading partners' countries	Data generated from http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database
Output gap (Booms and Slumps)	Boom and slumps are calculated based on the difference in GDP according to the Hodrick–Prescott trend using the standard smoothing parameter of 100	Authors' compilation

Export GDP index	Commodity export price index, individual commodities weighted by the ratio of exports to GDP historical, annual (1962–present), and fixed weights index (2012 = 100)	Commodity Terms of Trade IMF (2022)
Financial crisis (Dummy)	Years of financial crises, either banking, currency, or sovereign (restructuring)	Data extracted from the study of Laeven and Valencia (2018)
Debt relief of HIPC countries (IMF dummy)	1 indicates the year the Multilateral Debt Relief Initiative (MDRI) was granted	IMF’s History of Lending Arrangements (www.imf.org)
Net ODA received	Disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC)	WDI (2022)
Election (dummy)	1 indicates election year	every country’s electoral commission

Source: Authors’ construction

6.3.2. Fiscal consolidation determinants

To examine the factors affecting fiscal consolidation decisions in SSA economies, we use a pooled logit model with a dummy dependent variable that equals one when fiscal consolidation occurs and zero otherwise. Fiscal consolidation decisions are affected by various initial conditions, including macroeconomic, fiscal, and political factors.

The mathematical notation of the model is as follows:

$$FC_{i,t} = \alpha_0 + \beta_1 GDP_{i,t-1} + \beta_2 Y_gap_{i,t-1} + \beta_3 X_{i,t-1} + \beta_4 Z_{i,t-1} + \beta_5 P_{i,t-1} + \beta_6 I_{i,t-1} + \delta_i + \gamma_t + \varepsilon_{i,t} \quad (6.1)$$

where FC denotes a dummy variable that is one if there is consolidation or zero otherwise. i and t denote fiscal consolidation occurrences in country i and period t , respectively. GDP represents the output effect on the occurrence of fiscal consolidation. y_gap represents the output gap to test whether fiscal consolidations have to be preceded by an economic boom or recession. X denotes the lagged value of a set of macroeconomic covariates, such as inflation, interest rate, financial crisis, and current account balance to GDP ratio. Z , P , and I are a set of fiscal, political, and international covariates, respectively. δ_i and γ_t represent country and time-fixed effects, respectively. $\varepsilon_{i,t}$ is the error term. In our estimation, to control for potential reverse causality and indicate the initial conditions, lagged values of the regressors are used in the estimation, except for election years.

6.3.3. Measurement of fiscal adjustment episodes

Fiscal consolidation episodes are identified when the government takes concrete steps in raising taxes or cutting spending to reduce the fiscal deficit. However, the actual fiscal balance is affected endogenously by interest or inflation changes and does not indicate deliberate government policy decisions. To address these caveats, many cited papers identified fiscal consolidation periods using the change in CAPB-to-GDP. The CAPB-to-GDP addresses the caveats in netting out the automatic stabilizers effect and business cycle fluctuations. However, using CAPB is not without limitations. The first limitation is that it does not accurately measure the correlation between economic development and government decision. Therefore, governments increase taxes or cut

spending to avoid the risk of overhitting domestic demand due to a boom in the stock market. (Morris - Schuknecht, 2007; Afonso et al., 2022). Second, a problem of reverse causality can occur because of the motivation to react to cyclical fluctuations and may not reveal the discretionary changes in fiscal policy. Nevertheless, recent literature uses an alternative approach known as the “narrative approach or action-based consolidation” proposed by Devries et al. (2011). However, the dataset only unveils 17 advanced economies episodes from 1978 to 2009; SSA economies are not covered. Due to the drawbacks, this study uses the change in CAPB-to-GDP to identify fiscal consolidation episodes.

6.3.3.1 Definition of fiscal consolidation

This study adopts the definition of Alesina - Ardagna (2010) and sets the cutoff of the consolidation episodes at least a 1.5% improvement in the change in CAPB. In addition, this study uses the BFI (Blanchard, 1993) approach to identify the consolidation episodes. As a robustness check, the alternative definition proposed by Afonso et al. (2020) accounts for small changes in the CAPB-to-GDP ratio.

6.3.3.2 BFI

The BFI calculates the change in CAPB, assuming there has been no change in either unemployment or output gap since the preceding year (Blanchard, 1993; Alesina - Perotti, 1995, 1996; Alesina - Ardagna, 1998). The intuition is that government spending responds adversely to GDP due to unemployment benefits, making government revenue react positively to GDP. In addition, this approach is simple and transparent in its application. However, regarding the discrepancies in unemployment data, several authors have suggested that for developing countries, the real GDP growth rate instead of the unemployment rate should be used (Brunila et al., 1999; Fatás - Mihov, 2003; Alberola - Sousa, 2017; Yabré - Semedo, 2021). We follow the same procedure to formulate the BFI.

To construct the CAPB-to-GDP, first, we obtain the cyclically adjusted primary spending-to-GDP ratio (CAPS) and exclude the interest payments to account for discretionary fiscal adjustments. Then, in this study, for each country, we regress the CAPS on the time trend and output growth as follows:

$$G_t = \alpha_0 + \alpha_1 trend + \alpha_2 y_gr_t + \varepsilon_t \quad (6.2)$$

Then, using the estimated coefficients α_1 and α_2 from Equation 6.2 and the previous year's real GDP growth rate, we compute the value of primary expenditures adjusted for changes in real GDP growth rate as follows:

$$G_t^*(ygap_{t-1}) = \hat{\alpha}_0 + \hat{\alpha}_1 trend + \hat{\alpha}_2 \mu_{t-1} \quad (6.3)$$

The changes in discretionary spending (cyclically adjusted primary spending [CAPS]) can be obtained as follows:

$$CAPS_t = G_t^*(y_gr_{t-1}) - G_{t-1} \quad (6.4)$$

The cyclically adjusted revenue (CAR) is computed in the same manner as follows:

$$R_t = \alpha_0 + \alpha_1 trend + \alpha_2 y_gr_t + \varepsilon_t \quad (6.5)$$

$$R_t^*(ygap_{t-1}) = \hat{\alpha}_0 + \hat{\alpha}_1 trend + \hat{\alpha}_2 \mu_{t-1} \quad (6.6)$$

$$CAR_t = R_t^*(y_gr_{t-1}) - R_{t-1} \quad (6.7)$$

The discretionary change in the budget balance is obtained as follows:

$$\Delta CAPB_t = [R_t^*(Y_gr_{t-1}) - R_{t-1}] - [G_t^*(Y_gr_{t-1}) - G_{t-1}] \quad (6.8)$$

6.3.4 Effects of fiscal consolidations on economic activity

This study applies Jordà's (2005) LPM to estimate the fiscal impulses of consolidation episodes on economic activity. The LPM has advantages over other methods. First, the model does not constrain the shape of the impulse response functions. Second, it is flexible to estimate non-linear impulse responses. Third, it allows a more parsimonious specification because the LPM estimates include average transition probabilities across states and information about shock-state feedback. Fourth, it does not require the variables to be the same as those in a VAR specification (Auerbach - Gorodnichenko, 2013; Ramey - Zubairy, 2018; Arizala et al., 2021; Carrière-Swallow et al., 2021).

The mathematical notation can be written as follows:

$$y_{i,t+h} - y_{i,t-1} = \alpha_h^i + \gamma_t^h + \beta^h \sum_{s=t}^{t+h} FC_{i,s} + \delta X_{i,t} + \varepsilon_{i,t+h} \quad (6.9)$$

where y represents the economic activity; FC represents the change in CAPB-to-GDP; X_t is a set of control variables, such as commodity export value growth and two lags of the dependent, independent, and control variables. The commodity export value growth is included to control for commodity price dips the countries face. (γ_t^h) and (α_h^i) denote time and country fixed effects, respectively. We choose two forecast horizon years to represent the short-run effects of fiscal austerity. Two lags are used in the study to capture the sluggish response of fiscal consolidation and the dynamic responses of the outcome variables. β^h represents the cumulative response of economic activities to the cumulative effects of the contemporaneous and lagged effects of fiscal consolidation. Finally, the shock variable is trimmed at 5% to remove outliers and used in all the economic activity indicators.

6.3.4. Non-linear effects of fiscal consolidations

6.3.4.1. State of the business cycle and fiscal consolidations

To evaluate the fiscal consolidation effects on an economy's business cycle, two bins are added to reflect whether the state of the economy is in an expansion (represented by subscript “b”) or recession (represented by subscript “s”):

$$y_{i,t+h} - y_{i,t-1} = S_{i,t-1}[\alpha_{bh}^i + \gamma_{bt}^h + \beta_b^h \sum_{s=t}^{t+h} FC_{i,s} + \delta_b X_{i,t}] + (1 - S_{i,t-1})[\alpha_{rh}^i + \gamma_{rt}^h + \beta_r^h \sum_{s=t}^{t+h} FC_{i,s} + \delta_r X_{i,t}] + \varepsilon_{i,t+h} \quad (6.10)$$

S represents the state of the economy (obtained using the HP filter), where one represents boom and zero otherwise. $X_{i,t}$ denotes the set of control variables.

6.3.4.2 Composition of consolidation packages and fiscal consolidations

To evaluate the fiscal consolidation effects by consolidation composition, two bins are added to reflect the composition of the consolidation packages, where the subscript tb represents revenue-based consolidations while the subscript sb represents spending-based consolidations:

$$y_{i,t+h} - y_{i,t-1} = TB_{i,t-1}[\alpha_{tbh}^i + \gamma_{tbt}^h + \beta_{tb}^h \sum_{s=t}^{t+h} FC_{i,s} + \delta_b X_{i,t}] + (1 - TB_{i,t-1})[\alpha_{sbh}^i + \gamma_{sbt}^h + \beta_{sb}^h \sum_{s=t}^{t+h} FC_{i,s} + \delta_r X_{i,t}] + \varepsilon_{i,t+h} \quad (6.11)$$

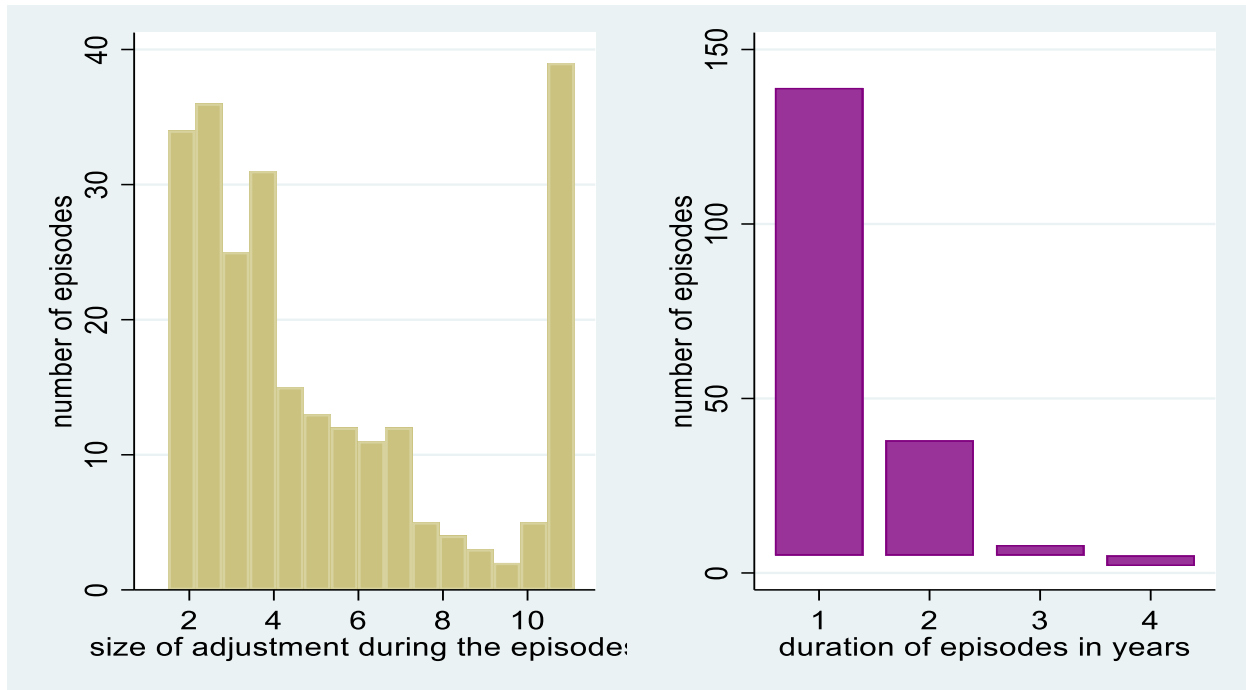
TB represents the composition of the consolidation packages (obtained using $\frac{|\text{Spending-GDP ratio}|}{|\Delta\text{CAPB}|} > 1.5\%$ of GDP and $\Delta\text{Spending} - \text{GDP ratio} < 0$ as spending-based consolidation, and it is a revenue-based consolidation when $\frac{|\text{Spending-GDP ratio}|}{|\Delta\text{CAPB}|} < 1.5\%$ of GDP and $\Delta\text{Spending} - \text{GDP ratio} > 0$). $X_{i,t}$ denotes the set of control variables.

6.4. Discussion and analysis

Using the change in CAPB-to-GDP, we identify 247 periods of fiscal adjustment, with an average of 5.24% and a standard deviation of 3.2% for 40 SSA countries from 2000- 2019. Spending-based consolidations are 5.49% of GDP, whereas revenue-based consolidations are 4.84% of GDP. Table 6.2 presents the consolidation episodes of 40 SSA countries. The duration of the adjustment for the SSA economies is characterized by “stop-and-go,” where 139 episodes in SSA countries have a duration of one-year fiscal adjustments, whereas 38 episodes lasted for two years, eight episodes for three years, and two episodes for four years. Figure 6.1a depicts the fiscal consolidation by size, whereas Figure 6.1b depicts the distribution of episodes by persistence. The consolidation episodes are further classified, where 96 are revenue-based, and 151 are spending-based (Table 6.3).

Figure 6.1: fiscal consolidation by (a) size of adjustment and (b) duration of episodes

episodes of the consolidation



Source: Authors' compilation

Table 6.3: Fiscal consolidation episodes in SSA countries

Country	Consolidations Years	Spending-based consolidation years	Revenue-based consolidation years
Angola	2003, 2006, 2009, 2010, 2011, 2015, 2016, 2018	2009, 2010, 2011, 2015, 2016, 2018	2003, 2006
Benin	2003, 2005, 2010, 2015, 2019	2003, 2010, 2019	2005, 2015
Botswana	2003, 2004, 2005, 2009, 2011, 2012, 2014, 2015, 2017	2003, 2004, 2005, 2011, 2012	2009, 2014, 2015, 2017

Burkina Faso	2002, 2004, 2006, 2009, 2011, 2014, 2018, 2019	2002, 2011, 2014, 2018, 2019	2004, 2006, 2009
Burundi	2002, 2005, 2007, 2011, 2015	2002, 2005, 2015	2007, 2011
Cabo Verde	2004, 2007, 2008, 2009, 2014, 2015	2007, 2014	2004, 2008, 2009, 2015
Cameroon	2005, 2006, 2017, 2018	2005, 2006, 2017, 2018	
Central African Republic	2003, 2006, 2013, 2019	2003, 2006, 2013, 2019	
Chad	2002, 2005, 2006, 2011, 2015, 2016	2002, 2005, 2006, 2011, 2015, 2016	2002, 2006
Comoros	2003, 2006, 2009, 2010, 2012, 2013, 2015, 2017	2003, 2009, 2010, 2013, 2017	2006, 2012, 2015,
Congo, Dem. Rep.	2004, 2005, 2009, 2012, 2015, 2016	2004, 2012, 2015, 2016	2005, 2009,
Congo, Rep.	2003, 2004, 2006, 2007, 2010, 2011, 2013, 2015, 2016, 2018	2003, 2004, 2010, 2015, 2018	2006, 2007, 2011, 2013, 2016
Cote d'Ivoire	2011, 2013	2011, 2013	
Equatorial Guinea	2002, 2005, 2006, 2010, 2013, 2015, 2016, 2017, 2018	2002, 2010, 2013, 2016, 2017, 2018	2005, 2006, 2015

Eswatini	2003, 2006, 2008, 2011, 2012, 2019	2003, 2006, 2011, 2019	2008, 2012,
Ethiopia	2002, 2003, 2006, 2009, 2012, 2016, 2018	2006, 2009, 2012, 2018	2002, 2003, 2016
Gabon	2002, 2003, 2005, 2006, 2008, 2012, 2014, 2017	2002, 2003, 2005, 2008, 2014, 2017	2006, 2012
Gambia, The	2002, 2005, 2011, 2014, 2016, 2019	2002, 2016	2005, 2011, 2014, 2019
Ghana	2009, 2012, 2014, 2015	2009, 2014, 2015	2012
Guinea	2003, 2005, 2008, 2009, 2011, 2018	2005, 2011, 2018	2003, 2008, 2009
Guinea-Bissau	2003, 2006, 2008, 2009, 2012, 2014, 2017	2006, 2008, 2009, 2012, 2017	2003, 2014
Kenya	2002, 2008, 2011	2011	2002, 2008
Lesotho	2002, 2004, 2006, 2012, 2013, 2014, 2017	2004, 2012, 2014, 2017	2002, 2006, 2013
Madagascar	2002, 2004, 2005, 2007, 2009, 2018	2002, 2005, 2007, 2009, 2018	2004
Malawi	2005, 2008, 2010, 2012, 2015	2008, 2010	2005, 2012, 2015
Mali	2002, 2004, 2006, 2011, 2012, 2015, 2017, 2019	2012	2002, 2004, 2006, 2011, 2015, 2017, 2019

Mauritius	2002, 2004, 2005, 2009, 2012	2004, 2005, 2012	2002, 2009
Mozambique	2002, 2003, 2005, 2007, 2015, 2016, 2017, 2019	2002, 2003, 2005, 2015, 2016, 2019	, 2007, 2017
Namibia	2005, 2006, 2007, 2012, 2016, 2017, 2019	2005, 2006, 2007, 2012, 2016, 2017	2019
Niger	2002, 2003, 2004, 2006, 2009, 2011, 2013, 2015	2003, 2006	2002, 2004, 006, 2009, 2011, 2013, 2015
Nigeria	2003, 2004, 2005, 2006, 2008, 2011, 2015, 2016	2004, 2005, 2006, 2008, 2015, 2016	2003, 2011
Rwanda	2003, 2009, 2013, 2016, 2017	2003, 2009, 2016, 2017	2013
Senegal	2002, 2004, 2011, 2013, 2019	2002, 2013	2004, 2011, 2019
Seychelles	2003, 2008, 2011, 2012, 2014, 2018	2003, 2008, 2014	2011, 2012, 2018
Sierra Leone	2003, 2004, 2005, 2007, 2009, 2014, 2015, 2017, 2018	2003, 2004, 2005, 2007, 2018	2009, 2014, 2015, 2017
South Africa	2009		2009
Tanzania	2006, 2008, 2012	2006	2008, 2012
Togo	2004, 2005, 2007, 2017, 2019	2007, 2017, 2019	2004, 2005

Uganda	2003, 2004, 2006, 2009, 2011, 2012, 2016, 2018	2003, 2004, 2006, 2009, 2011, 2012, 2016, 2018	
Zambia	2002, 2004, 2006, 2011, 2016, 2019	2002, 2004, 2006, 2016,	2011, 2019

Source: Authors' compilation

6.5. Fiscal consolidation determinants

Table 6.4 presents the initial conditions affecting fiscal consolidation decisions in SSA economies. Column (1) reports the model that employs all the initial conditions of variables that have been used in empirical studies (Afonso et al., 2006; Yang et al., 2015; Diniz, 2018; Yabr  - Semedo, 2021), as well as IMF arrangement and net ODA, received variables. In Column (2), we drop the macroeconomic variables; in Column (3), we drop the fiscal variables; in Column (4), we drop the international factors. Finally, in Column (5), we drop the output gap and determine the effects of the initial conditions on the occurrence of fiscal consolidation. Except for Column (3), in all the regressions, the likelihood of fiscal consolidation increases when the initial conditions of output growth increase. This might be because when the economy is performing well, governments react by cutting spending or increasing taxes, thereby increasing the probability of adopting adjustment measures. This finding is consistent with that of Yabr  - Semedo (2021). In all the regressions, the likelihood of fiscal consolidation increases when the output gap increases or is in a boom state. The initial current account balance to GDP ratio exerts a positive but weak effect on a fiscal consolidation decision.

In all the estimation results in Columns (1)–(6) of table 6.4, the likelihood of tight fiscal policies increases when there is a financial crisis in the economy. The conventional literature argues that fiscal expansion is adopted during crises to support the economy. However, consistent with our results, Coulibaly et al. (2019) found that the pro-cyclical nature of fiscal policy characterizes SSA economies, and when the economy is in crisis, the government employs consolidation measures. The likelihood of tight fiscal policies decreases with improvements in the initial levels of budget

balance. This indicates that the fiscal balance of the countries implies whether to consolidate or not. An increase in initial debt engenders a positive change in a fiscal consolidation decision and is statistically significant (Columns (2) and (4)). Initial debt makes governments undertake fiscal reform urgently in SSA countries to safeguard their long-run solvency, reduce the public debt buildup, and minimize the risk of solvency crises. Lastly, regarding the international factors, when the net ODA received improves, the likelihood of fiscal consolidation is positive; governments are motivated to adjust the fiscal balance.

Table 6.4: Initial conditions of fiscal consolidation occurrence (marginal effects)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Marginal effects	Marginal effects	Marginal effects	Marginal effects	Marginal effects
Lagged real GDP	0.09** (2.25)	0.08** (2.66)	0.05 (1.25)	0.10** (2.39)	0.12*** (3.00)
Lagged output gap	15.20*** (3.39)	18.07*** (4.75)	15.04*** (3.49)	14.38*** (3.27)	
Lagged inflation	-0.01 (-1.07)		-0.008 (-1.11)	-0.007 (-1.16)	-0.01 (-1.24)
Lagged interest rate	-0.004 (-0.25)		-0.01 (-0.91)	-0.0005 (-0.03)	-0.008 (-0.49)
Lagged current account balance to GDP ratio	0.02* (1.94)		0.003 (0.39)	0.01* (1.68)	0.02** (2.46)
Financial crisis (dummy)	1.27** (2.11)		1.33** (2.24)	1.30** (2.14)	1.42** (2.45)
Lagged primary balance GDP ratio	-0.08*** (-2.72)	-0.06** (-2.49)		-0.08*** (-2.63)	-0.09*** (-3.35)

Table 6.5: Initial conditions of fiscal consolidation occurrence (marginal effects) continued

Lagged gross debt GDP ratio	0.005 (1.34)	0.005** (2.23)		0.008** (2.26)	0.003 (0.97)
Election (dummy)	-0.16 (-0.75)	0.09 (-0.43)	-0.12 (-0.55)	-0.17 (-0.77)	-0.21 (-0.98)
Lagged IMF arrangement (dummy)	-0.15 (-0.63)	-0.24 (-1.24)	-0.20 (-0.97)		-0.08 (-0.34)
Net ODA received GDP ratio	0.03** (2.16)	0.02* (1.70)	0.05*** (3.00)		0.02* (1.89)
Constant	-1.53*** (-3.32)	-1.57*** (-5.30)	-1.029*** (-3.31)	-1.55*** (-3.25)	-1.40*** (-2.99)
Observations	449	712	450	449	449

Notes: *** p<0.01, ** p<0.05, * p<0.1. *t* – statistics are in parentheses. Marginal effects are reported. Model (1) indicates full regression; Model (2) is without economic variables; Model (3) indicates without fiscal variables; Model (4) indicates without IMF and other financial aid variables; and Model (5) runs a regression without an output gap.

Source: Authors' compilation

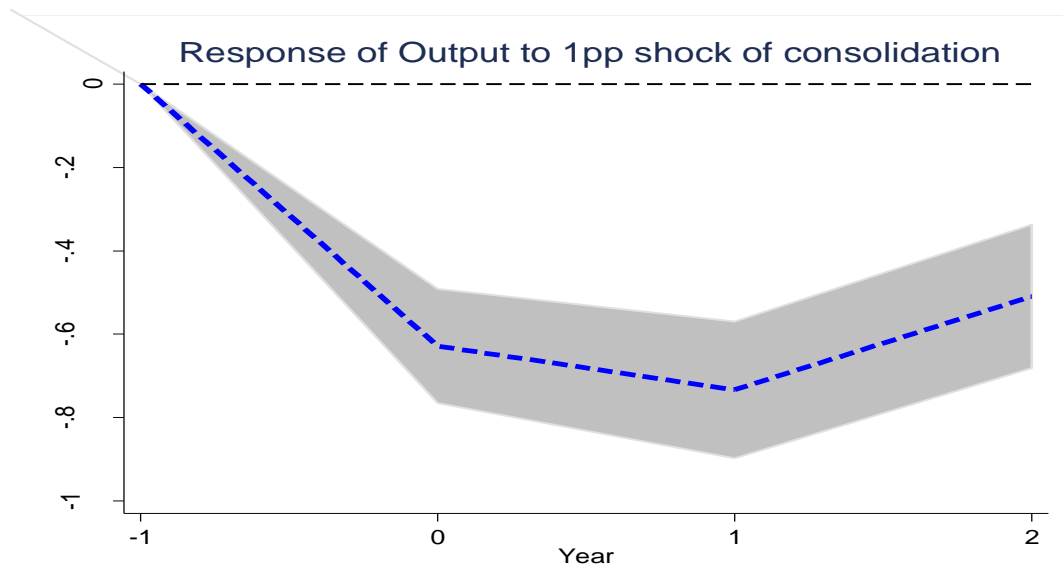
6.6. effects of fiscal consolidation on economic activity

6.6.1. Effect of fiscal consolidation on output

Figure 6.2 plots the economic slowdown to a shock in fiscal consolidation. For each percentage increment in CAPB-to-GDP, on average, real GDP drops by 0.65% in the year of implementation and approximately 0.57% two years later. This indicates that fiscal consolidations in SSA economies support the standard Keynesian proposition, arguing that fiscal consolidation implemented either by reducing spending or increasing tax reduces output in the short term. This

result is consistent with that of Carrière-Swallow et al. (2021), Yabré - Semedo (2021), and Arizala et al. (2021).

Figure 6.2: output response to a 1% shock in fiscal consolidation



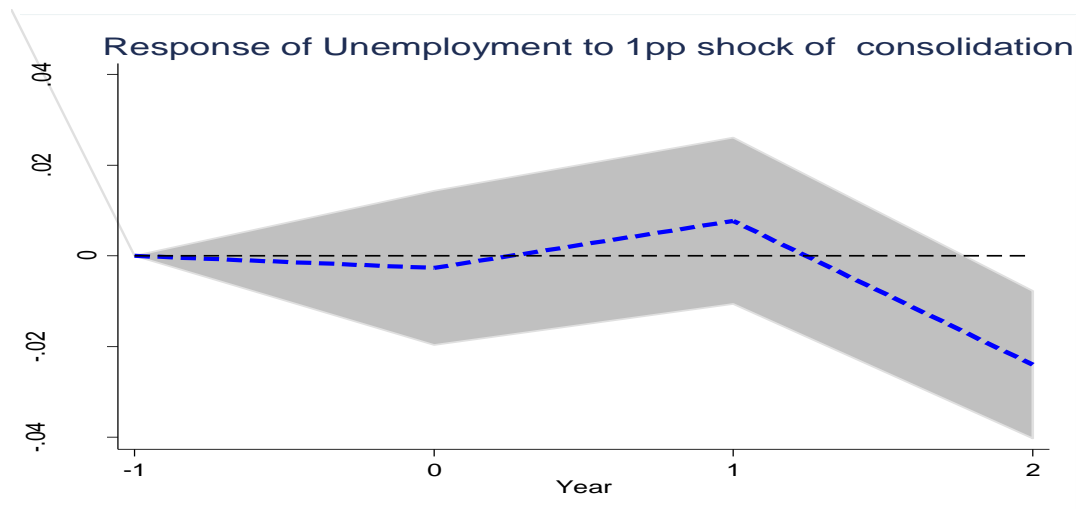
Note: the shaded area denotes a 90% confidence band.

Source: authors' compilation

6.6.2. Effect of fiscal consolidation on unemployment

In our study, a change in CAPB has unstable movements and insignificant effects on unemployment rates in SSA economies (see Figure 6.3). This might be due to the measurement error in surveying labor force data, or SSA economies' sizable informal labor markets might cause insignificant effects on unemployment.

Figure 6.3: Rate of unemployment response to a 1% shock in fiscal consolidation



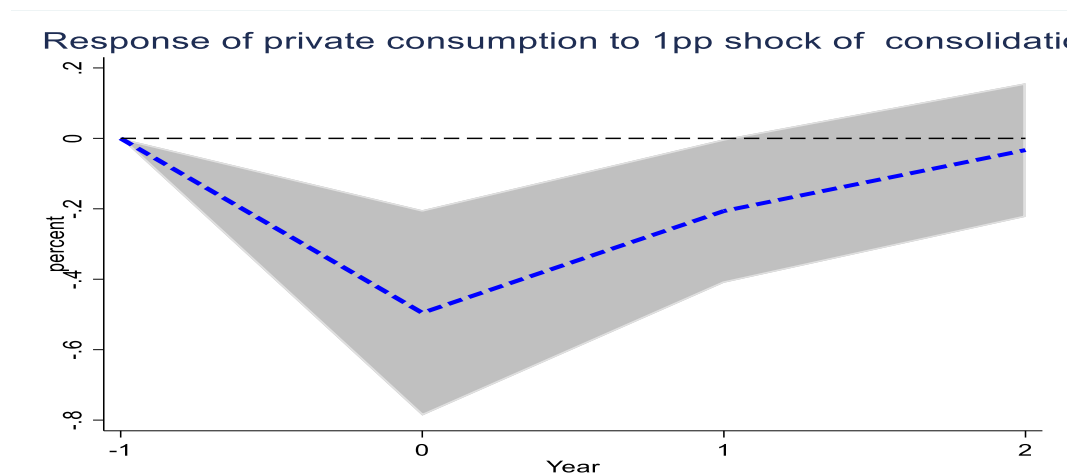
Note: the shaded area denotes a 90% confidence band.

Source: author's compilation

6.6.3. Effect of fiscal consolidation on private consumption

On average, as plotted in Figure 6.4, each percentage rise in fiscal consolidation leads to a 0.5% drop in real private consumption in the year of implementation and 0.001% after two years. The effect of consolidation on private consumption becomes statistically insignificant after two years of adjustment. This finding may be because, due to a large number of credit-constrained consumers in SSA economies, fiscal consolidation might crowd out private consumption in the year of implementation, and two years later, its effects taper off.

Figure 6.4: Private consumption response to a 1% shock in fiscal consolidation



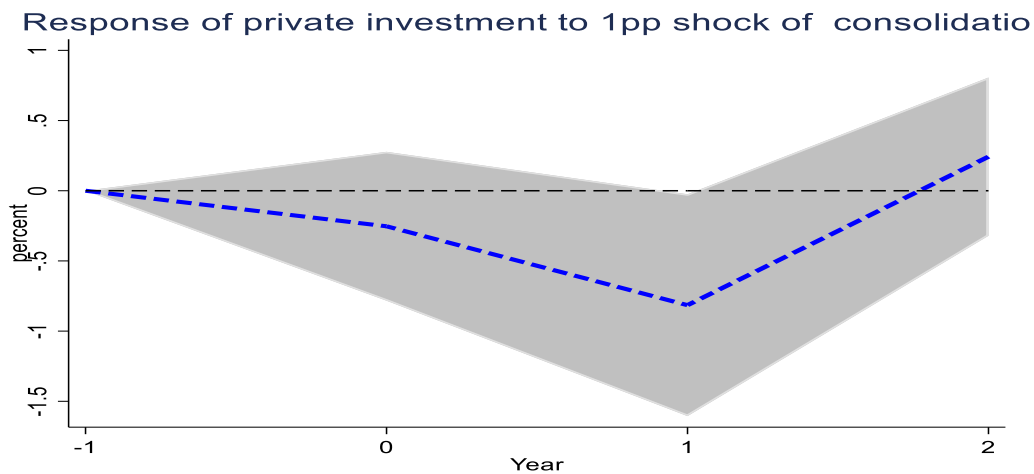
Note: the shaded area denotes a 90% confidence band.

Source: author's compilation

6.6.4. Effect of fiscal consolidation on private investment

The impact of changes in CAPB on private investment is negative but insignificant in the year of implementation and after two years. This may be because when a government borrows, and the supply of financial resources in the country is inelastic, the cost of borrowing will increase and have a crowding-out effect on investment and, thus, output (see Figure 6.5).

Figure 6.5: Private investment response to a 1% shock in fiscal consolidation



Note: the shaded area denotes a 90% confidence band.

Source: authors' compilation

6.6.5. Macroeconomic responses of current account balance and REER to fiscal consolidation shock

Table 6.5 presents the macroeconomic response of current account balance-to-GDP and REER to a 1% shock in fiscal consolidation. The result suggests that for each 1% rise in fiscal consolidation, the current account balance increases, having a 0.01% impact in the year of implementation and 0.18% after two years, supporting the twin deficits hypothesis. This may be because as countries implement fiscal consolidation, the real exchange rate falls, and the country's current account balance improves. This finding is consistent with that of Bluedorn - Leigh (2011).

Table 6.6: Response of current account balance and REER to a 1% shock in fiscal consolidation

Estimation result	h=0	h=1	h=2
Current account balance to GDP ratio	0.01 (0.11)	0.23** (2.30)	0.18* (1.99)
REER	-0.19* (1.90)	-0.26** (2.36)	-0.20 (1.42)

Notes: *** p<0.01, ** p<0.05, * p<0.1. *t* – statistics are in parentheses.

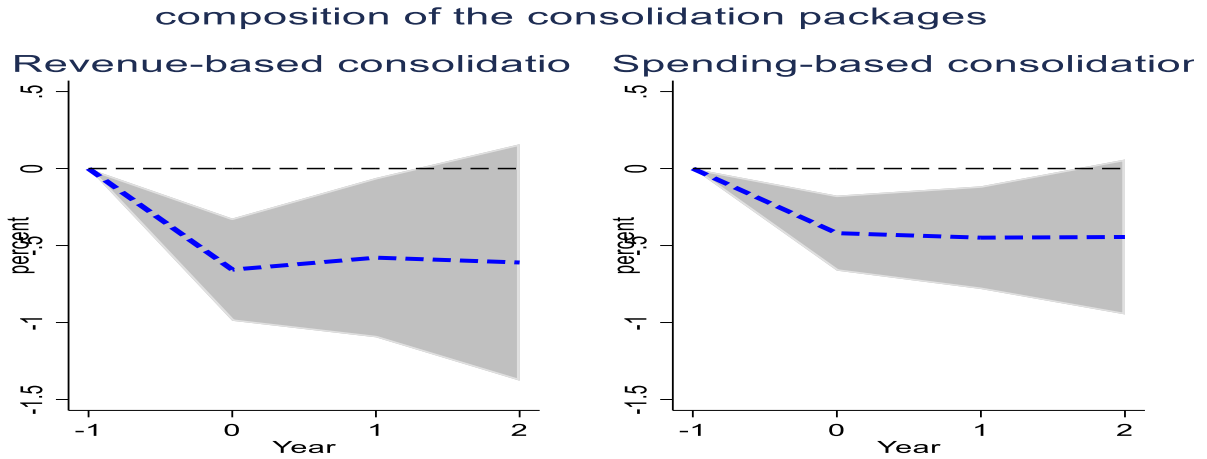
Source: Authors' compilation

A 1% rise in the change of CAPB to GDP leads to a depreciation of the REER, which can boost competitiveness and export-led growth and output in SSA countries (see Table 6.5). On the other hand, the depreciation in real effective exchange might increase the debt servicing costs of countries if their debt is denominated in foreign currency. Fiscal consolidation reduces the real exchange rate; a 1% increase in CAPB-to-GDP leads to a 0.19% drop in the year of implementation and a maximum of 0.26% after a year.

6.6.6. Macroeconomic responses by the composition of consolidation packages

Compared with revenue-based consolidation episodes, spending-based consolidation episodes are less recessionary to output dynamics (see Figure 6.6). This may be because spending-based fiscal consolidations are more monetary policy accommodative than revenue-based fiscal consolidations. Second, investors' confidence and private investment are mainly stimulated by spending cuts rather than tax hikes. Third, the less contractionary effect may be that the wealth effects offset the persistent impact of spending cuts on aggregate demand.

Figure 6.6: Effect of fiscal consolidation by the composition of consolidation packages



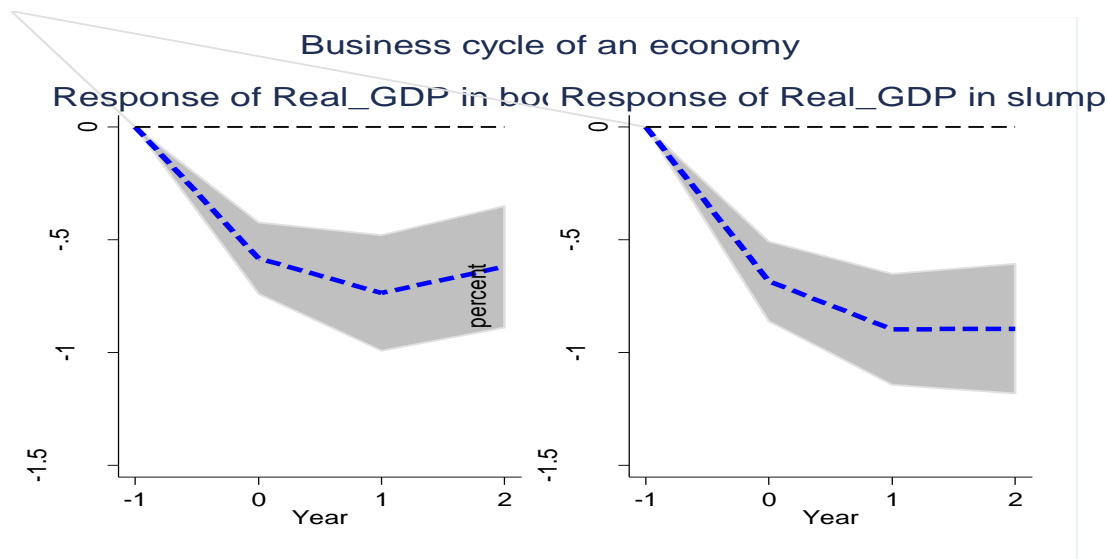
Note: the shaded area denotes a 90% confidence band.

Source: Authors' compilation

6.6.7. Effect of fiscal consolidation over a business cycle of an economy

The effect of fiscal consolidation varies with the state of an economy, having deeper negative effects in recession periods than in expansion periods (see Figure 6.7). During recession periods, fiscal consolidation reduces domestic demand and disposable incomes because liquidity-constrained agents cannot borrow to smooth their consumption, implying that fiscal consolidation is effective if an economic boom precedes it. This result is consistent with that of Carrière-Swallow et al. (2021) and Arizala et al. (2021).

Figure 6.7: Output response to a 1% shock in fiscal consolidation over a business cycle



Note: the shaded area denotes a 90% confidence band.

Source: Authors' compilation

6.7. Robustness checks

The baseline estimates are tested by conducting two robustness checks. First, we use a lower cutoff to examine whether changes in the cutoff significantly alter the transmission mechanism. Following Afonso et al. (2022), fiscal consolidation episodes are defined if the CAPB-to-GDP improves by 0.5% in a year. Therefore, the results confirm that the estimated impulse responses are not reverted and do not substantially alter the results (see Table 6.6 and Figures 6.8 and 6.9).

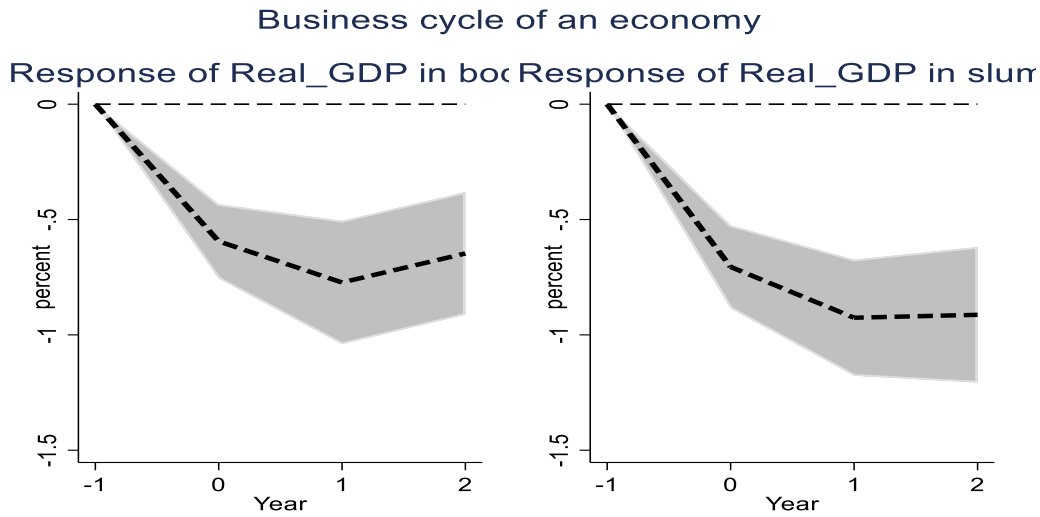
Table 6.7: Estimation results of the fiscal consolidation effects

Forecast horizons	GDP	Private consumption	Private investment	Unemployment	Current account balance	REER
Year	-0.70*** (-7.78)	-0.51*** (-2.83)	-0.28 (-0.88)	-0.001 (-0.10)	0.02 (0.22)	-0.19* (-1.73)
Year+1	-0.82*** (-7.45)	-0.24** (-2.00)	-0.82 (-1.67)	0.01 (0.50)	0.25** (2.27)	-0.26** (-2.17)
Year+2	-0.62*** (6.20)	-0.03 (-0.25)	0.25 (0.71)	-0.01 (-0.50)	0.20** (2.22)	-0.21 (1.50)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. t – statistics are in parentheses.

Source: Authors' compilation

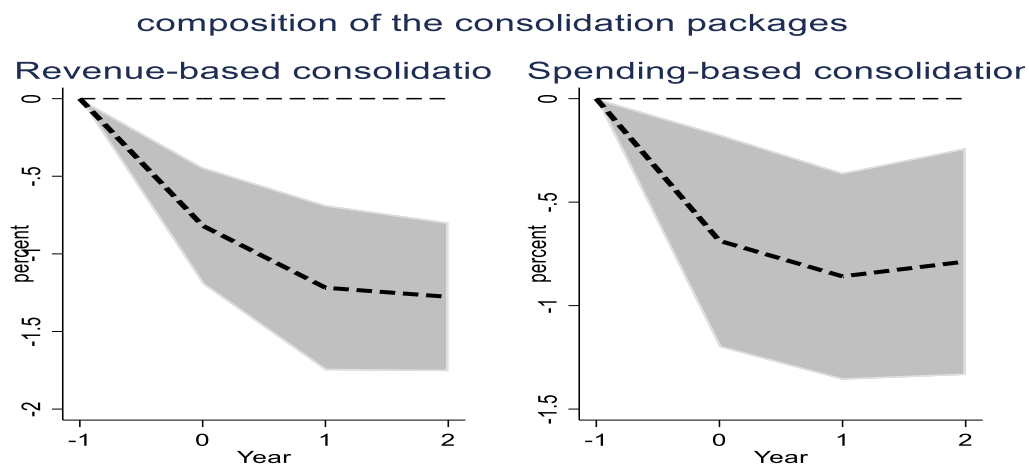
Figure 6.8: Output response to a 1% shock in fiscal consolidation over a business cycle



Note: the shaded area denotes a 90% confidence band.

Source: authors' compilation

Figure 6.9: Response of fiscal consolidation to the composition of consolidation packages



Note: the shaded area denotes a 90% confidence band.

Source: authors' compilation

To validate our estimates, we also apply a two-step GMM estimator (Arellano - Bover, 1995; Blundell - Bond, 1998). Then, the standard error of the impulse responses is computed using a delta method. GMM is preferred not only because of the advantages of solving the potential endogeneity that can arise from the reverse causality of economic activity with fiscal consolidation and Nickell bias (1981) but also deals with serial correlation and heteroscedasticity.

The mathematical model is adopted from the study of Yang et al. (2015) and is as follows:

$$\Delta Y_{i,t} = \alpha_0 + \beta_1 Y_{i,t-1} + \beta_2 FC_{i,t} + \beta_3 FC_{i,t-1} + \theta_i + \delta_t + \varepsilon_{i,t} \quad (6.12)$$

where $Y_{i,t}$ denotes the economic activity; FC is a dummy variable equal to one when consolidation episodes occur and zero otherwise. θ_i represents country fixed effect; δ_t denotes time-fixed effect, and $\varepsilon_{i,t}$ denotes the reduced form impulse. We use one lag of output and fiscal consolidation dummy as potential instruments. The AR(2) and over-identifying restrictions via the Hansen tests indicate the robustness of the instruments.

Table 6.8: Estimation results of the fiscal consolidation effects using GMM

	Col. (1)	Col. (2)	Col. (3)	Col. (4)	Col. (5)	Col. (6)
	GDP	Private consumption	Private investment	Unemplo yment	Current account balance	REER
Year	-0.70*** (-70.00)	-0.53** (-1.96)	-0.19 (-0.39)	-0.007 (-1.01)	0.05 (0.36)	-0.25* (-1.79)
Year+1	-1.01*** (-101.01)	-0.85* (-1.89)	-1.43 (-1.47)	0.04** (1.98)	0.23 (0.85)	-0.39* (-1.70)
Year+2	-0.77*** (-7.70)	-0.83* (-1.84)	-1.54 (-1.56)	0.05 (1.67)	0.31 (1.11)	-0.37 (-1.61)

Notes: *** p<0.01, ** p<0.05, * p<0.1. *t* – statistics are in parentheses.

Source: Authors' compilation

Table 6.7 presents the robustness results of the baseline estimation. It reveals the macroeconomic response of economic activity to a 1% shock in fiscal consolidation. Column (1) indicates that a 1% of GDP increase in CAPB reduces real GDP by 0.77% after two years of implementation. Column (2) reveals that a change in CAPB by one percentage point of GDP reduces private consumption by approximately 0.53% in the year of implementation and 0.83% after two years. Private investment is insignificant in all the forecast horizons (see Column (3)). Column (4) presents the unemployment response to fiscal consolidation shocks, and it is found that the unemployment rate increases by 0.04% after a shock, proving the recessionary effects of fiscal adjustment. Columns (5) and (6) present the effect of fiscal austerity in an open economy model, revealing that the current account balance improves (Column (5)) and REER depreciates (Column (6)), supporting the twin deficit hypothesis. Overall, Columns (1)–(6) present the estimation results using a GMM approach, suggesting that the results are robust and consistent with the main findings.

6.8. Chapter summary

This chapter investigates the effects of fiscal measures in sub-Saharan countries on economic output, unemployment, consumption, private investment, REER, and current account balance. First, it estimates impulse response functions with local projections based on a yearly dataset covering 40 countries from 2000-2019. The key variable in the dataset is a measure of fiscal stance computed following Blanchard (1993), with a threshold of 1.5%. Fiscal consolidation episodes are then identified as improvements to the previous year's cyclically adjusted primary balance. In a nutshell, the paper corroborates the Keynesian perspective on fiscal policy consolidations, as it finds consistently adverse effects on economic activity measured by real GDP growth. Other macroeconomic effects include a drop in private consumption, an improvement in the current account balance, and a real exchange rate depreciation.

Additionally, the paper also looks into two additional dimensions of fiscal consolidation. First, it finds that consolidations based on cuts to spending have less severe effects on GDP growth, as opposed to tax increases. Secondly, the state of the economy could amplify or curb the negative effects of fiscal adjustments: the paper finds that fiscal consolidations during booming phases are less contractionary in terms of GDP growth rate. Moreover, this section also offers some evidence

on the determinants of fiscal consolidation in SSA countries. Among these, real GDP, the output gap, the primary balance, and the occurrence of financial crises are consistently associated with fiscal consolidations.

The next chapter presents a summary of the main findings of the dissertation, followed by policy implications and knowledge gaps to be addressed in future studies.

7. Summary, conclusion, and recommendation

This thesis has investigated the macroeconomic effects of discretionary fiscal policy, fiscal sustainability, and consolidation effects. This research study was primarily motivated to provide valuable insights into the effects of discretionary fiscal actions on the economy through either fiscal stimulus packages (used to avoid another great recession) or fiscal consolidations (used to stabilize the fiscal deficit) using a large sample from SSA countries, long time-series periods, and novel estimation methodologies. The chapter summarizes the main findings of the dissertation and the central ideas that run through the thesis, establishing a connection between the macroeconomic effects of fiscal policy shocks, the long-term effects of fiscal sustainability and consolidation measures, followed by suggesting recommendations for action and identifying knowledge gaps to be addressed in future studies.

7.1. Summary

In pursuit of macroeconomic stability, SSA's economy prolongs periods of instability by relying on monetary policy instruments rather than fiscal policy instruments (Phiri, 2019). However, monetary-based policies failed to achieve macroeconomic stability for economies. Consequently, there is a growing consensus regarding implementing fiscal instruments as a critical policy to achieve a sustainable budget at a steady-state. Furthermore, the GFC has unequivocally illuminated the importance of fiscal policy to economic crises. That is, the sharp increase in fiscal spending implemented at the onset of the GFC was accompanied by a long-term worsening of budget deficits and public debt accumulations, which eventually led to a debt crisis. In turn, plans for fiscal consolidation must be evaluated based on their potential short-term impact on economic activity. As a result, these issues become a source of debate in the empirical literature, and there is little consensus on the effect of fiscal spending shocks, fiscal sustainability, and fiscal consolidation.

Due to unstable access to capital markets and these countries' inability to borrow, sustainable public finance is crucial for countries such as those SSA. This is a significant incentive to avoid a large accumulation of public debt (Mendoza and Ostry, 2008). Moreover, increasing debt accumulation due to fiscal stimulus is associated with a greater likelihood of default and a drag on economic growth, especially when it exceeds a certain threshold (Baharumshah et al., 2017;

Mahdavi and Westerlund, 2011). In addition, the sustainable level of public debt has sparked renewed interest in threshold analysis as a means of assessing the sustainability of fiscal stances in recent studies, despite little being known about the fiscal sustainability of SSA countries.

On the other hand, expansive fiscal policy could result in enormous public deficits, pressure interest rates, and discourage private investment, which is likely to result in unsustainable public finances. Therefore, governments may engage in restrictive fiscal policy via fiscal consolidations. In contrast, a reduction in public expenditures would likely result in a decline in consumption, output, and employment. The solution to this debate depends on answering the research questions that are not mutually exclusive: to what extent does expansionary fiscal policy stimulate economic growth? Considering an increase in government spending to stimulate the economy and the risk of a rise in the public debt-to-GDP ratio, what level of public debt would ensure the sustainability of public finances? How much does contractionary fiscal policy retard economic expansion?

Chapter three presents working definitions and concepts for the conduct of the study. It also presents fiscal policy instruments and fiscal policy goals in modern economies. Subsequently, the chapter introduces the concepts of fiscal spending shocks, fiscal sustainability, and consolidation from the existing literature. Lastly, the chapter highlights new dimensions of sustainable development.

Chapter three presents the overview of SSA countries' fiscal and economic performance. Over the last decade, the average public debt of SSA countries increased from 32% to 55.6% of GDP, causing the region's debt stock to grow rapidly, partly due to expansionary fiscal policy responses. The primary balance has deteriorated to its lowest point since the GFC, owing to a drop in oil prices. Following a series of fluctuations in economic growth, SSA economies' growth decreased in 2009 to 3% and has since experienced the lowest level of economic growth at 2.6% in 2015. This suggests that, while SSA countries' economic integration into the global economy is limited, their economies are vulnerable to shocks outside the continent.

Furthermore, when the COVID-19 pandemic began, SSA countries' macroeconomic situation suffered. Furthermore, the pandemic harmed countries' fiscal positions by causing revenue losses associated with an economic slowdown and declining commodity export revenues. Furthermore,

donor aid flows were reduced, which impacted most SSA countries because aid funds account for a sizable portion of their budgets.

In chapter four, this thesis identifies fiscal shocks using a panel threshold Vector Autoregressive (TVAR) model and examines several economic characteristics to fit the characteristics of African economies, for which there are few studies. This section's dataset was constructed annually, spanning from 2000 to 2019, for 40 SSA countries. The section raises five questions to be addressed. First, do the impulses of discretionary fiscal policy vary over business cycle shocks? Second, does debt burden determine fiscal multipliers' sign, size, and persistence? Third, is trade openness a factor in the output response to discretionary fiscal policy? Fourth, does the size of fiscal innovations vary under fixed and floating exchange rate regimes? Fifth, does institutional quality determine fiscal multipliers' sign, size, and persistence? The estimated fiscal multipliers cover a broad spectrum of SSA nations. This study contributes to the literature by considering the asymmetric effects of fiscal policy when estimating multipliers for a variety of key economic characteristics, as opposed to the linearity assumptions that have been the focus of many previous studies. Finally, this section calculated average multipliers considering SSA nations' cross-sectional dependence.

The results confirm an asymmetry or nonlinear output response to a discretionary fiscal policy under several structural economic characteristics in SSA economies. The findings suggest that: (1) an unanticipated fiscal policy raises output, on impact, has more impulse in periods of recession, 0.09%, than in periods of expansion, 0.024%. (2) on impact, the impact elasticity of fiscal policy shocks to output for highly indebted countries is 0.04%, whereas it is 0.08% for low-indebted countries. (3) As for the asymmetric effect of fiscal stimuli on impact, the response of output to structural shocks of fiscal spending under a closed economy is 0.09% and 0.04% under an open economy. (4) if fiscal policy increases by 1%, on impact, output increases by 0.05% in economies that practice a floating exchange rate. At the same time, the effect of unanticipated fiscal spending shocks on real GDP growth is small at all horizons, with a 0.08% impact multiplier in economies that practice a fixed exchange rate. Lastly, an increase in unanticipated government spending leads to an immediate increase in real GDP growth in SSA countries with a democratic political regime. The findings reveal that, fiscal policy innovations can be boosted by the conjunction of several structural economic characteristics, such as recession, fixed exchange rates, lower trade openness,

lower debt burden, and transformed into a democratic regime, among others. Hence, policymakers should act accordingly to cultivate sizable, persistent, and long-lasting effects through fiscal policy.

In chapter five, this thesis thoroughly examines fiscal sustainability through a nonlinear fiscal reaction function based on a dynamic panel threshold model, which is lacking in the empirical literature. This study used a nonlinear impact analysis with debt thresholds imposed endogenously. The study first estimated the coefficient of the FE model for government expenditure was 0.88, implying that governments' revenue climbs by less than 1% for every 1% increase in public expenditure. This finding has important implications, suggesting weak fiscal sustainability of SSA countries over the period 2000–2019. Second, applying a dynamic panel threshold model, the results indicate that fiscal responsiveness weakens when the public debt-to-GDP ratio exceeds 55%, suggesting that SSA countries will continue to face unsustainable debt burdens as debt mounts. Below the threshold, the lag of primary surplus is positive and significant, confirming the dynamism of primary balance and the persistence of governments' fiscal reaction to past debt accumulations. Lagged debt has both statistically significant and positive effects at the 10% level; however, above the threshold, the debt value is insignificant, although it exhibits a negative sign. This indicates the government's fiscal reaction to satisfy the IBC below the public debt threshold. Current account balance (%GDP) has both statistically significant and positive effects in the lower regime, supporting the twin deficit hypothesis for SSA countries. The coefficient of the spending gap is negative and significant, only below the threshold. The estimates of debt relief exhibit a positive sign in the lower regime and a negative in the upper regime. This can be justified as HIPC benefited countries below the threshold, helping to reduce foreign debt and improve primary surplus; however, as countries' borrowing increases and surpasses the threshold, it jeopardizes countries' budget balance.

Moreover, the causality linkages between government revenue and government expenditure reveal a unidirectional flow from expenditure to revenue in SSA countries, implying that governments correct fiscal revenue to match the budgetary expenditure. Lastly, a nonlinear quadratic reaction in the debt (%GDP) specification using alternative estimation methods was tested to validate the results. The results from the alternative models demonstrate that no significant change in the signs of the public debt and the control variables is observed.

In chapter six, this thesis investigates the macroeconomic effects of fiscal consolidation, which is far from having reached a consensus by using recent and comprehensive datasets and applying the Nobel method, and local projection method (Jordà, 2005). This chapter empirically answers these questions: What are the determining factors of fiscal consolidation decisions? Does the expansionary austerity hypothesis hold for SSA countries? To what extent is the decrease in economic activities associated with fiscal consolidations? Compared with revenue-based consolidation, is spending-based consolidation less recessive to growth? Should fiscal consolidation be preceded by recession or expansion? The data is constructed from a balanced panel dataset of 40 SSA economies from 2000 to 2019. The findings of the study are twofold. First, the paper finds that the initial conditions of output growth, output gap, current account balance, financial crisis, public debt, and official development assistance (ODA) received are positively associated with the likelihood of fiscal consolidation implementation.

In contrast, the initial budget balance decreases the likelihood of tight fiscal policy decisions. Second, based on the local projection method (LPM) estimation, our study rejects the expansionary austerity hypothesis and supports its recessionary effect on output and the crowding-out effect on private demand. Moreover, we find that revenue-based consolidations lead to more output loss than spending-based consolidations. Furthermore, our findings support the claim that consolidation episodes initiated in boom periods have lower contractionary effects than those initiated in recession periods. Finally, the robustness of the findings of this study is tested by using an alternative definition of fiscal consolidation and various econometric methodologies.

7.2 Conclusion

The thesis focuses on the interaction among transmission mechanisms for discretionary fiscal policy, long-run fiscal sustainability, and contractionary fiscal policy. We lighten the contemporaneous effects of discretionary fiscal policy shocks, the threshold level of the public debt level that makes the fiscal policy sustainable, and identifies the causes and effects of fiscal consolidation on economic activity.

Based on the preceding discussion and addressing pertinent research questions, this thesis concluded the following:

I. Fiscal Multipliers and Structural Economic Characteristics: Evidence from Countries in Sub-Saharan Africa

This study examined the output response to discretionary fiscal spending shocks under several key characteristics of economies using annual data from 40 SSA countries covering periods from 2000 to 2019. The study applied a panel TVAR model to assess the effects of orthogonal and unanticipated fiscal spending shocks. The results confirm an asymmetry or nonlinear response of output to a discretionary fiscal policy under several structural economic characteristics. The impact of an unanticipated increase in fiscal spending on output reveals (1) the exogenous cumulative government spending shock effect on output is gauged to be sizable in downturns than in upturns. (2) the cumulative fiscal multiplier of less indebted countries is sizable and more persistent than that of highly indebted countries. (3) The long-run multiplier suggests that economic openness is the primary determinant of fiscal multipliers, with larger cumulative impulse responses under economies with a lower propensity to import than those open to trade. (4) The output response to an exogenous fiscal policy under flexible exchange rate regimes is smaller than the fixed exchange regime at all horizons. Finally, (5) the cumulative output response under a democratic governance regime has a larger multiplier in the long run than in autocratic governance regime countries. In sum, this study corroborates the Keynesian perspective on fiscal spending shocks, as it consistently finds the responses of an economy's business cycle, exchange rate regime, trade openness, debt burden, and governance regime to the announcements of fiscal policy in SSA countries. Similarly, no single fiscal multiplier can be assigned to a country.

I. Fiscal sustainability in sub-Saharan African countries: A dynamic panel threshold model

We investigate the primary budget balance response to public indebtedness in SSA countries, assessing governments' nonlinear fiscal reaction functions from 2000–2019. The study applies various techniques, including a dynamic panel threshold model, two-step GMM, Prais–Winsten regression, bias-corrected FE, Driscoll–Kraay standard error regressions, and FE (within) regression with AR(1) disturbances. The study demonstrates that primary balance reacts much more slowly to government solvency constraints when debt exceeds 55% of GDP. From all the various techniques applied, the estimated coefficients indicate that the primary balance positively

responds to rising lagged debt at low to moderate levels; however, when the debt ratio becomes sufficiently high, the primary balance slowly responds to the rising debt level to satisfy government solvency constraints. The findings of the study also indicate that fiscal policy is countercyclical, evidence for the “twin deficits” hypotheses, and a negative effect from temporary increases in government outlays. Furthermore, there is a unidirectional flow from expenditure to revenue in SSA countries, implying that the government corrects fiscal revenue to match the budgetary expenditure.

II. Effects of fiscal consolidation on economic activity in SSA countries

Using panel data from 40 SSA countries from 2000 to 2019, this study finds the determinants of the initial conditions for tight fiscal policy decisions and examines whether the contractionary austerity hypothesis holds for SSA countries. In addition, this study unveils output response to the composition of consolidation episodes and the business cycle of an economy. This study identifies the fiscal episodes using the change in the CAPB-to-GDP and applies the LPM proposed by Jordà (2005) to estimate the impulse response functions. Based on our definition, the study identifies 247 fiscal consolidation episodes in SSA countries from 2000 to 2019. Among the 247 fiscal episodes, 151 are spending-based consolidations, and 96 are revenue-based consolidations. Regarding the duration of the episodes, 139 instances are short-stay episodes that last a year, whereas 48 episodes stay two to three years. The average improvement in the CAPB is 5.24% of GDP, with a standard deviation of 3.2%.

The study finds that the probability of fiscal consolidation is positively associated with initial GDP growth, initial output gap, initial current account balance, and financial crisis in the economy. In contrast, the lagged budget balance reduces the probability of fiscal consolidation decisions. Moreover, the study finds that fiscal consolidation supports the standard Keynesian proposition, having contractionary effects on output and private demand in the short term. In addition, compared with tax-based consolidations, spending-based consolidations lead to smaller losses in output. Furthermore, fiscal consolidations implemented in an expansion period are less contractionary than those implemented in a recession period. In a nutshell, the paper corroborates the Keynesian perspective on fiscal policy consolidations, as it finds consistently adverse effects on economic activity as measured by real GDP growth.

7.3 Policy Implication

The thesis following the results of chapters four, five, and six, therefore, recommends policymakers to earn sizable, persistent, and long-lasting effects through fiscal policy have to do the following:

Policy recommendation from Chapter four

- Countercyclical fiscal policy is found to be substantial, and contractionary fiscal adjustment is advised when there are positive output gaps rather than negative output gaps.
- In order to have effective fiscal policy must target hand-to-mouth consumers (non-Ricardian consumers) and firms with limited liquidity, concentrating on social services and social protection to increase short-term demand.
- The effectiveness of interventions in fiscal policy depends on how well-established the institutions are that support public trust in the government. Therefore, SSA nations must practice democratic governance to improve their institutional capabilities to hasten the effects of fiscal policy on private demand.
- Fiscal multipliers are discovered to be larger for less indebted countries. Thus, maintaining control over public debt can enhance the impact of fiscal stimulus programs.

Policy recommendation from Chapter five

- SSA governments should ensure that their public debt management plans adhere to the public debt ceiling that promotes fiscal sustainability.
- The study's findings rule out using excessive public debt to achieve fiscal sustainability.
- Policymakers should maintain prudent fiscal policies by enhancing revenue mobilization and rationalizing expenditures to ensure fiscal sustainability and build fiscal buffers over the long term.

Policy recommendation from Chapter six

- This study recommends that if governments decide to tighten fiscal policy in the future, it has to be carried out by reducing spending rather than increasing taxes. Restructuring state-owned businesses and reducing fuel and energy subsidies are some ways how this can be

achieved to demonstrate the fiscal health of governments and stabilize macroeconomic conditions in various nations. In addition, to reduce costs to the government, governments should also broaden their tax bases.

- If fiscal consolidation is necessary, it should be carried out during economic expansion to avoid incurring excessive costs.

7.4 Limitations and directions for future research

This study has contributed to the literature by presenting new findings that can serve as guidelines for future research. Nonetheless, there are some limitations to this study. First, many variables have missing observations, or long comparable annual series are unavailable. For example, the study's analysis is limited to only public spending effects due to a lack of long time-series data on fiscal variables such as public investment and government consumption variables at the disaggregated level.

Second, global shocks such as the COVID-19 pandemic and the conflict in Ukraine are not considered. Further research incorporating these global shocks would add another dimension to policy formulation because these factors significantly impacted fiscal policy.

Third, future research focusing on disaggregating public spending into public consumption and investment, as well as tax revenue into direct tax and indirect tax, and examining the relationship between the budget balance and the budget composition would add another dimension to policy formulation, given that the composition of government spending has shifted significantly over time. Furthermore, future research on the distributional effects of fiscal consolidation and the political difficulty of cutting government spending could have policy implications. Furthermore, investigating fiscal policy financing sources may have additional implications for macroeconomic stability and fiscal policy sustainability.

Fourth, this dissertation is limited to economic perspectives only, whereas institutional factors and the political economy of the countries have significant contributions to public debt and budget balance. Finally, more research could add further insights into the body of knowledge.

Fifth, focusing only on the optimal quantity of debt is not enough to examine the fiscal sustainability of countries but also requires a comprehensive policy response that considers the

residual maturity of the debt and public debt structure. Moreover, it should also be complemented by pension and healthcare expenses arising from population aging. Thus, future research should focus on the debt structure, denomination, residual maturity of the debt and aging to address long-term fiscal sustainability smoothly.

7.5 Contribution of the study

Chapter four estimates the nonlinear effect of SSA fiscal impulses. To the researcher's best knowledge, this study is the first to conduct a panel TVAR model to examine the asymmetric effects of fiscal policy on output by extending the scope of previous research by estimating the fiscal multipliers under various structural and transient factors of the economies. In addition, this section sheds light on adding to the limited research on the output response to discretionary fiscal policy in SSA countries, covering forty SSA nations and identifying the fiscal shock using a panel TVAR model. Furthermore, this chapter is the first systematic paper to estimate how fiscal multipliers vary with the political regimes of the economies of SSA countries. On top of these, previous studies on state-dependent fiscal multipliers focus only on the business cycle of an economy, while this study characterized the state based on the economic cycle, debt burden, exchange rate regime, trade openness, and political regime. The main message of this section is that the macroeconomic effect of fiscal impulses on output depends on various factors, including the state of the economy, its debt burden, its openness, its exchange rate regimes, and political governance regimes.

Chapter five helps in three ways. First, the study's primary novelty is its coverage of a diverse range of SSA countries and examination of a nonlinear fiscal reaction function for SSA countries, which few studies have done. Second, existing studies overestimate the threshold level by employing the general method of moments (GMM) (Okwoche and Iheonu, 2021; Mupunga and Ngundu, 2020). Unlike previous studies, this one employs a dynamic panel threshold model with a first-differenced estimator GMM to address the issue of endogeneity. Third, identifying causality links between government revenue and government expenditure could provide essential insights into how these economies can manage fiscal imbalances in the future. We test a nonlinear quadratic reaction in the debt (percent GDP) specification using alternative estimation methods such as the

two-step GMM, Prais-Winsten regression, bias-corrected FE, regression with Driscoll-Kraay standard errors, and FE (within) regression with AR(1) disturbances to validate the baseline results.

Chapter six contributes to the literature by empirically analyzing determinant factors of fiscal consolidation occurrence and examines the macroeconomic response of economic activity to a tight fiscal policy for SSA economies. Remarkably, this chapter identifies the determinant factors for fiscal consolidation occurrence. Second, it examines the effect of contractionary fiscal policy on private demand and unemployment. Third, it assesses whether the twin deficits hypothesis holds for SSA economies and examines whether the current account balance moves in the same direction as fiscal contraction. Fourth, it investigates how output responds to tightening fiscal policy through spending cuts and tax hikes. Fifth, it assesses whether consolidation effects vary with the state of the economy.

Unlike previous regional studies, this thesis addresses problems related to cross-sectional dependence, model misspecification, and time framework. In addition, we bridge the gap among regional researchers by estimating the coefficients of discretionary fiscal policy, fiscal sustainability, and effects of fiscal consolidation. Last but not least, this study will contribute to increasing the government's awareness of the dynamics of fiscal sustainability and how the economies respond to fiscal shocks and suggests a better solution to macroeconomic stability and sustainable public finances.

In tandem, the contribution of this study is, therefore, to provide a better understanding of the accurate relationship between discretionary fiscal policy and economic growth given the historical challenges confronting SSA countries, that are, significant social needs and wide-spread poverty in one side and increasing debt accumulation on the other side. Thus, by so doing, this thesis has important policy implications for enhancing sound fiscal policy in the region.

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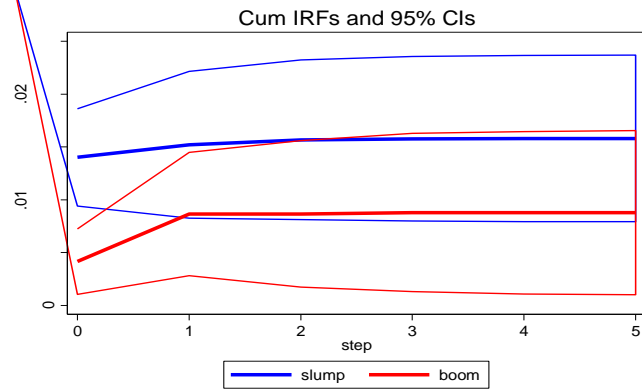
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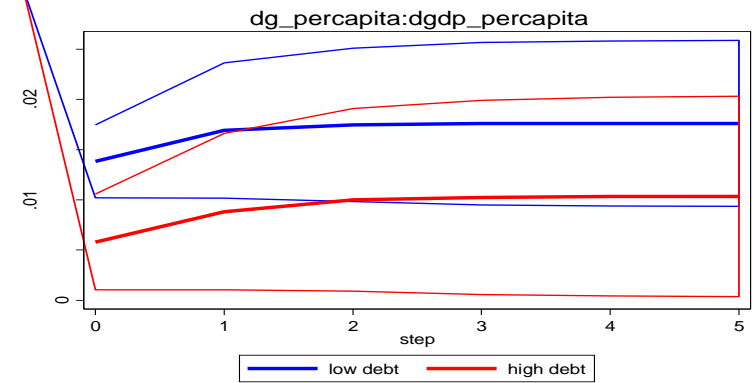
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Figure A1: Cumulative Orthogonalized IRFS by including per capita values and percentage values of GDP

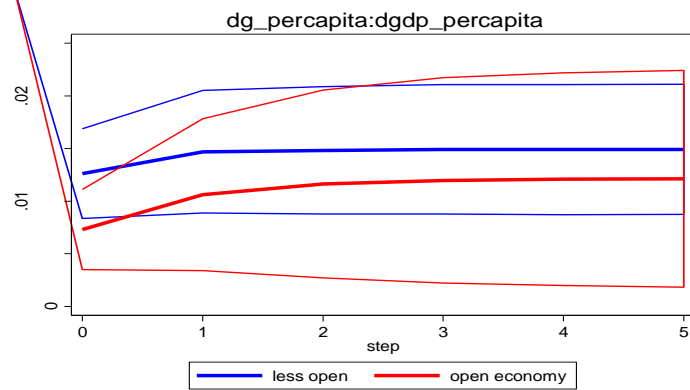
A) Based on economic cycle



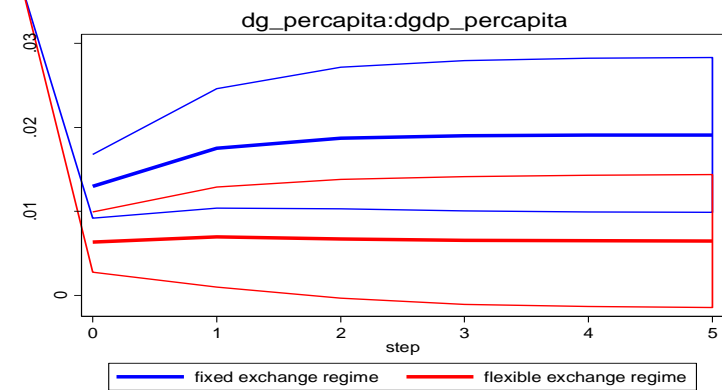
B) Based on debt burden



C) Based on trade openness



D) Based on exchange rate regime



E) Based on governance regime

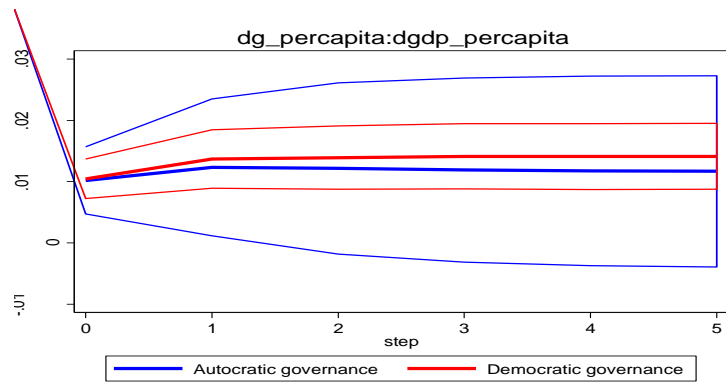
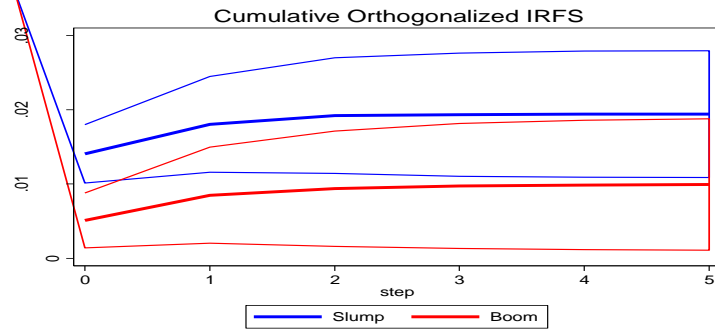
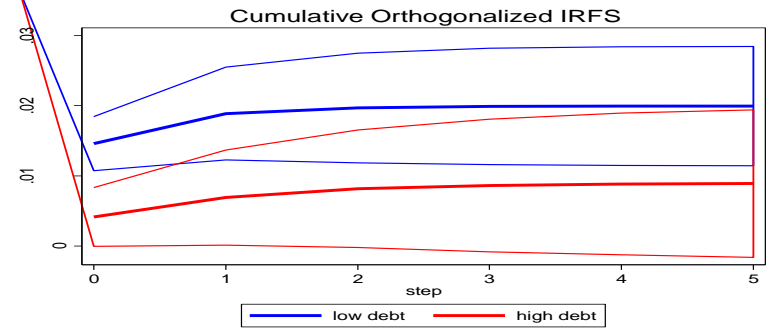


Figure A2: Cumulative Orthogonalized IRFS by considering the cyclically adjusted government revenue

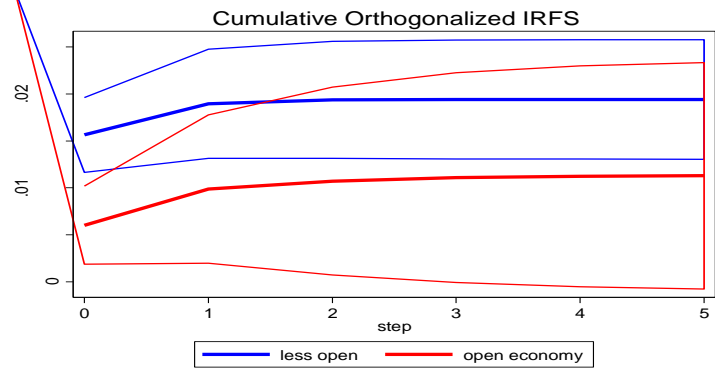
A) Based on economic cycle



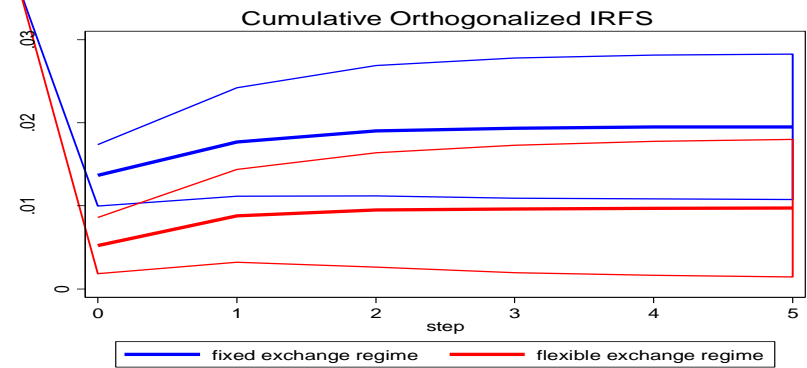
B) Based on debt burden



C) Based on trade openness



D) Based on exchange rate regime



E) Based on governance regime

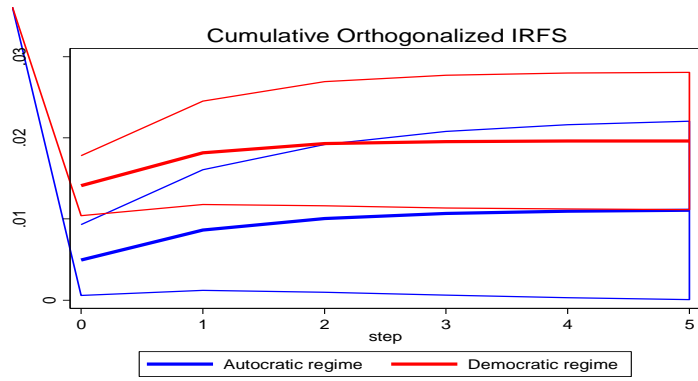
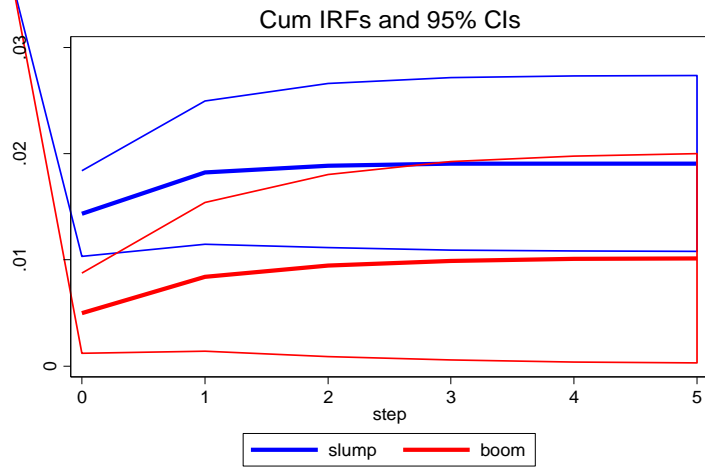


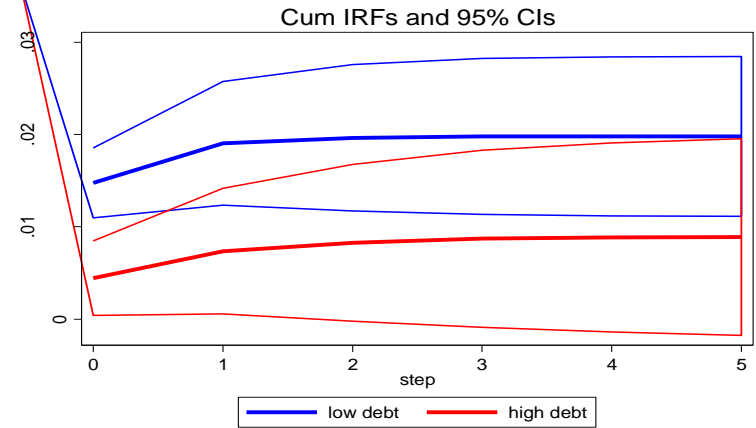
Figure A.3 Cumulative Orthogonalized IRFS by altering the order of the endogenous variables [Δ spending Δ revenue Δ gdp Δ CABGDP Δ reer]

A) Based on economic cycle

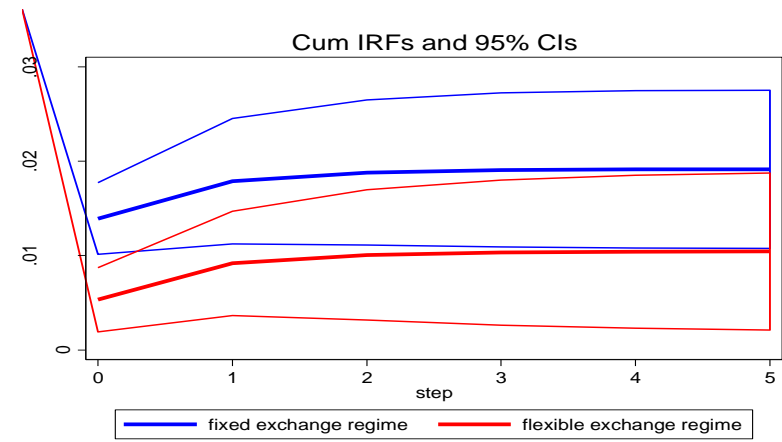
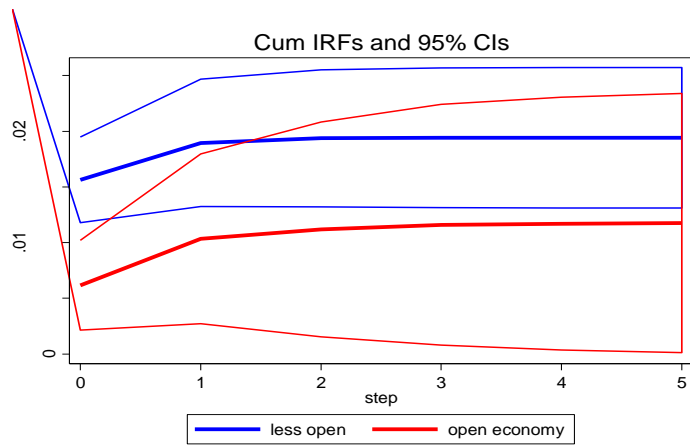


C) Based on trade openness

B) Based on debt burden



D) Based on exchange rate regime



E) Based on governance regime

