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Essays on Tax Effort and Fiscal Balance: A Case of Selected African Economies

Research submitted to the Faculty of Commerce, Law, and Management, University of the Witwatersrand, to fulfil the requirements for the PhD in Economics.

By

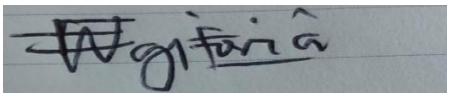
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Date: 31st March 2025

Declaration

I declare that this thesis is my original work, completed independently. It is submitted in fulfilment of the PhD (Economics) in the field of Public Finance at the University of Witwatersrand, Johannesburg and has not been submitted before for any degree or examination in any other institution.



Signature of Candidate:

Acknowledgement

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List of Acronyms

DGE	Dynamic General Equilibrium
DK	Driscoll and Kraay
DRC	Democratic Republic of Congo
ECI	Economic Complexity Index
ECOWAS	Economic Community of West African States
EMV	Equity Market Volatility
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GMM	Generalised Methods of Moments
IMF	International Monetary Fund
MIMIC	Multiple Indicators, Multiple Causes
MMQ	Method of Moments Quantile
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
SADC	Southern African Development Community
SSA	Sub-Saharan Africa
WDI	World Development Indicator

Thesis Outline

The thesis consists of three unique but interrelated essays, each with its own introduction, literature review, methodology, empirical analysis, results, discussion, and conclusion. The thesis has five chapters. Chapter 1 introduces the three essays. Chapter 2 presents Essay 1 titled: *Tax effort in developing countries: Unravelling the impact of the informal economy and economic complexity*. Chapter 3 presents Essay 2 titled: *Election proximity, political regimes, and fiscal balance dynamic: Evidence from selected African countries*. Essay 3 titled: *Assessing the impact of COVID-19 on fiscal balance: Evidence from selected African countries*[1] is presented in Chapter 4. Chapter 5 provides a general conclusion and policy recommendations.

[1] Algeria, Angola, Cabo Verde, Botswana, Congo Dem. Rep, Eswatini, Egypt Arab Rep., Ethiopia, Kenya, Ghana, Lesotho, Tunisia, Zimbabwe, Madagascar, Tanzania, Mauritius, Malawi, Morocco, Senegal, Mozambique, Namibia, Rwanda, Seychelles, South Africa, and Zambia. The countries were chosen based on sufficient data availability and representation of the African continent in mind.

Abstract

Many African economies are confronting a persistent dual problem of lower tax revenues and a growing level of indebtedness. Infrastructure projects, for example, take a long time to complete and start generating revenues to repay the borrowed funds used to finance them. Because of such financial risk (i.e., a lack of long-term exchange hedge), financial institutions are often reluctant to finance such projects, despite the benefits they bring to society, making tax collection the most credible source of financing. So far, these problems have adversely affected development progress in the region and made these economies vulnerable to both exogenous and endogenous shocks, exacerbating slow growth and posing a threat of debt trap. This thesis explores the challenges of a narrow tax base and the influence of political factors and exposure to exogenous shocks on the budget balance in 25 selected African countries in three essays.

The first essay examines tax effort in 25 selected African countries and its implications for economic development. It assesses the extent to which tax mobilisation is constrained by informality and economic complexity, limiting the ability of governments to leverage their full tax capacity for public expenditure. Additionally, the study compares tax effort across countries, providing insights into optimal tax structures for addressing budget deficits and managing debt.

Using a panel data set from 2000 to 2021, tax effort and tax capacity were estimated using the stochastic frontier technique. Given data limitations and potential endogeneity concerns, the analysis was further validated using Ordinary Least Squares, panel Fixed Effects, and dynamic Generalized Method of Moments (GMM) for robustness. Key findings from the analysis indicate that the informal economy, coupled with agriculture, population size, voice accountability, and corruption control, negatively affect tax effort. Conversely, economic complexity, per capita gross domestic product, trade openness, remittances, foreign direct investment, and manufacturing contribute positively to tax revenue.

These results underscore the critical role of reducing informality, strengthening governance, and advancing economic structural transformation to enhance revenue mobilisation in African economies. The study provides valuable insights into fiscal policy dynamics across the region and offers policy recommendations for improving tax efficiency and ensuring fiscal sustainability.

The second essay provides an empirical analysis of the relations between election proximity, institutions and political regimes, and fiscal balance in 25 selected African countries, using unbalanced panel data for the period 2000 to 2021 and employing the dynamic panel data estimation technique (System and Difference-GMM techniques) for analysis. While accounting for endogeneity, cross-sectional dependence, instrument validity, and serial correlation problems in the panel data, the evidence supports the influence of election timing and regime type on budget deficits in these countries. The results indicate that, while

controlling for other indicators—such as economic growth, financial crisis, and institutional variables, all of which are statistically significant to the budget deficit—the proximity of the election cycle tends to increase budget deficits in these countries. The existence of the election-cycle shock to budget deficits suggests that there may be a need for robust fiscal prudence, especially during election years, or a need for the adoption of a strictly balanced budget rule that limits spending during the election cycle period.

The third essay examines the change in fiscal balance in the context of the COVID-19 crisis. It analyses whether exogenous shocks stemming from the pandemic's outbreak have any moderating effects on the budget balance determinants and whether these effects reinforce or dampen the initial effects of macroeconomic, demographic, and institutional setting variables on fiscal balance. The analysis used data from 25 African countries, and the Method of Moments Quantile regression and system GMM approaches. Various pandemic measures are employed to investigate this problem. The results show that the overall effect of the COVID-19 crisis has resulted in a disproportionate increase in the estimated impact of macroeconomic, demographic, and institutional quality determinants on the budget balance.

The results suggest that the COVID-19 pandemic has had a reinforcing (dampening) effect on population expenditure (economic growth) variables on fiscal balance, both in the short term and the long term. These findings hold across different model specifications and datasets. The study also finds that containment measures, COVID-19-related deaths, economic market volatility, and the stringent index exert a long-term adverse effect on fiscal balance by increasing fiscal deficits across all quantiles. The effects of economic growth and population on the budget balance hold in both the long run and the short term, while the effect of the real interest rate is statistically significant only at the upper end of the distribution. Total expenditure as a percentage of gross domestic product is statistically significant only in the short term.

Overall, the results suggest that efforts to broaden the tax base through reduction in levels of the informal sector, the infusion of technology into production, and other endowments in these countries are vital for increasing both revenue sources and broadening the tax base. At the same time, the political business cycle and fiscal balance results suggest that the continuous effort of institution building is necessary to strengthen the utilisation of available resources in addressing public social and economic problems. The exogenous shock to the economy caused by COVID-19 has had overreaching effects in various areas of the economy. The results suggest that, although the outbreak is one of its kind, it significantly impacts the fiscal balance. Thus, the results provide a learning opportunity in terms of how exogenous shocks impact budgetary planning should a similar outbreak occur in the future.

Chapter 1

1.0 General introduction

A country's economic progress depends on the effectiveness of its tax system. A well-organised tax system is vital for the state's ability to finance development projects and repay its debts. Tax effort and capacity analysis are usually performed to establish the size of government capacity to meet its fiscal commitments and check whether there is room for additional tax collections. Research on government policymaking has shown that a state's endowments, production capacity, and available institutions are the primary determinants of policy choices (Caldeira et al., 2020). Many developing countries have failed to fulfil their tax collection targets and, as such, have not met their developmental goals (Mawejje and Sebudde, 2019). Various studies have shown that despite various concerted efforts put into place by developing economies to address the budgetary slippages, the status of revenue collection is still bleak for many countries. For example, during the period 2000–2021, the average tax-to-GDP (gross domestic product) ratios for the Democratic Republic of Congo (DRC), Madagascar, Malawi, Tanzania, and Zimbabwe have been below 15 percent, which is the recommended level by the World Bank for sustainable growth[2]. Nevertheless, the search for various mechanisms to address the revenue shortage experienced in these countries has resulted in a plethora of studies, which have investigated the determinants of tax efforts in these countries. Studies by Piancastelli and Thirlwall (2020) and Gupta et al. (2022), among others, have explored the tax effort question from various dimensions (i.e., macroeconomics, social and political institutions, and demographic).

Some literatures show that economic informality (the shadow economy, specifically) and economic complexity have a significant influence on the structure of the economy and are, therefore, likely to have an influence on tax mobilisation (De Soto, 1989; Hart, 2008; Arthur, 2021; Balland et al., 2022). Economic complexity estimates the productive competence of countries by describing the knowledge accumulated in a population based on manufactured and exported goods and to which countries they export (Breitenbach et al., 2022). The economic complexity index (ECI) ranges from -2 to +2, with the highest rank being 2, which corresponds to the country with the most complex economy, and the lowest being -2. Feige (2016) argues that unobserved economic activities germane to tax evasion, such as unreported, non-observed, underground, illegal, and unrecorded activities, can be termed as informal economies. The shadow (informal) economic index ranges from 0 percent to 100 percent, with 0 percent being the least informal

[2] 52% of the sampled countries have an average tax-to-GDP ratio below 15% (see Table 2.10, column 9)

and 100 percent being a completely informal economy[3]. Higher levels of informality limit the state's ability to collect taxes, thereby reducing its tax capacity.

In the advent of the development of novel ways of measuring both informality (Medina and Schneider, 2019) and economic complexity (Hidalgo and Hausmann, 2009)[4], this study contributes to our understanding of tax effort literature through the incorporation of both economic informality (the shadow economy) and economic complexity as determinants of tax effort. Informality, as the source of inefficiency, distorts tax mobilisation, while economic complexity, as the source of efficiency, is indicative of countries that can produce more complex, less ubiquitous products for export, thus have higher productivity capacity and can derive high output and, therefore, have a higher tax base (Hausmann et al., 2014)[5].

The inadequacy of tax revenue (see Table 1.0), which emanates from economic fundamentals and other major contributors, causes the collapse of the social contract between the state (political class) and the public[6]. Such a collapse manifests in different ways in developing countries. One way this can be viewed is in the growth and persistence of the informal sector (Loayza, 2016, 2018). With the public losing faith in political institutions and the state, they opt to engage in less regulated activities, such as the shadow economy[7]. The literature shows that informality tends to rise with a rise in government spending and the budget deficit (Esaku, 2021). Thus, if tax effort is adversely affected by the informality, and informality is influenced by government expenditure and fiscal balance (deficit), an understanding of fiscal balance drivers tied to political factors in these countries will provide valuable insights into their budgetary indiscipline.

Political actions influence economic outcomes and make it difficult to create stable fiscal policy (Schuknecht, 1996, 1999, 2000; de Haan, 2014; Ngo and Nguyen, 2020). The nature of political regimes coupled with political business cycles are likely to influence the budgetary planning of countries, subsequently affecting the revenue mobilisation (Brender and Drazen, 2007). Another potential factor that

[3] The informal economy indices are accessible at: https://www.worldbank.org/en/research/brief/informal-economy-database.

[4] The ECI index is based on skill, ubiquity, product diversity, and knowledge and is deemed as the most encompassing predictor of a country's economic growth. The ECI data is collected from the Observatory of Economic Complexity (https://legacy.oec.world/en/ rankings/country/eci/).

[5] Nguyen (2022) find that ECI drives the shadow economy, and therefore, poses a cofounding problem; to address this, the results will be estimated independently with ECI and the shadow economy. Moreover, possible instrumentation will be explored to correct this problem.

[6] The sampled countries have a tax-to-GDP ratio of 19.01%, which is slightly above the 15% suggested by the World Bank, but far below the 25-40% of GDP in advanced economies.

[7] Feige (2016) argues that unobserved economic activities germane to tax evasion, such as illegal, non-observed, unreported, underground, unrecorded economies, can be termed as informal economies.

adversely affects public finance is exogenous shocks, which are outside economic and political fundamentals.

Political business cycles are prevalent in developing countries and are heavily shaped by institutional factors. de Haan (2014) and Obakemi (2021) extensively examines fiscal deficit dynamics across diverse perspectives. However, regime types and institutions' impact on political business cycles vary across studies. The second essay in this thesis examines the influence of such variations on fiscal balance in 25 selected African countries. Additionally, it explores how the dynamic nature of democracy (Brender and Drazen, 2007) affects budgets. Specifically, the essay attempts to uncover insights into how electoral proximity and democratic processes affect fiscal discipline in these countries.

The literature also shows that exogenous shocks influence economic outcomes and are likely to distort fiscal policy[8]. Nevertheless, to my knowledge, no research has explored the effect of the exogenous shocks of the COVID-19 pandemic on the fiscal balance (deficit).

The COVID-19 pandemic accelerated the already ailing fiscal positions of many developing countries. For instance, the debt-to-GDP ratios of Eritrea (176.2%), Cabo Verde (142.3%), Zambia (119.1%), Mozambique (106.4%), and Mauritius (93.5%) are significantly above the 90% level (Were, 2024). The International Monetary Fund (IMF) lists Ghana, Zambia, and the DRC as countries in debt distress as of June 2024. During the COVID-19 pandemic, some countries were forced to request a grace period for their debt repayments[9], while others requested further financial assistance to improve their financial footing after the outbreak[10]. These further worsened the fiscal balance and tax mobilisation of the respective countries (see Figure A1.1 and A1.2 in *Annexure A.1*).

This thesis provides a novel way of analysing the moderating effect of the COVID-19 pandemic on the association among macroeconomic factors, demographic factors, and institutions across 25 African countries. The influence of the COVID-19 pandemic on fiscal balance, with a moderating role of institutions, macroeconomic drivers, and demographic factors, is still a research gap in extant literature. Whether an increase in COVID-19 pandemic levels of stringent lockdowns, death cases, or infection cases

[8] Table 3.1 panel A and B show the impairments of four key fiscal variables (Fiscal balance, total government revenues, government expenditure and debt as a % of GDP), together with economic growth two years before COVID-19 outbreak and two years during COVID-19. The results show all these variables plummeting during COVID-19 period than before.

[9] For example, Zambia, Ethiopia, and Mozambique are experiencing high and rising debt stock according to the IMF economic outlook report (IMF, 2024; Were, 2024).

[10] IMF extended support during COVID-19 outbreak to member countries in terms of financial support, policy advice, debt relief, and capacity development. (https://www.imf.org/en/About/FAQ/imf-response-to-covid-19).

amplified or lessened the influence of macroeconomic drivers, institutions, or demographic factors on fiscal balance remains unanswered. Quantifying the short- and medium-run economic effects and determining whether they vary across containment measures is vital for policymakers facing a difficult trade-off between ensuring stable growth and managing an ever-growing deficit. Therefore, it is vital to fill this gap since various stakeholders, including policymakers, will benefit from understanding how exogenous shocks, such as the COVID-19 pandemic, influence fiscal balance through macroeconomic, demographic, and institutional channels. Such an understanding is vital for future preparedness in the event of similar outbreaks.

In summary, the atrophied African economies engender various areas of chronic weakness, including informal markets that challenge revenue collection hard, weak institutions that undermine democracy, and fragile and narrow fiscal space to respond to unprecedented events. From these backdrops, this thesis is set to answer the research questions presented in section 1.1.

1.1 Research questions

Given the above background, several relevant policy questions are worthy of deliberation. First, to what extent do the shadow economy and economic complexity influence tax effort and tax capacity in Africa? Second, how do political settings, such as regime type, election proximity, and other institutions, influence fiscal balance outcomes in these countries? Third, besides the economic and institutional settings which potentially influence fiscal finance, what role (direct and indirect) does exogenous shock (COVID-19 pandemic) play in explaining the size of fiscal balance (deficit) in 25 selected African countries? This thesis explores these questions and provides answers using stochastic frontier analysis (Chapter 2), Generalised Methods of Moments (GMM) (Chapter 3) and both GMM and Method of Moments Quantile (MMQ) regressions (Chapter 4). The analysis utilises secondary data[11] for 25 selected countries for the period 2000 to 2021.

The effect of informality and economic complexity on tax mobilisation is understudied. Valodia and Francis (2020) and Sebele-Mpofu (2020) discuss the interplay between informality in South Africa and Zimbabwe; however, they do not explicitly analyse the association between informality and tax effort. Because of the shortage of studies encompassing these two determinants in tax effort literature, their empirical contribution remains unknown. The inclusion of these variables in the analysis is expected to provide valuable insights into the tax mobilisation in these countries. In the case of political business cycles, the type of regimes and the nature of institutions that affect political business cycles vary and are mixed from one study to another. This thesis contributes to the literature by examining how variation (dynamism) of regime type, electoral

[11] See Tables 1.4, 2.1, and 3.2 for variables definitions and their sources.

events (proximity), and other institutions influence fiscal balance (deficit) in these countries. The hope is that new channels and insights can be gleaned on how election proximity and democratic processes influence fiscal discipline in these countries. Predicting the effect of the COVID-19 pandemic on the economy is vital for preparedness and protecting the social well-being of society. Lastly, given the persistent nature of fiscal deficits observed in many developing economies, a key challenge is to understand and develop strategies to manage fiscal balance volatility, which emanates from either endogenous or exogenous shocks. To this end, this study contributes toward increasing our understanding of the effect of exogenous shocks on fiscal deficit and explores possible policy actions for moderating similar shocks in the future.

Chapter 2

Essay 1: Tax effort in developing countries: Unravelling the impact of informality and economic complexity

2.0 Introduction

This essay focuses on calculating the tax effort indices for 25 selected African countries, taking into account economic structure and tax capacity, and discusses the implications of such estimates for economic development across the continent. A well-functioning tax system is vital for a country to finance its development (Mawejje and Sebudde, 2019; Chigome and Robinson, 2021; Gupta et al., 2022). Tax potential represents a country's maximum achievable tax revenue, considering its economic structure, social dynamics, institutional framework, and demographic characteristics. Tax effort measures the extent to which actual tax revenue approaches this potential, expressed as a percentage. Taxable capacity refers to the estimated tax-to-GDP ratio. Evaluations of tax estimates are often performed to establish how public finances influence economic progress. Studies on country policy design have shown that a country's economic endowments and production capacity, as well as its institutional settings, are the primary drivers of policy choices.

Studies on tax effort and tax capacity (Bird, 2004; Mawejje and Sebudde, 2019; Chigome and Robinson, 2021; Gupta et al., 2022) explore its different dimensions using various estimation techniques. While some introduced novel ways to estimate tax effort in terms of econometric techniques, others incorporated new variables. Also, some span regions and others are country specific. For example, Fenochietto and Pessino (2013) used a sample of 113 countries spanning the period 1991 to 2012, while Ndiaye and Korsu (2014) used a sample span the 2000–2010 period in the ECOWAS (Economic Community of West African States) region, and Majjewe and Sebudde (2019) used a panel of 150 countries spanning the 1996–2015 period. These approaches resulted in useful insights and contributions to tax effort literature. However, no tax effort studies have incorporated informality and economic complexity as determinants[12]. There is no evidence of the role of both informality and economic complexity in tax effort and capacity studies. Thus, the current study assessed the extent to which a country's tax mobilisation is restricted by its informal sector (the shadow economy) and the level of sophistication of the economy, rendering it unable to optimally use available tax capacity to fund its public spending (Feld and Schneider, 2010; Caldeira et al., 2020). This

[12] La Porta and Shleifer (2014) assert that the informal sector tends to be small, unproductive, and stagnant and, therefore, adversely effects economic growth and development.

study also introduces the ECI constructed by Hidalgo and Hausmann (2009) and Hidalgo (2021) and subsequently refined by Arthur (2021) and Balland et al. (2022)[13] in tax effort determination.

Since economies are not static and often tend to undergo structural shifts over time from less to high knowledge intensive because of technological advancement, it is vital to understand how such economic sophistication influences tax mobilisation in these countries. Various studies have shown that the complex nature of the economy plays an important role in predicting the trajectory of economic advancement (Ferrarini and Scaramozzino, 2016; van Dam and Frenken, 2020). The tax structure in market-based economies influences economic efficiency and fairness. Economic efficiency is crucial because it underpins the scope for improving living standards for the populous. Tax mobilisation is also an important mechanism in ensuring distributional fairness in society. However, the question of whether an economy with higher productive knowledge enjoys higher tax revenues, controlling for all other factors that influence tax mobilisation, is still not explored. To my knowledge, no study has researched the influence of economic sophistication (complexity) on tax mobilisation.

The shadow economic index, which is one of the determinants to be explored, was developed and refined by Schneider et al. (2010), Feige (2016), and Medina and Schneider (2019). They define the shadow economy (informality) as the legal production of goods and services that are not reported to relevant public authorities for various reasons, such as monetary (for social security contributions and tax avoidance) and regulatory reasons (regulatory burden or avoidance of government bureaucracy). For institutional reasons, which result from economic agents devising mechanisms to deal with corruption issues, due to the weak rule of law and an absence of property rights. Valodia and Francis (2020) and Elgin et al. (2021) suggest that tax burdens, complex tax systems, and demoralised citizens are a few of the reasons that explain the persistence of the informal sector, which tends to undermine resource mobilisation in the economy. Sufficient knowledge of how the informal sector influences tax mobilisation is vital in designing tax mobilisation policies in developing countries.

Revenue mobilisation is the challenge that takes different facets from structural, social, institution, and political settings. Besides incorporating the shadow economy and economic complexity from the tax effort literature, the current study also incorporates institutional qualities attributed to the model. Kaldor (1963), Bird and Zolt (2005), and Caldeira et al. (2020) contend that institutional quality significantly influences economic outcomes. The expectation is that institutional quality attributes have a significant direct or

[13] The index measures the diversification of product produced within an economy, the countries with fewer such products have weak incentives to produce such products that are knowledge intensive and run the risk of falling into a poverty trap (Hidalgo, 2021)

indirect influence on determining tax effort outcomes in many developing countries. Such potential effects are examined in this study, and their policy implications are discussed.

2.1 Research gap

The existing literature on tax capacity and tax effort in developing and developed contexts is rich (Attiya and Umaima, 2012; Le et al., 2012; Fenochietto and Pessino, 2013; Khwaja and Iyer, 2014; Ndiaye and Korsu, 2014; Mawejje and Sebudde, 2019; Chigome and Robinson, 2021; Gupta et al., 2022). However, little attention has been given to the role that informality and economic sophistication (complexity) play in tax mobilisation, partly because of data being fragmented and patchy. Despite ample evidence of a persistent informal sector in developing countries (La Porta and Shleifer, 2014; Medina and Schneider, 2019), it is not clear how such a reality is reflected in tax mobilisation analysis. The sampled data on informality in the current study suggest that informality is a reality in these countries (see Tables 2.2 and 2.3). The nexus between institutional quality and tax effort is also sufficiently studied (Mkandawire, 2010; Latif, 2023), nevertheless, the effect of institutional quality coupled with informality on tax effort is under-explored.

Additionally, little is known about how economic complexity influences the tax effort in the 25 selected countries. The inclusion of these variables is expected to significantly enhance the explanatory power of the model used to assess the factors driving the observed variations in the tax ratios across countries (Joshi et al., 2014; Rogan, 2019).

2.2 Objectives of the study

This study aimed to uncover the direct and indirect effects that informality, economic complexity, and institutional quality have on tax mobilisation in 25 selected countries in Africa[14]. That is,

- to explore the potential effect of the shadow economy on tax effort in 25 selected countries.
- to analyse the potential effect of economic complexity on tax effort in 25 selected countries.

2.3 Research questions

This essay answers the following research questions:

- What is the effect of the shadow economy on tax effort mobilisation in Africa?
- What influence does economic complexity play in tax effort mobilisation in these 25 countries?

[14] Table 3.0 presents a list of countries include in this study, which were chosen depending on data availability and considering sufficient representation of the continent.

2.4 Contribution of the study

Previous works have exhaustively documented the extent of tax revenue shortages in developing countries (Piancastelli and Thirlwall, 2020; Chigome and Robinson, 2021; Gupta et al., 2022). However, the effect of informality and economic complexity on tax mobilisation is understudied. Due to the shortage of studies encompassing these two determinants in tax effort literature, their contribution empirically remains unknown. Some studies have explored the potential effect that informality has on tax revenue, such as those of Friedman et al. (2000), La Porta and Shleifer (2014), Mitra (2017), Valodia and Francis (2020), and El Badaoui and Magnani (2020). Other studies have examined informality across different dimensions other than tax (Loayza, 2016; Kanbur, 2017; Docquier et al., 2017; Loayza, 2018; Ozgur et al., 2021). However, these studies are often narrow in scope. For example, Valodia and Francis (2020) focus solely on the South Africa economy, while Docquier et al. (2017) focus on the link between informality and long-run economic growth. The uniqueness of the current essay is that it tracks tax capacity and tax effort at an aggregate level and links tax revenue and revenue potentials to informality and economic complexity, while controlling for other covariates, such as macroeconomics, demographic profile, and institutional characteristics in these economies using stochastic frontier technique (Battese and Coelli, 1995; Kumbhakar et al., 2015; Chigome and Robinson, 2021).

In summary, this essay contributes to the existing tax literature by analysing tax effort and capacity at an aggregate level using the stochastic frontier method and assessing the impact of the informal economy and economic complexity on tax mobilisation. Incorporating the shadow economy and economic complexity enhances the model's explanatory power in identifying the key factors driving variations in tax ratios across countries (Joshi et al., 2014; Rogan, 2019; Resnick et al., 2020).

2.5 Significance of the study

- This essay augments tax effort estimation by incorporating informality, economic complexity, and institutional settings in 25 selected African economies. The study provides insights on the contribution of both informality and economic complexity on tax effort.
- The study uses different time dimensions from those of Fenochietto and Pessino (2013), Ndiaye and Korsu (2014), and Mawejje and Sebudde (2019)[15]. The current analysis covers the period of 2000 to 2021, which has comprehensive data on the primary variables for most of the sampled countries.

[15] Fenochietto and Pessino's (2013) sample spans the 1991–2012 period, while Ndiaye and Korsu's (2014) spans the 2000–2010 period, and Majjewe and Sebudde (2019) considered the 1996–2015 period.

2.6 The measurements of the shadow economy (informality)

The major challenge in empirical studies concerning the shadow economy is the difficulty of obtaining an appropriate proxy for it (La Porta and Shleifer, 2014; Kanbur, 2017). Nevertheless, some scholars have developed a few methods to measure the size of the shadow economy (Medina and Schneider, 2019). These measures can be grouped into indirect, direct, and model-based methods (Schneider and Buehn, 2018). First, the direct approaches comprise of survey or interviews-based methods, which is riddled with country and time limitations. Second, the indirect methods use macroeconomics factors, such as transaction indicators (Feige, 1979), currency demand (Awad and Alazzeh, 2020), and electricity utilisation (Psychoyios et al., 2021) to deduce the magnitude of the shadow economy, considering specific assumptions. Third, the size of the shadow economy can be measured using model-based techniques, such as Multiple Indicators, Multiple Causes (MIMIC) and Dynamic General Equilibrium (DGE) measure methods. Medina and Schneider (2019) estimate the size of informal economies for 157 countries from 1991 to 2020 using the MIMIC method. The MIMIC model, despite some of its imperfections, is widely used in macroeconomic studies about the shadow economy because of its broad coverage (Schneider and Buehn, 2018; Kelmanson et al., 2019; Wu and Schneider, 2019). The current study uses the model-based derived shadow economic indices (MIMIC and DGE) in the analysis of tax effort and tax capacity. Nevertheless, the MIMIC measure is more appropriate for the current study because of its depth in terms of coverage.

2.7 The measurement of the Economic Complexity Index

The ECI estimates the degree of a nation's productive knowledge and the volume of details on its production competence (Hausmann et al., 2014; Gomez-Gonzalez et al., 2023). It also considers factors such as diversification and sophistication of domestic exports and compares them with the foreign exporting countries' development and diversity. This essay uses the ECI developed by Hidalgo and Hausmann (2009), which is available and updated regularly online ("Economic Complexity Atlas of Harvard's Growth Lab" webpage). The ECI was designed following the theoretical work by Veblen (1898), Hidalgo and Hausmann (2009), Gräbner (2017), Arthur (2021) and Balland et al. (2022). It measures technological density and the knowledge of an economy by studying the degree of knowledge concentration in its exported goods and services (Gomez-Gonzalez et al., 2023). Hidalgo (2021) provides an extensive review of the latest applications of ECI in various studies. With paltry growth in tax base and persistence of the informal sector in many African countries, economic complexity, which is correlated with economic growth, is an area of interest to policymakers and the researcher. The index is deemed superior because it is based on the emergent nature of the economy; therefore, countries that use technologies to build complex, less ubiquitous goods for exports tend to experience economies of scale and benefit from them. This study introduces

economic complexity to the tax effort paradigm as a measure of efficiency, exploring the relationship between informality, economic complexity, and taxation, contributing to the understanding of cross-country differences in tax mobilisation.

Güneri and Yalta (2021) give evidence of the role of ECI in reducing output volatility. Additionally, Breitenbach et al. (2022) assert that the ECI effect on output volatility is heterogeneous and depends on countries' income levels. The transmission mechanism of how economic complexity influences tax revenue and fiscal balance can be understood as follows: countries with complex production structures tend to have more stable income and, therefore, stable tax revenue flows. As such, complexity can be associated with a lower risk premium and lower cost of sovereign debt (Gomez-Gonzalez et al., 2023). Nguyen (2022) examines whether there is a nexus between the shadow economy and economic complexity and concludes that an increase in economic complexity reduces the relative and absolute size of the informal economy in the long run[16].

2.8 A snapshot of tax and informality data

Table 2.0 presents some highlights of tax as a percentage of GDP. The sub-Saharan Africa (SSA) region has the second-lowest estimate of tax revenue, with a median of 12.1 percent, while the South Asia region has the lowest, with a median of 11 percent. The Middle East and North Africa regions have a median of 14.1 percent, and the East Asia and Pacific regions have a median of 16.4 percent. Latin America and the Caribbean have a median tax revenue of 17.0 percent, which is the same as the world median. The sampled countries for this study are approximately the same as the world median. The Organisation for Economic Co-operation and Development (OECD) countries have a median tax revenue of 22.7 percent, while Europe and Central Asia have a median of 22.1%.

[16] The possible way to disentangle the confounding effect is to perform the causality tests and search for other proxies for ECI or the shadow economy variable.

Table 2.0 Average tax (% of gross domestic product) by World Bank's regions (2000–2021)[17]

	Region	Mean	Median	Min	Max	sd
EAP	East Asia and Pacific	16.8	16.4	1.9	42.3	6.3
ECA	Europe and Central Asia	22.7	22.1	4.1	48.5	6.3
LAC	Latin America and the Caribbean	17.0	17.0	4.2	33.7	5.5
MENA	Middle East and North Africa	13.5	14.1	0.3	45.6	9.7
OECD	OECD	23.8	22.7	9.2	48.5	6.7
SAS	South Asia	11.5	11.0	2.5	20.2	3.7
SSA	sub-Saharan Africa[18]	14.6	**12.1**	0.6	54.7	8.5
SC	Sampled countries	19.0	**17.1**	0.58	54.7	9.6
World		17.3	17.0	0.3	54.7	8.1

Source (WDI, 2023): Author's own compilation.

Tables 2.1 and 2.2 present economic informality indices (MIMIC and DGE). Under the MIMIC index, the SSA region has the highest proportion of the informal economy (MIMIC), with a median of 40.1 percent, followed by the sampled countries for this study (37.6 percent), then Latin America and the Caribbean (36.5 percent), and Europe and Central Asia (27.0 percent). While the OECD countries have an informal economy with a median of 18.8 percent and South Asia has a median of 35.0 percent. These statistics, coupled with lower tax/GDP for the sampled countries and the SSA region in Table 2.0, underscore the nature of the challenges these countries face in mobilising revenue for development goals.

In terms of DGE index of informal economy, again, SSSA has the highest median of 39.2 percent, followed by sampled countries in this study with a median of 35.8 percent, followed by Latin America and Caribbean 32.7 percent, and South Asia (32.5 percent), Eastern Europe and Central Asia regions have informal economy of 25.6 percent. The OECD countries have a median of (17.2) percent. Generally, the level of informality is greater in SSA than in all other regions considered. Notably, MIMIC estimates give smaller and less volatile shadow economic estimates than the DGE method. The MIMIC underlying drivers of informality are created from slow-moving variables, such as one relating to governance quality, whereas

[17] Since there are potential country-level differences across continents, the country level differences for sampled countries are performed as well, for the samples presented in Tables 2.0, 2.1, and 2.2.

[18] The World Bank propose that a tax to GDP ratio of at least 15% as sub-minimum requirement for a country to achieve sustainable development and renders essential services such as infrastructure education and healthcare (https://www.worldbank.org/en/results/2019/09/09/mobilizing-tax-resources-to-boost-growth-and-prosperity-in-sub-saharan-africa).

DGE is created from a set of more cyclical variables, such as employment, investments, and productivity (Schneider and Buehn, 2018; Medina and Schneider, 2019).

Table 2.1. Average informality (MIMIC) by World Bank's regions (2000–2018)[19]

	Region	Mean	median	min	max	sd
EAP	East Asia and Pacific	26.6	26.6	10.2	52.6	13.6
ECA	Europe and Central Asia	27.7	27.0	8.1	68.9	12.7
LAC	Latin America and the Caribbean	39.1	36.5	18.2	68.6	11.8
MENA	Middle East and North Africa	24.9	21.0	16.7	38.4	6.9
OECD	OECD	20.3	18.8	8.1	39.1	7.4
SAS	South Asia	32.8	35.0	19.7	45.1	6.5
SSA	sub-Saharan Africa	40.6	**40.1**	21.3	63.3	7.8
SC	Sampled countries	38.5	**37.6**	21.0	64.4	8.6
World		33.1	33.4	8.1	68.9	12.6

Source (WDI, 2023): Author's own compilation. MIMIC: Multiple Indicators, Multiple Causes

Table 2.2. Average informality (DGE) by World Bank's regions (2000–2021)

	Region	Mean	median	min	max	sd
EAP	East Asia and Pacific	24.6	23.7	8.6	54.6	12.5
ECA	Europe and Central Asia	26.2	25.6	8.0	66.4	11.8
LAC	Latin America and the Caribbean	35.6	32.7	16.1	63.9	11.1
MENA	Middle East and North Africa	23.1	20.6	14.5	37.5	6.8
OECD	OECD	18.9	17.2	8.0	34.4	6.7
SAS	South Asia	31.1	32.5	16.7	45.3	6.9
SSA	sub-Saharan Africa	38.6	**39.2**	20.2	65.1	8.2
SC	Sampled countries	36.2	**35.8**	20.6	64.2	9.1
World		30.9	30.7	8.0	66.4	12.0

Source (WDI, 2023): Author's own compilation. DGE: Dynamic General Equilibrium; OECD: Organisation for Economic Co-operation and Development

[19] Tables 2.1 and 2.2 data is extended to include the two years of data (2019–2020), which have become available in the main analysis.

2.9 Literature review

2.9.1 Theoretical consideration

The earlier theoretical development and subsequent refinements of studies on tax effort are those of Lotz and Morss (1967, 1970) followed by Bahl (1971, 1972, 2003) and Stotsky and WoldeMariam (1997) and Mertens (2003). These authors examine the tax effort question from different dimensions, such as social and political, structural, and the historical legacy context. They rank tax efforts considering the differences in economic, social, and political structures of countries. The current study adopted the same approach for analysis using the shadow economy and economic complexity as variables of interest. De Soto (1989), North (1991), Hart (2008), and Acemoglu et al. (2001) provide an extensive contribution on how institutional setting influences economic outcomes, including tax. Mkandawire (2010) highlights the channels through which historical legacy influences tax mobilisation in Africa. Whereas Gupta et al. (2022) emphasised the role of institutional setting in terms of corruption and other macroeconomic drivers that influence tax efforts. Other studies that looked at tax effort from different dimensions (macroeconomic, demographic, institutions, political setting) are those of Brun and Diakite (2016), Mawejje and Sebudde (2019), Piancastelli and Thirlwall (2020), and Chigome and Robinson (2021), using the stochastic frontier approach in their analysis of tax effort. The current study included similar sets of covariates as analysis controls as those of recent work by Chigome and Robinson (2021), Piancastelli and Thirlwall (2020), and Mawejje and Sebudde (2019), expecting their signs to be similar. While these studies have provided useful insights in tax effort literature, they do not discuss the inefficiency and efficiency attributes of informality and economic complexity in tax effort.

Hart (1973) introduced the theory of informality in economic development and used it to study the nexus between the informal structure of the economy and job creation in Africa. Subsequent studies expand Hart's work and apply it to various areas of economic studies (Docquier et al., 2017). However, there is limited empirical application of informality theory to taxation, especially in Africa. The initial limitation to that end was due to the difficulty of obtaining the appropriate proxy for the level of informality. However, the shadow economic indices developed by Schneider and Enste (2002), Feld and Sneider (2010), and Medina and Schneider (2019) have paved the way, enabling one to analyse the influence of the shadow economy on tax mobilisation. Hart's (1973) theory of informality is used to examine the association between informality and tax effort. The expectation is that growth of informal economy limits the scope of tax collection (Medina and Schneider, 2019); therefore, we expect it to correlate negatively with tax effort and tax capacity.

Tax mobilisation constraints are not limited to the shadow economy aspect only; the structure of the economy in terms of complexity also has a significant influence on tax mobilisation. Just as for the shadow

economy, tax mobilisation literature lacked an economic complexity dimension in terms of analysis due to the limited data and a suitable economic complexity measure. The ECI formulated by Hidalgo and Hausmann (2009) and subsequent refinements have been central in economic growth studies; however, it has yet to be introduced in the tax effort literature. Economic complexity is associated with economic growth (Arthur, 2021; Hidalgo and Hausmann, 2021); therefore, the expectation is that the more complex a country's economy is, the higher the income level and the higher the taxable base. One of this essay's contributions is to introduce the ECI in tax effort analysis.

All these studies, among many others, provide invaluable insights on characteristics, challenges, and potential areas of improvement in developing countries' tax collection efforts. The incorporation of economic informality and economic complexity indexes developed by Schneider and Enste (2002), Feld and Schneider (2010), Schneider and Buehn (2018), and Hidalgo and Hausmann (2009) in tax effort studies provide valuable insights on tax mobilisation efforts in these countries. The current study follows these studies theoretical premises for interpretating the results. The next section discusses the potential transmission mechanisms based on these theories through which informality, economic complexity, and other commonly used variables in the literature are linked to tax effort analysis.

2.9.2 Envisaged transmission mechanism between the shadow economy, economic complexity, and tax effort

Figure 2.0 presents the potential transmission mechanism through which economic complexity, the shadow economy, macroeconomic indicators, and institutional settings influence tax effort. The following section discusses channels through which both the ECI and informal economy index influence tax efforts, both directly and indirectly. The direction of the arrows shows the direction through which the effect flows between variables.

2.9.3 Tax effort and the shadow economy (informal economy)

The shadow economy (informal economy) operates outside the official settings of taxation and regulations. Informal economy tends to have a significant impact on tax effort. In countries where the shadow economy is prevalent[20], tax revenue may be lower either due to productivity loss or tax evasion (Friedman et al., 2000; Loayza, 2016, 2018; Elgin et al., 2021[21]; Ohnsorge and Yu, 2021). Friedman et al. (2000) cite efforts to dodge the grabbing hand of the state as the source of informal sector growth. This can undermine tax effort and hinder the state's ability to fund public services provision (Schneider and Enste, 2002; Feld and

[20] El Badaoui and Magnani (2020) provide evidence of the informal sector growth in many underdeveloped countries.
[21] The persistence of the informal economy in developing countries result in economic agents not reporting their income taxes or paying the required taxes.

Schneider, 2010; La Porta and Shleifer, 2014). Furthermore, the presence of a large shadow economy signals weaknesses in governance frameworks, which can also affect economic complexity, playing a critical role in driving tax revenues, as explained above. One potential way to disentangle the effects is to orthogonalise these two variables, create an index, and use the index instead of analysing them individually. The channel through which the informal economy index influences tax effort is either directly or indirectly through its effect on macroeconomics, institutions, and the size of the population, as indicated by the arrows in Figure 2.0.

As stated earlier, informality also accelerates levels of income inequality and poverty, which, in turn, result in loss of revenue to the state and even exacerbate funding shortages for the provision of public goods and other developmental projects (Berdiev and Saunoris, 2019; Berdiev et al., 2020). De Soto (1989) suggests that a productive informal sector and a skilled labour force can be a source of growth, which is contrary to the arguments by Berdiev and Saunoris (2019) and Berdiev et al. (2020). Lastly, the prevalence of informality undermines human capital formation, as many skills acquired in the informal activities are not easily transferable (Docquier et al., 2017). Untransferability of skills from the shadow economy limits the revenue potential of the participants and the tax base at large.

The informal sector in developing countries is substantially large. Available data shows that the informal sector contributes over 70 percent of employment and up to one-third of GDP in developing countries (Loayza, 2016; Elgin et al., 2021; Ohnsorge and Yu, 2021). Moreover, Acs et al. (2013) suggest that over 50 percent of all existing enterprises in developing countries operate in the informal sector. There is consensus that businesses which operate in a formal setting have higher productivity than those which operate informally, and, therefore, informality matters (La Porta and Shleifer, 2014). Both authors show that countries which are engendered with high levels of informality suffer productivity losses and revenue losses because informal firms or business tends to be small, unproductive, and stagnant.

Goel et al. (2019) assert that some informal economy production is legal and contributes to both employment and the share of GDP; however, they are not registered with tax authorities for tax collection purposes. A large proportion of the shadow economy puts an increasing burden on the formal economy and impedes inclusive economic growth, mainly in developing economies. The shadow economy adversely affects the official economy in various ways. First, the shadow economy erodes tax revenue. The loss of tax revenue impedes the government's capacity to improve social inclusion and economic development (Elgin and Erturk, 2019). Second, a larger shadow economy engenders low productivity (Loayza, 2018) and limits human capital development (Docquier et al., 2017) and the unskilled labour force, which, in turn, slows economic growth (Esaku, 2021; Ozgur et al., 2021). Third, the shadow economy can accelerate poverty and income inequality (Berdiev and Saunoris, 2019; Berdiev et al., 2020). Moreover, various

studies have shown that the shadow economy is correlated with elevated levels of corruption (Friedman et al., 2000; Johnson et al., 2000), which exacerbates political instability (Elbahnasawy et al., 2016).

Studies by Cichello and Rogan (2017) and Gatti and Honorati (2008) refer to informality as proxied by asking whether an individual pays tax or not; however, this excludes workers doing infrequent informal activities in the formal setting. Gnimassoun and Do Santos (2021) argue that, because the informal economy escapes government scrutiny and given its size, the shadow economy contributes a significant shortfall of tax revenues. Therefore, countries with a large informal economy tend to suffer revenue losses and are susceptible to fiscal deficit problems. Moreover, Elgin and Uras (2013) show that countries in which a large share of their economy is informal have a higher cost of debt financing and a higher probability of sovereign default than others.

Schneider (2005) and Schneider and Buehn (2007) performed empirical analysis of the tax burden on the shadow economy and found statistically significant evidence of the adverse effect of taxation on the shadow economy. Specifically, the authors found strong evidence of the effect of direct and indirect taxes on the informal economy. For example, the main determinant for shadow economy activities is the direct tax burden. The intensity of existing regulations and the complexity of the tax system are another main driver of the shadow economy. The rise in the intensity of regulation is a vital factor that restricts freedom of choice regarding formal economy activities (Schneider and Buehn, 2007). Regulations include factors such as labour market regulations (dismissal protections or minimum wages), trade barriers (tariffs), and labour market barriers for foreigners (restricted labour mobility of foreign workers). Johnson et al. (1998) find a statistically significant influence of labour regulation on the informal economy. Complex and opaque regulations raise labour costs in the informal economy, and since these costs are often passed on to workers, they create incentives for workers to move into the shadow economy to avoid them. Friedman et al. (2000) assert that available estimates of regulation are positively associated with the size of the unofficial economy.

Informal economy growth can result in the reduction of government revenues, which, in turn, decreases the quality and quantity of public goods and services supplied by the government. This can result in a rise in the tax rate for entities and individuals in the formal sector, coupled with a worsening in the quality of public goods (such as infrastructure) and administration, causing even stronger incentives to engage in the informal economy. Johnson et al. (1998) suggest that smaller informal economies are found in economies with higher tax revenues attained through fewer laws and regulations, lower tax rates, and less corruption. Similarly, they argue that countries which are characterised by bad tax policies and regulatory laxity and a weaker rule of law tend to have a high incidence of bribery and market failures, and thus a relatively high proportion of economic activities in the informal economy. Thus, the size of informal economies in

developing countries, to some extent, reflects issues of tax burden and regulations, and limited formal employment in the local economy restricts the ability to earn a living wage legitimately.

Few studies have explored the drivers of the shadow economy, such as institutions, taxation, employment, globalisation, and trade openness (Mauleón and Sardà, 2017; Wu and Schneider, 2019). Elgin and Erturk (2019) highlight the ongoing debate of the vital role that the shadow economy plays in the economy and its policy implications.

2.9.4 Tax effort and economic complexity

Tax effort and economic complexity are intertwined in various ways. Tax effort can be influenced by economic complexity. Countries with higher economic complexity frequently have more diverse and sophisticated economies and less volatile output, which provides a broader tax base (Hidalgo and Hausmann, 2009; Ferrarini and Scaramozzino, 2016; Breitenbach et al., 2022). Therefore, governments in these countries could have room to implement more efficient and effective tax systems, resulting in higher tax revenues relative to less complex economies. Moreover, a higher ECI is correlated with a rise in future economic growth and, consequently, higher tax revenue (Balland et al., 2022). To address potential reverse causality, a bidirectional causality analysis was done in the current study following Juodis et al.'s (2021) techniques and adopting the 2SLS-IV model to disentangle the source of causality.

Previous studies placed more emphasis on political institutions in explaining the differences in economies' development and, hence, the taxable base (North, 1991; Acemoglu and Robinson, 2005). However, current research on the evolution of economic growth proposes that institutionalists overlook the important role of a country's economic configuration in steering economic growth. Thus, a nation's ability to manufacture sophisticated, high-value-added products signifies its potential in achieving an increasing productive capacity, while production of low-value products and services tends to engender decreasing returns to scale, which stifle sustainable growth and revenue collection.

Complexity economic theory challenges the equilibrium assumption in traditional economics, proposing that economies are dynamic, characterised by ever-changing beliefs, organising principles, and behaviours (Veblen, 1898; Gräbner, 2017; Arthur, 2021). ECI captures both the productive capabilities and product diversity of goods produced by an economy (Hausmann et al., 2014). The ECI not only estimates a country's ability to manufacture and export a wide variety of complex goods but also measures the country's human capital accumulation (Hausmann et al., 2014). Examining the implications of economic complexity on tax mobilisation, this study employed the ECI, developed by Hidalgo and Hausmann (2009) and Hausmann et al. (2014), across 25 African economies. This is the first attempt to incorporate economic complexity into tax mobilisation literature. Productive capabilities, encompassing inputs, technologies, and collective

knowledge shape a nation's success (Hausmann and Hidalgo, 2009; Arthur, 2021). Therefore, productive capacity has an immediate influence on production composition and, therefore, the taxable base. The ECI, measuring a country's product clustering, suggests that higher economic complexity correlates with an increased in tax revenue, emphasising the economic consequences of the division of knowledge (Mealy et al., 2019). Gräbner (2017) examined the interplay between institutional setting and economic complexity, emphasising the role complexity plays in explaining economic outcomes. This suggests the importance of variables that predict the complex nature of the economy.

The ECI is derived from export data, which reflects a country's diverse and complex productive capabilities, demonstrating a strong correlation with income levels and predictive power for future growth (Hausmann and Hidalgo, 2009; Balland et al., 2022). The ECI shows that not all imports and exports are created equal, and that the volume of exports is not enough for long-term economic growth, but rather the diversity (less ubiquity) of the country's export basket and the relative complexity of the goods included in the basket relative to those included by other economies in theirs. Countries with a high density of agricultural and mining sectors tend to have a lower ECI than those with more technological embodied products, such as Japan, which is considered a low ubiquity and highly sophisticated export economy. Hidalgo (2021) posits that the ECI is a superior proxy for productive economics since it measures the productive nature of nations and mirrors the level of sophistication and variations in industrial structure.

Complexity-driven development efforts, fostering conditions for complexity emergence, can lead to sustained growth and prosperity (Balland et al., 2022). The productive capabilities of a country include the diversity of knowledge across its labour force and market efficiency, or institutions involved in allocating and utilising such knowledge (Hausmann et al., 2014). A well-organised market driven by specialised knowledge of a diverse labour force efficiently enhances the total productivity at the individual, firm, and country overall (Haltiwanger, 2011). Thus, economic complexity drives economic growth, subsequently widening the tax base.

Nguyen and Schinckus (2023) explore the significance of economic complexity and its influence on economic volatility and show that ECI represents an economy's ability to reduce shocks in the face of equity price volatility and geographical instability. Gomez-Gonzales et al. (2023) show that increasing the ECI tends to decrease the likelihood of a financial crisis. They report that a unit increase in ECI decreases the probability of a fiscal crisis by half. The argument is that through the reduction of fiscal crisis, ECI fosters economic stability, which is an essential precondition for economic prosperity. Güneri and Yalta (2021) show that economic policies proposed to improve the economic complexity are essential in addressing the economic shocks in developing countries. Through the reduction of output volatility, ECI fosters stable economic growth, which is correlated with the stabilisation of fiscal budgets. Ballard et al. (2022) assert

that supporting economic progress by building complex competences is a preferred development plan over the production of costly goods and services, which are susceptible to rapid changes from changing market conditions, regulations, customers' preferences, war, and even crises, such as the recent COVID-19 pandemic. Gomez-Gonzales et al. (2023) argue that, for the very reason stated by Ballard et al. (2022), countries should focus on developing capabilities to manufacture complex goods as a natural path to guarantee economic growth in the long run, which is vital for stable fiscal policy. Moreover, sustainable economic growth is vital for stabilising budget deficits and promoting debt consolidation in developing countries.

Besides, the increase in incomes and improvement in the standard of living, sustainable economic growth caused by the increase in ECI increases the taxable economic base and improves the country's ability to repay its debts. Tacchella et al. (2018) show that estimation techniques, which embody ECI as a measure, outperform the precision of the five-year prediction developed by the IMF, which forecasts growth using macroeconomic indicators by more than 25 percent. Sweet and Eterovic (2019) provide evidence that economic complexity has a significant influence on explaining factor productivity, contrary to earlier findings, which put more weight on patents instead.

Another study by Nguyen (2022) shows that countries with higher economic complexity are associated with a small shadow economy, while Gomez-Saldivar et al. (2022) and argues that an increase in economic complexity is correlated with a fall in wealth and income inequalities and is a vital driver of economic growth. Gomez-Saldivar et al. (2022) argue that there is no conflict between export diversification and sophistication and the production of commodities, which provide much-needed tax revenue to an economy. Salinas (2021) asserts that tax revenue from commodity exports can be a vital source of capital for financing public policies and promoting long-run growth.

The adoption of the ECI index instead of indices such as the Herfindahl index of economic diversification gives a superior measure of sophisticated knowledge found in an economy and hence a better assessment of its impact on tax effort. The current research includes the ECI in its analysis to examine whether it increases (or decreases) the effect of all other determinants of tax effort. Current studies have only focused on the direct effects of tax effort determinants (macroeconomics, political and social institutions, and demographics) on tax effort, while the moderating effect of economic complexity through its effects on the role of economic structure is understudied. The current study introduces complexity economics to the tax effort paradigm, exploring the ontological affinity between institutions, taxation, and economic complexity, contributing to the understanding of cross-country differences in tax mobilisation.

2.9.5 Tax effort and macroeconomic variables (macroeconomic indicators)

Macroeconomic indicators, such as economic growth, unemployment rates, inflation,[22] and income inequality, can be influenced by tax effort, economic complexity, and the shadow economy. For example, countries with higher tax efforts have more resources for investments and social programs, resulting in higher output growth and lower unemployment rates (Elgin and Erturk, 2019; Gupta et al., 2022). However, higher tax effort engenders higher development, which is also one of the characteristics of highly complex economies (Hausmann et al., 2014). However, the shadow economy, which influences tax revenues in an economy, may exacerbate income inequality and hinder efforts to reduce poverty.

2.9.6 Tax effort and institutions

Institutions, including legal frameworks, governance, and regulatory bodies, have a crucial role in shaping tax effort, the size of the shadow economy, and economic complexity. A country's tax system is vital and a highly visible symbol of its underlying political choices (Kaldor, 1963). Thus, strong institutions are essential for enforcing tax compliance, protecting property rights, and fostering a business-friendly environment conducive to economic diversification and complexity (De Soto, 1989; Acemoglu et al., 2001). Weak or corrupt institutions promote tax evasion, foster informal economic activities, and reduce economic growth (Elbahnasawy et al., 2016). For the current study, governance quality indicators developed by Kaufmann et al. (2010) were included in the analysis to capture the role of institutions' quality in tax revenue mobilisation. In this chapter, corruption control and voice accountability variables were selected to examine their role in tax mobilisation. Voice accountability was selected since it captures perceptions of the extent to which a society can engage in choosing its government, freedom of expression, and association and media freedom (Kaufmann et al., 2010), all of which are essential for tax mobilisation. Corruption control proxies public views of the extent to which public power is exercised for private gain and state capture by nobles and private interests (Kaufmann et al., 2010), all of which undermine the state's ability to collect taxes. The other governance quality indicators, such as political stability, governance effectiveness, regulatory quality, and rule of law, were sampled but not used in this chapter since they either exhibit a high collinearity with corruption control and voice accountability or they tend to mute or change the direction of other covariates in the analysis[23].

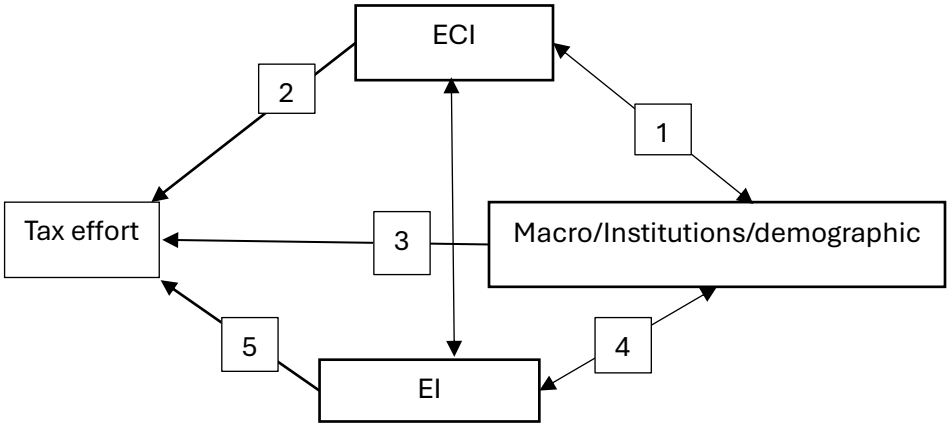
As discussed in the above sections, tax effort, economic complexity, the shadow economy and other macroeconomic variables, and institutions are intertwined and can have both indirect and direct effects on

[22] Sub-Saharan Africa's economic growth remains sluggish, and cost of living levels remain elevated in the region (IMF, 2023, SSA economic outlook).

[23] While these indicators are useful for cross-countries comparisons, they lack nuances and tend to be less reliable due to perception bias, aggregation opacity, and limited comparability over time.

each other. Understanding these linkages is important for policymakers in designing good strategies for promoting economic development, reducing inequality, and enhancing overall welfare. This study is informed by multiple theories—tax effort theories of Bahl (1971), Lotz and Morss (1967), and Stotsky and WoldeMariam (1997), institutions theories of De Soto (1989), North (1991), and Acemoglu et al. (2003), shadow economy theories of Schneider and Enste (2002) and Feld and Schneider (2010), and economic complexity theories of Hidalgo and Hausmann (2009) and Breitenbach et al. (2022)—to examine the effect of informality and economic complexity on tax mobilisation.

Figure 2.0. The potential channels through which informal economy index (IE) and economic complexity index (ECI) influence tax effort



Source: Author's own compilation

2.9.7 Empirical literature

Developing economies face the critical need to increase expenditure on essential service provision, such as health, public infrastructure, and education, necessitating the expansion of their tax base (Bird et al., 2008; Piancastelli and Thirlwall, 2020; Chigome and Robinson, 2021; Gupta et al., 2022). However, studies on revenue mobilisation methods, particularly the role of the informal sector, remain limited. Although previous work has examined tax (effort) capacity across several economies, the observed trends offer inadequate guidance for African economies, which are underdeveloped and heavily dependent on remittances, borrowing, and donor assistance, with less focus on their informal economic structure (Mawejje and Sebudde, 2019; Chigome and Robinson, 2021; Naape and Mahonye, 2021). El Badaoui and Magnani (2020) show that the informal sector plays a substantial and expanding role in many African economies, yet its impact on tax mobilisation is seldom explored (Sebele-Mpofu, 2020; Mpofu, 2021).

Taxable capacity is imputed from the regression results of tax-to-GDP ratios against other covariates. The tax effort index, as defined by Mawejje and Sebudde (2019) and Chigome and Robinson (2021), measures the efficiency of tax collection in relation to GDP and taxable capacity, where an index above one signifies efficient tax base utilisation, while below one indicates untapped tax capacity. Understanding and improving tax effort and tax capacity are essential for African countries' efforts for financing self-sufficiency and sustainable growth. This study contributes to the ongoing search for mechanisms to broaden the tax base for development purposes.

Earlier inter-country tax effort assessments were performed by Lotz and Morss (1970) by calculating actual and estimated tax ratios. Subsequently, Bahl (1971) emphasised the importance of openness in tax collection variations in developing countries. Chelliah et al. (1975) conducted the same exercise of estimating tax effort using a different set of covariates and the ordinary least squares (OLS) method, while Tait et al. (1979) presented further refinement of empirical techniques. Piancastelli (2001) explored tax effort from 1985 to 1995 in 75 countries, both developing and developed, using a panel data analysis method. Meda (2015) defined the tax gap as the difference between actual tax collection and potential revenue, asserting that diagnosing and evaluating tax collection efficiency is crucial for prioritising resource allocation in South Africa. Alm and Torgler (2006) studied tax morale in Europe and the United States and established a correlation between democracy and willingness to pay tax. However, these studies do not account for the informal markets and the nature of the production processes in these countries, which are important for tax mobilisation.

Zee (1996) and Tung et al. (2012) compared tax mobilisation efficiency across different income sub-groups and concluded that the tax-to-GDP ratio can be distorted due to variations in institutional settings, economic structure, and demographic profiles. Le et al. (2012) suggested that the tax system significantly influences investment decisions, with higher tax revenue being essential for reducing high dependency on aid support in low-income countries. Tax revenue in SSA accounts for just 15% of GDP, which is far below the 25–40% in developed countries (Feger, 2014). Le et al. (2012) classified economies based on tax effort and collection as follows:

(i) Low tax collection, high tax effort
(ii) High tax collection, low tax effort
(iii) High tax collection, high tax effort
(iv) Low tax collection, low tax effort

A tax effort index equalling one indicates a balance between taxable capacity and actual tax collection. Countries with low tax effort and collection are considered to have untapped revenue potential, while those

with high tax collection and effort are seen as utilising their tax base efficiently. However, Bahl (1971) argued that tax effort below one in a country indicates a lower performance relative to others, but it does not necessarily correspond to a higher tax ratio. Similar patterns were observed in the current study's analysis; for example, the DRC and Madagascar have relatively higher tax effort values but very low tax-to-GDP ratios (see Table 2.11). Chelliah et al. (1975) and Tait et al. (1979) show that modest comparisons of tax ratios are appropriate for relative tax levels but can yield misleading results due to measurement errors or insufficient data. Bird (1976) noted that individual countries have unique political, economic, and governance characteristics, making generalisation comparisons less informative. Including informality and economic complexity, which are unique characteristics, is expected to yield new insights.

The 2008–2009 financial crisis, along with the outbreak of the COVID-19 pandemic, led to rising budget deficits, compelling governments to seek new revenue sources that are less distortive of consumption and production. Hinrichs (1966) and Musgrave (1969) emphasised the relevance of tax structural features, such as import tariffs, in tax collection efforts. Kaldor (1963) and Bird (2004) emphasised the role of political will and stable institutions in successful tax reforms. Contrary to Bird (2004), the current study finds that corruption is not significant in explaining tax efforts; however, voice accountability is significant. While Easterly and Levine (2002) highlighted the significance of property rights, the rule of law, financial systems, and the reduction of corruption in affecting economic outcomes, such as tax collection, Gupta et al. (2022) affixed the fragility of institutions in SSA countries as the source of low tax buoyance in the short term, while Rodrik et al. (2004) concluded that the relevance of institution quality supersedes that of other economic drivers in tax mobilisation.

Dom and Miller (2018) noted sporadic revenue mobilisation in SSA, with other authors highlighting problems like tax evasion, revenue instability, political instability, policy incredibility, and institutional flaws (Carrillo et al., 2017; Gwaindepi, 2021). economic development and institutional effectiveness were controlled in the current study's analysis by incorporating these variables besides the primary variables of interest. Sebele-Mpofu et al. (2022) suggested that African countries face economic challenges, fragile institutions, demoralised taxpayers, and growing mistrust toward the state. Levin (2021) emphasised the need for a well-designed tax system to foster structural reforms and job creation. Some authors stress the importance of improving administrative structures and designing fiscal capacity to cater to each country's social, political, and economic needs. Yet, the extant literature is mute about the role economic sophistication (complexity) plays in a country's taxation. Sebele-Mpofu et al. (2022) admitted that inadequate tax management capabilities, tax agreements, dispute-resolution mechanisms, and audit frameworks are barriers to effective tax mobilisation.

While foreign direct investments (FDIs) and official development assistance (aid) contribute to development (Clist Morrissey, 2011; Clist, 2016), they also produce budgeting uncertainty (Mosley et al., 1987; Junquera-Varela et al., 2017). To minimise aid reliance, donors have emphasised the need to expand tax bases for long-term fiscal sustainability (Mascagni et al., 2014). The current study included the net official development assistance variable, but the crowd out effect of donor assistance was not observed in the results, as suggested by Benedek et al. (2014). The IMF and World Bank recommend measures such as improving value added tax management, broadening value added tax regulations, and taxing the digital economy (Akpen, 2022; Onuoha and Gillwald, 2022). Other proposals include broad adoption of digital collection technologies (Kelbesa, 2020), increasing property and excise taxes, and closing loopholes used by multinational corporations (Meagher, 2018; Sebele-Mpofu, 2020; Sebele-Mpofu et al., 2021). These are all much-needed reforms; however, they don't specifically redress the challenges of informality persistent, which limit taxable income.

Revenue mobilisation constraints include the misuse of tax exemptions and incentives (Oguttu, 2018), rampant corruption, low public tax compliance (Alm and Torgler et al., 2006; Daude et al., 2013), and ineffective governance. The challenge of tax collection is also due to a large proportion of the economy being in informal and agricultural sectors, and multinational corporations' transfer pricing strategies and the untaxed digital economy (Sebele-Mpofu et al., 2022). Piancastelli and Thirlwall (2020) report that more than 50% of developing countries have a tax effort below unity. With 85.8% of employment in Africa taking place in the informal sector (International Labour Organization, 2018), revenue mobilisation remains challenging. Their work is like the current study's in terms of methodology; however, it does not include informality or economic complexity in the analysis.

The digital economy offers new opportunities for tax mobilisation in underdeveloped economies. Emerging technologies can help formalise a large part of the economy by reducing the costs of business formalisation (e.g., through registration or adoption of contract operations). However, governments often lag in adopting and designing mechanisms to collect taxes in new markets, including the digital economy. Yet, leveraging technologies to widen the tax base is likely to increase tax revenue (Bunn et al., 2020; Onuoha and Gillward, 2022). Currently, 21 million people in Africa are engaged in e-commerce (Bunn et al., 2020; Kelbesa, 2020; Ganter, 2021). The number is paltry for a continent of approximately 1.3 billion people. Singh (2018) noted that underdeveloped countries lose over $500 billion in tax revenues annually through tax evasion by various mechanisms such as underreporting and misinvoicing. Therefore, formalisation will make it possible for African countries to tax the digital economy through digital service taxes, withholding taxes, and value added tax.

Several studies have examined tax mobilisation in the Southern African Development Community (SADC), including Ade et al. (2018) and Chigome and Robinson (2021). Ade et al. (2018) and Chigome and Robinson (2021) emphasised the importance of FDI and institutional quality in tax collection but did not account for the role of the informal sector and economic complexity. Naape and Mahonye (2021) analysed South Africa's tax effort using the 2-SLS method, identifying positive relationships with GDP per capita, FDI, and inflation, while noting that population growth, trade openness, and agriculture negatively impact tax effort. This aligns with Gupta (2007), who found that per capita GDP, foreign aid, trade openness, and stable institutions significantly affect revenue performance. Ndiaye and Korsu (2014) demonstrated that literacy rates positively influence tax groups, financial deepening positively impacts trade and indirect taxes, while agricultural output negatively affects both direct and indirect taxes in ECOWAS countries. Brun and Diakite (2016) applied the Stochastic Frontier method to estimate tax effort, observing that low-income countries tend to exhibit higher tax effort, attributing inefficiencies to policy choices.

Addison and Jorgen (2012) linked a high tax-to-GDP ratio to trade growth, smaller populations, peaceful conditions, and a smaller agricultural sector. Garikai (2009) investigated tax buoyancy in the SADC region and found that financialisation, aid assistance, and fiscal deficit growth negatively impact tax buoyancy. These variables were included in the current study's analysis alongside the primary variables of choice.

2.10 Research methodology

This essay leverages the stochastic frontier model developed by Aigner et al. (1977) to optimise production. Specifically, the study adopted the subsequent refinement of Aigner et al.'s model by Battese and Coelli (1995) and Sickles and Zelenyuk (2019) into panel data form to study whether informality (source of inefficiency) and economic complexity (source of efficiency) play a role in tax effort determination. The stochastic frontier techniques control for individual heterogeneity and transient and persistent efficiencies, which other methods often ignore in tax effort analysis (Mawejje and Sebudde, 2019; Piancastelli and Thirlwall, 2020; Chigome and Robinson, 2021).

The stochastic frontier model provides an elegant way to study tax effort through its dual non-symmetrical error term structure, where the first part is the idiosyncratic error component, which captures the model's misspecifications, measurements errors, and the stochastic nature of tax. Second, the one-sided nonnegative error element, which captures technical inefficiencies that limit the highest attainable tax (Battese and Coelli, 1995). The stochastic frontier model takes the following form:

$$TE_{it} = \frac{\exp\left(\alpha + \beta^T x_{it} + \alpha_i\, lnIE_{it} + \alpha_i\, lnECI_{it} + v_{it} - u_{it}\right)}{exp(\alpha + \beta^T x_{it} + \alpha_i\, lnIE_{it} + \alpha_i\, lnECI_{it} + v_{it})} = \exp\left(-u_{it}\right)$$

$x_{it} = f(TOP_{it}, GDPP_{it}, GDPP^2{}_{it}, POP_{it}, AID_{it}, REMI_{it}, AGRI_{it}, COR_{it}, VA_{it}, MAN_{it}, DEBT_{it}, PE_{it}, MI_{it}, INF_{it})$ [24] (1.0)

$TE_{it} = \frac{T_{it}}{GDP_{it}}$ is the ratio of total tax revenues over GDP for individual countries over time.

Thus, the primary model is as follows:

$$\ln\left(\frac{T_{it}}{GDP_{it}}\right) = \alpha_0 + \beta_i ln\vec{x}_{it} + \alpha_i\, lnIE_{it} + \alpha_i\, lnECI_{it} + \varepsilon_t \quad (1.1)$$

Once the model parameters are calculated, the expected level of technical inefficiency is attained by calculating $E[u] = \sqrt{\frac{2}{\pi\sigma_u}}$, and the expected level of efficiency is given by $E[e^{-u}] \approx 1 - E[u]$. Since informality does not influence all tax types equally, the estimation entails estimation at an aggregate level with total tax as a percentage of GDP and at a fragmented level (direct and indirect tax), depending on data availability[25]. The appropriate diagnostic tests engendered in the tax effort literature are performed. Moreover, since the shadow economy, economic complexity, institutions, and macroeconomics are intertwined, the causal relation is tested before further estimation[26]. To assess the effects of informality and economic complexity on tax effort, the results are estimated without informality and complexity, then with them, and the results are compared.

Other potential methods, such as the Driscoll and Kraay (DK) model, the fixed effects model and system GMM estimations, were included to assess the robustness of the current study's findings. Pesaran (2004) asserts that assuming cross-sectional independence in panel data is often inappropriate since countries share mutual dependencies, such as trade relations, and standard covariance matrix estimators fail to account for this, leading to biased inferences. The DK method, for example, refines standard errors estimation by applying a New-West type correction to address cross-sectional dependence, preserving the consistency of the covariance matrix estimators. This nonparametric approach provides robust residuals against spatial and temporal dependencies, ensuring reliability under heteroscedasticity. Table 2.4 lists the variables and definitions used in Equation (1.0).

[24] Even though these are covariates (defined in Table 2.4) that are found in tax effort literature, including all of them in the model at once could constitute specification errors of including unnecessary variables in the model, making the variance of intercept larger and the other partial slopes less precise. The inclusion of other covariates in Equation 1.1 is strictly based on foundation theory found in the literature.

[25] Estimation in tax sub-groups was left out due to a lack of sufficient data for all sampled countries; however, country-level analysis is a potential future research area.

[26] In the case of reversal causality, further exploration of an appropriate instrument variable is performed to establish unique causality between these variables and if possible, use instrument variables to try to identify unique causality.

2.11 Data

This essay uses secondary data from the World Bank's World Development Indicators (WDIs). The dataset consists of a panel of 25 countries over the period of 2000 to 2021. The sampled countries are Algeria, Angola, Cabo Verde, Botswana, Congo Dem. Rep, Eswatini, Egypt Arab Rep., Ethiopia, Kenya, Ghana, Lesotho, Tunisia, Zimbabwe, Madagascar, Tanzania, Mauritius, Malawi, Morocco, Senegal, Mozambique, Namibia, Rwanda, Seychelles, South Africa, and Zambia. The countries were chosen depending on sufficient data availability and representation of the African continent in mind.

The collected variables include total tax revenue as percentage of GDP, which encompasses revenues from payroll taxes, income and profit taxes, taxes on goods and services, property-related taxes, and other forms of taxation. Trade openness is measured as the sum of imports and exports as a percentage of GDP, capturing the degree of a country's integration into global trade. The agricultural sector's share of GDP is defined as the net output of the sector, accounting for total production adjusted for immediate inputs.

In this study, informality was measured in two ways. First, it was calculated indirectly as the proportion of informal output relative to official national income. Second, it was estimated directly using labour market, households, opinions, or the firm's surveys. To proxy the informal economy, two indices were used: the MIMIC model, developed by Medina and Schneider (2019) and Schneider et al. (2010), and the DGE model, as proposed by Orsi et al. (2014), Elgin and Oztunali (2012), and Ihrig and Moe (2004). Both indices range from 0 to 100 percent. Elgin et al. (2021) provide an extensive analysis of these two indices, discussing both their advantages and limitations.

The ECI ranges from -2 to +2, with the highest rank being 2, corresponding to the country with the most complex economy, and the lowest being -2. The ECI data was collected from the Observatory of Economic Complexity[27]. The data for economic complexity is also available and updated on the Economic Complexity Atlas of Harvard's Growth Lab.

The corruption and voice accountability indices proxy institutions take values of -2.5 for the minimum and 2.5 for the maximum (Bird et al., 2008; Kaufmann et al., 2010). Before performing the logarithm transformation of these variables, a value of 2.5 was added to them and divided by 5 to avoid the problem of negative values in taking logs. Table 2.3 provides a list of all covariates used and their definition, together with the source of data. To ensure data completeness and reliability, only countries with fully available datasets for all variables were included in the analysis. Applying the logarithmic transformation to all

[27] The data is accessible at https://legacy.oec.world/en/ rankings/country/eci/.

variables reduces data variance and enhances the goodness of fit for the estimated equation, as demonstrated by Piancastelli and Thirlwall (2020).

Table 2.3. Description of model variables

Variable	Definition	Source
Dependent variable		
lnTTAX	Total tax revenues as % of gross domestic product (GDP)	World Bank (WDI, 2023)
Independent variables		
lnTOP	Trade openness (average of import and exports) as the ratio to GDP	World Bank (WDI, 2023)
lnAGRI	Agricultural output as % of GDP	World Bank (WDI, 2023)
lnCPI	Log of consumer price index (inflation)	World Bank (WDI, 2023)
lnPOP	Total population of people of age between 15 and 64 (productive population)	World Bank (WDI, 2023)
lnVA[28]	Voice accountability	World Bank (WDI, 2023)
lnCOR	Corruption control	World Bank (WDI, 2023)
lnGDPP	Per capita GDP (2015 constant in US $)	World Bank (WDI, 2023)
lnGDPP2	Square of per capita GDP (2015 constant in US $)	World Bank (WDI, 2023)
lnMAN	Manufacturing output as % of GDP	World Bank (WDI, 2023)
lnREMI	Remittances inflows (total in US $)	World Bank (WDI, 2023)
lnDEBT	Total external debt as % of GDP	World Bank (WDI, 2023)
lnAID	Total foreign donor assistance as % of GDP	World Bank (WDI, 2023)
lnPE	Total public expenditure in education as % of GDP	World Bank (WDI, 2023)
lnFDI	Total foreign direct investment as % of GDP	World Bank (WDI, 2023)
lnIE/lnDGE	Informal sector index (MIMIC/DGE)	Schneider and Buehn (2018)
lnECI	Economic complexity index (ECI)	Hidalgo and Hausmann (2009)
lnMI	Mineral rents as % of GDP	World Bank (WDI, 2023)

Source: Author's own compilation

2.12 Results discussion

Table 2.4 provides a snapshot of the data utilised for empirical analysis in this study, which includes the average, maximum, minimum, and standard deviation of the variables used. It is reiterated that all data were obtained from the WDI database and Harvard's Growth Lab for economic complexity data. The data span the period from 2000 to 2021. Most of the African countries have no observations for many of the chosen

[28] Governance quality variables (i.e., corruption control and voice accountability) were transformed by adding a value of 2.5, and divided by 5 to remove the zero values, which will cause problem in log transformation.

variables before 2000. The informality variables, MIMIC and DGE, have an average of 38.35 and 36.33 percent and kurtosis of 3.62 and 4.42, signifying a normal distribution. The average tax revenue as a percentage of GDP average is 19.01%, while the average agriculture share of GDP average is 14.95%. Corruption control has an average of 0.44 units and a maximum of 0.83. The population average is 2.6 million and the trade openness average is 39.64 percent. The standard deviation for all indicators is less than their mean; therefore, there are no obvious signs of extreme outliers.

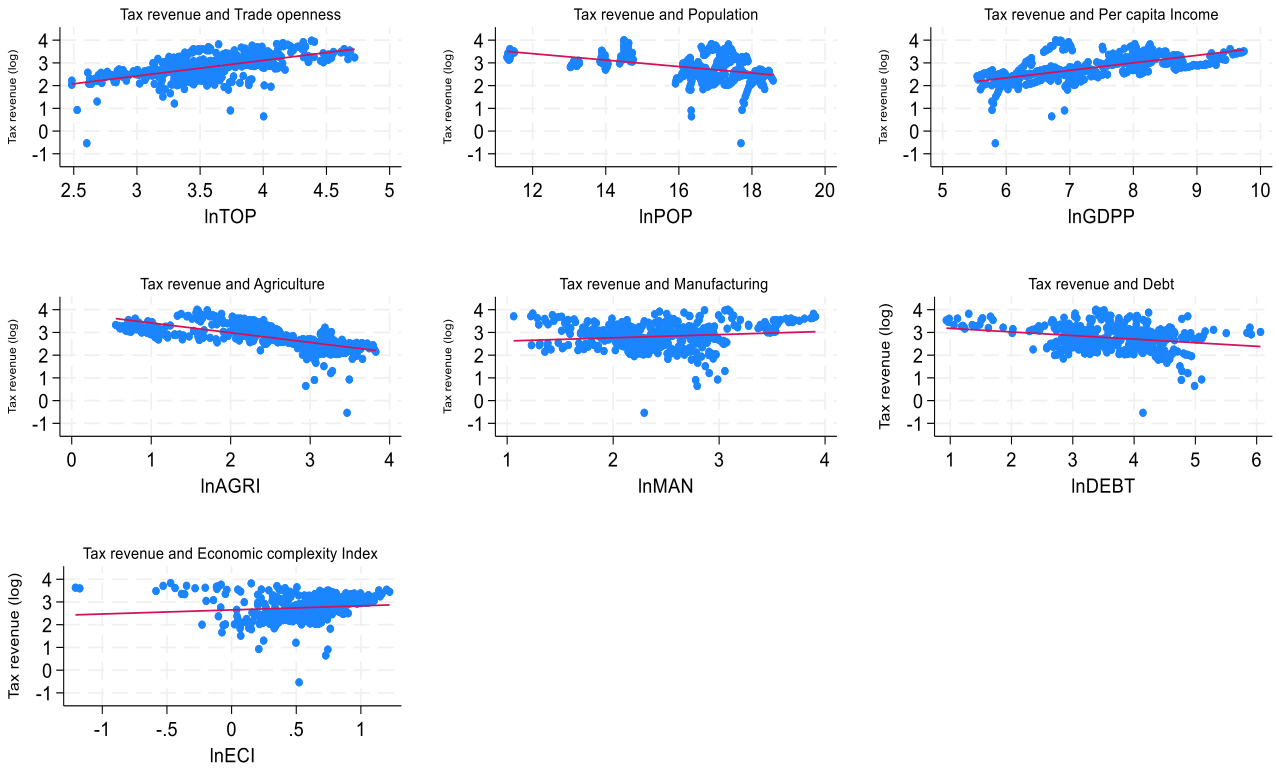
Table 2.4. Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
TTAX	513	19.013	9.588	.586	54.737	3.673	48.166	1.004	3.884
TOP	510	39.637	18.551	11.99	112.512	13.617	105.117	1.341	5.223
AGRI	549	14.952	10.472	1.722	45.883	1.927	42.341	.726	2.649
INF	550	16.861	117.438	-16.762	2630.123	-6.333	196.984	20.417	448.855
POP	550	25800000	26800000	81131	1.203e+08	83723	1.082e+08	1.365	4.312
VA	525	.432	.146	.165	.697	.192	.691	.03	1.774
COR	525	.444	.127	.206	.827	.216	.732	.292	2.572
GDPP	550	2791.315	2989.147	255.1	16992.032	272.289	15551.558	2.241	8.911
GDPP2	550	16700000	39700000	65076.16	2.887e+08	74141.07	2.419e+08	4.365	24.152
MAN	540	13.211	7.783	2.89	49.879	3.662	42.845	1.93	7.745
REMI	505	1.800e+08	3.500e+08	0	2.750e+09	0	1.420e+09	3.502	18.753
DEBT	506	52.165	49.978	2.551	429.738	3.278	344.935	3.769	23.757
AID	547	1.010e+09	1.060e+09	-18400000	7.800e+09	7170000	4.990e+09	2.002	9.202
PE	402	5.048	1.951	1.1	13.22	1.544	11.109	.914	4.451
FDI	550	3.851	5.405	-10.725	57.877	-3.95	26.205	3.967	29.389
MIMIC	504	38.348	8.602	20.839	64.586	21.661	61.748	.712	3.624
MI	525	99.995	200.191	0	1499.4	0	939.174	3.369	17.253
DGE	496	36.333	9.003	20.209	65.144	20.573	64.228	.994	4.417
ECI	462	1.855	.539	.299	3.395	.624	3.124	.039	2.885

Source: Author's own compilation

Figure 2.1 shows a positive correlation between tax revenue as a percentage of GDP and economic complexity. Trade openness, manufacturing, and per capita GDP also exhibit a positive correlation with tax revenue, while debt, population, and agriculture exhibit a negative correlation with tax revenue as a percentage of GDP. There are a few observable outliers in the plots of all variables.

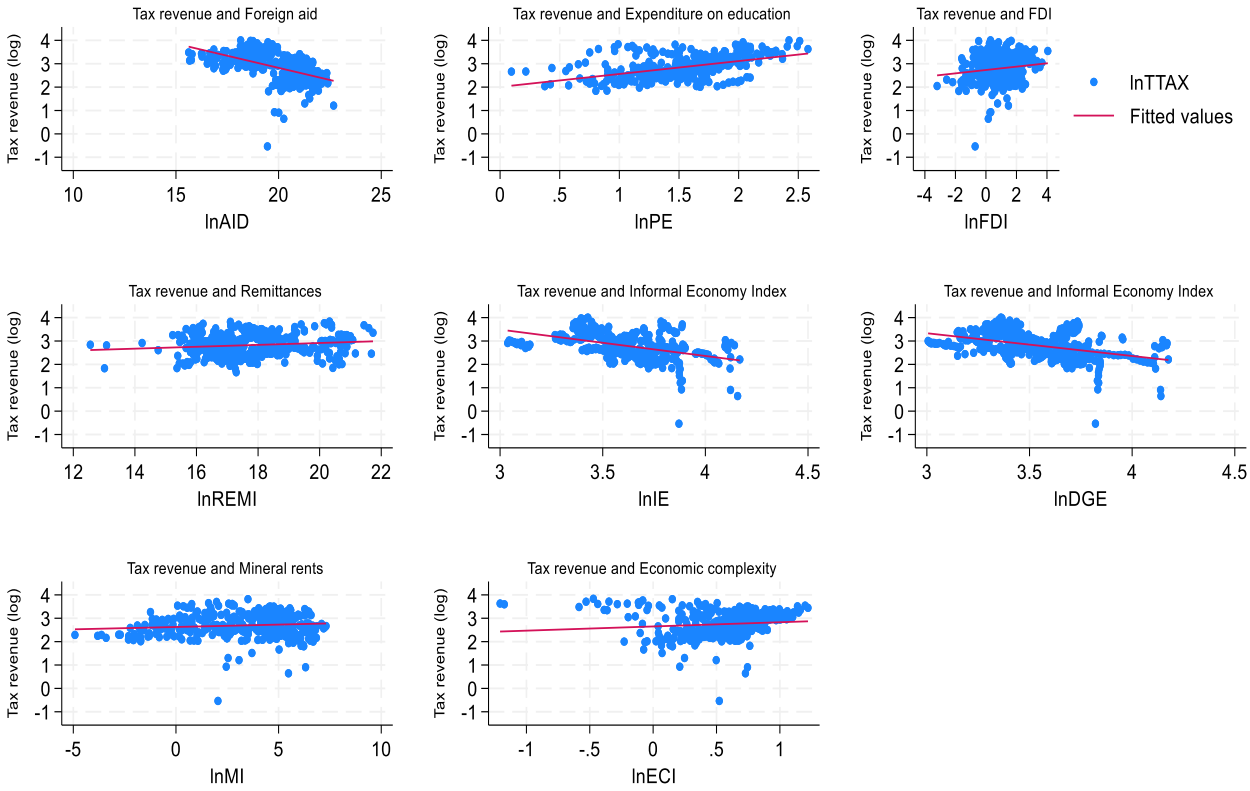
Figure 2.1. Tax revenues against other variables



Data Source:WDI (2023), Author's own compilation

Figure 2.2 shows a positive correlation between FDI, education expenditure, remittances, mineral rent, and tax revenue. Conversely, the informal economic indices (lnMIMIC and lnDGE) and foreign aid exhibit a negative relationship with tax revenue as a percentage of GDP.

Figure 2.2. Tax revenues against other variables



Data Source:WDI (2023), Author's own compilation

Table 2.5 presents a correlation of all covariates (in logs). The informal economy index (lnMIMIC) is negatively correlated with total tax. All variables are correlated with total tax at a 10% level of significance, with trade openness, agriculture, per capita GDP, its square, and external donor assistance having a correlation value above 0.50, while per capita GDP and its square, manufacturing, donor assistance, and ECI are positively correlated with total tax. Both informality proxies (MIMIC and DGE), inflation, and population exhibit a negative correlation with tax revenue as a percentage of GDP. In terms of severity, per capita GDP and its square are highly negatively correlated with agriculture output. Population is highly correlated with foreign donor assistance. Similarly, these two measures of informality are highly correlated with each other; however, the estimation is performed with each type of informality independently. For the other sets of severely correlated variables, a multicollinearity test was performed, and the results are discussed in the diagnostic section 2.12.9.

Table 2.5. Correlation results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) lnTTAX	1.000																		
(2) lnTOP	0.574*	1.000																	
(3) lnAGRI	-0.683*	-0.567*	1.000																
(4) lnINF	-0.222*	-0.121*	0.186*	1.000															
(5) lnPOP	-0.464*	-0.737*	0.558*	0.225*	1.000														
(6) lnVA	0.203*	0.297*	-0.406*	-0.170*	-0.386*	1.000													
(7) lnCOR	0.386*	0.365*	-0.463*	-0.316*	-0.633*	0.612*	1.000												
(8) lnGDPP	0.633*	0.510*	-0.819*	-0.265*	-0.510*	0.320*	0.495*	1.000											
(9) lnGDPP2	0.621*	0.519*	-0.824*	-0.262*	-0.530*	0.329*	0.506*	0.997*	1.000										
(10) lnMAN	0.140*	-0.010	-0.061	-0.094	0.030	-0.170*	-0.050	0.141*	0.129*	1.000									
(11) lnREMI	0.140*	-0.139*	-0.284*	-0.020	0.321*	0.025	-0.141*	0.205*	0.199*	-0.053	1.000								
(12) lnDEBT	-0.244*	0.095	0.175*	0.000	-0.061	0.108	-0.114	-0.257*	-0.257*	-0.223*	-0.106	1.000							
(13) lnAID	-0.538*	-0.669*	0.631*	0.133*	0.828*	-0.223*	-0.467*	-0.613*	-0.631*	-0.124*	0.144*	0.180*	1.000						
(14) lnPE	0.480*	0.256*	-0.254*	-0.207*	-0.268*	0.202*	0.368*	0.264*	0.248*	0.200*	-0.200*	-0.097	-0.242*	1.000					
(15) lnFDI	0.138*	0.397*	-0.065	-0.008	-0.245*	0.175*	0.185*	0.040	0.051	-0.271*	0.064	0.222*	-0.069	-0.062	1.000				
(16) lnIE	-0.461*	-0.282*	0.508*	0.215*	0.311*	-0.463*	-0.586*	-0.574*	-0.598*	-0.166*	-0.070	0.215*	0.388*	-0.377*	0.061	1.000			
(17) lnMI	0.100	0.305*	-0.307*	0.012	-0.076	0.076	0.054	0.260*	0.251*	-0.046	0.342*	-0.082	-0.007	-0.022	0.213*	0.209*	1.000		
(18) lnDGE	-0.428*	-0.234*	0.407*	0.169*	0.227*	-0.415*	-0.524*	-0.510*	-0.528*	-0.078	-0.093	0.181*	0.282*	-0.343*	0.004	0.926*	0.184*	1.000	
(19) lnECI	0.117	0.063	-0.301*	-0.321*	-0.347*	0.236*	0.544*	0.455*	0.454*	0.346*	-0.117	-0.069	-0.216*	0.334*	-0.209*	-0.354*	0.088	-0.289*	1.000

Notes: lnTOP is the trade openness (average of import and exports); lnAGRI is agricultural output as % of GDP; lnCPI is log of consumer price index (inflation); lnPOP is total population of people of age between age 15-64 (productive population); lnVA is the log of voice accountability; lnCOR is the log of corruption control; lnGDPP is per capita as % of GDP in logs; lnGDPP2 is log of square of per capita s% of GDP; lnMAN is log of manufacturing output as % of GDP; lnREMI is log of remittances inflows (total in US $); lnDEBT is log of total external debt as % of GDP; lnAID is log of total foreign donor assistance as % of GDP; lnPE is log of total public expenditure in education as % of GDP; lnFDI is log of total foreign direct investment as % of GDP; lnIE/lnDGE is log of Informal sector index (MIMIC/DGE); lnECI is log of Economic complexity index (ECI); lnMI is log of Mineral rents as % of GDP. **** p<0.01, ** p<0.05, * p<0.1:* Source*:* Lengaram (2023), Data source (WDI, 2023).

2.12.1 Results of multivariate analysis

The following section discusses the multivariate results obtained using the stochastic frontier method by first performing the analysis without the primary variables, namely economic complexity and informal economy, followed by the analysis, which included the informal economy index (MIMIC) only, followed by introducing ECI with informal economy (MIMIC and DGE). Lastly, the tax efforts estimates of all their analysis are discussed. The stochastic frontier regression results are partitioned into four models, with Model 1 including the corruption control and mineral rent as additional variables. Model 2 excludes the mineral rent variable, and Model 3 includes mineral rent and voice accountability. Model 4 excludes mineral rent and includes the voice accountability variable only. The results discussion is structured as follows for ease of interpretation: the analysis of primary variables of interest is discussed first, and afterwards, an aggregate discussion of other covariates is provided for all sets of results together.

2.12.2 Results without economic complexity and informal economy (baseline)

Table 2.6 presents the results without the informal economy and economic complexity indices (at the baseline), included in the estimation. All the coefficients have the anticipated signs. Trade openness, per capita GDP, net official assistance (aid), FDI, and remittances are positive and significant in explaining tax effort. The square of per capita GDP, agriculture as a percentage of GDP, and manufacturing are negative and statistically significant in explaining tax effort. A turning point analysis for per capita GDP produced a value of 7.78 with a z-value of 29.90 and a corresponding probability of 0.000. This suggests that total tax revenue has a non-linear relationship with per capita GDP. Thus, tax revenue increases with per capita GDP and peaks when per capita GDP is 7.78 percent and then declines. External debt stocks and public expenditure on education are negative and significant. Population, government expenditure on education, mineral rent, and inflation are insignificant in this instance. Whereas institutional variables (corruption control and voice accountability) are statistically insignificant in all four model specifications.

These results are consistent with those observed in extant studies of tax effort (c.f. Gupta, 2000; Langford and Ohlenburg, 2015; Mawejje and Sebudde, 2019; Piancastelli and Thirlwall, 2020; Chigome and Robinson, 2021). The next section provides a discussion of the regression results when the first variable of interest, the informal economy index (MIMIC), was included in the regression analysis.

Table 2.6. Results without informal economy and economic complexity index (baseline)

	Model 1	Model 2	Model 3	Model 4
Trade openness	0.197**	0.190***	0.202***	0.199***
	(2.88)	(3.75)	(3.41)	(4.02)
Agriculture	-0.120*	-0.144***	-0.114*	-0.146***
	(-2.07)	(-3.31)	(-2.19)	(-3.36)
Population	-0.0669	-0.0169	-0.0648	0.000792
	(-0.46)	(-0.37)	(-0.66)	(0.02)
Per capita GDP	-0.0401	2.975***	0.154	2.940***
	(-0.03)	(6.17)	(0.17)	(6.10)
Sq.per capita GDP	0.0374	-0.178***	0.0244	-0.177***
	(0.48)	(-5.39)	(0.39)	(-5.33)
Manufacturing	-0.0368	-0.115*	-0.0291	-0.117*
	(-0.40)	(-2.16)	(-0.42)	(-2.18)
Personal remittances	0.0157	0.0214*	0.0144	0.0221*
	(1.47)	(2.46)	(1.36)	(2.56)
External debt stocks	0.0145	-0.0216	0.0133	-0.0199
	(0.69)	(-1.12)	(0.64)	(-1.02)
Net official development assistance	0.0577*	0.0738***	0.0658*	0.0720***
	(2.12)	(3.99)	(2.52)	(3.82)
Government expenditure on education	-0.0665	-0.0524	-0.0682	-0.0543
	(-1.43)	(-1.43)	(-1.57)	(-1.47)
Foreign direct investment	0.0725***	0.0493***	0.0708***	0.0485***
	(4.98)	(4.49)	(5.31)	(4.46)
Mineral rent	0.00226		0.00245	
	(0.29)		(0.35)	
Inflation	-0.000929	0.00747	-0.00200	0.00725
	(-0.09)	(0.80)	(-0.19)	(0.78)
Corruption	0.0433	-0.0893		
	(0.33)	(-0.91)		
Voice accountability			0.0322	0.0438
			(0.47)	(0.71)
Constant	0.854	-10.27***	-0.0808	-10.26***
	(0.27)	(-5.80)	(-0.03)	(-5.78)
Sigma	0.531	-2.433***	0.330	-2.358***
Gamma	4.935***	1.909***	4.756***	2.001***
Mu	-2.791	0.700***	-2.119	0.711***
Observations	197	249	197	249

Notes: Model 1 includes corruption control and mineral rent in the analysis, Model 2 excludes mineral rent, but includes corruption control, Model 3 includes voice accountability and mineral rent, and Model 4 excludes mineral rent, but includes voice accountability. Source: Author self-computed. t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2.12.3 Results with informal economy (MIMIC)

The results of tax frontier estimation, which include the informal economy index (MIMIC), are shown in Table 2.7. All the coefficients have the anticipated signs across all four models; a substantial number of variables are statistically significant. As stated above, only the primary variable of interest is discussed at length, and an aggregate discussion of other covariates is provided in section 2.12.6 The findings indicate a negative correlation between the informal economy variable (MIMIC) and tax effort. Specifically, a one percent increase in the informal economy is associated with a reduction in tax revenue by 0.70, 1.40, 0.78, and 1.06 percent across the four estimated models, respectively. Since both the dependent and independent variables are in logs, we can interpret the results in terms of elasticities. Inclusion of mineral rent and corruption controls in the analysis (Models 1 and 3) makes the informal elasticity of tax effort inelastic. However, when voice accountability is included instead (Models 2 and 4), the coefficients become elastic, with the largest elasticity observed under the corruption control specification (Model 2). This suggests that the informality effect on tax effort is higher in countries with higher voice accountability, compared to those without.

These findings also align with the conclusions of Berdiev and Saunoris (2019), who assert that an underdeveloped financial sector is positively correlated with the expansion of the informal economy. This relationship implies that in economies with a larger informal economy and limited financial technological adoption, tax collection becomes more challenging, thereby discouraging tax mobilisation efforts. Furthermore, empirical evidence from Beck et al. (2014) and Alm et al. (2018) suggests that financial constraints often reflect the level of informality within an economy. The result is re-estimated using DGE as a proxy for the shadow economy instead. The results presented in Table A.2.2 in *Annexure* A.1 show that the DGE proxy informality poorly for the selected sample. The variable maintains the negative signs, but it is only statistically significant for one model (Model 3), which includes mineral rent and voice accountability.

These results highlight the adverse effect informality has on tax revenue mobilisation, grounded in the type of informality (MIMIC). The analysis brings to light the understanding that the incorporation of the shadow economy in the tax literature provides useful insights, in that the prevalent growth of informality is likely to compromise tax mobilisation efforts. Thus, this result corroborates the current study's initial conjecture that informality is deleterious to tax effort. The next section introduces the economic complexity in the analysis of tax effort.

Table 2.7. Tax revenue stochastic frontier regression results with MIMIC included

	Model 1	Model 2	Model 3	Model 4
Trade openness	0.232***	0.210***	0.227***	0.345***
	(4.36)	(3.94)	(4.06)	(6.20)
Agriculture	-0.0989*	-0.0911*	-0.0917*	0.0135
	(-1.83)	(-1.84)	(-1.62)	(0.32)
Population	-0.0772	-0.236**	-0.0942	-0.0608
	(-1.47)	(-3.22)	(-1.89)	(-1.94)
Per capita GDP	2.948***	3.964***	3.048***	3.933***
	(6.11)	(6.68)	(6.33)	(5.72)
Sq. per capita GDP	-0.191***	-0.270***	-0.197***	-0.250***
	(-5.89)	(-6.61)	(-6.05)	(-5.54)
Manufacturing	-0.0555	-0.0589	-0.0439	0.125**
	(-1.08)	(-0.95)	(-0.79)	(2.78)
Personal remittances	0.0200*	0.0171	0.0180	-0.00259
	(2.11)	(1.78)	(1.83)	(-0.26)
External debt stocks	-0.0282	0.0214	-0.0301	0.00273
	(-1.46)	(1.12)	(-1.57)	(0.15)
Net official development assistance	0.0605**	0.110***	0.0600**	0.0625**
	(3.06)	(4.89)	(2.99)	(2.83)
Government expenditure on education	-0.0108	-0.0446	-0.00285	-0.000281
	(-0.29)	(-1.25)	(-0.07)	(-0.01)
Foreign direct investment	0.0389***	0.0372***	0.0386**	0.0204
	(3.35)	(3.32)	(3.25)	(1.64)
Informal economy index (MIMIC)	-0.699*	-1.377***	-0.782**	-1.057***
	(-2.48)	(-4.50)	(-2.76)	(-7.44)
Inflation	0.0111	-0.00256	0.0104	-0.00496
	(1.15)	(-0.29)	(1.08)	(-0.52)
Voice and Accountability	0.0520	0.0947		
	(0.81)	(1.61)		
Mineral rents		0.0131*		-0.00136
		(2.11)		(-0.20)
Control of Corruption			-0.165	-0.278**
			(-1.57)	(-3.24)
Constant	-5.824*	-4.520	-5.914**	-10.33***
	(-2.42)	(-1.66)	(-2.64)	(-4.03)
Inefficiency				
Sigma	-2.406***	-2.187***	-2.543***	-0.162
	(-6.44)	(-5.56)	(-7.12)	(-0.03)
Gamma	2.047***	2.670***	1.884***	4.578
	(4.58)	(5.93)	(4.35)	(0.92)
mu	0.647***	0.953***	0.579***	-3.045
	(4.22)	(5.08)	(3.44)	(-0.17)
eta	0.0103*	0.00736**	0.0112*	0.0250***
	(2.45)	(2.61)	(2.29)	(3.82)
Observations	225	182	225	182

Notes: Model 1 includes corruption control and mineral rent in the analysis, Model 2 excludes mineral rent, but includes corruption control, Model 3 includes voice accountability and mineral rent, and Model 4 excludes mineral rent, but includes voice accountability. t-statistics in parentheses. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$: Source (WDI, 2023): Author's own computation.

2.12.4 Results with economic complexity (ECI) and informal economy (MIMIC)

Table 2.8 presents the results with the informal economy index (MIMIC) and ECI included. Both variables' coefficients have the anticipated signs (negative and positive). The informal economy is negative and statistically different from zero in explaining tax effort. The informal economy coefficient is above one when mineral rent is included in the models (columns 1 and 3) and below one otherwise. Inclusion of ECI in the model increases the size effect of MIMIC by 60% in Model 1 (from -0.699 to -1.119) and 74% in Model 3 (from -0.782 to -1.367), while it decreases the size effect of MIMIC by 33% in Model 2 (from -1.377 to -0.916), and 41% in Model 4 (from -1.057 to -0.625). Thus, the size effect of informality is magnified under two specifications with the inclusion of ECI and dampened in the other two specifications. Possible explanations for the increase in size of the informality coefficient can be due to omitted variable bias and the addition of mineral rent, correcting this bias and revealing the true strength of the association between the informal economy and tax effort. As stated earlier, the results suggest that elevated levels of informality are inimical to higher tax efforts. The observed variation suggests that omitting the informal economy and economic complexity in the tax effort analysis could have biased the estimate downward in previous literature.

The ECI (lnECI) coefficient is only positive and significant at a 5% level for one model (Model 1), with a value of 0.18. This indicates that a one percent rise in economic complexity leads to a 0.18 percent increase in tax effort, holding everything else constant. This suggests that economic complexity is tax revenue-enhancing under certain specifications. Thus, structurally sophisticated countries have a competitive advantage in terms of revenue collections over those that are not. However, this finding is not robust since the variable is only significant in a single model.

The following subsection discusses the introduction of the second informal economy index (DGE) variable, together with ECI, in the analysis.

Table 2.8. Regression results with ECI and MIMIC variables (all variables are in log)

	Model 1	Model 2	Model 3	Model 4
Trade openness	0.249***	0.212***	0.189***	0.239***
	(4.73)	(3.90)	(3.59)	(4.50)
Agriculture	-0.0875	-0.122*	-0.134**	-0.129*
	(-1.83)	(-2.36)	(-2.79)	(-2.48)
Population	-0.105*	-0.0224	-0.190**	-0.00554
	(-2.25)	(-0.59)	(-2.76)	(-0.16)
Per capita GDP	4.035***	2.859***	4.202***	2.953***
	(6.48)	(5.76)	(6.81)	(5.93)
Sq. Per capita GDP	-0.251***	-0.174***	-0.277***	-0.177***
	(-5.77)	(-5.03)	(-6.46)	(-5.11)
Manufacturing	-0.00870	-0.0432	-0.0998	-0.0511
	(-0.15)	(-0.89)	(-1.69)	(-1.06)
Personal remittances	0.0156	0.0221*	0.0226*	0.0237**
	(1.62)	(2.41)	(2.38)	(2.59)
External debt stock	-0.00995	-0.0308	0.0256	-0.0294
	(-0.50)	(-1.50)	(1.21)	(-1.44)
Net official development assistance	0.121***	0.0652***	0.133***	0.0639**
	(5.41)	(3.34)	(5.87)	(3.21)
Government expenditure on education	-0.0629	-0.0218	-0.0679	-0.0388
	(-1.67)	(-0.58)	(-1.85)	(-1.05)
Foreign direct investment	0.0319**	0.0403***	0.0388***	0.0405***
	(2.67)	(3.45)	(3.43)	(3.45)
Informal economy index (MIMIC)	-1.119***	-0.916***	-1.367***	-0.625**
	(-4.71)	(-3.96)	(-4.16)	(-3.17)
Mineral rents	0.00853		0.0164**	
	(1.29)		(2.64)	
Economic complexity index	0.177*	-0.0321	0.122	0.0235
	(2.22)	(-0.45)	(1.63)	(0.33)
Inflation	-0.00301	0.00715	-0.00521	0.00669
	(-0.31)	(0.68)	(-0.56)	(0.63)
Corruption	-0.0538	-0.236		
	(-0.43)	(-1.92)		
Voice Accountability			0.121*	0.0845
			(1.98)	(1.23)
Constant	-11.05***	-6.654**	-7.513**	-8.474***
	(-4.41)	(-3.13)	(-2.58)	(-4.30)
Sigma	-0.355	-0.0878	-2.048***	0.530
Gamma	4.382***	4.370***	2.755***	4.997***
Mu	-0.947	-1.482	0.917***	-2.968
Observations	174	206	174	206

Notes: Model 1 includes corruption control and mineral rent in the analysis, Model 2 excludes mineral rent, but includes corruption control, Model 3 includes voice accountability and mineral rent, and Model 4 excludes mineral rent, but includes voice accountability. t statistics in parentheses. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; Source (WDI, 2023): Author's own computation.

2.12.5 Results with economic complexity (ECI) and informal economy (DGE)

Table 2.9 presents the result with another proxy of informal economy index (DGE) together with ECI. Again, all the coefficients have the anticipated signs. However, the informal economy (DGE) is negative and statistically insignificant in explaining tax effort. The coefficient of informal economy is below unity for all four models.

The ECI variable is positive and significant for Model 3 only, with a value of 0.24 percent. The size effect of ECI increases slightly when estimated with the voice accountability governance variable compared to when it is estimated under corruption control. This means that economic sophistication (ECI) has a positive effect on explaining tax mobilisation under certain institutional settings. Thus, the more complex an economy, the better it is in its tax mobilisation efforts, as suggested in the previous section. Countries that invest in higher knowledge density products are more likely to garner more tax revenues from such efforts. However, the single model significance of economic complexity renders the results not robust across all model specifications.

As mentioned earlier, the DGE index proxies poorly for the effect of informality on tax effort for the selected sample compared to the MIMIC index. This could be due to the previously mentioned limitation of DGE as a proxy of informality, in that it is derived from variables such as investments, productivity, and employment, which are volatile (Schneider and Buehn, 2018).

Table 2.9. Regression results with ECI with DGE variables included

	Model 1	Model 2	Model 3	Model 4
Trade openness	0.214***	0.174**	0.267***	0.235***
	(3.73)	(2.94)	(4.87)	(4.19)
Agriculture	-0.147**	-0.164**	-0.102	-0.139*
	(-2.84)	(-2.97)	(-1.88)	(-2.49)
Population	-0.123	-0.0669	-0.0962	-0.0176
	(-1.83)	(-1.14)	(-1.46)	(-0.40)
Per capita GDP	3.573***	2.952***	3.231**	2.670***
	(4.74)	(5.30)	(2.91)	(5.05)
Sq. Per capita GDP	-0.222***	-0.181***	-0.193**	-0.158***
	(-4.43)	(-4.84)	(-2.73)	(-4.40)
Manufacturing	-0.0639	-0.0745	0.0426	-0.0229
	(-0.96)	(-1.18)	(0.59)	(-0.50)
Personal remittance	0.0204*	0.0234*	0.0142	0.0209*
	(2.01)	(2.39)	(1.41)	(2.20)
External debt stocks	-0.00833	-0.0371	-0.0421	-0.0525*
	(-0.32)	(-1.45)	(-1.05)	(-2.03)
Net official development assistance	0.139***	0.0803***	0.110***	0.0666**
	(5.75)	(3.82)	(4.30)	(3.20)
Government expenditure on education	-0.0880*	-0.0431	-0.0745	-0.0487
	(-2.16)	(-1.04)	(-1.49)	(-1.25)
Foreign direct investment	0.0462***	0.0461***	0.0445***	0.0441***
	(3.85)	(3.87)	(3.75)	(3.73)
Informal economy (DGE)	-0.210	-0.207	-0.395	-0.297
	(-0.87)	(-1.05)	(-0.84)	(-1.47)
Mineral rent	0.00407		0.00232	
	(0.62)		(0.32)	
Economic complexity index (ECI)	0.141	-0.0201	0.236**	0.0782
	(1.70)	(-0.26)	(2.66)	(1.01)
Inflation	-0.00392	0.00516	-0.00517	0.00445
	(-0.35)	(0.43)	(-0.46)	(0.37)
Corruption control	0.0382	-0.153		
	(0.31)	(-1.34)		
Voice accountability			0.0902	0.0897
			(1.35)	(1.30)
Constant	-11.61**	-8.476**	-11.07	-8.673**
	(-3.05)	(-3.18)	(-1.71)	(-3.25)
Sigma	-2.343***	-2.522***	0.163	-0.947***
Gamma	2.264***	1.751***	4.800***	3.455
Mu	0.824**	0.686**	-2.366	-0.181
Observations	173	203	173	203

Notes: Model 1 includes corruption control and mineral rent in the analysis, Model 2 excludes mineral rent, but includes corruption control, Model 3 includes voice accountability and mineral rent, and Model 4 excludes mineral rent, but includes voice accountability. Source (WDI, 2023): Author's own computation. *t* statistics in parentheses, Source: author self-computed, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2.12.6 Result discussion for the rest of the control variables for all sets of results

The following section discusses all other covariates included in Tables 2.6–2.9. The discussion tracks the signs, magnitude, and levels of significance of these covariates, starting with initial regression results

without the informal sector, then with the introduction of informality and economic complexity in the analysis. Only the results of the variables that are statistically significant are discussed.

The findings indicate that countries closer to their tax frontier generally have higher income levels. The per capita GDP variable, representing economic development and a broader tax base, shows a positive and statistically significant correlation with tax effort. This finding supports the hypothesis that tax effort increases with economic development, consistent with the conclusions of Lengaram (2023), Castro and Camarillo (2014) and Bird (1976). For each one percent increase in per capita GDP, tax revenue increases by 2.95, 3.96, 3.05 and 3.93 percent for the four models, respectively. The size of economic development plays an important role in aiding the government's ability to generate sufficient revenue to fund public expenditures, since higher per capita GDP is correlated with urbanisation and the decline of agricultural sector (Steenekamp, 2007; Besley and Persson, 2013). The variable maintains the sign and level of significant with a marginal increase in the size of the coefficient (see the value of variable in Tables 2.6, 2.7, 2.8, and 2.9). Generally, the size effect for per capita GDP ranges between 3% to 4% approximately. This implies that as a country develops, a greater proportion of economic activities transition into the formal sector, thereby expanding the potential tax base. This finding aligns with a broad body of empirical literature on the determinants of tax revenue performance, including studies by Chigome and Robinson (2021), Terefe and Teera (2018), Coulibaly and Gandhi (2018), and Lotz and Morss (1967).

When controlling for the nonlinear relationship between per capita GDP and tax effort by including the *squared term of per capita GDP*, the coefficient is negative, confirming the existence of a nonlinear correlation. This suggests that the effect of per capita income on tax effort exhibits an inflection point, indicating that beyond a certain threshold, further increases in per capita GDP no longer enhance tax mobilisation. Specifically, a one percent increase in the square of per capita GDP is associated with a decrease in tax revenue by 0.19, 0.27, 0.20, and 0.25 percent in the four models, respectively. The negative sign and statistical significance remain consistent across all the estimates, with the coefficient size marginally increasing when primary variables are introduced. The size effect ranges from -0.16 to -0.28 percent. These results align with the findings of Fenochietto and Pessino (2013), Langford and Ohlenburg (2016), Mawejje and Sebudde (2019), and Caldeira et al. (2020), who also identified a similar nonlinear impact of per capita GDP on tax mobilisation.

Regarding structural variables and the composition of GDP, the findings indicate that countries with a larger share of *agriculture* as part of its GDP tends to exhibit lower tax potential. The *agriculture indicator* has a negative sign and is significant across all set of results for some models. Introducing informal economy (MIMIC) collapse the size of the coefficient across all models, but subsequent addition of economic complexity returns the coefficient size within the initial value. The average size effect across all sets of

results ranges from 0.0989 percent (observed in Table 2.7) to 0.164 percent (observed in Table 2.9, Model 2). In many countries, a dominant agricultural sector is associated with high informality, low-income levels, and low productivity, creating challenges for effective taxation (Gupta, 2007; Mawejje and Munyambonera, 2016; Caldeira et al., 2020). The negative relationship between agricultural output and tax effort can be attributed to inadequate tax collection infrastructure and agricultural subsidies. Additionally, countries operating well below their tax frontier tend to have a high proportion of agriculture in their GDP (see Chelliah et al., 1975; Mkandawire, 2010; Atsan, 2017; Terefe and Teera, 2018). This suggests that nations with a dominant agricultural sector often face challenges in generating sufficient tax revenue. Edward and Tabellini (1991) argue that tax evasion is more pronounced in countries with a larger agricultural sector compared to those with a strong manufacturing base. The difficulty of taxing the agricultural sector is evident across all the estimates models, although its negative impact is statistically significant in only three models.

The findings indicate that *public expenditure on education* is negatively linked to tax effort in only one instance (Table 2.9, Model 1), although the coefficient for public education spending remains negative and statistically insignificant across all models. These results contrast with previous studies that suggest that investment in human capital boosts productivity, widens the tax base, and increases tax effort (Fenochietto and Pessino, 2013; Langford and Ohlenburg, 2015, 2016; Mawejje and Sebudde, 2019). Furthermore, it is generally expected that higher education levels would enhance citizens' understanding of the importance of taxation, leading to improved compliance. This finding may suggest a weak social contract between the government and the public, where higher social development expenditure does not necessarily lead to improved tax compliance, as suggested by Ali et al. (2014).

In terms of the *trade openness* variable, which reflects the degree of a country's economic integration, the coefficient is positive and statistically significant across all model specifications. The average size effect varies from 0.2 percent (see Table 2.6, Model 1) to 0.27 percent (Table 2.9, Model 3). Adding the informal economy and economic complexity magnifies the size effect of trade openness on tax effort estimation. The findings show that countries with a higher degree of trade openness relative to GDP tend to exhibit greater tax effort. As a country develops, its engagement in international trade increases, enhancing its capacity to generate higher tax revenues compared to other countries with lower trade openness (Stotsky and WoldeMariam, 1997; Gupta, 2007; Addison and Jorgen, 2012; Le et al., 2012; Coulibaly and Gandhi, 2018; Terefe and Teera, 2018; Caldeira et al., 2020). The results are also consistent with recent studies (c.f. Mawejje and Sebudde, 2019; Chigome and Robinson, 2021).

The findings indicate that the *manufacturing* sector contributes positively to enhancing tax potential, but this relationship is statistically significant in only one model (Table 2.6, Model 4). Specifically, a one

percent increase in manufacturing corresponds to a 0.13 percent rise in tax revenue. Similar findings have been reported by Simbachawane (2018) in the context of Tanzania's tax revenue determinants and Ahmed and Muhammad's (2010) work on tax buoyancy in developing economies. The contribution of manufacturing to GDP highlights the broader significance of sectoral composition for tax performance, as it reflects key structural factors influencing tax collection. This suggests that more concentrated, complex, and organised business activities enhance tax collection efficiency, consistent with the findings of Langford and Ohlenburg (2015). In the other three models, manufacturing exhibits a negative relationship with tax effort, though the results are insignificant. This may be attributed to tax evasion, tax incentives, and the high costs of tax collection, which are common challenges in underdeveloped economies (Edward and Tabellini, 1991; Feger, 2014). Additionally, many emerging economies offer tax exemptions to foreign investors initially to attract capital inflows, a practice that negatively impacts tax revenue collection (Simbachawene, 2018).

The *net official development assistance* coefficient is positively associated with efficient tax collection across all sets of results and models. The increase in official development assistance increases the tax revenue, holding all else constant. The average size effect across the set of results ranges from 0.06 percent (Table 2.6, Model 1) to 0.139 percent (Table 2.9, Model 1). This suggests that official donor aid boosts consumption and productivity, ultimately leading to higher government tax revenues. These findings align with previous studies indicating that increased donor assistance fosters development, thereby expanding the country's tax base. Similarly, Ayenew (2016) reports comparable results in a time-series analysis of tax mobilisation in Ethiopia. However, existing literature, including studies by Clements et al. (2003) and Benedek et al. (2014), argues that economies heavily dependent on foreign aid often face different tax collection incentives compared to those with minimal or no aid. In some cases, a nation receiving substantial aid may have little motivation to enhance its tax collection efforts. Boukbech et al. (2018), Terefe and Teera (2018), and Chigome and Robinson (2021) argue that foreign aid can hinder tax collection efforts, potentially reducing tax revenue mobilisation. Over-reliance on aid as a revenue source may have adverse effects, including Dutch disease and aid conditionality, as highlighted by Mosley et al. (1987), which could weaken state accountability and strain state public relations. Morrissey (2015) discusses the ongoing debate regarding the relationship between grants and tax revenues, with some studies suggesting that grants displace tax collection efforts (Benedek et al., 2014). However, more recent literature challenges this assertion, providing evidence that grants can positively impact tax collection by supporting efficiency-enhancing reforms that strengthen revenue mobilisation (Clist and Morrissey, 2011; Clist, 2016; Mascagni, 2016).

Concerning *FDI* flows into the country, the results show that FDI is associated with higher tax revenues across all set of results with a varying size effect. The coefficient size ranges from approximately 0.073 percent (Table 2.6, Model 1) to 0.032 percent (Table 2.8, Model 1). An increase in financial flows can enhance economic productivity by stimulating investments. This outcome is supported by the findings of Ndiaye and Korsu (2014) and Langford and Ohlenburg (2015), who emphasise financial deepening as a key driver of tax revenue mobilisation. A well-developed financial market promotes the flow of credit into productive activities, thereby increasing both business and individual incomes and ultimately widening the tax base. In this regard, Ndiaye and Korsu (2014) suggest that greater financialisation simplifies and improves tax collection. Additionally, Ade et al. (2018) report that FDI positively influenced tax revenue in SADC countries from 1990 to 2010, aligning with the current study's results. These findings also support Wood's (2008) argument, which proposes linking international aid to tax effort as a strategy to increase tax revenues. He suggests that for every dollar raised in taxes, donors should collectively contribute an additional fifty cents in aid, up to a maximum of 50 percent of the aid-to-tax ratio. This approach would provide a strong incentive for economies with a low aid-to-tax ratio to improve their tax mobilisation efforts.

Regarding the governance quality variables, the findings indicate that *corruption control* is negatively related to tax revenue performance in one model (Table 2.7, Model 4). Specifically, a one percent increase in corruption control corresponds to a 0.28 percent decline in tax revenue. This finding aligns with the existing literature, which highlights the significance of institutional quality, particularly corruption control and voice accountability, as key determinants of tax effort. Studies by Langford and Ohlenburg (2015), Baum et al. (2017), and Bird et al. (2008) report a negative relationship between bribery, corruption, and tax revenue performance. Similarly, Tanzi and Hamid (1997) and Ayenew (2016) underscore the crucial role of institutional quality in facilitating tax collection, a conclusion consistent with the present study's findings, particularly regarding corruption control and voice accountability. Furthermore, Cukierman et al. (1989) and Langford and Ohlenburg (2015) emphasise the influence of political systems on tax mobilisation problems across different economies. In the case of voice accountability, it is positive but insignificant across all model specifications.

In terms of the *population* variable, the findings show that population is negatively correlated with the tax frontier. Nevertheless, the coefficient is only significant for a few sets of results (Table 2.7, Model 2; Table 2.8, Models 1 and 3). The size effect decreased after the introduction of both economic and informality indices. These results suggest that higher levels of population growth are associated with lower levels of tax revenues. Aizenman and Jinjarak (2009) and Bahl (2003) argue that a growing population may contribute to the negative correlation between population density and the efficiency of tax collection. The

current study's results are consistent with those of Ndiaye and Korsu (2014) and Chigome and Robinson (2021) who report a negative coefficient for population measured as the fraction of urban population to the total population.

Considering the impact of *personal remittances* on the tax frontier, the coefficients have a positive sign and are statistically significant for a few sets of results (see Tables 2.6, 2.7, 2.8, and 2.9). The results suggest that an increase in personal remittances flows is associated with an increase in tax revenues, holding all else constant. The implication of these results is that countries can leverage remittance inflows to enhance domestic tax revenues by implementing policies that incentivise increased remittances. Pasara and Zuze (2021) find that remittance inflows have a significant impact on income tax revenues in Zimbabwe. They argue that higher remittance inflows can contribute to increased tax revenues through both income and consumption taxes. Likewise, Ebeke (2011) demonstrates that remittances are pivotal in improving the level of stability of government tax revenue in recipient countries with a value added tax system.

The results further indicate that *external debt* is negatively correlated with tax revenue in one model (Table 2.9, Model 4), with statistical significance at the one percent level. This finding aligns with the conclusion of Gupta et al. (2022), who argue that central government debt negatively impacts tax buoyancy, although it was insignificant in their study. However, the results of the current study's analysis are not robust, as the variable is only significant in one of the specified models.

For the *mineral rent* variable, the coefficient is positive and statistically significant when the informal economy and economic complexity are introduced into the analysis (Tables 2.7 and 2.8, Models 2 and 3), with voice accountability serving as the institutional proxy. However, when corruption control is used as the institutional proxy, the variable becomes insignificant. The size effect increased from 0.0131 percent (Table 2.7, Model 2) to 0.0164 percent (Table 2.8, Model 3). This suggests that countries with higher levels of mineral endowments garner higher levels of tax revenues, holding all else constant. Chelliah et al. (1975), Tait et al. (1979), and Tanzi (1992) found similar results in their studies. However, mineral rent as a source of tax revenue is vulnerable to price volatility, and the Dutch disease aspect of it reduces incentives to invest in other skills and education (Bornhorst et al., 2009; Caldeira et al., 2020). Countries dependent on mineral rent for revenue face rent-seeking challenges, such as corruption, where political elites or foreign investors capture most of the revenue from mineral resources. As a result, mineral rents are unlikely to make a significant contribution to the country's tax base (Langford and Ohlenburg, 2015).

2.12.7 Sensitivity tests for all results reported above

The diagnostic tests for model inefficiency shows that mu (μ) is statistically significant, confirming the assumption that the truncated normal distribution for inefficiency is suitable for Models 1, 2, and 3 (see

Table 2.7). The same is true for the baseline results (Table 2.6) for Models 1 and 2, the MIMIC and ECI (Table 2.8) results are significant for Model 3 only, and the ECI and DGE (Table 2.9) mu coefficient is statistically significant for Models 1 and 2, respectively.

The sigma coefficient, which represents the average total variation over time in the model, is statistically significant. This indicates adequate variation in tax effort performance across the sample period for the three models (columns 1, 2, and 3, Table 2.7). This is also true for the baseline set of results for Models 3 and 4 (Table 2.6), Model 3 for the ECI and MIMIC set of results (Table 2.8), and Models 1, 2, and 4 for the ECI and DGE set of results (Table 2.9).

The gamma coefficient is larger and statistically significantly different from zero for all four models under the baseline set of results (Table 2.6). This suggests that a set of input variables in the model accounts for a substantial portion of the overall variance in tax revenue performance. The coefficient is also statistically significant under Models 1, 2, and 3 for the MIMIC set of results (Table 2.7), all models under the MIMIC and ECI set of results (Table 2.8), and Models 1, 2, and 3 for the ECI and DGE set of results. Lastly, the eta coefficient reported in Table 2.6 is positive and significant, indicating that the inefficiencies in tax mobilisation are persistent.

2.12.8 Tax effort indices discussion for all sets of results

Table 2.10 depicts the tax effort index, tax revenue, tax potential, and per capita GDP estimates for the 25 countries sampled. The tax effort index is calculated by dividing the actual tax-to-GDP ratio by the estimated tax-to-GDP ratio from the stochastic frontier results. Tax efforts for all sets of results discussed above are presented in each column with their tax potential.

Column 1 of Table 2.10 presents the tax effort index estimates obtained by first estimating the results without the ECI and informal economy variables (baseline set of results). All countries have a tax effort below one, with South Africa having the smallest value (0.46), followed by Zambia (0.47), Kenya (0.50), Egypt (0.51), Tanzania (0.52), Mauritius (0.54), Cape Verde (0.62), and Ghana (0.63). Other countries have a tax effort above 0.70, with the maximum value (0.99) for Algeria, Angola, Cape Verde, Lesotho, Malawi, Mauritius, Namibia, Rwanda, and Seychelles. At a baseline, these countries are operating below their tax potential and have room to increase their tax revenue by broadening their tax base. It is hoped that the inclusion of the informal economy and economic complexity could provide useful insights in this regard. These results differ in magnitude from those estimated with the informal economy index (MIMIC) as a driver of tax effort, as presented in Table 2.10. Some countries have a tax effort which is marginally (small) larger when the results are estimated without the informality index in the model.

Column 3 presents the tax effort index for the informal economy index (MIMIC) set of results. South Africa has the highest average tax potential in the sample (55.02 percent) compared to an average tax revenue of 22.74 percent. In contrast, the DRC has the lowest average tax potential of 8.56 percent of GDP, with an average tax revenue of 6.86 percent. These findings highlight the significant disparities between tax potential and actual tax revenues across countries. Despite considerable heterogeneity in countries' level outcomes, the findings indicate that nations operating closer to their tax frontier tend to have higher income levels, such as Algeria, Angola, Cabo Verde, Mauritius, Seychelles, and Namibia. However, while Lesotho and Malawi are also near their tax frontier, their income levels remain relatively low. Lower-income countries are generally correlated with lower tax revenues (Bornhorst et al., 2009; Benedek et al., 2014; Mawejje and Sebudde, 2019; Chigome and Robinson, 2021).

Total tax revenue as a percentage of GDP is highest in Lesotho (42.9%), Algeria (33.5%), and Angola (31.3%), among others, while the lowest is observed in the DRC (6.9%) and Madagascar (8.9%). The tax effort index is highest in Angola, Cabo Verde, Lesotho, Mauritius, Namibia, and Malawi, all at 0.98, whereas South Africa (0.41), Tunisia (0.48), Zambia (0.44), and Kenya (0.38) exhibit the lowest tax effort. No country exceeds a tax effort of one, indicating that all are operating below their potential. A tax effort above one would signify tax collection surpassing targets, while values below one suggests room for improving tax collection. These findings align with previous studies by Gupta (2000), Mawejje and Sebudde (2019), and Piancastelli et al. (2020), but contrast with Leuthold (1991) regarding Senegal's tax effort. The heterogeneity in tax effort across countries is influenced not only by economic, demographic, and institutional factors but also by country-specific policy decisions. For example, South Africa, with a high income and strong institutions, has a relatively low tax effort of 0.41, while Malawi, with a low per capita GDP of $388, operates closer to its tax frontier at 0.98. This disparity in tax performance could be attributed to the heterogeneity of tax structures across countries. Moreover, countries that have a tax effort closer to unity might have exhausted room for tax base expansion given the prevailing conditions both economically and structurally of the economy in terms of levels of informality.

For the 25 countries in the study, the average total tax revenue to GDP is 18.932 percent over the period of the study, and their average estimated tax effort is 0.74. This suggests that these countries could raise 25.58 percent of GDP in their tax revenues if they fully utilised their potential. Overall, tax effort and capacity play a significant role in explaining the difference in tax revenue trends across African economies, particularly when the shadow economy is factored into the estimated models.

Although many countries have maintained a tax effort below one over an extended period, it is not definitive that this constraint arises solely from inadequate tax collection. Other factors such as business cycle might also lead to under capacity, rather than just ineffective collection mechanisms. From the current study's

results, we observe that tax effort has consistently lagged capacity during the sampled period; however, further analysis is required to pinpoint the causes of annual country averages or form an expansion of tax base in a given year. Consequently, the tax effort and tax capacity indices are only comparable over time if a change between periods accurately reflects a shift in a country's tax capacity or effort relative to the national average.

In summary, these results support previous studies by revealing a significant correlation between tax revenue as a percentage of GDP and the levels of economic complexity and informality. These findings emphasise the importance for these economies to persist with tax reform initiatives that enhance the adaptability of their tax system to changes in income levels. Furthermore, the sampled countries stand to gain considerably by formalising a larger share of their economies, which is easily taxable. In terms of policy implications, policymakers should balance efforts to boost tax revenue with measures aimed at improving the quality of tax expenditures.

Column 5 (Table 2.10) presents the tax effort estimates obtained from the above estimated results for ECI and MIMIC (tax effort index). All countries have a tax effort below one, with Kenya having the smallest value (0.57) followed by Egypt (0.63), South Africa (0.63), and Ghana (0.69), while all other countries have the tax effort above (0.70), with the maximum value is (0.99) for Algeria, Angola, Cape Verde, Lesotho, Malawi, Mauritius, Namibia, Rwanda, and Seychelles. All sampled countries are operating below their tax potential and have a potential of 21.86 percent tax mobilisation capacity, which is unexploited. Looking at recent available tax capacities for SADC countries (c.f. Chigome and Robinson, 2021), the current study's results suggest that tax capacity estimated controlling for both informality and economic complexity is higher than that estimated without. However, the important caveat is that the sample covers a different time span (2000–2021) compared to theirs, which spans 2002–2016.

Notable differences between the results obtained without the economic complexity variable (column 3, Table 2.10) and those with it (column 5, Table 2.10) are significant. Countries such as Egypt, Ghana, Senegal, South Africa, Tunisia, and Zambia have tax effort values of 0.53, 0.55, 0.54, 0.41, 0.48, and 0.44, respectively (column 3) and the total tax effort value of 0.74. Upon inclusion of economic complexity in the estimation, these countries' tax efforts improve dramatically to 0.63, 0.68, 0.80, 0.63, 0.70, and 0.70, respectively (column 5), with a total tax effort index of 0.87. This implies that empirically, economic complexity and informal economy play a significant role in tax effort estimation.

As discussed in the theoretical section, economic complexity is expected to give a country a competitive advantage, which translates into higher economic growth and subsequently more taxable income. This result suggests that efforts put toward the country's production of more complex and less ubiquitous

products result in a material change in the country's fiscal position. The structure inefficiencies brought about by the informal nature of the economy persist, as seen in the negative and statistically significant coefficient of the shadow economy variable (MIMIC). Economies with a larger share of their production in the informal sector are likely to experience paltry growth and a narrow tax base.

The asymmetrical nature of tax efforts estimates across countries can also be attributed to other heterogenous characteristics of these countries, depending on other characteristics such as endowments, geographical location, or even prevailing political dispositions.

Column 7 (Table 2.10) presents the tax efforts obtained from the above estimated results using ECI and the informal economy index (DGE) as the main variables of interest. Again, all countries have a tax effort below one, with Egypt having the smallest value (0.68) followed by South Africa (0.69), Zambia (0.68), and Kenya (0.67), while all other countries have the tax effort above (0.70), with the maximum value (0.99) for Algeria, Angola, Cape Verde, Lesotho, Malawi, Mauritius, Namibia, Rwanda, and Seychelles. All countries are operating below their tax potential and can increase their tax revenue by broadening their tax base through policies that formalise their economies. These results still have a higher tax effort than those observed at baseline (column 3, Table 2.10), suggesting that informality and economic complexity play an important role in tax mobilisation.

In general, the results show that consistently, many countries included in the study are underperforming in tax mobilisation efforts. Moreover, the inclusion of economic complexity as a driver of tax effort increased the tax effort index substantially (comparing columns 1, 3, and 5, Table 2.10). These estimates suggest that the inclusion of economic complexity and informal economy has a significant influence on the level of tax effort across countries, despite the observed heterogeneity. The estimates under the MIMIC and ECI in column 5 and those of DGE and ECI in column 7 are higher for all countries relative to those obtained at the baseline (column 1). The results when economic informality is included alone (column 3) compared to those obtained at the baseline (column 1) are mixed across countries. The results confirm the initial proposition that including the informality (inefficient) and complexity (efficient) drivers in tax effort estimates have material effects, which might not have manifested at the individual level.

Table 2.10. Combined tax effort estimates for all models discussed in this essay

Country	Tax effort (baseline)	Potential(base)	Tax effort (MIMIC)	Potential (MIMIC)	Tax effort (ECI & MIMIC)	Potential (ECI & MIMIC)	Tax effort (ECI & DGE)	Potential (ECI & DGE)	Total tax (% of GDP)	GDPP ($)
	1	2	3	4	5	6	7	8	9	10
Algeria	0.970	34.529	0.969	34.542	0.985	34.000	0.984	34.024	33.481	3857.020
Angola	0.954	32.859	0.984	31.835	0.985	31.824	0.984	31.847	31.333	2631.811
Botswana	0.745	33.157	0.673	36.709	0.822	30.050	0.844	29.281	24.706	5709.084
Cabo Verde	0.615	31.472	0.984	19.668	0.985	19.661	0.984	19.675	19.357	2664.488
Congo, Dem. Rep.	0.785	8.734	0.801	8.561	0.919	7.465	0.913	7.513	6.859	410.745
Egypt, Arab Rep.	0.512	26.380	0.528	25.602	0.632	21.374	0.675	20.009	13.511	3165.632
Eswatini	0.823	31.429	0.915	28.284	0.979	26.428	0.981	26.360	25.867	3194.235
Ethiopia	0.785	14.053	0.710	15.535	0.914	12.066	0.974	11.326	11.026	494.604
Ghana	0.627	16.015	0.550	18.266	0.687	14.610	0.708	14.189	10.044	1475.808
Kenya	0.502	23.812	0.380	31.466	0.572	20.902	0.669	17.890	11.964	1381.780
Lesotho	0.981	43.706	0.984	43.546	0.985	43.531	0.984	43.562	42.859	958.132
Madagascar	0.651	13.689	0.687	12.971	0.924	9.652	0.912	9.777	8.917	460.279
Malawi	0.981	11.863	0.984	11.820	0.985	11.816	0.984	11.824	11.633	338.928
Mauritius	0.536	33.172	0.984	18.062	0.985	18.056	0.984	18.068	17.777	8122.833
Morocco	0.793	27.414	0.766	28.377	0.869	25.001	0.899	24.172	21.731	2523.874
Mozambique	0.820	17.974	0.615	23.970	0.964	15.289	0.973	15.153	14.744	484.614
Namibia	0.981	29.300	0.984	29.193	0.985	29.183	0.984	29.204	28.732	4108.955
Rwanda	0.809	15.311	0.656	18.884	0.985	12.588	0.984	12.597	12.394	604.686
Senegal	0.674	21.943	0.543	27.257	0.797	18.569	0.780	18.962	14.797	1205.700
Seychelles	0.981	29.817	0.984	29.708	0.985	29.698	0.984	29.719	29.239	13352.58
South Africa	0.461	49.294	0.413	55.021	0.633	35.911	0.688	33.077	22.743	5795.531
Tanzania	0.517	20.325	0.577	18.211	0.900	11.668	0.809	12.986	10.506	810.645
Tunisia	0.581	35.871	0.479	43.459	0.704	29.585	0.737	28.264	20.831	3614.624
Zambia	0.472	31.384	0.435	34.069	0.704	21.045	0.681	21.767	14.821	1127.139
Zimbabwe	0.789	17.033	0.817	16.444	0.978	13.733	0.955	14.068	13.438	1289.139
Total	0.734	26.170	0.738	26.458	0.874	21.855	0.882	21.513	19.013	2791.315

Source (WDI, 2023): Author's own computation

Table 2.11 tracks the changes of tax effort index for each country across the set of results and establishes whether the index increased (decreased) from baseline compared to the introduction of our primary variables (MIMIC), (MIMIC and ECI), and (DGE and ECI).

Table 2.11 results show that tax effort indices for 12 countries decrease from the initial base-tax effort as the informal economy measure (MIMIC) was introduced in the analysis, which is 46.2 percent of the entire

sample. This suggests that the informal economy adversely influences tax effort in these countries, confirming the inefficiency of informality in tax mobilisation effort suggested in the theory discussion. Whereas tax effort indices for 14 countries increased from the initial value of baseline results. The introduction of the ECI into the analysis increases the tax effort indices for all sampled countries from the base indices (see column 9, Table 2.11). This suggests that economic complexity is, indeed, income enhancing and subsequently, tax revenue enhancing. Similarly, swapping the MIMIC index with DGE index and estimating the results with ECI together still yield indices higher than those observed in the baseline set of results for all sampled countries.

Thirteen out of 25 countries' tax effort increased overall from the baseline specification, when the informal economy (DGE) and economic complexity are accounted for 52 percent of the sampled countries' tax effort increased compared to baseline estimation. On aggregate, total tax effort (see the last row of Table 2.11) has increased throughout from the initial baseline value (column 1). This means that beside the individual changes observed across countries, total tax effort did increase for the entire sample.

Table 2.11. Tax efforts trends across sets of results

Country	base	mimic	mimic_eci	eci_dge	change_mimic	change_mimic_eci	change_eci_dge	mimic_vs_base	mimic_eci_vs_base	eci_dge_vs_base
	1	2	3	4	5	6	7	8	9	10
Algeria	0.9700	0.9690	0.9850	0.9840	-0.0010	0.0150	0.0140	Decrease	Increase	Increase
Angola	0.9540	0.9840	0.9850	0.9840	0.0300	0.0310	0.0300	Increase	Increase	Increase
Botswana	0.7450	0.6730	0.8220	0.8440	-0.0720	0.0770	0.0990	Decrease	Increase	Increase
Cabo Verde	0.6150	0.9840	0.9850	0.9840	0.3690	0.3700	0.3690	Increase	Increase	Increase
Congo, Dem. Rep.	0.7850	0.8010	0.9190	0.9130	0.0160	0.1340	0.1280	Increase	Increase	Increase
Egypt, Arab Rep.	0.5120	0.5280	0.6320	0.6750	0.0160	0.1200	0.1630	Increase	Increase	Increase
Eswatini	0.8230	0.9150	0.9790	0.9810	0.0920	0.1560	0.1580	Increase	Increase	Increase
Ethiopia	0.7850	0.7100	0.9140	0.9740	-0.0750	0.1290	0.1890	Decrease	Increase	Increase
Ghana	0.6270	0.5500	0.6870	0.7080	-0.0770	0.0600	0.0810	Decrease	Increase	Increase
Kenya	0.5020	0.3800	0.5720	0.6690	-0.1220	0.0700	0.1670	Decrease	Increase	Increase
Lesotho	0.9810	0.9840	0.9850	0.9840	0.0030	0.0040	0.0030	Increase	Increase	Increase
Madagascar	0.6510	0.6870	0.9240	0.9120	0.0360	0.2730	0.2610	Increase	Increase	Increase
Malawi	0.9810	0.9840	0.9850	0.9840	0.0030	0.0040	0.0030	Increase	Increase	Increase
Mauritius	0.5360	0.9840	0.9850	0.9840	0.4480	0.4490	0.4480	Increase	Increase	Increase
Morocco	0.7930	0.7660	0.8690	0.8990	-0.0270	0.0760	0.1060	Decrease	Increase	Increase
Mozambique	0.8200	0.6150	0.9640	0.9730	-0.2050	0.1440	0.1530	Decrease	Increase	Increase
Namibia	0.9810	0.9840	0.9850	0.9840	0.0030	0.0040	0.0030	Increase	Increase	Increase
Rwanda	0.8090	0.6560	0.9850	0.9840	-0.1530	0.1760	0.1750	Decrease	Increase	Increase
Senegal	0.6740	0.5430	0.7970	0.7800	-0.1310	0.1230	0.1060	Decrease	Increase	Increase
Seychelles	0.9810	0.9840	0.9850	0.9840	0.0030	0.0040	0.0030	Increase	Increase	Increase
South Africa	0.4610	0.4130	0.6330	0.6880	-0.0480	0.1720	0.2270	Decrease	Increase	Increase
Tanzania	0.5170	0.5770	0.9000	0.8090	0.0600	0.3830	0.2920	Increase	Increase	Increase
Tunisia	0.5810	0.4790	0.7040	0.7370	-0.1020	0.1230	0.1560	Decrease	Increase	Increase
Zambia	0.4720	0.4350	0.7040	0.6810	-0.0370	0.2320	0.2090	Decrease	Increase	Increase
Zimbabwe	0.7890	0.8170	0.9780	0.9550	0.0280	0.1890	0.1660	Increase	Increase	Increase
Total	0.7340	0.7380	0.8740	0.8820	0.0040	0.1400	0.1480	Increase	Increase	Increase

Source (WDI, 2023): Author's own computation

2.12.9 Robust check

Table A.2.1 in *Annexure A.1* presents the results performed for the reliability check, which include the DK, the fixed effects model, and system GMM estimations. The estimated results using various models for robustness check show that informality (MIMIC) is still negative and statistically significant only under the DK model with voice accountability as an institution variable. Whereas economic complexity (ECI) is negative and statistically significant under DK estimation and the fixed effects model. Excluding per capita GDP and per capita GDP squared changes the signs of economic complexity from negative to positive; thus, per capita GDP distorts the sign of economic complexity in the model (not reported). In the case of other variables, trade openness, agriculture, per capita GDP, per-capita income squared, manufacturing, education expenditure, donor assistance, remittances, FDI, inflation, and voice accountability are significant with correct signs under DK and the fixed effects model. System GMM, which helps in addressing the endogeneity challenge, does not fit this model well. The trade openness variable is the sole variable which is positive and statistically significant in predicting tax revenues under the system GMM specification.

The assertion that the disturbance term is cross-sectionally independent in the panel data is often unrealistic (Pesaran, 2004). Countries typically exhibit some degree of interdependence among cross-sectional units, such as trade relationships through exports and imports. Standard covariance matrix estimators generally do not account for cross-sectional dependence, and failing to recognise this correlation in panel estimation can lead to severely biased statistical inferences. To enhance robustness of the results, the DK model adjusts standard errors estimations for coefficients estimates, accounting for potential interdependence in error terms. This adjustment entails applying a Newey-West type correction to the cross-sectional mean of the moment conditions. By modifying the error term, this approach ensures that the covariance matrix estimator remains nonparametric, yielding standard errors that are robust to different forms of spatial and temporal dependence, making them well-suited for handling heteroskedasticity. When applying DK's method to remedy the autocorrelation with MA(q), heteroscedasticity, and cross-sectional dependence, all covariates are significant and align with the expected signs.

To test the presence of heteroskedasticity, the Breusch-Pagan/Cook-Weisberg test was performed, which yields a chi-square value of 2.20 with a probability of 0.138. As a result, the null hypothesis of constant variance in the error term is rejected, confirming the presence of heteroskedasticity. Consequently, the model is re-estimated using a robust specification. In testing for multicollinearity, the variance inflation factor for all chosen covariates is below five, exception per capita GDP and its square, which are highly correlated; however, this is expected. The Woodridge test for autocorrelation in panel data was performed. The computed F-value is 18.06, with a p-value of 0.005, confirming the presence of autocorrelation in the

panel data. The autocorrelation is remedied by re-estimating the results using Driscoll and Kraay's (1998) method, which corrects for serial autocorrelation, as discussed above.

Table 2.12 presents the normality test results on the χ^2 and the p-value, indicating that the error term does not follow a normal distribution. Specifically, both skewness and Kurtosis deviate from those expected under normality. The test strongly rejects the null hypothesis that the residuals have a skewness of zero and a Kurtosis of 3. Consequently, the assumption that skewness and Kurtosis jointly follow a normal distribution is rejected. To mitigate the impact of extreme outliers in the sample, a log transformation was applied to all covariates.

Table 2.12. Normality test

Skewness and Kurtosis tests for Normality					
Joint					
Indicator	Observations	Pr (Skewness)	Pr (Kurtosis)	Adj chi^2	Prob chi^2
residuals	201	0.0771	0.9836	3.16	0.2060

Source: Author's own computation

The Ramsey test for omitted variable bias yields an F-value of 10.21 with a probability of 0.000, leading to the rejection of the null hypothesis and confirming the presence of omitted variables. However, the test results validate the appropriateness of the selected linear functional form. For model selection, the Hausman test produces a chi-square value of 23.16 with a probability of 0.04, rejecting the null hypothesis in favour of the fixed effects model for estimation.

Given the large cross-sectional dimension (N) and short time (T) in the sample, cross-sectional dependence was tested using Pesaran's (2004) parametric technique, which results in a value of -1.50 with a probability of 0.133. Since the null hypothesis of no cross-sectional dependence is not rejected, residuals are deemed cross-sectionally independent. Additionally, a modified Wald test for group-wise heteroscedasticity in the fixed-effect model yields a chi-square value of 626.69 with a probability of 0.000, confirming the presence of heteroscedasticity. Consequently, an estimation was performed using a robust specification. The Wooldridge test for autocorrelation in the panel data yields a F-value of 13.94 with a corresponding p-value of 0.002; therefore, the null hypothesis of no first-order autocorrelation is rejected, and the results are re-estimated. Therefore, with a clustered panel robust standard error, which corrects for both autocorrelation and heteroskedasticity within the panel.

Since the analysis involved macroeconomic covariates, there is a likelihood that shocks in one country are correlated with shocks in another country and, therefore, engender cross-sectional dependency. Similarly, if the covariates are not stationary, the regression results obtained are likely to be spurious. We used

Pesaran's (2004) and Im-Pesaran-Shin panel unit roots tests and report the results. The Pesaran cross-sectional dependence test the null hypothesis that the residuals are cross-sectionally independent (if the p-value is less than 5 percent), implying the absence of correlation across countries. The alternative hypothesis is that cross-sectional dependence exists. The Im-Pesaran-Shin panel unit root tests the null hypothesis that all panel countries have a unit root (variable is not stationary), and the alternative is that at least some panels are stationary. If the p-value is less than 5 percent, we can conclude that the panel is at least stationary.

The finding shows that most cross-sectional dependence among most variables—tax revenue, agriculture, inflation, debt, aid, and economic complexity—are stationary, while trade openness, per capita GDP and its square, manufacturing, and the informal economy index are non-stationary at all levels.

Dumitrescu and Hurlin's (2012) Granger Non-Causality test was employed to test whether informality Granger cause economic complexity. The test null hypothesis is that informality Granger does cause economic complexity, while the alternative hypothesis suggests that informality Granger does cause economic complexity for at least one country. The z-bar p-value is 0.0089, suggesting that the informality Granger causes economic complexity; however, the z-bar-tilde p-value is 0.1794, suggesting that the results are sensitive to panel heterogeneity. Under reverse causality, the z-bar p-value is 0.8624, which is greater than 0.05, and the z-bar tilde p-value is 0.6688. So, the null hypothesis is rejected, concluding that there is no evidence that the economic complexity Granger causes informality in any panel. Thus, there is a weak unidirectional causality to economic complexity, but not the other way around; also, such causality is weak and sensitive to panel heterogeneity. System GMM (which addresses endogeneity and controls for dynamic effects) was used to validate these results (not reported). ECI does not affect the informal economy index as the coefficient is small and insignificant; the model passes all diagnostic tests, suggesting that the results are reliable, and the instruments are valid.

2.13 Conclusion

This study set out to investigate the extent to which the shadow economy and economic complexity influence tax effort and tax capacity in selected African countries. To answer this question, the stochastic frontier technique was used to analyse data from 25 selected African economies.

Overall, the results suggest several conclusions. First, key variables of interest, including the shadow economy, economic complexity, macroeconomic factors, demographic indicators, and institutional variables, play a crucial role in shaping tax revenue collection in the selected African countries. Second, across all regression analyses conducted, the informal economy (MIMIC/DGE), GDP per capita, trade, remittances, foreign aid, manufacturing, FDI, population, voice accountability, and corruption controls are statistically significant, exhibiting the expected signs. The informal economy is found to significantly

influence tax effort estimates under the MIMIC index. However, the DGE index is not robust in proxying informality. ECI is also found to be positive and statistically significant in explaining tax revenue in two models only. All sampled countries exhibit a tax effort below one, signifying room for improvement in tax mobilisation in the respective countries by formalising their economies and adopting technologies, giving countries a competitive advantage in terms of production sophistication, which can yield significant results in economic growth and fiscal space expansion. In terms of tax capacity, all sampled countries are operating below their tax potential and have a potential of approximately 20 percent tax mobilisation capacity, which is unexploited. Government spending in public education, external debt as a percentage of GDP, inflation, mineral rent, and voice accountability were expected to have a significant impact on tax effort. However, this expectation is not born out in the data.

The robust test results corroborate earlier empirical results. These findings suggest that enhancing governance, reducing the informal sector, promoting trade openness and manufacturing, increasing FDI and remittance inflows, and minimising reliance on agriculture can serve as effective strategies for boosting tax revenue in African economies. Over the 20-year period analysed, most countries recorded a tax effort below one for at least five years, indicating untapped potential for revenue mobilisation. To improve tax collection, African nations must diversify away from agriculture and informal activities, which, despite being major sources of employment, contribute minimally to tax revenue. These findings underscore the need for tailored policies and strategies to address the informal economy's role in tax mobilisation while considering the specific context of each country. Formalisation of the economy and reduction of bureaucratic hurdles have the potential to unlock the economy and widen the tax base.

These findings are particularly significant as the sampled period (2000–2021) extends beyond the timeframe analysed in previous studies. Moreover, unlike most prior research that relies on OLS regression, this study employed the stochastic frontier technique, which effectively mitigates key specification biases encountered in earlier studies. Contrary to other studies, this study introduces informal economy and economic complexity data in tax effort literature and investigates their role in driving tax revenue mobilisation in Africa. Developing countries can enhance tax revenue by exploiting new taxation strategies for emerging economic activities, such as the digital economy, and by strengthening their ability to tax the informal sector. Investing in the capacity of tax authorities, particularly in tax collection, compliance, and governance, which are crucial in improving overall revenue mobilisation. Furthermore, investing in the production of products that are more complex and less ubiquitous for export markets could allow countries to gain from both income and tax revenues from exports. Ultimately, a defining feature of an efficient tax system is its ability to generate adequate government revenue while minimising collection costs.

For countries with a tax effort below unity, the policy implications are clear. Targeted efforts are required to expand the tax base, enforce the tax rate effectively, and ensure revenue stability while adhering to the core principles of taxation (administrative convenience, equity, and efficiency). Additionally, implementing policies that foster industrial development can support the expansion of the manufacturing sector, which is easier to tax. Since tax policies often reflect the consent of the public in democratic countries, future research could explore the role electoral cycles play in the dynamic of tax efforts in emerging economies.

Chapter 3

Essay 2: Election proximity, political regimes, and fiscal balance dynamics: Evidence from selected African countries

3.0 Introduction

The debate about fiscal balance (deficit) in developing countries has re-emerged following the global financial crisis (GFC), growing political polarity, and the outbreak of coronavirus disease in 2019 (COVID-19) (Obakemi, 2021)[29]. The lack of fiscal devolution threatens the growth prospects of most African economies. The austerity measures, often caused by unsustainable levels of fiscal deficits, slow down economic growth and increase unemployment. In definitional terms, the budget balance is the difference between consolidated government expenditures and revenue, where the negative value implies that the government is running a budget deficit and a positive value implies the state is running a budget surplus (Ball and Mankiw, 1995). Conventionally, the value of the budget balance (deficit) is usually in terms of percentage of GDP, which is easily relatable to the size of the economy (Mawejje and Odhiambo, 2020).

The sampled countries have an elevated fiscal balance compared to other regions of the world. Table A3.4 in *Annexure A.2* presents the fiscal balance as a percentage of GDP for the region of the world between 2000 and 2021. The median fiscal balance for sampled countries is (-2.96) percent, which is relatively higher than the world median of (-2.34) percent. The fiscal deficit for the sampled countries is higher than all other regions with the exception of South Asia, with a median of (-3.97) percent. The East Asia and Pacific region have the lowest median fiscal deficit of (-1.38) percent, followed by the OECD, with a median fiscal deficit of (-2.32) percent.

Various studies have explored fiscal deficits from different angles using various techniques, refinements and different sample size, and different geographical coverage with the objective of gleaning useful insights on the drivers of fiscal balance and economic consequences (Buchanan, 1954; Fatás and Mihov, 2006; Grier, 2008; Benito et al., 2021; Gnimassoun and Do Santos, 2021). However, the literature is filled with divergent findings with very few agreements on factors that are important in explaining the dynamics of fiscal balance (deficit) (c.f. Artés and Jurado, 2018; Bonfatti and Forni, 2019, de Haan et al., 2025).

Nevertheless, the harmful effect of excessive budget deficit is undisputed. Ball and Mankiw (1995), Solomon and de Wet (2004), and Yu (2017) articulate well the economic dislocation caused by excessive budget deficits. Obakemi (2021) and Bobbo and Melingue-Bate (2021) report that excessive budget deficit

[29] African economies have experienced a range of shocks from commodities shocks, war, the COVID-19 pandemic, and the funding squeeze from 2020 to 2023 (IMF, 2023).

distorts macroeconomic outcomes through exchange rate[30], inflation, economic growth volatility, and making policy less credible. Cifuentes-Faura et al. (2022) contend that unbounded levels of fiscal deficits are the main source of debt and inflationary crises. Other studies explore the question of fiscal balance (deficit) from the macroeconomics side (c.f. Afonso and Jalles, 2013; Romer and Romer, 2018, 2019) by studying fiscal crises episodes in various economies. Drazen and Enslava (2005, 2010), and Janků and Libich (2019) explore the nexus between fiscal budget and political settings, where they contend that fiscal balance plays a crucial role in economic management. However, the highly debated question from different points of view is, besides economic fundamentals which affect the fiscal balance (deficit), to what extent do other events, such as political business cycle and type of regimes (c.f. Block, 2002; De Haan, 2014; Artés and Jurado, 2018), influence the direction of fiscal balance (deficit)?

A country's fiscal stance is largely influenced by governments' broader macroeconomic objectives both during and after a given fiscal year. Thus, there are competing arguments against and for the influences of fiscal deficits on the economy. The studies by De Haan (2014) and Aidt et al. (2015) assert that the often-experienced fiscal deficit persistence in various economies is the results of fiscal indiscipline. Such indiscipline, coupled with pre-matured level of democracies in many African countries, elevate the susceptibility of these economies to various negative effects of excessive budget deficits, such as exchange rate volatility and inflation effect, which are detrimental to economic development (Ball and Mankiw, 1995; Odhiambo et al., 2013; Bobbo and Melingue-Bate, 2021; Obakemi, 2021). These phenomena raise an important question of whether the structure of the political setting, both in terms of time and regime type (the democracy spectrum), influences fiscal balances in 25 selected African countries.

Opportunistic political motives often clash with myopic voters' motives (c.f. Buchanan and Tullock, 1962; Nordhaus, 1975; Rogoff and Sibert, 1988; Rogoff, 1990), resulting in budgetary planning disruption closer to political events such as elections. In such scenarios, the economy is likely to experience a political business cycle resulting from the divergence of political agent and economic agent motives. Buchanan and Tullock (1962) assert that even if Keynes' devised solution to economic disequilibrium of using budget deficit to correct it was perfect, it is still harmful in general, since it exposes politicians to irresistible importunities and sectional pressures to misuse it. Thus, Keynes' well-thought-out solution to economic shocks is susceptible to political manipulation in a representative democracy. Self-interested politicians, less informed voters, and fragile institutions threaten the sustainability of fiscal balance (Alesina and Paradisi, 2017; Działo et al., 2019). It is, therefore, important to examine whether politically timed macroeconomics interventions explain the fiscal indiscipline experienced in developing economies. Thus,

[30] IMF (2023) outlook report for SSA asserts that exchange rate pressures persist and likely undermine growth prospect in the region.

the main goal of this essay is to explore whether election cycles, institutions (social, political) quality and political regime types (democratic, anocratic, and autocratic)[31] drive fiscal balance in 25 selected African countries.

3.1 Research gap

The literature is replete with evidence of resource mobilisation shortages in Africa (c.f. Mawejje and Sebudde, 2019; Gupta et al., 2022) and the perverseness of fiscal indiscipline in SSA (Obakemi, 2021). It is essential to continue exploring the causes for fiscal indiscipline and how to ameliorate it[32]. Remedying the fiscal indiscipline challenge is vital for these countries' development. Despite voluminous literature on fiscal balance (deficit) from different dimensions, there is no consensus on how and to what magnitude (direct and indirect) political, social and economic factors influence budgetary management in developing countries. Henisz (2004), Hallerberg and Von Hagen (1999), and Ngo and Nguyen (2020) assert that the presence of institutional features and fiscal balance tends to enhance economic outcomes. There is a need to understand the channels through which institutional settings, election cycles, and democratic settings enumerate the fiscal indiscipline outcomes observed in these countries. This study aims to fill these gaps using 25 selected African countries.

3.2 Objective of the study

The aim of this study was to determine whether there is a political business cycle in 25 selected African countries. The specific objectives are:

- To assess the effect of the time path and election year on fiscal balance.
- To determine the effect of political regimes on fiscal balance in selected countries.

3.3 Research question

The research questions this study aimed to answer are:

- In terms of fiscal discipline in selected countries, does election proximity matter?
- What influence does the type of political regime have on budgetary discipline in 25 selected countries?
- Do other institutional attributes, coupled with election cycle, influence the dynamics of fiscal balance in these countries?

[31] Anocracy engender (partial democratic and partial autocratic features together).

[32] Since debts and budget deficits evolve and accumulate over time (Artés and Jurado, 2018), this study focuses more on the dynamic influence of regime types and election proximity on fiscal outcomes in Africa.

3.4 Contribution of the study

Political business cycles are a common phenomenon in developing countries and are significantly influenced by institutions (Bonfatti and Forni, 2019; Działo et al., 2019; Benito et al., 2021; Obakiemi, 2021; Bobbo and Melingue-Bate, 2021). The studies by Schuknecht (1996, 1999, 2000), de Haan (2014) and Obakemi (2021) provide an exhaustive discussion of fiscal deficit dynamics in many developing countries from different angles. However, the type of regimes and the nature of institutions, which affect political business cycles, vary and are mixed from one study to another. Tying the link between regimes and elections to fiscal policy is important because elections give legitimacy to the prevailing regime by purportedly showing its widespread acceptance during elections. However, to achieve these, politicians have incentives to signal to their opponents that their administration garners strong support from the public. Such incentive signalling is not free and has significant economic consequences. This essay contributes to the literature by analysing how such variation (dynamism) of regimes, electoral events (proximity), and other institutions influence fiscal balance (deficit) in these countries.

Another aspect of literature this study contributes to is exploring the non-static nature of democracy's (autocratic, anocratic, or democratic) influence on budget in developing countries (Brender and Drazen, 2007). From the latest available World Data, only eight percent of countries in the world are considered fully democratic, whereas 40 percent are authoritarian regimes[33]. From the current study's sample, 16 countries are categorised as anocratic, four as autocratic, and 13 as democratic (see Table A3.5 in *Annexure A.2*). From Table A3.5, we observe that countries such Ghana, Kenya, Madagascar, Malawi, Tunisia, and Zambia have been categorised as anocratic and democratic for some years. Therefore, there is some form of non-linearity in their democracy. In this analysis, autocratic regimes are considered as electoral autocracies since countries categorised as autocratic regimes still hold elections. The non-linear nature of institution (democracy) is incorporated in the analysis to determine whether it has any significant role. This will help us examine whether democracy has any role in explaining the fiscal soundness of the economy. Through doing these refinements, our hope is that new channels and insights can be gleaned on how election proximity and democratic process influence fiscal discipline in these countries.

3.5 Literature review

3.5.1 Theoretical background

Earlier studies in this area are those of Nordhaus (1975), Rogoff and Sibert (1988) and Rogoff (1990) who discuss the opportunistic theory and myopic voter under adaptive expectation hypothesis. Brender and

[33] https://ourworldindata.org/grapher/democracy-index-polity

Drazen (2008) dispute Nordhaus (1975), Rogoff and Sibert (1988) and Rogoff (1990), who argue that voters are rational and cannot be duped continuously. Therefore, there is a time effect in political business cycles, where over time the cycle should disappear as voters become aware of political budget manipulation. The assertion that ignorance is bliss is very expensive and has an adverse effect on fiscal deficit (Buchanan, 1954). The political incumbents have incentives to increase borrowing instead of raising taxes to finance additional spending if they believe that the electorate can suffer fools under fiscal illusion, where they fail to realise that a rise in budget deficit currently represents a future increase in tax receipts. Drazen and Eslava (2005) provide theoretical evidence of election manipulation through expenditure composition. The persistent fiscal deficit experiences, coupled with growing pervasive corruption, multidimensional poverty, and illiteracy rate among voters in developing countries, motivate the adoption of Nordhaus' political business cycles (adaptive hypothesis) theory to study fiscal balance (deficit) in these countries. The assumption is that both macroeconomic factors and institutions (political and social) in different dimensions have an influence on economic outcomes (Acemoglu et al., 2003). These theories inform this chapter's analysis. The following subsections discuss the channels through which political business cycles, regime types, institutions, and other macroeconomic factors influence the fiscal balance.

3.5.2 Hypothesis development

From the discussion in section 3.5.1, we observe that the civic aspiration for the development of collective good is often threatened by the power and corruption of private interests. This section discusses the potential channels through which political business cycles, regime types, and other institutions influence the fiscal balance. Figure 3.1 depicts the interlink between regimes, election cycles, macroeconomics factors, and the fiscal balance. The following section provides a discussion of the possible transmission mechanism between fiscal balance and the proposed determinants.

3.5.3 Fiscal balance and election cycles

Election cycles have a significant influence on fiscal policy decisions. Politicians could prioritise myopic goals, such as boosting spending or cutting taxes to appeal to voters during election years, even if these actions contribute to widening fiscal deficits in the future (Buchanan and Tullock, 1962; Alesina and Perotti, 1997, 1999). Besides, the incentives to pursue expansionary policy close to election for re-election objective, the policymakers will be forced to pursue fiscal discipline to mitigate economic instability or negative electoral consequences, which often come at the cost of a potential rise in inflation and an increase exchange rate volatility, creating policy uncertainties for investments and development goals (Solomon and de Wet, 2004; Yu, 2017; Bonfatti and Forni, 2019). Drazen and Enslava (2005) link expenditure composition to election proximity in Colombia municipalities. The rise in fiscal policy closer to elections

is used by political candidates to nudge voters for votes through signalling of competence (Rogoff and Sibert, 1988; Rogoff, 1990). However, since the voter-candidate information asymmetry problem causes the candidate to align current expenditures if it increases the chances of winning an election, this disregards future consequences. Shi and Svenson (2006) confirm these divergences by showing that voters observe the overall government expenditure but tend to miss the budgetary imbalances. Such a direct link between the election cycle and fiscal balance is depicted in Figure 3.0 by number one.

3.5.4 Fiscal balance and democratic regimes

An autocracy is a form of governance where the supreme power is concentrated in the hands of a single individual, whose decisions are not subjected to external legal limits or regularised instruments of popular control. Democracy, on the other hand, is a form of governance in which power is vested in the hands of the people, either directly or through elected representatives. Anocracy is the system of governance which exhibits a mix of democratic and autocratic features. Anocracy allows some form of political participation but lacks robust mechanisms for resolving grievances and ensuring accountability. Table A3.5 in *Annexure A.2* presents the regime decomposition of the current study's sampled countries according to these definitions. Fiscal balance (deficit) can be influenced by the political dynamics (democratic, autocratic) regimes (Gonzales, 2002). In democracies, elected governments usually face pressure to deliver goods and services to cater to the electorate's wishes and stand a chance of re-election. This pressure can result in higher government spending, potentially resulting in larger deficits, especially during election cycles when politicians are inclined to implement unplanned expansionary fiscal policies to garner support (Janků and Libich, 2019). This is not the same in less democratic regimes (anocratic/autocratic), where the incumbent remaining in power is not conditioned on good public provision or a democratic election process. The indirect effects of election on fiscal balance caused by the prevailing regime type are represented by channel 2 in Figure 3.1.

3.5.5 Fiscal balance and other macroeconomic and election cycle

Macroeconomic indicators, such as economic growth, inflation, and real interest rate, can influence the fiscal balance (deficit) (Ball and Mankiw, 1995; Vergne, 2009; Obakemi, 2021). Excessive fiscal deficits can result in an upsurge in borrowing, which can exert upward pressure on interest rates and inflation, potentially dampening economic growth. Furthermore, the timing and magnitude of fiscal policy changes during election cycles can affect macroeconomic stability and investor confidence. The collapse in investors' confidence can cause the cost of borrowing to rise and cause a further funding squeeze. The liquidity squeeze, coupled with already elevated levels of debts in the region, is likely to undermine growth

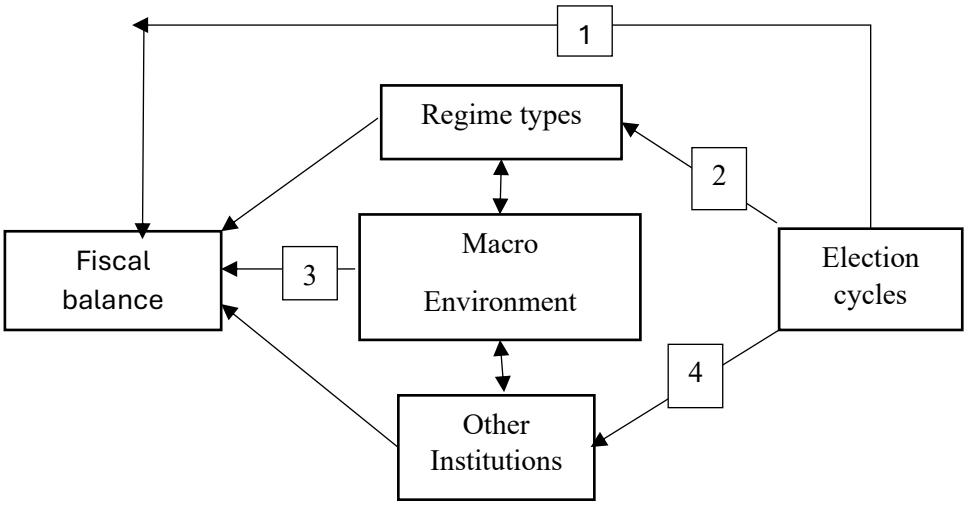
prospects and incentivise incumbent politicians to use electoral manipulation during elections. This linkage is depicted by number 3 in Figure 3.0.

3.5.6 Fiscal balance and institutions

Institutions play a vital role in informing the link between fiscal deficit, democratic regimes, and election cycles. Corruption, for instance, can exacerbate fiscal deficits by diverting public funds for private gain, undermining the effectiveness of fiscal policy and eroding trust in democratic institutions (Ngo and Nguyen, 2020). The actions of politicians on budgetary planning depend on both their knowledge and the incentives they face. Institutions such as voice accountability (transparency, accountability, and citizen participation) can help mitigate corruption and promote responsible fiscal management by holding policymakers accountable for their actions. Here, the election cycle is examined from a context of election-driven spending and not illegal corruption, where candidates can buy votes or rig an election, which is hard to measure across countries. The indirect channel where election cycles influence fiscal balance through institutional structure is depicted by number 4 in Figure 3.1.

The interplay between fiscal balance (deficit), democratic regimes, election cycles, other macroeconomic variables, and institutions, such as corruption control and voice accountability, are multifaceted and dynamic. Understanding these interlinkages is essential for policymakers and citizens alike in promoting fiscal sustainability, democratic governance, and economic prosperity. Evidence of political business cycles contradict the rational expectation that voters' decisions about the candidate choice is based on post-election policies rather than past policies outcomes (Drazen and Enslava, 2005; Grier, 2008; de Haan et.al., 2025).

Figure 3.0. Flow chat of the links between election proximity, regime type, macroeconomic environment, and other institutions and fiscal balance



Source Author's own compilation

3.5.7 Empirical literature

Given the revenue mobilisation challenges discussed in Chapter 2, the question which arises is whether the fiscal policy in these countries is subjected to political manipulation and whether such manipulation depends on election proximity or regime type. Political influence on fiscal policy is vastly studied from various angles, e.g., Ifere and Okoi (2018) explore the link between corruption, literacy rate, election, and fiscal discipline. However, the analysis of the interplay between fiscal policy and political events in the current study's selected countries is lacking, despite having elevated levels of fiscal deficits (see Table 3.1).

Schuknecht (1996, 1999, 2000) gives a historical context of fiscal budget in developing countries, concluding that political considerations trump sound economic fundamentals. Many of the current study's sampled countries have nascent or quasi democracy, making this study relevant. Obakemi (2021) discuss budgetary laxity in African countries. Janků and Libich (2019) show that the gullibility of voters has fiscal implications. They show that countries in the OECD region with less informed voters experienced a budget deficit of 0.7 to 1.2 percent of GDP in the election year. A timeline close to the election and during the election year was designed to investigate the correlation between fiscal balance and election cycles in the current study's selected countries.

Adeyi (2014) and de Haan (2014) provide evidence of the growth of profligacy and extra-budgetary spending caused by approved contingency votes or excess budgetary resources. A robust analysis performed using total revenue and expenditure confirms the same phenomenon in terms of the contraction in total tax

revenues and the expansion of total expenditure during elections for the current study's selected countries (see Table A3.1 and A3.2 in *Annexure A.2*).

Other studies provide competing views about the correlation between fiscal deficit and election cycle. Alesina and Paradisi (1997, 1999) and Collier and Vicente (2010) give empirical evidence of the political manipulation of electoral systems in developing countries and OECD economies, ranging from vote buying and fraud to corruption. Alesina and Paradisi (1997, 1999) suggest that regimes that implement expansionary fiscal policy during elections are not necessarily rewarded with longer tenure in power. Ngo and Nguyen (2020) examine the link between politics, economics, and institutions on budget deficit in the ASEAN region using panel data, emphasising the importance of strong institutions in limiting budgetary manipulation.

However, Obinyeluaku (2006) refutes the disappearance of fiscal deficit during periods of prosperity in the SSA context, while Obakemi (2021) confirms the persistent of budget deficit in SSA countries. Other recent studies examining the drivers of fiscal deficits are those of Klomp and de Haan (2013), Bonfatti and Forni (2019), Dzialo et al. (2019), Benito et al. (2021), Cifuentes-Faura et al. (2022), and Galiński (2023a, b).

Mosley and Chiripanhura (2016) assert that stiff competition in matured democracies can be a forcing function to disincentivise incumbents from indulging in election manipulation and thus political business cycles might be negligible. Democratic governance is an appropriate mechanism of protecting and promoting personal liberty and is the most efficacious way of removing unsatisfactory leaders without violence. However, considering the nascent nature of democracy in developing countries, Mosley and Chiripanhura (2016) argue that it might not hold in the current study's selected countries. Pepinsky (2007) analyse the association between fiscal policy, elections, and autocracy in Malaysia, concluding that election is a focal point for budgetary manipulation and distribution of political patronage in authoritative settings.

Cifuentes-Faura et al. (2022) uses Spanish municipalities' data to highlight the importance of understanding the drivers of fiscal deficit. They show that economic growth is vital in decreasing fiscal deficit both in the short and long run, while higher levels of unemployment is deleterious to fiscal balance both in the short and long run. Cifuentes-Faura et al. (2022) admit that the persistent growth of fiscal deficit in many countries presents a unique problem of controlling fiscal balance volatility. To be able to combat these fiscal deficits' volatilities, we first need to understand their sources, hence the need to explore the influence that political, macroeconomic, and institutional factors play in explaining fiscal deficits. These authors discuss the election influence has on budget deficit. Considering these political and economic concerns, the current study explored whether the persistence of fiscal indiscipline in the selected countries is caused by political

manipulation conditioned on the types of regimes and institutions, and whether this can confirm fragility and prematurity of budgetary institutions in these countries.

The link between democracy and fiscal policy management is a highly contested matter (Pepinsky, 2007) mainly because democracy is an anomaly. Often tyranny is the historical norm, thus even democratic systems tend to deviate to the equilibrium norm of tyranny if left alone. Besides, the literature on democracy assert that democracy is inherently nonlinear both in its development and its effects on political, social, and economic outcomes (Brender and Drazen, 2008). The democratic progression is usually irregular, with reversals and turning points, and its effect is subject to historical context, institutional strength, and prevailing economic conditions. Despite these realities, the literature is thin on the link between fiscal balance and the nonlinear nature of democracy in an African context. The current study incorporates the aspect of the nonlinearity of democracy in the analysis to bridge this gap.

3.6 Research methodology and data

This study empirically investigated whether institutional setting, election proximity, and regime type (democracy, autocracy, and anocracy) have any direct or indirect influence in driving budgetary changes in 25 selected African countries. The standard dynamic GMM model of Arrenallo and Bover (1995), Blundell and Bond (1998), and Blundell et al. (2000) was adopted with minor refinements to estimate the results. Dynamic GMM was chosen to correct for potential problems, such as endogeneity across the panel of countries. GMM estimators are also ideal when dealing with a small-time span and large cross-sectional data (Roodman, 2009), whereas the panel structure is suitable in controlling for panel heterogeneity across countries. The specification is as follows:

$$FB_{it} = \alpha_0 + \alpha_1 FB_{it-1} + \delta_i \overrightarrow{before}_{it} + \beta_i \overrightarrow{Election}_{it} + \gamma_i \vec{E}_{it} + u_{it} \quad (3.1)$$

$$FB_{it} = \alpha_0 + \alpha_1 FB_{it-1} + \beta_i Elect_{it} + \gamma_i \vec{E}_{it} + \delta_i \overrightarrow{inst}_{it} + \theta_i \vec{P}_{it} + \varphi\left(Elect_{it} * \vec{P}_{it}\right) + \vartheta\left(Elect_{it} * \overrightarrow{inst}_{it}\right) + u_{it} \quad (3.2)$$

Where FB_{it} is the fiscal balance (deficit) as a percentage of GDP, $Election_{it}$ is the election dummy, which takes a value of one during election year and zero otherwise, and $\overrightarrow{before}_{it}$, is the time path, which is partitioned between one, two, and three years before the election year (this helps to establish whether there are any patterns between the proximity to election and the fiscal balance using Equation 3.1). This approach is consistent with Brender and Drazen (2005), de Haan et al. (2025). $\vec{E}_{it}$ is the vector of other macroeconomic indicators, such as economic growth and external donor assistance. $\vec{P}_{it}$ is the vector of regime type (autocracy, anocracy, democracy) derived from Polity-V and the democracy index. Democratic countries were separated from non-democratic countries by applying the Polity-V classification, covering countries with a population rate more than five million. A country is autocratic if its Polity-V ranges from

-10 to -6; anocratic if its Polity-V range from -5 to 5, and democratic if its Polity-V ranges from 6 to 10 (Marshall and Ted, 2020).

The interactions between elections, political institutions, and other institutional qualities were estimated using Equation (3.2), providing a joint effect of election and institutions on the budget balance (deficit) in these countries. All appropriate robustness checks, such as the addition of other controls, the adoption of other dependent variables, and other model specifications, are explored. All necessary diagnostic tests were performed and are discussed for each set of results to ensure the reliability and consistence of the results.

Table 3.0 depicts the list of sampled countries and corresponding years in which elections took place between 2000 and 2021. All sampled countries have at least three election cycles, except for Eswatini, with only two election cycles.

Table 3.0. The list of countries and the years in which elections took place

Country	Election years	Country	Election years
Algeria	2004, 2009, 2014, 2019	Madagascar	2001, 2006, 2013, 2018
Angola	2008, 2012, 2017	Malawi	2004, 2009, 2014, 2020
Botswana	2004 2009 2014, 2019	Mauritius	2000, 2005, 2010, 2014, 2019
Cabo Verde	2001, 2006, 2011, 2016,2021	Morocco	2002, 2007, 2011, 2016
Congo Dem. Rep.	2006, 2011, 2018	Mozambique	2004, 2009, 2014, 2019
Egypt, Arap Rep.	2005, 2012, 2014, 2018	Namibia	2004, 2009, 2014, 2019
Eswatini	2013, 2018	Rwanda	2008, 2013, 2017
Ethiopia	2000, 2005, 2010, 2015, 2021	Senegal	2000, 2007, 2012, 2019
Ghana	2004, 2008, 2012, 2016, 2020	Seychelles	2001, 2006, 2011, 2015
Kenya	2002, 2007, 2013, 2017	South Africa	2004, 2009, 2014, 2019
Lesotho	2007, 2012, 2015, 2017	Tanzania	2000, 2005, 2010, 2015, 2020
Tunisia	2004, 2009, 2014, 2019	Zambia	2001, 2006, 2008, 2011, 2015, 2021
Zimbabwe	2002, 2008, 2013, 2018		

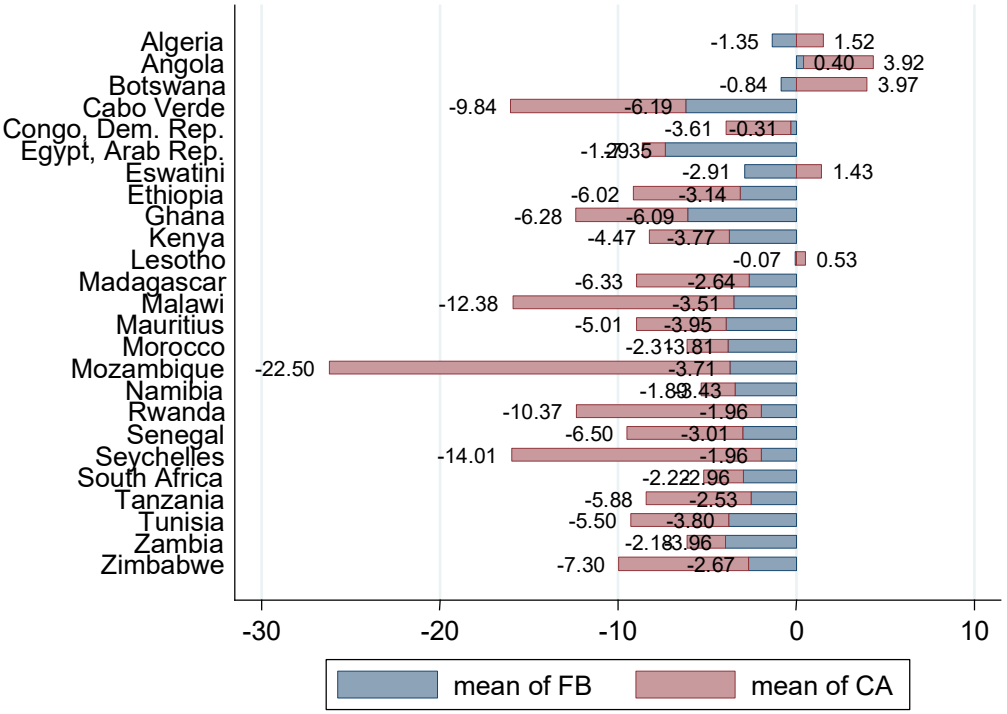
Source (IFES and EISA[34]): Author's own sampling.

Figure 3.1 shows that the sampled countries have experienced twin deficits (fiscal and current account). Besides the trade-off of fiscal deficits mentioned by Ball and Mankiw (1995), Bresser-Pereira (2020) attest that countries with high current account deficit are often consumption oriented rather than production oriented, which means that the public prioritises immediate consumption over long-term capital accumulation and growth. With enough election date data and the presence of twin deficit evidence in the selected countries, this essay explores whether there are budgetary manipulations tied to the election proximity and what the policy implications of such manipulations are.

Algeria, Angola, Botswana, Eswatini, and Lesotho have had an average current account surplus for the period of the study. Only Angola has had both fiscal balance and current account surpluses. Botswana recorded the highest fiscal balance surplus of an average of 3.97 percent of GDP, while Lesotho recorded the least surplus of 0.53 percent of GDP. Mozambique recorded the highest deficits per average for the period, followed by Seychelles. Elevated levels of current account deficits suggest that these countries also have weaker domestic currencies, exposing them to imported inflation. By implication, if these countries attempt to finance their fiscal deficit through seigniorage, they immediately face further inflationary pressures. Therefore, money printing is not an option for these economies. The statistics in Figure 3.1 indicate that both fiscal and current account deficits are very much a permanent feature of these economies for the period of study.

[34] International Foundation for Electoral System (IFES) and Electoral Institute for Sustainable Democracy in Africa (EISA)

Figure 3.1. Fiscal balance (deficit) and current account balance for the sampled countries (2000–2021)



Source: (World Bank Indicators 2000–2021) Author's own computation

Table 3.1 provides a glossary of variables used in this essay.

Table 3.1. Data collected and sources

Variable	Definition	Source
Fiscal balance	Budget deficits (% of GDP)	International Monetary Fund
Economic growth	Annual (% of GDP)	World Bank Indicators
Election	Presidential election year	IFES and EISA[35]
Financial crisis	Financial crisis indicator	World Bank Indicators
Corruption control	Corruption control indicator	World Bank Indicators
Democracy index	Include electoral process, functioning of government, pluralism, political participation, civil liberties, and political culture	World Data
Polity-V	Democracy index	World Data
Voice accountability	Voice accountability indicator	World Bank Indicators

Author's own compilation

3.7 Empirical analysis of the sampled data

This section discusses the results obtained by estimating Equations 3.1 and 3.2. The first part discusses the summary statistics and correlation analyses, followed by the regression estimations, as specified in the methodology section.

Table 3.2 presents the fiscal balance for the 25 selected African countries at -3.02 percent of GDP per annum, with the maximum value taken as a percentage of GDP at 16.91 percent, and the minimum at -17.84 percent. This means that the fiscal balance takes both negative and positive values in the sample, where negative represents a budget deficit, and a positive value represents a budget surplus as a percentage of GDP. Economy growth has a minimum of -19.44 percent (worsening of the economy), a maximum of 9.44 percent, and an average of 3.98 percent. The election cycles show that the minimum is 0, the maximum is 1, and the average is 0.20, which is the sample average of any country having an election within the period of study. This is the average number of observations, and each country has held at least three elections over the past 21 years. For institutional variables, corruption control and voice accountability have an average of -0.28 and -0.34 units, respectively. The negative values indicate the deterioration of corruption control and voice accountability in these countries. The democracy polity has an average of 3.06, the maximum

[35] IFES is the International Foundation for Electoral System, and EISA is the Electoral Institute for Sustainable Democracy in Africa.

value of 10 being the most democratic, and the least democratic being -9. The institutional variables take both positive and negative values; the more negative it is, the less effective it is in the respective country.

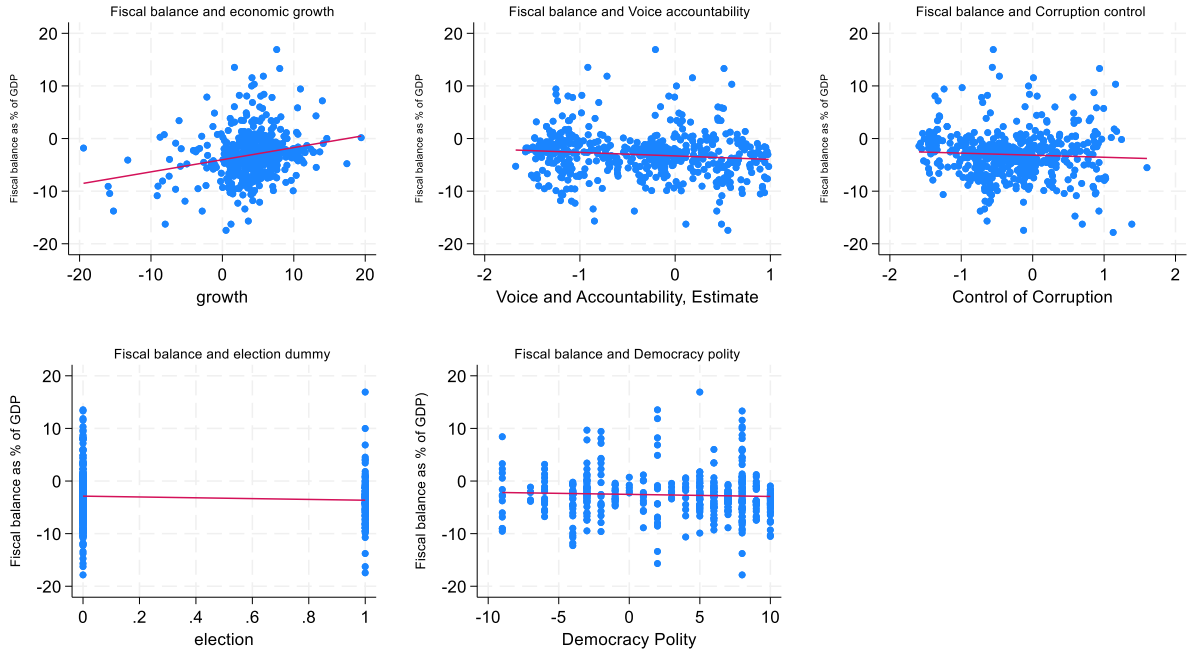
Table 3.2. Summary statistics of the data collected

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Fiscal balance	543	-3.023	4.321	-17.84	16.913	-14.74	10.325	.471	5.678
Financial crisis	550	.091	.288	0	1	0	1	2.846	9.1
Growth	525	3.979	4.383	-19.442	19.435	-13.248	13.645	-1.362	8.648
Expenditure	490	108.552	13.573	67.689	169.374	73.175	156.866	.901	6.821
Total revenue	490	23.485	10.426	.637	61.559	4.892	57.185	1.03	4.185
Accountability	525	-.339	.731	-1.675	.983	-1.539	.955	.03	1.774
Corruption	525	-.278	.633	-1.468	1.633	-1.42	1.161	.292	2.572
Election	550	.195	.396	0	1	0	1	1.543	3.382
Polity-V	456	3.055	5.491	-9	10	-9	10	-.525	1.949
Time	550	2010.5	6.35	2000	2021	2000	2021	0	1.795

Source (WDI; IMF, World Data, 2023): Author's own computation

Figure 3.2 shows that fiscal balance and economic growth are positively correlated. However, both corruption control and voice accountability are negatively correlated with fiscal balance as a percentage of GDP. The election cycle and democracy index relationship with the fiscal balance is not immediately obvious from the plots. Table 2.4 provides a pairwise correlation between them.

Figure 3.2. Fiscal balance (% of GDP) against other variables



Data Source:WDI (2000-2021), Author's own compilation

3.7.1 Two sample tests: does budget balance differ during election and other periods?

Before estimating the results, a two independent sample means t-test was performed to establish whether the fiscal balance average differs between the election and other periods. The assumption is that all observations are identically independent and normally distributed. The test uses a continuous variable (fiscal balance) and a categorical variable (election dummy). To test for a significant difference between the two means, t-statistics is calculated. The null hypothesis is that there is no difference between the two period averages of fiscal balance. According to the test results, the probability of observing a t-value greater than 1.67 or less than -1.67 is 0.096; therefore, the null hypothesis was rejected at 10% level of significance, and there is a significant difference in the mean fiscal balance under the two periods. This result suggests that the variance of fiscal balance differs systematically between election and non-election periods.

Table 3.3 shows the average fiscal balance through a structured time path during the election, a year before the election, two years before the election, and three years before the election. The mean and median are not very different during the election and the other periods, generally. However, the average fiscal balance is the highest for the election year at -3.64 percent, and between levels with one, two, or three years left before the election year having averages of -2.23, -2.40, and -2.55 percent, respectively. A year before elections, the average is -2.97 percent compared to other periods. Similarly, there is no significant divergence between the mean and the median. That is, the average fiscal balance tends to be smaller in earlier periods before the election than in periods closer to the election[36]. Thus, the fiscal balance is smaller in absolute value than in other periods.

Even with this initial synopsis, these figures offer preliminary evidence of an association between elections and the fiscal balance changes. The finding makes a rather stark point that the budget deficit rises more on average during election cycles compared to other periods.

[36] As elections approach, the political discount rate on long-term policy outcomes increases, raising the likelihood of implementing inflationary measures.

Table 3.3. Fiscal balance (as % of GDP) during election, one year before election, two years before election, and three years before election

Election year	Mean	SD	Median	Max	Min	N
0	-2.870851	4.229199	-2.911	13.535	-17.84	437
1	-3.64966	4.648644	-3.349	16.913	-17.443	106
Total	-3.022884	4.320877	-2.969	16.913	-17.84	543

One year before	Mean	SD	Median	Max	Min	N
0	-2.976683	4.236665	-3.035	16.913	-17.443	445
1	-3.232673	4.701794	-2.7575	11.553	-17.84	98
Total	-3.022884	4.320877	-2.969	16.913	-17.84	543

Two years before	Mean	SD	Median	Max	Min	N
0	-3.152563	4.375112	-3.144	13.535	-17.84	449
1	-2.403457	4.016194	-2.53	16.913	-11.796	94
Total	-3.022884	4.320877	-2.969	16.913	-17.84	543

Three years before	Mean	SD	Median	Max	Min	N
0	-3.116638	4.298251	-2.968	16.913	-17.84	453
1	-2.550989	4.427219	-3.013	13.535	-13.382	90
Total	-3.022884	4.320877	-2.969	16.913	-17.84	543

Source: Author's own computation

Table 3.4 presents the correlation results, where fiscal balance is positively and significantly correlated with economic growth, and negatively and significantly correlated with voice accountability. A positive correlation exists between the fiscal balance and financial crisis, but it is not significant. The corruption control, election cycle, and democratic polity variables are negatively correlated with fiscal balance but are insignificant. There is a significantly high and positive correlation between voice accountability and corruption control (0.65); similarly, there is a high, positive, and significant correlation between the democratic polity index and voice accountability (0.84). The result section provides a discussion of the formal collinearity test under the diagnostic section.

Table 3.4. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Fiscal balance	1.000						
(2) Financial crisis	0.069	1.000					
(3) Economic growth	0.229*	-0.042	1.000				
(4) Voice accountability	-0.115*	-0.030	-0.098	1.000			
(5) Corruption	-0.051	0.014	-0.075	0.651*	1.000		
(6) Election cycle	-0.072	0.036	-0.034	0.042	0.021	1.000	
(7) Polity-V	-0.052	-0.011	-0.038	0.837*	0.360*	0.027	1.000

*Source: Author's own computation: Notes *** p<0.01, ** p<0.05, * p<0.1*

3.7.2 Regression analysis

This section presents the estimated results when different institutional variables were included in the analysis. Since the endogeneity problem is expected with the type of data used here, both difference and system GMM were estimated to obtain robust results while controlling for it. Because the panel data has a time series aspect, a stability test was performed before further analysis (Levin and Lin, 1992; Hadri, 2000). Levin and Lin (1992) propose the Fisher-type tests using the Augmented Dickey Fuller and the Phillips-Perron tests to examine the null hypothesis of common stationarity. The test-statistic value for the fiscal balance is -4.5194, with a corresponding p-value of 0.000. Similarly, economic growth and election cycle have statistical values of -6.97 and -14.76, respectively, with corresponding values of 0.00. The results suggest that fiscal balance, economic growth, and election cycle are stationary series at the level.

Table 3.5 reports empirical results obtained based on multivariate differences and system GMM of annual budget fiscal balance as a percentage of GDP, election cycle, financial crisis categorical variable, and economic growth. To obtain more nuanced indicators of the effect of election proximity on fiscal balance, various election indicators were introduced to permit the electoral influence on fiscal policies to vary conditionally on whether the election happens in either year one, two, or three. The results were estimated by categorising three periods before the election (one year before the election, two years before the election and three years before the election), as well as during the election.

The election variable coefficient is positive and insignificant when estimated under a difference GMM estimation technique. The fiscal balance increased by 0.06 percentage points during the election year compared to other periods. The coefficient becomes significantly larger at 0.14 percent when the system GMM technique is used instead. This implies that there is a fiscal expansion during elections in these countries (Brender, 2003). This finding is consistent with those of Mink and de Haan (2006), who found that budget deficits increase at the time of elections in European Monetary Union member states, and Schuknecht (1996, 1999, 2000), who found similar results in developing economies. Efthyvoulou (2012)

found similar results where the political business cycle is larger and more significant in 27 European Union countries studied, whereas Tujula and Wolswijk (2007) assert that fiscal balance ratios, on average, deteriorate by 0.34 percentage points on output during election years. Additionally, Ademmer and Dreher (2016) observe a strong political budget cycle in a panel of European Union countries. These findings corroborate those of Streb et al. (2009), who suggest that there is an electoral budget cycle in low-income countries.

In the case of the dynamic time path structure, for the impact of one year before the election, the estimation under the difference GMM shows that fiscal balance increases by 0.81 percentage points compared to other non-election periods, while the increase is 1.41 percentage points under the system GMM estimation (column 5, Table 3.5). The effect is statistically significant for both of the estimation techniques. In the case of two years before the election consideration, for the influence on fiscal balance under difference GMM methods, the effect rose by 2.82 percentage points, which is significant at one percent compared to other periods; while the effect under system GMM is 4.00 percentage points (which is also significant at one percent) compared to other periods. The three years before the election (dummy variable), under the difference GMM shows a fiscal balance (deficit) decrease (increase) by 1.23 percentage points (significant) and 0.98 percent points (significant) increase (decrease) under the system GMM technique. The electoral influence on the fiscal balance is observable three periods away from the election year. Akhmedov and Zhuravskaya (2004) argue that the positive influence of fiscal expenditures on an incumbent's electoral prospects would decrease in the long run and even change as citizens gain more knowledge of competitive elections. In addition, Block (2001) includes time lags to capture the time path of the election effects on consumption and finds a reduction in consumption expenditure share two years after elections. The same phenomenon is observed here, looking at the effects one, two, and three years before the election.

The time path results are consistent with those of Rogoff and Sibert (1988), Rogoff (1990) and Shi and Svensson (2006), who included rational expectations in their political opportunistic models to account for information asymmetry. They argue that since voters are ignorant of the true competence of an incumbent regime, which is essential in their evaluation of its performance, the current government has an incentive to signal its competence through management of fiscal balance (deficit) before elections. The coefficients of fiscal balance, one, two, and three years before the election in the current study agree with their conclusion.

Using the dynamic difference GMM model to test the statistical significance of political and institutional factors as drivers of fiscal balance, the results show a persistence in fiscal balance as captured by the lag of fiscal balance. For every one percent increase in the previous year's fiscal balance, fiscal balance increases by 0.41, 0.42, 0.40, and 0.38 percentage points for estimation, one year before the election, two years before

the election, three years before the election, and the election year itself, respectively. Estimation under the system GMM (0.57, 0.56, 0.58, and 0.56) maintains the sign and significance of the lagged fiscal balance. Notably, the size of the coefficient is smaller during the election than in other periods. There is a diminishing effect toward the election year.

The output growth was incorporated to assess its potential indirect impact on fiscal balance, particularly in the context of election-driven expansionary fiscal policies. The results indicate that the economic growth variable has a positive and significant influence on fiscal balance. For every one percent increase in economic growth, fiscal balance increases by 0.50, 0.46, 0.47, and 0.50 percentage points, respectively, when estimated using the system GMM technique. The estimate under the difference GMM technique is not materially different to those under the system GMM technique. The variable maintains the sign and the level of significance under the difference GMM estimation methods. The size of the coefficients is larger during the election year compared to other non-election periods. The positive sign implies that strong economic growth cushion economies from unstainable fiscal expenditures, which strains public finance. The results suggest that fiscal fluctuation during election periods caused by economic growth activities tends to positively influence budget balance more than during other periods. The results were estimated using other factors that influence the fiscal policy, such as total revenue and total expenditure. The estimated results show that total revenue as a percentage of GDP growth is positive and statistically significant, while for gross expenditure, output growth is negative and statistically significant, as seen in Tables A3.1 and A3.2 in the *Annexure A.2*. Vergne (2009) obtained similar results in terms of the link between output growth and current expenditure. By implication, economic growth increases total revenue and decreases gross total expenditure during election cycles.

The financial crisis dummy variable was included to moderate the effects of financial market shock on fiscal balance. The 2008–2009 financial crisis categorial variable has a positive and significant effect on fiscal balance for the difference GMM for two models only. The fiscal balance increased by 0.45, 0.38, and 0.53 percentage points, respectively, under the difference GMM model (columns 2, 3 and 4, Table 3.5); however, it is not statistically significant under the system GMM model. These results are surprising as one would expect the budget balance to worsen during the financial crisis period. There are several possible explanations for these results. The most obvious is that some countries received financial support from the IMF and the World Bank during the crisis, shielding their economies from the shock. Another reason could be a decrease in government spending as a state precautionary measure from the uncertainty emanating from the crisis. The government's ability to borrow and spend during the financial crisis is limited (Janků and Libich, 2019). Therefore, if the financial crisis took place in the election year, the influence on budget deficits is insignificant compared to if it happens one, two, or three years before election. The estimation

was performed with financial crisis and the election dummy variables (not reported here). Both dummy variables are not significant individually; however, the interaction is negative and statistically significant. de Hann (2014) argues that the financial position of the state matters considering the effect that political business cycles have on the fiscal balance; therefore, one expects the financial crisis shocks to have an adverse effect on the fiscal balance. The results show that the intensity of electoral manipulation is not constant and tends to vary throughout time.

The autoregressive of order one (AR1) coefficient is statistically different from zero, which suggests that the lagged budget deficit significantly influences the current budget deficit, while the higher order of AR2 process is insignificant. These results are consistent for three institutional variables. The joint significance for all models is also statistically significant, as shown by the p-values of the F-statistics value. The next section discusses the results obtained for different regime types and their impact on fiscal balance in the study sample.

Table 3.5. Regression results of fiscal balance and election with time effect (proximity)

VARIABLES	(1) Difference GMM	(2) Difference GMM	(3) Difference GMM	(4) Difference GMM	(5) System GMM	(6) System GMM	(7) System GMM	(8) System GMM
Fiscal balance	0.4095***	0.4194***	0.4008***	0.3830***	0.5688***	0.5600***	0.5806***	0.5572***
	(0.029)	(0.018)	(0.019)	(0.016)	(0.025)	(0.012)	(0.022)	(0.010)
Financial crisis	0.2126	0.4569**	0.3794**	0.5311***	-0.0255	0.2748	-0.1200	0.0224
	(0.161)	(0.192)	(0.148)	(0.125)	(0.144)	(0.168)	(0.136)	(0.083)
Growth	0.4949***	0.4440***	0.5053***	0.5907***	0.5011***	0.4576***	0.4744***	0.5028***
	(0.035)	(0.027)	(0.027)	(0.021)	(0.027)	(0.025)	(0.031)	(0.018)
1 year before	0.8088***				1.4119***			
	(0.192)				(0.269)			
2 years before		2.8193***				3.9986***		
		(0.223)				(0.217)		
3 years before			-1.2273***				0.9844***	
			(0.276)				(0.285)	
Election cycle				0.0640				0.1413
				(0.098)				(0.141)
Constant					-3.7670***	-3.9995***	-3.5090***	-3.5099***
					(0.226)	(0.119)	(0.290)	(0.125)
Observations	424	424	424	464	449	449	449	449
Countries	25	25	25	25	25	25	25	25
No. of instruments	23	23	23	23	25	25	25	25
AR1 p-value	0.0128	0.0100	0.0141	0.0062	0.0110	0.0070	0.0105	0.0114
AR2 p-value	0.5023	0.1306	0.4898	0.5898	0.3947	0.0832	0.2963	0.3327
Hansen p-value	0.3464	0.3631	0.4252	0.3195	0.3175	0.3714	0.3553	0.2512
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*Source: Author's own compilation, Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.10, AR1: autoregressive of order one*

Table 3.6 reports the empirical results for a multivariate estimation of the difference GMM technique for fiscal balance as a percentage of GDP, election cycle, Polity-V categories and their interaction (autocracy, anocracy, democracy), corruption control, and voice accountability and their interactions with the election cycle, and corruption control and voice accountability.

The election variable coefficient is negative and statistically significant at the one percent level when estimated using system GMM method, for all institutional variables considered. From the results for the election dummy variable in Table 3.6, the coefficients had (-4.05, -4.35, and -2.91) percentage points, respectively, during the election year for the three Polity-V categorisations (autocracy, anocracy, and democracy). The coefficient remained negative (-2.79 and -3.20) and statistically significant at one percent under the corruption control and voice accountability variables specification as well. The negative coefficient for the election year is associated with lower (higher) fiscal balance (deficit). Mink and de Haan (2006) show that governments with no ideological preferences with policies aimed at maximising the chance of winning the upcoming election tend to have higher budget deficits in the election year. Shi and

Svensson (2006) observed that from 1975 to 1995, developing countries experienced a 1.27 percentage point deterioration of the budget balance in the election years in their analysis.

These results are in line with those of Mink and de Haan (2006), who found that budget deficit increased during the election period in European Monetary Union member states. Krueger and Turan (1993) find similar results for fiscal aggregates in Turkey. Similarly, Efthyvoulou (2012) found similar results, where the political business cycle is larger and significant in the 27 European Union countries studied. Similarly, Tujula and Wolswijk (2007) assert that the fiscal balance ratios on average deteriorate by 0.34 percent of GDP in election years. Another study by Ademmer and Dreher (2016) observe a strong political budget cycle in a panel of European Union economies. While Jones et al. (2012) find similar results in Argentina. The current study's results also corroborate with those of Streb et al. (2009), who argue that there is an electoral budget cycle in low-income countries. Other studies, which find evidence of the election budget cycle are those of Schuknecht (2000), Block (2002), Akhmedov and Zhuravskaya (2004), Barberia and Avelino (2011), KoKsal et al. (2012), and de Haan and Klomp (2013).

The lag of the outcome variable confirms the persistence in fiscal balance. For every one percent increase in last year fiscal balance, the fiscal balance increases by 0.43, 0.53, and 0.36 percentage points for estimation under autocracy, anocracy, and democracy regimes, respectively. These figures are statistically significant at the one percent level. For institutional indicators, corruption control and voice accountability contribute 0.50 and 0.43 percent to current fiscal balance, respectively, holding all else constant. For the economic variable, which serves to filter out the fiscal fluctuation emanating from economic fluctuations, the results indicate that economic growth has a positive and significant influence on fiscal balance when estimated using system GMM (columns 6 to 10, Table 3.6). For every one percent increase in economic growth, the fiscal balance increases by 0.51, 0.45, 0.46, 0.48, and 0.42 percent, respectively. Again, economic growth makes budgetary constraints binding. These results corroborate those of Hagen (2010) and Efthyvoulou (2012), who found evidence for the political budget deficits in countries with higher per capita GDP and matured democracies.

The corruption control, which proxies each country's degree of corruption as viewed by the business community and risk analysts, is statistically significant under both estimation techniques, which include the election as a regressor. For every one-unit improvement in corruption control, the fiscal balance decreases by 3.50 percent for the system GMM (column 9, Table 3.6). Moreover, when voice accountability is used instead, the estimate is statistically significant and has the negative sign (8.10 percent). Corruption control and voice accountability, which are good measures of government transparency and credibility, show that fiscal balance worsens (deficit increases) in countries that are replete with corruption events, where citizens lack representation in policymaking (Woo, 2003; Henisz, 2004; Alt and Lassen, 2006). A larger coefficient

of the institutional variables indicates stronger institutional constraints on politicians' ability to manipulate policies ahead of elections, which should correspond to smaller political budget cycles. These results suggest that institutional settings in sampled countries are not strong enough to shield fiscal balance from political manipulation. The results corroborate the arguments by Andersson and Anechiarico (2019) who argue that corruption in public administration politics is ubiquitous and hard to eliminate. Moreover, corruption has a strong influence on public attitudes toward the government, and it is at the same time poorly understood.

To examine whether the political regimes (Polity-V) can elucidate the differences in the magnitude of the political business cycles in selected countries, the original model was augmented with Polity-V categorisation, which measures the influence of democratic/autocratic regimes on the fiscal balance. By categorising political regimes (see Table A3.5 in *Annexure A.2* for the regime categories), the study examined how variations in the degree of political regimes over time and across different countries affect electoral budget cycles. In column 1 of Table 3.6, the interactive term (election*autocracy) reflects how the impact of elections on the fiscal balance differs in countries governed by autocratic regimes during election periods. As seen in column 1, the interactive term (interactive1) enters the model with a positive sign and 5 percent level of significant. The coefficient of interactive1, means that the election-induced change in fiscal balance is 79.4 percentage points different compared to non-autocratic regimes. The value is quantitatively large to warrant reliability, besides the positive sign. Since the coefficient is positive, the autocratic regimes experience an increase in fiscal balance during elections, which contradicts the arguments of Gonzales (2002) and Klomp and de Haan (2013), who assert that fiscal policy is insensitive to elections in autocratic regimes compared to democratic regimes. The caveat here is that there are only four countries (Angola, Egypt, Eswatini, and Morocco) which are categorised as autocratic; therefore, the sample size could also be driving the results[37]. However, autocratic governments tend to be unpopular, and they tend to be opportunists during elections, as argued by Frey and Schneider (1978). Shi and Svensson (2006) also suggest that even dictators have incentives to act, which reduces the level of public discontent before the sham elections. Brender and Drazen (2007, 2008) give evidence of the political business cycle during elections for fragile democracies. Of course, the assumption here is that democracy, with all its limitations, is not as fragile as autocracy.

Column 2 of Table 3.6 reports the estimated coefficients for the interactive2 (election*anocracy) term. The coefficient is negative (-9.70 percentage points) and significant at a 10 percent level. The findings suggest that countries with anocratic regimes tend to have lower fiscal balance (high deficit) induced by election

[37] See Table 3.7 column 4 for the value for the autocracy variable, which is more credible in terms of sign and level of significance.

cycles compared to non-anocratic regimes. These results corroborate Brender and Drazen (2005), who suggest that voters in less mature democracies fall prey to fiscal manipulation during elections because they often lack the information required to evaluate politicians' incentives closer to or during the election.

Column 3 presents the coefficient estimate for the interactive3 (election*democracy) term. The parameter is positive and significant, which shows that the election induces an increase (decrease) in fiscal balance (deficit) in the democratic regimes. These results are in line with those of Feld and Kirchgassener (2001) in their Swiss towns study and Blume et al.'s (2009) study of a sample of 87 countries, which find evidence of low indebtedness in stronger democratic towns and countries, respectively. In democratic states, fiscal manipulation is less likely because voters can collect and process information, hence they are unlikely to fall under the fiscal illusion devised by politicians during the election year (Brender and Drazen, 2005; de Haan, 2014). However, the results contradict those of Gnimassoun and Do Santos (2021), which argues that countries with robust democratic tend to have higher public deficits[38]. The results of regime specifications in columns 1, 2, and 3 (Table 3.6) suggest that countries with autocratic and anocratic regimes tend to have budgetary manipulation during the election. However, the political regime heterogeneity is likely to have an impact on the size of the electoral business cycle (Vergne, 2009).

To examine the role of institutions in shaping the incentive structure within which political agents operate when managing the fiscal balance, column 4 (Table 3.6) presents the coefficient estimates for the interaction term (election*corruption). The election variable and the interaction (interactive4) are significant and with the expected sign. The election-induced decrease (increase) in fiscal balance (deficit) in a country that has high levels of corruption is 12.97 percent. Alesina et al. (2008) associate most of the pro-cyclicality of fiscal policy observed in developing economies to higher corruption levels. Collier and Vicente (2010) show that because of corruption, firms that support the existing regime can receive subsidies even when they are under economic duress and run the risk of going bankrupt, a phenomenon likely to exacerbate fiscal deficits in countries with weaker institutions.

In terms of voice accountability, the effect is captured by the coefficient estimate of the interactive5 (election*voice accountability) term, which suggests an increase in fiscal deficit in countries where citizens' opinions have less or no influence on the political process. The coefficient estimates for anocracy, and democracy is not significant. These results suggest that institutions in these countries are weak to shield the fiscal balance from political manipulation during elections. However, during elections, the combined effect captured by the interactions between the variable and the election dummy suggest that political

[38] Note that results align with those of Gnimassoun and Do Santos (2021) when estimated using system GMM alone. as see in Table 3.8 for the democracy variable.

manipulation during elections tends to increase fiscal deficit in these countries. In all cases considered here, the results show that pre-set elections have a greater influence on fiscal balance in countries that are less democratic and have weaker institutional constraints on politicians. The expectation that restricted political rights and manipulated voting outcomes would prevent elections from influencing fiscal policy is not supported by the findings; instead, the results indicate the opposite effect.

The autoregressive of order one (AR1) is significant, which means that the lagged budget deficit significantly influences the current budget deficit, while the higher order of AR-process is insignificant. These results are consistent for three institutional variables. Following Arellano and Bond's (1991) approach, the p-value is greater than five percent in the second-order serial correlation of different error terms (AR2); therefore, the null hypothesis test (absence of serial correlation) was not rejected, and the instrumental variables are valid. Following Hansen (1982), the validity of orthogonality conditions for an overly identified model was tested, which confirmed the exogeneity of the instruments' sets. The null hypothesis that the residuals are not correlated with instruments was not rejected; therefore, the instruments are orthogonal. The third factor causality potentiality (another indicator determining the political budget cycle and election effect) cannot be ruled out completely. No evidence from extant fiscal balance literature and election cycles has explored the possibility of a third-factor causality. Nevertheless, the incorporation of other control variables in the model is likely to alleviate such concerns.

The estimates obtained using the dynamic panel regression (GMM), which controls for endogeneity and is appropriate when the number of observations (N) is larger than the timespan (T), show a political induced deficit and that the output growth and financial crisis dummy variables are positive and significant in explaining fiscal balance. However, political regimes and institutional variables are negative and significant in explaining the political budget cycle in selected countries. While some measures of political business cycles and institutions seem to affect fiscal balance (deficit), the impacts are generally moderate, and some are marginally significant. However, the interaction effect with the election cycle is significant and quantitatively important. That is, regime types and other institutional qualities jointly influence fiscal balance outcomes even after controlling for the effect of output growth on fiscal balance and other drivers of fiscal balance (deficit). These results align with Nordhaus' (1975) political business cycle theory, as discussed earlier.

Table 3.6. Regression results with regimes type and other institutional variables

VARIABLES	(1) Difference GMM	(2) Difference GMM	(3) Difference GMM	(4) Difference GMM	(5) Difference GMM	(6) System GMM	(7) System GMM	(8) System GMM	(9) System GMM	(10) System GMM
L. Fiscal balance	0.3276***	0.3226***	0.3481***	0.3511***	0.4176***	0.4322***	0.5354***	0.3601***	0.4974***	0.4258***
	(0.059)	(0.060)	(0.047)	(0.043)	(0.044)	(0.064)	(0.043)	(0.036)	(0.042)	(0.033)
Growth	0.5510***	0.5019***	0.6234***	0.5593***	0.5083***	0.5055***	0.4504***	0.4614***	0.4825***	0.4201***
	(0.036)	(0.051)	(0.046)	(0.050)	(0.077)	(0.031)	(0.061)	(0.041)	(0.039)	(0.039)
Election cycle	-3.8746***	-3.2380***	-3.1652***	-4.0686***	-4.1242***	-4.051***	-4.349***	-2.9100***	-2.7942***	-3.201***
	(0.394)	(0.193)	(0.511)	(0.457)	(0.388)	(0.234)	(0.566)	(0.673)	(0.399)	(0.454)
Autocracy	-4.1340					26.5277**				
	(4.438)					(11.301)				
interactive1	53.3161**					79.3936**				
	(20.564)					(37.253)				
Anocracy		9.4699***					-1.2726			
		(2.265)					(4.864)			
interactive2		16.8286***					-9.6966*			
		(3.530)					(5.153)			
democracy			-0.8142					0.0772		
			(0.767)					(1.032)		
interactive3			7.4301**					18.8083***		
			(2.863)					(4.460)		
Corruption				11.0880***					-3.4994***	
				(2.376)					(1.119)	
interactive4				12.6475*					-12.968***	
				(6.513)					(4.522)	
Voice accountability					10.2853**					-8.095***
					(3.953)					(2.185)
interactive5					-2.2696					-3.550***
					(2.198)					(1.017)
Constant						-3.636***	-3.973***	-3.6421***	-4.9616***	-5.828***
Observations	464	464	464	464	464	489	489	489	489	489
Countries	25	25	25	25	25	25	25	25	25	25
No-IV	21	21	21	21	21	23	23	23	23	23
AR1 p-value	0.0064	0.0063	0.0067	0.0063	0.0075	0.0086	0.0098	0.0097	0.0102	0.0109
AR2 p-value	0.5868	0.3035	0.3140	0.2281	0.1715	0.7506	0.1120	0.2240	0.1594	0.1583
Hansen p-value	0.1809	0.5456	0.1902	0.1763	0.1889	0.2890	0.6466	0.1709	0.2688	0.4699

*Source: Author's own computation: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.10: No-IV is the number of instruments*

3.7.3 Regime types and institutions results analysis

Table 3.7 presents result for the effect of government regime and institution effects on fiscal balance estimated using system GMM only. Dynamic system GMM provide reliable results than those produced under difference GMM. There is a possibility that the fiscal balance is also influenced by the type of regime and institutional setting in the country. The results are for three types of regimes (autocracy, anocracy and democracy) with corruption control and voice accountability interaction with these regimes. The results show that when considering regime alone under corruption control setting, autocracy is positive and statistically significant. The estimated coefficient of 24.50 percentage points for autocracy, implies that autocratic regime is associated with higher fiscal balance or lower fiscal deficit. The corruption control coefficient itself is negative but insignificant under autocratic regime (column 1 results). However, when corruption control is interacted with autocracy, the combined effect captured by interactive1, has a coefficient of 75.68 percentage points, implying that the combined effect of both variables is positive and significant in explaining fiscal balance. The improvement in fiscal balance is magnified by the presence of corruption control under autocratic regime.

In terms of anocracy, both anocracy and corruption control coefficients are negative and insignificant individually. That is anocracy and corruption control seems to imply that budget deficit increases under such setting, however not significant. The coefficient of interactive2 which captures the combined effect of anocracy, and corruption control has on budget deficit is negative and significant, which implies that the budget deficit increases in the anocratic regime under corruption control setting. From these results, we see that fiscal outcomes vary across regime types in terms of the size effect. Alesina and Perotti (1995) and Persson and Tabellini (2002), observe variations in fiscal outcomes depends on the type of regimes such as "presidential versus parliamentary" and electoral system such as "proportional versus majoritarian".
Considering the effect of democracy and corruption control on fiscal balance (column 3), the results show that corruption control and democracy coefficients are positive but insignificant in explaining fiscal balance. That is, democracy and corruption control improve fiscal balance. The combined effect represented by interactive3 coefficient is positive and significant. This implies that democratic regimes with strong corruption control institutions in place tend to have improved fiscal balances (decreasing fiscal deficits). Gnimassoun and Do Santos (2021), find that fiscal deficit tends to increase with levels of democracy, which is contrary our results.

Interacting another institutional variable in the model, voice accountability with regimes gives interesting results. The autocratic regime coefficient (column 4) itself is negative and statistically significant. This implies that under autocratic regime with voice accountability, the fiscal deficit increases. Having voice

accountability in place does not improve the fiscal balance of the country. The voice accountability coefficient (in column 4) indicates that fiscal deficit increases by 14.76 percentage points. The combined effect of autocratic regime and voice accountability (interactive4) on fiscal balance (column 4) is negative and statistically significant (-30.55 percentage point); however, its value is less than the individual coefficient of autocracy (-50.14 percentage points). This implies that having voice accountability in place does moderate the autocratic regime influence on fiscal balance. The results suggest that the autocratic regime tends to have fiscal indiscipline. This is consistent with Pepinsky's (2007) assertion that autocratic regimes tend to reward supporters and penalise political opponents.

Column 5 gives the results for the effect of anocratic regime and voice accountability on fiscal balance. The estimated coefficient of -16.39 percentage points in column 5, which is statistically significant, is associated with lower fiscal balance (or higher fiscal deficit). This suggests that the fiscal deficit is higher under anocratic regimes. The effect of institutional setting (voice accountability) is negative but insignificant in this case. However, the combining effect of voice accountability and anocratic regime, captured by interactive5 is negative and statistically significant. The coefficient of -21.75 percentage points implies that the combined effect of anocracy and voice accountability is associated with lower fiscal balance (higher fiscal deficit). Therefore, the opportunistic nature of anocratic regime in excessive public spending is not moderate by the presences of voice accountability institution in our sample. Confirming the fragility of such institutions in these countries.

Lastly, column 6 represents the results of the effect of democratic regime and voice accountability on fiscal balance. The democracy coefficient of -3.05 percentage points, which is statistically significant, implies that the democratic regime is associated with lower(higher) fiscal balance (fiscal deficit). The effect of voice accountability setting on fiscal balance under democratic regime is negative and significant; however, it is small in magnitude compared to that of anocratic and autocratic regime. The combined effect of democratic regime and voice accountability(interactive6) is positive and statistically significant. This means that the presence of voice accountability does not cushion the fiscal balance from autocracy or anocracy, however under democratic regime it enhances fiscal discipline. The work of Woo (2003) and Obakemi et al. (2021) suggest that stable democracy tend to limit budget deficit financing. These results highlight the mediating role institutions plays in explaining changes in fiscal balance in these countries. That is, erosion or fragility of such institutions compromises the economic outcomes of these countries.

The other covariates included as controls are economic growth and net official development assistance received. The estimated coefficient of economic growth is positive and statistically significant, implying that growth has a significant impact on fiscal balance in the sampled countries. Tujula and Wolswijk (2007), Matritz (2015) and Rana and Wahid (2017) find opposite results in their studies, however Obakemi et al.

(2021) found positive and insignificant results in their study. The net official developmental assistance is negative and significant, which shows that economies that rely more on official donor assistance register more fiscal deficit. The coefficient of the lagged fiscal balance is positive and significant, which indicates that the dynamic specification in this study is justified. Since all the coefficients are less than one, dynamic system is said to be stable.

The results for autocracy, anocracy and democracy regimes under system GMM model provide a theme these regimes play in mediating fiscal balance. The results shows that the fiscal deficit increases for countries which are under autocratic regime, followed by anocratic and worsen the least under the democratic regime. This supports our initial conjecture that regimes impact fiscal balance with varying degrees.

The post estimate diagnostics test results presented in the last few rows of the results show 23 number of instruments and 25 countries. Since the number of instruments are fewer than the number of groups, the condition for the validity of instruments in dynamic panel model is met. The Hansen test, which also checks the validity of instrument, has the p-values above 5 percent, and therefore we fail to reject the null hypothesis. Moreover, the AR (1) p-values are all less than 5 percent validating the presences of first order autocorrelation in all models estimated. This is expected, as the lag of dependent variable is included as a regressor. The AR (2) p-values are all above 5 percent and therefore no second order auto correlation.

The governance structure (i.e. regime types) and institutional settings have a significant impact on fiscal balance of the country. Specifically, regime setting explains the propensity of countries to run fiscal deficit.

Table 3.7. Fiscal balance, regime type, and institution regression results

VARIABLES	(1) System GMM	(2) System GMM	(3) System GMM	(4) System GMM	(5) System GMM	(6) System GMM
L. Fiscal balance	0.4778***	0.5259***	0.3632***	0.3272***	0.5396***	0.3489***
	(0.025)	(0.034)	(0.038)	(0.045)	(0.037)	(0.035)
ODA[39]	-1.2912*	-2.1653***	-1.0144**	-2.8204**	0.8473	-1.2244
	(0.678)	(0.542)	(0.474)	(1.126)	(0.633)	(1.087)
Growth	0.3015***	0.3087***	0.3320***	0.2404***	0.2971***	0.3192***
	(0.033)	(0.041)	(0.026)	(0.037)	(0.057)	(0.041)
Corruption control	-0.4637	-1.1428	1.8284			
	(1.008)	(1.845)	(1.861)			
Autocracy	24.4681***			-50.1390**		
	(5.493)			(19.786)		
interactive1	75.6842**					
	(31.150)					
Anocracy		-5.7822			-16.3877**	
		(3.805)			(6.158)	
interactive2		-14.5426***				
		(4.464)				
Democracy			0.0414			-3.0497***
			(1.136)			(0.728)
interactive3			20.0543***			
			(2.569)			
Voice accountability				-14.7672***	-1.3441	-7.6185**
				(4.305)	(3.289)	(3.622)
interactive4				-30.5495***		
				(10.663)		
interactive5					-21.7457**	
					(7.950)	
interactive6						5.7257***
						(1.307)
Constant	22.9244	39.8566***	17.2811*	50.5546**	-21.2793*	19.7525
	(13.990)	(10.546)	(9.509)	(21.938)	(12.347)	(21.289)
Observations	485	485	485	485	485	485
Countries	25	25	25	25	25	25
No. of instruments	23	23	23	23	23	23
AR1 p-value	0.0172	0.0165	0.0163	0.0081	0.0215	0.0156
AR2 p-value	0.8184	0.2935	0.4203	0.6081	0.8234	0.4190
Hansen p-value	0.2121	0.3745	0.1925	0.6104	0.4690	0.4810
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*Source: Author's own computation, Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.10*

Table 3.8 presents the findings with some refinement designed to measure whether the democracy (Polity-V) variable is non-linear and to embody the institutional variable index using all governance quality variables (political stability, government effectiveness, voice accountability, rule of law, and corruption

[39] ODA – is Official Donor Assistance

control)[40]. The index was estimated using principal components analysis to control for potential multicollinearity in institutional quality variables. The impact of a democracy regime on fiscal balance might not necessarily be linear. The assumption is that there is a certain level of democracy (Polity-V) that triggers a sudden and significant change in fiscal balance, and this threshold may vary depending on the specific context. If such is the nature of democracy, estimating the model without controlling this phenomenon will raise an imminent problem where democracy could be driving fiscal balance without showing up in our linearly specified estimation.

The results were initially estimated using the political stability variable as an institutional quality variable for the three-time paths (one year before the election, two years before the election, and three years before the election). The results indicate that one year before the election, the fiscal balance (deficit) improves (worsens). However, two years before the election (before2), the fiscal balance (deficit) worsens (improves), while three years before the election, the coefficient is positive, but insignificant. Similarly, during the election itself, the coefficient is negative, but insignificant. This implies that closer to an election, politicians tend to signal fiscal discipline compared to two years away from the election. As Landes (2015) states, "You can fool some … and voters almost all the time."

When considering institutional quality alone, the coefficients for political stability and composite index of institutional indicators are positive and statistically significant in explaining the fiscal balance. This finding implies that the stronger the institutional setting, the more fiscal discipline the countries have. Note that the index provides a clearer direction of institutions' effects on fiscal balance than those observed under corruption control and voice accountability individually (see Tables 3.6 and 3.7), which tended to be noisy and volatile.

In terms of levels of democracy (Polity-V), the results are quite interesting. First, the coefficient of polity, which measures the level of democracy, is negative and insignificant; this means that young democracies tend to run larger fiscal deficits. The influence of democracy on fiscal discipline is muted at initial stages; however, when squaring the variable to capture the non-linearity of the democratic level, the coefficient becomes positive and statistically significant at the ten percent level. The turning point analysis for the results reported in column 1 in Table 3.8 yields a value of 1.85 with a z-value of 3.22, with a corresponding probability of 0.001. This suggests that fiscal deficit has a non-linear relationship with democracy. Thus, the effect of polity increases up to about 1.85, and then changes direction. This is also true for other time path specifications and during the election itself. This confirms that mature democracies tend to have higher fiscal discipline compared to younger democracies. The macroeconomic variables (economic growth and

[40] *Annexure A.3* discusses the index construction using principal component analysis.

official donor assistance) have the expected signs and maintain the level of significant observed earlier. The inclusion of the demographic variable (population) to measure the effect of population size on fiscal balance is positive but not significant.

The lag coefficient is positive and below unity; therefore, the model is said to be stable. Using the Hansen p-value, the instruments' restriction criteria are satisfied. AR-1 is statistically significant; therefore, there is serial autocorrelation of order one; however, AR-2 is insignificant, which is an appropriate condition for orthogonality of the model. The joint statistics measured by F-statistics have a p-value less than five percent; therefore, the variables jointly explain the dependent variable.

Table 3.8. Election proximity, non-linearity of democracy, and institutions index

VARIABLES	(1) System GMM	(2) System GMM	(3) System GMM	(4) System GMM	(5) System GMM	(6) System GMM	(7) System GMM
L. Fiscal balance	0.3144***	0.3086***	0.3547***	0.3144***	0.3086***	0.3547***	0.3239***
	(0.073)	(0.060)	(0.099)	(0.073)	(0.060)	(0.099)	(0.068)
Growth	0.5104***	0.5341***	0.5257***	0.5104***	0.5341***	0.5257***	0.5381***
	(0.096)	(0.095)	(0.102)	(0.096)	(0.095)	(0.102)	(0.106)
ODA	-4.4634***	-5.3520***	-4.4706***	-4.4634***	-5.3520***	-4.4706***	-4.4014***
	(0.960)	(1.356)	(1.215)	(0.960)	(1.356)	(1.215)	(1.382)
Population(log)	2.2740	1.4907	3.1290	2.2740	1.4907	3.1290	2.6649
	(2.553)	(2.598)	(3.709)	(2.553)	(2.598)	(3.709)	(2.523)
Polity-V	-0.8551	-0.7203	-0.4066	-0.8551	-0.7203	-0.4066	-0.1797
	(0.851)	(0.812)	(0.856)	(0.851)	(0.812)	(0.856)	(0.824)
polity2	0.2922*	0.2743*	0.2891*	0.2922*	0.2743*	0.2891*	0.1535
	(0.157)	(0.156)	(0.168)	(0.157)	(0.156)	(0.168)	(0.189)
Political stability	5.8357**	8.2786***	8.0357***				
	(2.083)	(2.363)	(2.528)				
before1	2.5642**			2.5642**			
	(1.204)			(1.204)			
before2		-2.1563**			-2.1563**		
		(0.797)			(0.797)		
before3			0.2324			0.2324	
			(1.880)			(1.880)	
index				4.7552**	6.7458***	6.5480***	5.3906**
				(1.697)	(1.926)	(2.060)	(2.370)
Election							-0.3464
							(1.260)
Constant	42.3677	74.7127	28.1202	40.7597	72.4313	25.9058	37.3564
	(49.281)	(55.856)	(55.753)	(49.140)	(55.569)	(55.792)	(51.601)
Observations	402	402	402	402	402	402	402
Countries	24	24	24	24	24	24	24
No. of instruments	20	20	20	20	20	20	20
AR1 p-value	0.0133	0.0089	0.0127	0.0133	0.0089	0.0127	0.0116
AR2 p-value	0.6187	0.9087	0.8916	0.6187	0.9087	0.8916	0.9686
Hansen(p-value)	0.9149	0.7906	0.7274	0.9149	0.7906	0.7274	0.9192
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*Source: Author's own computation, Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10*

3.7.4 Sensitivity analysis

Tables A3.1 and A3.2 in *Annexure A.2* show results for the estimation equation (3) using total revenue as percentage of GDP and gross expenditure as percentage of GDP as dependent variables instead. Other studies used these variables to estimate political business cycles, hence the adoption here to test for the robustness of the current study's findings. The coefficients for economic growth under fiscal balance and expenditures have the opposite signs. The same is true for time path dynamic variables (before1) under both

specifications. Total revenue falls two years before the election and rises three years before the election and during the election year itself. Total revenue increases by 0.70 percentage points during the election year (column 8, Table A3.1 in the *Annexure A.2*), while gross government expenditure decreases by 1.08 percentage points during the election year (column 8, Table A3.2 in the *Annexure A.2*). The results suggests that revenue tends to improve three years before the election but dwindles one and two years before the election. Thus, the further away from the election, the more stable the total revenue.

However, looking at the time path toward the election, the time dummy for two years before the election for the total revenue (expenditure) coefficients are -3.10 and -0.66 percentage points (not significant), which implies that two years before the election, total revenue (expenditure) tends to decrease. Similarly, for three years before elections, the total revenue (expenditure) coefficients are 1.44 and 1.35 percentage points, meaning that three years before the election, revenue (expenditure) is increasing, while expenditure again is not significant. Ames (1987), Rogoff (1990), Gonzales (1999), and Brender and Drazen (2005) suggest that expenditure increases during the election could signal government efforts to protect fragile new democracies, and this is likely to be the case in many developing countries. Gonzales (1999) finds that the election cycle has a positive and significant effect on total government expenditure in Mexico. In addition, this finding aligns with Vergne's (2009) composition of public expenditure in developing countries, which suggests that competitive elections tend to distort public expenditure.

Comparing the election coefficient of fiscal balance from Table 3.6 (column 8) with those of gross aggregate expenditure in Table A3.2 in the *Annexure* A.2 (column 8), the signs of the coefficients are same. However, the coefficient is not significant for the total expenditure results. The size of the coefficient of elections for the expenditure model is smaller than that of the fiscal balance. This finding is contrary to Alt and Rose's (2009) argument that the effect of political business cycles is stronger in expenditure than in budget deficits. These results align with those of Ames (1987), who gives evidence in support of the opportunistic behaviour of the state in fiscal and monetary policy prior and post-election in 17 Latin America countries.

Moreover, Acemoglu and Robinson (2005) discuss the consolidation of democracies in newly democratic countries, which is likely to have a far-reaching influence on the fiscal balance. However, the increase in government expenditure two years before the election (see Table A3.2, *Annexure* A.2, column 4) will have far-reaching implications for the economy. If government spending increases during the election year, most countries will be forced to either increase the progressive tax burden (unlikely) from existing data or experience a chronic budget deficit going forward. The results show that there are fiscal balance, expenditure, and total revenue political cycles in the sample countries. Similarly, both the financial crisis and output growth have a positive and significant effect in explaining total revenues as a percentage of GDP for both the difference and system GMM methods. Table A3.3 in *Annexure A.2* presents a summary of a

few empirical and theoretical studies that solely focus on public expenditure, and their findings are used as a focal source for the discussion of the current study's findings.

Additionally, two tests were conducted to assess the robustness of the GMM models reported. It is crucial to consider the validity of the assumption that the disturbance term is free of serial correlation since the moment condition relies on this assumption. To assess this, the Hansen test for over-identifying restrictions is presented in second row of Table A3.1 and A3.2 (*Annexure A.2*), with the null hypothesis that the IV are uncorrelated with the disturbance term. Both the serial correlation test for the error term and the Hansen test for the validity of instruments confirm that the moment condition cannot be rejected.

3.8 Conclusion

This essay examines factors influencing budget deficits in 25 selected African countries, focusing specifically on the role of electoral cycles, political regimes, and other institutions on fiscal balance. The study identifies several key determinants of budget deficits, including election cycles, economic growth, democratic regimes, and institutional factors such as corruption control and voice accountability. The main findings indicate that the election cycle has a negative and significant impact on budget deficits, which implies that spending is increased during election years, which aligns with previous research findings on political business cycles. The fiscal policy distortions resulting from political manipulation are confirmed. The results also show that there is a sizeable increase in fiscal balance one, two, and three years before the elections, with the largest size effect observed for two years before the election. Alesina's (1987) assertion that the business cycle is not caused by the electoral cycle, because political agents are not able to dupe voters and that voters are rational, is disconfirmed.

Additionally, the financial crisis influenced the fiscal balance positively and significantly in the sampled countries. The analysis highlights the presence of systematic distortions in fiscal balance, gross expenditure, and total revenues as a percentage of GDP in these countries, contributing to the existing literature on opportunistic political business cycles. Moreover, the social contract exercise remains elusive if the critical dependence of politically generated outcomes upon the rules that constrain political actions is missing. The institutions control individually produce noisy results; however, using an index produces results consistent with literature. That is, institutions proxied by an index suggest that strong institutions foster fiscal balance management in the sample countries.

The results in Tables 3.6 and 3.7 show that even without election timing, government structure in terms of regimes and institutional settings significantly influence fiscal balance in the sampled countries, reinforcing the need for strong institutions to ensure fiscal discipline. Regime type increases fiscal deficits when moderated with voice accountability, with autocracy having the largest size effect, followed by an anocratic

regime. The least size effect is observed under the democratic regime, suggesting that democratic regimes tend to have lower fiscal deficits under certain institutional settings than other forms of regimes.

The inherent nonlinear nature of democracy is confirmed by the positive and significant results obtained by imputing the squared of the democracy proxy in the analysis (see polity2 in Table 3.8). This suggests that mature democracies manage fiscal balance better than premature ones, and supports the assertion that the adoption, practice, and safeguarding of democratic institutions are fiscal prudence enhancing (Brender and Drazen, 2005, 2007).

To minimise election-related budget distortions, this essay recommends the formulation of regulations that enhance transparency and accountability in budgetary legislation. Strengthening the fiscal control mechanisms is also essential in preventing opportunistic policies during elections. While acknowledging the limitations of the study's sample size, the research highlights the importance of election cycles and strong institutional factors in determining budget deficits across African countries. It also underscores the opportunistic behaviour closer to the election, emphasising the need for bylaws targeted to such behaviour in these nations. The policy implication of these results is that strong budgetary and other political institutions are vital in managing fiscal policy. To achieve these goals, governments should execute their fiscal operations with a high level of transparency, and, in the event of any surplus, government should allocate such surplus in a diverse portfolio of productive investments, which generate more revenue for the state in future, rather than wasteful expenditures.

Lastly, it is recommended that fiscal policy rules should not be held during the election cycles based on the obtained results and, therefore, require robust oversight to curb excessive expenditure. Future research could explore the relative effect of fiscal policy risk and economic growth on budget deficits and compare election cycle effects between developed and developing economies.

The next essay explores the role of exogenous shocks on fiscal balance in the sampled countries using various measures of exogenous shocks from the COVID-19 pandemic to examine its impact, independently and coupled with other macroeconomic factors, as well as demographic and social-institutional settings.

Chapter 4

Essay 3: Assessing the impact of COVID-19 on fiscal balance: Evidence from selected African countries

4.0 Introduction

This essay examines changes in fiscal balance in the context of the COVID-19 pandemic crisis. Bloom et al. (2020) and Dieppe (2020) give evidence that the pandemic did cause excessive spending, resulting in an explosion of fiscal deficit for many countries globally. Even before the pandemic outbreak, many countries were already running excessive budget deficits, as shown by Abakah and Adusah-Poku (2016) and Adamu (2019). Although there are sufficient studies that evaluate the direct relationship between macroeconomic and institutional settings measures and fiscal balance, incorporating the exogenous shock into the analysis will help us to determine whether such shocks punctuate or dampen the macroeconomic, institutional settings[41] and demographic (in)direct effect on fiscal balance. The pandemic outbreak has elevated fiscal imbalances, increasing the need for further tax mobilisation efforts in the sampled countries. By including the interaction of the COVID-19 pandemic outbreak measures in the analysis, this essay tests whether macroeconomics, demographic, and institutional settings are effective in moderating the effect of the COVID-19 pandemic on fiscal balance in 25 selected African countries. There are no previous studies that provide insights into the effect an exogenous shock such as COVID-19 has on fiscal balance contingent on economics, demographics, and institutions factors in these countries.

Besides, the results of tax effort mobilisation in Essay 1 revealed that the sample countries have limited tax effort and are operating below their tax potential. Furthermore, Clemens and Veuger (2020) provide evidence of tax collection shortfalls caused by the COVID-19 pandemic. They contend that such shortfalls have resulted in support being implemented through state legislation aimed at meeting public health demands. During periods of high uncertainty, the cost of borrowing increases as financial markets become tepid, putting upward pressure on the cost of capital during downturns, precisely when many expenditures are most valuable.

The imposed restrictions due to the COVID-19 outbreak caused a substantial decline in consumption relative to income. This resulted in a decline in tax revenues from consumption expenditure. These short-run revenue strains are likely to be severe in economies that rely on a larger portion of their tax revenue from sales. Poterba (1994) and Clemens and Miran (2012) have shown that the inability to carry unexpected deficits across fiscal years has empirically significant impacts on the speed at which the states reduce

[41] Shang et al. (2021) argue that a pandemic tends to accelerate tensions and unrest in economies with weak institutions.

expenditure or raise taxes following unexpected shocks. Thus, efforts to cushion the economy during a crisis with limited tax revenue inflows forced the countries to borrow, running a risk of further budgetary imbalances.

Given the revenue collection uncertainty in the economy caused by the pandemic outbreak, understanding the influence of the shocks on the fiscal position of these countries is a precondition for correctly determining the baseline response. This essay builds on Essay 2 by incorporating the effects of exogenous shocks to fiscal balance and examining the change of fiscal balance emanating from the moderating effects of the pandemic on macroeconomics, demographic, and institutional settings in these countries.

A fall in productivity (see Table 4.1, panels A and B), which was often accompanied by wage and tax revenue losses due to the COVID-19 outbreak, forced various countries to resort to excessive debt use to finance their spending needs (Eichenbaum et al., 2020; Saadi-Sedik and Xu, 2020; IMF, 2023). Barrero et al. (2020) and Barrero and Bloom (2020) assert that the pandemic outbreak did in fact fuel expectations of downward risks, exacerbated recession risk, slowed down recovery from old shocks, and dampened the effectiveness of policy interventions. Vázquez-Muñoz et al. (2021) observe an asymmetric fiscal policy adoption in the United States, Mexico and Canada during the COVID-19 outbreak, where the United States and Canada pursued a countercyclical policy while Mexico adopted a procyclical policy. Thus, it is important to examine the manifold roles that imperceptible events like a pandemic have on the dynamic of budget balance (deficit) and subsequently elevate the need for additional revenue mobilisation efforts in selected countries.

Poor fiscal performance, marked by excessive and rising fiscal deficits, is likely to lead the economy into a vicious cycle of excessive borrowing, accumulation of public debt, and shortages in debt servicing payments, which will result in an explosion of fiscal deficit[42]. Gnimassoun and Do Santos (2021), in their study of the effect of external shocks on fiscal deficits, propose the need for wider economic diversification as a mechanism to dampen the adverse effects of such shocks on public finances. There are various potential explanations of how the COVID-19 outbreak influenced fiscal balance. First, all things being equal, the pandemic resulted in the loss of productive labour, which affects productivity and, therefore, a decline in output (Yu et al., 2020; Tevdovski et al., 2021). Second, because of the disease outbreak, the austerity risk level rose, causing lenders to demand high interest rates and even be reluctant to lend. In such a scenario, borrowers are likely to fail to meet their repayment commitments and incur further penalties for such failure; thus, their debt level becomes elevated further. Third, unplanned government spending in response to the

[42] Table 4.1 panels A and B show a drastic rise in fiscal deficits and debt as the percent of GDP for the sampled countries.

pandemic is likely to have increased government expenditure. Countries, which borrowed money to spend in response to the COVID-19 pandemic outbreak, further punctuated their fiscal deficit position. There is evidence of a sharp increase in government expenditure as a percentage of GDP during the COVID-19 period (see Table 3.1). There is ample evidence of fiscal deficit being a persistent feature of many African economies even before the pandemic outbreak. For example, Ghana, Kenya, and Mozambique are listed as countries at risk of debt distress by the IMF (Olaoye, 2023). The current study's sampled countries have had no headroom within their public finances for the study's time period; only Angola has an average budget surplus over the 21 years of the study (see Figure 4.0).

4.1 Research gap

While fiscal balance has macroeconomic, demography, social, and political institutional dimensions, there is evidence that it might vary largely due to some exogenous shocks, such as the COVID-19 pandemic and the nature of the sample distribution[43]. Replete studies have explored these other dimensions; however, researchers have given little attention to the effect of exogenous shocks on fiscal balance (Alesina et al., 2008; Agnello and Sousa, 2009; Frankel et al., 2013; Barro et al., 2020).

To address this gap, the current study asks whether an exogenous shock (COVID-19 pandemic) has any moderating effects on macroeconomic, demographic, and institutional drivers of fiscal balance (deficit). Ngo and Nguyen (2020) and Yahaya et al. (2021) admit that developing countries are predisposed to external shocks, which can result in fiscal instability.

4.2 Objectives of the study

This essay determines the direct and indirect effects of the COVID-19 pandemic on the fiscal balance (deficit) in selected African countries. The objectives are:

- To determine the effect of the pandemic shock on the fiscal balance (deficit) for the 25 selected countries.
- To determine the effect of the COVID-19 shock on moderating macroeconomic, demographic, and institutional influences on fiscal balance.

4.3 Research questions

The research questions this essay answers are as follows:

[43] Tevdovski et al. (2021) uses the 2020 year as a COVID-19 dummy in the analysis of determinants of budget deficits, which is different to the current study's approach, which uses the actual number of cases, deaths and stringent index to analyse the effect of COVID-19 on fiscal balance.

- What is the effect of the COVID-19 pandemic shock on fiscal balance for the sampled countries?
- What influence did COVID-19 have on macroeconomic, demographic, and institutional factors that explain the budget balance or deficit in Africa?

4.4 Contribution of the study

Given the persistent nature of fiscal deficit in many developing countries, a key challenge is managing the volatility of the fiscal balance, which arises from both endogenous and exogenous shocks. To this end, this essay aims to contribute to increasing our understanding of the effect of exogenous shocks on fiscal deficit and explore possible policy actions for moderating the effects of similar shocks in the future (Abang Abdul Rahma et al., 2019; Muhamad et al., 2020).

Makin and Layton (2021) investigate the growth of fiscal deficit and suggest sustainable policies to repay the ever-increasing debt. Gnimassoun and Do Santos (2021) and Yahaya et al. (2021) confirm that external economic shocks (trade and climate change) play a vital role in explaining fiscal balance generally. The chance of a similar event to COVID-19 happening is non-zero. Using the complement rule and assuming the COVID-19 event is independent and has a probability of 1 percent occurring in a single year, the probability of it occurring at least once in 20 years is approximately 18 percent[44]. On this backdrop, the lacuna still exists in the nature of the effect COVID-19 has on macroeconomic, demographic, and institutional influences on fiscal balance (deficit). The knowledge of COVID-19's effect on public finance is essential for future planning in the case of similar events.

4.5 Literature review

The following section discusses the theoretical background and provides a theoretical consideration employed in this essay.

4.5.1 Budget deficit theoretical background

Previous studies that explored the drivers of debt included those based on Ricardian theory, which posits that fiscal deficits are neutral to macroeconomic factors (Seater, 1993; Tung, 2018; Ahmed and Alamdar, 2018; Nwanna and Umeh, 2019; Ssebulime and Edward, 2019; Usman et al., 2020). Another component of debt theories is that of Keynesian theory, which links fiscal deficit and economic growth; however, at this point, consensus regarding the effects remains elusive. Gupta et al. (2005), Bose et al. (2007), and Taylor

[44] If an event has a 1% chance of taking place in a single year, the probability of it not occurring in a given year is 0.99 (1-0.01), and if the event is independent, the probability of not occurring in over 20 year is given by 0.99^{20}, so the chance that it occurs at least once in 20 years is given by $1 - 0.99^{20} \approx 0.182 = 18\%$.

et al. (2012) provide evidence of a positive relationship between fiscal deficits and growth. However, Brender and Drazen (2008), Roy and Van de Berg (2009), and Fatima et al. (2011) obtained contrary results. Additionally, the work of Dalyop (2010) and Abd Rahman (2012) finds no link between economic growth and fiscal deficits.

Diamond (1965) presents the Neoclassical model, which is premised on the assumption that financial markets determine demand and supply of funds decisions and argues that budget deficit is caused by the disequilibrium between demand and supply of borrowing and lending decisions. The model connects current account deficits with budget deficits, commonly referred to as the twin deficit hypothesis, which asserts that current account deficits lead to budget deficits (Bird et al., 2019).

Political economic theories postulate that variation in budget deficits is described by differences in political economic settings. For example, Nordhaus (1975) demonstrates that electorates often view deficit-financed public spending positive, while underestimating its long-term costs in terms of future tax burdens. Another theoretical consideration is developed by Benson and Clay (2004), which links the fiscal position and natural disasters. They argue that natural disasters tend to dislocate government revenue collections while raising government spending, which could undermine government fiscal sustainability depending on whether the budget deficit is financed by borrowing or budgetary reallocations. For the current study, the budget deficits theory of interest is that of political economy, Nordhaus's and others, which the next subsection explains, to better grasp how the pandemic influences the drivers of fiscal balance.

4.5.2 Theoretical considerations

Bernheim (1989) and Cifuentes-Faura et al. (2022) provide theoretical considerations that are vital in modelling fiscal balance. They cite neoclassical, Keynesian, and Ricardian theories, where the neoclassical school claims that economic agents implement long-run planning over their life cycles. In this context, budget deficits increase lifetime consumption by shifting the tax burdens to future generations. However, sustained budget deficits tend to crowd out private capital accumulation, leading to higher real interest rates necessary to restore equilibrium in capital markets. The Keynesian theory approach shows that a deficit causes a decrease in revenue due to an economic slowdown (Brown-Collier, and Collier 1995; Galiński, 2022, 2023a, 2023b). However, considering the business cycle, the fiscal balance is required to balance on average (Fischer and Easterly, 1990). Lastly, under Ricardian theory, fiscal deficits are assumed to be neutral in terms of their impact on other economic variables in the long run (Mawejje and Odhiambo, 2022).

To establish the channels through which exogenous shocks influence fiscal balance, the current study adopts a few theories. Among them is the Keynesian theory (Eisner, 1989; Aschauer, 1989, 1990; Pelagidis and Desli, 2004). The Keynesian theory of aggregate demand side shocks posits that exogenous shocks, such

as the pandemic or financial crisis, can result in increased public spending and a contraction in tax revenues. This takes place as the government take up discretionary measures to respond to a crisis, such as increasing public spending or cutting taxes to stimulate demand or as automatic stabilisers (unemployment benefit rising, tax collection falling). Both efforts by the government will result in an increase in budget deficits (Barro, 1974, 1986, 1989; Pelagidis and Desli, 2004; Mawejje and Odhiambo, 2020). The premise is that fiscal adjustments to macroeconomic conditions primarily occur through automatic stabilisers, such as tax revenue fluctuations and unemployment-related expenditures, or through deliberate discretionary fiscal fine-tuning efforts.

In the event of an exogenous shock, such as the COVID-19 outbreak, the government can undertake demand-side actions of either increasing government borrowing or seigniorage (Schwarzer, 2018; Cochrane, 2021). Both approaches come with trade-offs. If the government increases borrowing to respond to the crisis, the public will face high debt servicing costs and higher taxation in the future to repay the borrowed funds. These potential externalities resulting from the COVID-19 fiscal effect are likely to accelerate the fiscal deficit and stunt growth in the future in these countries. Atkeson (2020) provides theoretical modelling of COVID-19 and the potential economic cost of the pandemic; however, the paper does not tie the cost to a specific aspect of the economy, such as budgetary imbalances, which is the current study's focus.

Another potential channel through which exogenous shocks influence the fiscal balance is through the supply side shocks, which, according to the real business cycle theory, include supply side shocks, such as technological shocks, e.g., supply chain disruptions due to restrictions causing shortages of manufactured goods, input materials, and medicine. For example, severe drought due to climate change (Yahaya et al., 2021) can reduce agriculture output and income, leading to lower tax revenues and potentially causing higher spending on social security and leading to higher growth in budget deficits. However, subsequently, the government will have to increase taxes to decrease the fiscal deficit. Higher taxes raise the cost of production, which exerts upward pressure on the market price level (Cochrane, 2021). Thus, deficit financing during the pandemic could trigger inflation increase as the government tries to minimise fiscal deficit.

As discussed in Chapter 3, the political economy theories by Nordhaus (1975), Weingast (1996), and Alesina and Perotti (1999), coupled with institution theories of North (1991) and Acemoglu et al. (2003), suggested that political shocks and the nature of the institutions available can influence economic decisions. Nordhaus (1975) espouses the link between political-cycle shocks and economic outcomes. The assumption is that specific political factors influence the probability of significant shifts in the fiscal policy direction. For example, in response to a crisis, governments might increase spending to maintain public support,

causing a rise in budget deficits. This is like in an election cycle where incumbents have incentives to increase deficits before elections to garner political support from myopic voters; however, election cycles are endogenous in nature. Weingast (1996) discusses the rational choice theory, which explains the influence of political institutions (elections, bureaucracies, corruption, civil war, and political instability) on economic outcomes. The rational choice theory is used to discuss whether institutions account for COVID-19-induced variation in the size of the fiscal balance (deficit). These theories—Keynesian theory, real business cycle theory, coupled with political economy theory—espouse the link between exogenous shocks and fiscal balance (deficit). Thus, this essay uses them to investigate how COVID-19 affects fiscal balance.

4.5.3 COVID-19 and fiscal balance (deficit) potential transmission channels

There is a limited body of research analysing the impact of exogenous shocks, such as the COVID-19 pandemic, on fiscal balance in Africa or within the context of developing countries. However, there are studies exploring the economic consequences of the pandemic outbreak, such as those of Shang et al. (2021). Bresser-Pereira (2020) admits that policies put in place to counter the effect of the pandemic on the economy are likely to cause a larger increase in public debt[45]. Nonetheless, there is no consensus on the net effect of the pandemic shocks, partly because its enduring effect is dependent on the policy reactions (Hu and Liu, 2022). Eichenbaum et al. (2020) show that containment policies put in place to minimise the spread of the disease come at a cost of severe recession. The supply-side impact stems from the pandemic exposing workers to the virus, which, in response, reduces their labour supply, whereas the demand-side impact arises due to the pandemic exposing consumers to the virus. Consumers then react to such risks by decreasing consumption. Both supply and demand-side effects interact to create a prolonged recession, significantly impacting countries' fiscal positions (Eichenbaum et al., 2020).

Makin and Layton (2021) and Ridzuan et al. (2021) discuss the dual nature of the COVID-19 shock (supply and demand side) and the various channels through which these shocks influence other economic variables. The COVID-19 pandemic caused aggregate supply to shrink due to supply chain disruptions and forced business closure (Eichenbaum et al., 2020). Whereas aggregate demand collapses because of job and income losses, restrictions limiting consumption, and investment collapses due to cost overrun. Blanchard (2020) and Gaspar et al. (2020) discuss appropriate policy responses to the pandemic, such as the provision of the correct incentives to business, support of aggregate demand, and social assistance for households[46].

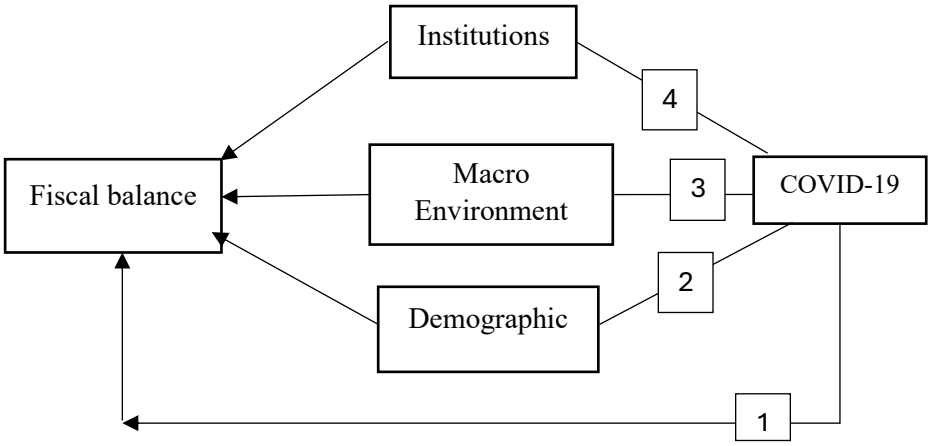
[45] Debt as a percentage of GDP increase from 58.6% (2018–2019) to 70.9% (2020–2021), see Table 4.1 (Panels A and B).

[46] This can be seen through changes in government expenditure (% of GDP) that increased from 26.08 % (2018–2019) to 28.21% (2020–2021) in the study's sample of countries.

All these efforts have had direct and indirect spillovers into the national budgetary planning and fiscal balance (deficit).

Figure 4.0 presents potential channels through which COVID-19 affects fiscal balance directly and indirectly. The link between COVID-19 and institutions and the fiscal balance follows the political theory discussed above, where strong institutions play a moderating role in the effect the COVID-19 outbreak has on the budget balance. The macroeconomic and COVID-19 channel adopts the Keynesian theory, where COVID-19 shocks are transmitted through macroeconomics indicators and reflected in changes in the budget position. In case of the demographic and COVID-19 link to fiscal balance, the real business cycle theory is adopted, where the COVID-19 outbreak is expected to have both supply and demand-side effects on productivity, consequently affecting the fiscal position of the budget depending on the size effect of the shock. As discussed in section 4.6.3, the direct link between COVID-19 and fiscal policy is contentious; however, our expectation is that negative shocks of this nature are likely to adversely affect fiscal balance.

Figure 4.0. Potential channels through which COVID-19 influences the budget balance



Source: Author's own compilation

4.5.4 Empirical literature

Prior studies on the relationship between exogenous shocks and fiscal balance are based on theory suggesting that such shocks influence fiscal balance through direct or indirect channels, including economic growth, demographic shifts, and resource distribution (Saadi-Sedik and Xu, 2020; Yu et al., 2020). The latest studies, which explore the influence of pandemics on socio-economic outcomes, are those of Atkeson (2020), Barro et al. (2020), Deb et al. (2020), Eichenbaum et al. (2020), Jordà et al. (2020), Gonzalez-Torres and Esposito (2020), and Furceri et al. (2020). Furceri et al. (2020) show that major epidemics over the last

20 years, despite being mild in scale compared to COVID-19, have resulted in a persistent increase in inequality. Gonzalez-Torres and Esposito's (2020) study of the Ebola outbreak in West Africa suggests that the outbreak resulted in a rise in civil unrest by 40% one year after the outbreak and its effects persist several years after the outbreak ended. Moreover, Li and Coppo (2020) demonstrate that severe epidemics, those raising mortality rates above the 75th percentile of the global disaster mortality distribution, heighten the risk of riots and anti-government protests in the medium term. Fasanya (2023) explores the influence of pandemic uncertainty on stock returns in South Africa and concludes that health pandemics induce pessimistic expectations on future economic outcomes.

However, most studies have yet to incorporate the COVID-19 pandemic effect in the budget literature, especially in the fiscal balance studies[47]. Nevertheless, the moderating effect of COVID-19 on fiscal balance and other drivers should be considered since fiscal performance might be contingent on exogenous shocks influencing other general determinants. This implies that the pandemic can favourably or adversely moderate the effect of macroeconomic (or demographic) and institutional indicators on the size of the fiscal balance. Moreover, the long COVID effect experienced in other areas of the economy or the recurrence of shocks of a similar nature cannot be ruled out.

Figure A1.2 in *Annexure A.1* provides initial conditions of fiscal balance of the sampled countries two years prior to the pandemic (2018–2019) and the years during COVID-19 (2020–2021). Fiscal deficit increased dramatically during the COVID-19 outbreak compared to the period before. Figure A1.1 in *Annexure A.1* provides total revenue and total government expenditure as a percentage of GDP two years before and after the outbreak. The results also show that total revenue plummeted and total expenditure increased. Saadi-Sedik and Xu (2020) provide evidence that the pandemic caused social unrest through channels such as economic growth and inequality. They argue that the pandemic's impact on social unrest is more enduring, as sluggish economic growth, high inequality, and heightened social tensions mutually reinforce one another, creating a vicious cycle.

The COVID-19 outbreak did result in government having to increase its expenditures to provide necessary infrastructure, such as healthcare facilities and medical access. Governments shifting resources from previous planned expenditure to meet imminent needs, such as health, food provision, and business rescue caused the fiscal deficits to grow for many countries. Moreover, the COVID-19 outbreak resulted in restrictions, causing business closure, productivity loss, wage loss and a total decrease in aggregate output.

[47] Saadi-Sedik and Xu (2020) provide a comprehensive analysis of channels through which previous pandemics are linked to social unrest, while Barro et al. (2020) investigate the short-term and medium-term impact war and pandemic outbreak have on economic growth and consumption and equity prices.

With a decrease in output, government revenue and tax effort dwindled, which also impaired the fiscal balance.

Directly, the pandemic caused loss of lives, resulting in productivity loss and the loss of human capital; thus, the COVID-19 outbreak has had an adverse effect on the population of the countries. The quality of institutions, which are persistent, also played a critical role in the way countries responded to the pandemic. Countries which have strong institutions managed the pandemic effectively with less loss of funding through corruption. Figure 4.0, the transmission pathways, both direct and indirect, shows that there could be potential reverse causality, which is tested during the estimation process[48].

The outbreak of COVID-19 imposed structural changes on the economies. The "long COVID effect" on social, economic, and health is an ongoing investigation. Among the restrictions introduced by health authorities, such as social distancing, teleworking, and movement restrictions, did result in a redistribution of societal resources from highly inflexible sectors of the economy to highly adaptive sectors. Consequently, welfare losses stemming from labour market distortions, such as employment concentrated in the lower wage quantiles of the informal sector with short-term work arrangements and disruptions in human capital development, including schooling interruptions and structural transformations, are expected to exacerbate poverty and inequality. This, in turn, will necessitate greater resource reallocation and reschedule debt payments, further escalating debt levels in the future. Barro et al. (2020) argued that the larger potential losses of lives and economic activity justify the large government spending toward limiting the fatality effect; however, this spending has also resulted in a substantial increase in government budget deficits.

Furthermore, governments worldwide expanded their budget deficits in response to the significant drop in production resulting from the widespread disruptions caused by the pandemic. Governments had to provide liquidity support, replace household lost income, save jobs, and act to avert larger-scale bankruptcies (Furceri et al., 2020). The sudden fall in government revenue, coupled with a sharp rise in government expenditure, is expected to exacerbate public debts to new levels in these countries.

Benson and Clay (2004), who studied the economic and financial impacts of natural disasters in developing countries, confirm that natural disasters tend to cause both short-and long-run adverse effects. They argue that natural disasters, for example, expose countries to higher budgetary pressures in the short run and disrupt economic development plans through reallocation of resources in response to disaster events. They

[48] Granger causality tests are performed before doing the empirical analysis together with impulse response analysis to check the magnitude of shock persistence, if any. The instrument variables are used to examine if there is a unique relation between fiscal balance and the exogenous shock in presences of reversal causality.

call for governments to design and implement a risk management strategy both in the short and long run. Despite their council in 2004, the COVID-19 outbreak exposed the unpreparedness of many countries to deal with exogenous shocks. The pandemic saddled these economies with additional debt and accentuated the risk of fiscal imbalance. The following section discusses the methods used to analyse the sampled data to answer the stipulated question in section 4.4.

4.6 Research methodology and data

The current study used MMQ regression (Koenker and Bassett, 1978; Cifuentes-Faura et al., 2022), together with Blundell and Bond's (1998) system GMM, to analyse the data collected from the WDI and World Health Organization databases. The system GMM technique is useful in estimating short-run effects since it provides an elegant way of correcting for the endogeneity problem[49], which is likely to be encountered in the current study's data. Nevertheless, GMM techniques suffer from the instrument proliferation problem, and it is often difficult to choose appropriate instruments. Second, GMM requires that the number of observations must be greater than the time dimension. Thus, MMQ was also used in this analysis. MMQ regression provides a novel way to deal with the non-normality of the sampled variables (Cifuentes-Faura et al., 2022). Violation of the normality assumption will result in estimators being inconsistent and biased. The MMQ method controls non-normality in the sample and provides both a cross-sectional and time-dynamic estimate across different quantiles. Moreover, MMQ[50] enables the researcher to estimate short- and long-run effects of the variables, unlike the GMM technique, which only provides a short-run effect.

4.6.1 Method of moment quantile regression (MMQ)

Since countries' sizes and other unique sample characteristics are likely to influence the way countries manage their fiscal policy matters, quantile regression might be helpful in discerning such a possibility across the sample distribution. Besides, the GMM methods, we also estimate the results using a panel quantile regression (MMQ). The applicability of quantile regression assumes that the sample distribution is not normal; therefore, the partial slopes from OLS or panel fixed effects are inadequate in capturing the effects of the regressors have on the outcome variable. Because of this drawback, the panel quantile regression technique was used in the current study to investigate the heterogeneous and distributional impacts across quantiles (Ike et al., 2020; Cifuentes-Faura et al., 2022). The initial development of the

[49] The potential endogeneity problem, which makes estimates unbiased and inconsistent, could arise from fiscal balance being correlated with the disturbance term due to either omitted variables, measurement errors, possible reversal causality (dependent variable influencing one of the independent variables), etc.
[50] This method enables one to investigate various effects of independent variables across the sample distribution.

MMQ model was done by Koenker and Bassett (1978), and subsequent refinements made it possible for its application to other data types, such as panel data.

Unlike OLS, which provides coefficient estimates for the conditional mean of endogenous variables based on specific values of explanatory indicators, MMQ regression estimates the conditional median or various quantiles of the dependent variable given the values of exogenous variables. Additionally, MMQ regressions are more robust to outliers, reducing their influence on the estimation process. Additionally, the MMQ method is superior when the conditional means of two variables have a weak or non-existent connection (Binder and Coad, 2011). Additionally, the observed effect of the correlation between variables might suggest a positive relation; however, the same variable may affect the other variable in a negative way at different levels of the distribution. Thus, identifying the characteristics related to the direction and magnitude of these variables is vital in determining the appropriate policy design.

The normality test was performed before attempting further estimations of the results. Ike et al. (2020) state that quantile regression provides some versatility, such as removing the need for normal distribution in data, and the existence of moment function, presence of unobserved heterogeneity in distribution, and cross sections, improves robustness in instances of outliers or heavy tailed distributions (see Figures 4.1 and 4.2 regarding potential outliers in COVID-19 data and the fiscal balance (deficit) data). In summary, the MMQ method enables the identification of conditional heterogeneous covariance effects of fiscal balance drivers by allowing individual effects to influence the entire distribution, rather than just the moving averages. The assumption here is that the effect of an exogenous shock on fiscal balance is likely to be asymmetry across the sample.

To apply MMQ, the model is defined as follows:

$$FB_{it} = f(\,COVID_{it}, macro_{it}, instit_{it}, demographic_{it}, cases_{it}, death_{it}) \tag{4.0}$$

Let α_i capture the unobserved country effects, and redefine (4.0) as follows:

$$E[FB_{it}|(COVID_{it}, macro_{it}, instit_{it}, demographic_{it}, cases_{it}, death_{it}), \alpha_i] = (X^T{}_{it})\beta + \alpha_i \tag{4.1}$$

Where, $X_{it} = (COVID_{it}, macro_{it}, instit_{it}, demographic_{it}, cases_{it}, death_{it})$ and parameter $\hat{\beta}\ (\rho)$ is the ρ^{th} quantile level, which is distributed as follows: $\rho = 0.10, 0.25, 0.50, 075\ and\ 0.95$. The ρ conditional quantile function is defined as:

$$\hat{\beta}(\rho) = argmin_{\beta \epsilon R^k}\left[\sum_{i \epsilon \{i: y_i \geq x_i\beta} \rho|y_i - x_i\beta| + \sum_{i \epsilon \{i: y_i < x_i\beta} (1-\rho)|y_i - x_i\beta|\right] \tag{4.2}$$

The quantile ρ is bounded within the interval of [0; 1], and (4.1) represents the minimum value of the weighted sum of deviation in absolute terms. All variables were tested for stationarity and cross-sectional dependence before the results were estimated. The Westerlund (2007) cointegration test was performed for fiscal balance, cases, deaths, and the COVID-19 stringent index to establish whether there is any cointegration between the exogenous variables and the fiscal balance.

Previous studies have used panel data and applied methodologies such as the Vector Error Correction Model (Murwirapachena et al., 2013) and GMM (Yahaya et al., 2021) to investigate the drivers of fiscal deficit. Following the work of Alesina and Perotti (1997; 1999), Agnello and Sousa (2009), Maltritz and Wüste (2015), and Yahaya et al. (2021), this study designs an econometric model to isolate the effect of the pandemic outbreak on fiscal balance as follows:

$$FB_{it} = \alpha_0 + \beta_i \vec{x}_{it} + \varepsilon_{it} \tag{4.3}$$

$$\vec{x}_{it} = (COVID_{it}, macro_{it}, instit_{it}, demographic_{it}) \tag{4.4}$$

Where FB_{it} is the total fiscal balance (deficit) as a percentage of GDP, and $\vec{x}_{it}$ is a vector of all macroeconomic, demographic, institutional, and various measures of COVID-19 included in both GMM and MMQ. The variable of interest, COVID-19, was measured in four ways: a time dummy (2020–2021), number of cases of those infected with COVID-19 recorded, number of recorded deaths due to COVID-19, which are scaled by log transformation, and the stringiness index, which is the average of various measures taken by a country to curb the spread of the disease between 2020 and 2021.

$$\begin{aligned} FB_{it} = \alpha_0 + \alpha_i FB_{it-1} + \gamma_i COVID_{it} + \beta_i macro_{it} + \delta_i instit_{it} + \psi_i demogra_{it} + \theta(COVID_{it} * macro_{it}) \\ + \vartheta(COVID_{it} * instit_{it}) + \phi(COVID_{it} * demogra_{it}) + \varepsilon_{it} \end{aligned} \tag{4.5}$$

The $macro_{it}$ includes variables such as economic growth, government expenditure, real interest rate, unemployment rate, and official donor assistance. Examples of $instit_{it}$ variables are Polity-V, political stability, regulatory quality, rule of law, corruption control, and voice accountability. $demogra_{it}$ is represented by the log of the total population.

α_i captures the marginal effect of the lagged fiscal balance, γ_i is the marginal effect of COVID-19 on fiscal balance, and β_i captures the marginal effect of all macroeconomic variables. δ_i captures the marginal effect of institutions on fiscal balance, and ψ_i represents the partial slope of the impact of the demographic variable on fiscal balance. θ, ϑ, and ϕ captures the joint effect between COVID-19 and macroeconomic, institutional and demographic variables, respectively. The signs and significance of individual marginal slopes coupled with those of joint-effect variables determine whether COVID-19 reinforces or dampens the effect the interacted variable (macroeconomic, institutional or demographic) has on fiscal balance.

$$\frac{\partial FB_{it}}{\partial macro_{it}} = \beta_i + \theta_i COVID_{it} \quad (4.6)$$

$$\frac{\partial FB_{it}}{\partial inst_{it}} = \delta_i + \vartheta_i COVID_{it} \quad (4.7)$$

$$\frac{\partial FB_{it}}{\partial demogra_{it}} = \psi_i + \phi_i COVID_{it} \quad (4.8)$$

- If β_i and θ_i are statistically significant and have the same sign, COVID-19 is said to have a reinforcing effect on the macroeconomic variables on fiscal balance (deficit); otherwise, if they have opposite signs but are significant, this implies that the COVID-19 pandemic dampens the impact of the macroeconomic variables on fiscal balance.
- If δ_i and ϑ_i are statistically significant and have the same sign, COVID-19 is said to have a reinforcing effect of the institutional variables on fiscal balance (deficit); otherwise, if they have opposite signs but are significant, this implies that the COVID-19 pandemic dampens the impact of the institutional variables on fiscal balance.
- If ψ_i and ϕ_i are statistically significant and have the same sign, COVID-19 is said to have a reinforcing effect of the demographic variables on fiscal balance (deficit); otherwise, if they have opposite signs but are significant, this implies that the COVID-19 pandemic dampens the impact of the demographic variables on fiscal balance.

The cross partial derivatives of Equations (4.6, 4.7, 4.8) give coefficients ($\theta_i, \vartheta_i, \phi_i$), which, depending on the signs and level of significance, substantiate the importance of exploring the question from a mathematical point of view. Equation 4.5 was also estimated to see whether there is a significant effect in terms of the speed of COVID-19 recovery within the current study's sample and time span.

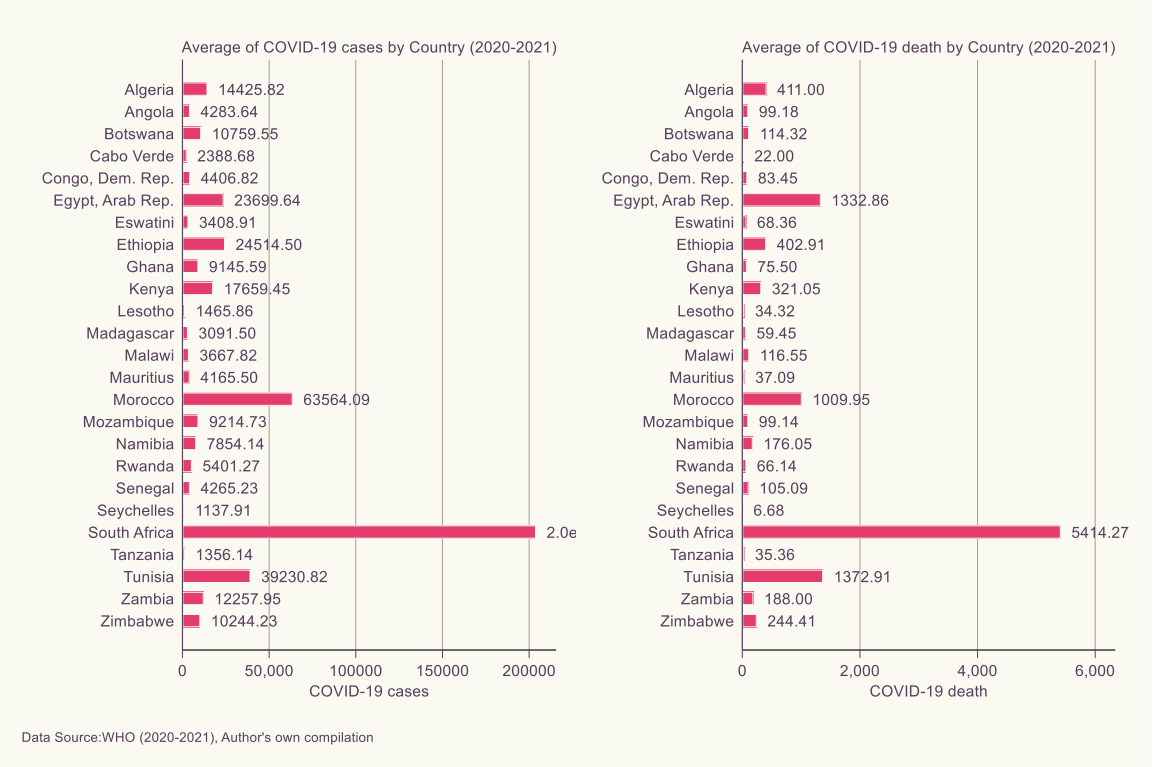
To ensure the robustness of the results, other uncertainty measures were used to estimate the results besides the COVID-19 measures stated above. Specifically, Baker et al. (2020) developed the uncertainties index due to pandemics and epidemics available to download at http://www.policyuncertainty.com/. Other sources of exogenous shocks, such as geopolitical risks discussed by Dario and Iacoviello (2022), were also explored to see if their incorporation gives new insights.

4.6.2 Data

The study employed panel data for 25 countries spanning the period of 2000 to 2021. All appropriate transformations were made before estimating the results to improve the accuracy of the results. The COVID-19 data were normalised with the total population, and the logarithm was used instead of using

them at level. Table 4.1 provides the list of variables used to estimate the results in this essay. Figure 4.1 provides a summary of COVID-19 cases and deaths for all the countries in the sample. The data heterogeneity and fragmentation could be due to countries' ability to track and report cases and deaths during the pandemic. A few of the sampled countries purged their statistics during the pandemic. Thus, some of these countries' data could potentially be suspect. Nevertheless, appropriate normalisation of the data was performed[51]. To improve the efficacy of the result, the stringency index, which measures the number of restrictions implemented during the pandemic outbreak to minimise the spread of the disease, was also collected and the 30-day moving average was computed for analysis (Figure 4.2).

Figure 4.1 COVID-19 number of cases and deaths for sampled countries



[51] To reduce the skewness caused by extreme outliers, these data were logarithmically transformed before using in the analysis. Normalising by dividing by the total population was inappropriate because this makes the values infinitesimally small and potentially mutes the effect the number of death or cases has in moderating macroeconomic, demographic, and institutional variables on fiscal balance.

Figure 4.2 The stringency index for sampled countries

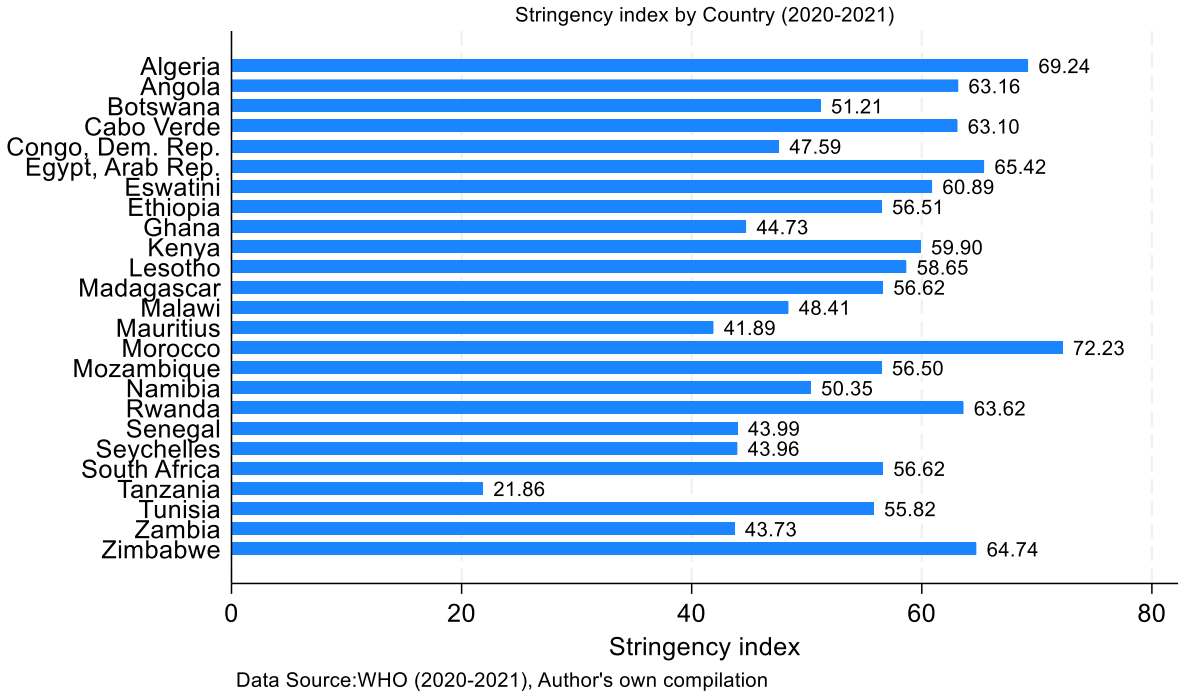


Table 4.1 presents fiscal balance, government revenue, government expenditure, and debt as a percentage of GDP, together with economic growth for 25 countries with a complete set of data, two years before the pandemic outbreak (Panel A) and two years during the pandemic (Panel B). All five variables changed during the pandemic, with fiscal balance rising from 5.03 percent to 7.31 percent. Government revenue as percentage of GDP decreased from 21.04 to 20.89 percent. Many countries were forced to increase government expenditure in an effort to curb the severe damage caused by the pandemic. This is reflected in a rise in expenditure from 26.08 to 28.21 percent during the period. The pandemic also caused the countries to seek further forms of financing to meet the unplanned spending and fill the gap left by revenue losses. This caused the debt levels to elevate from 58.60 to 70.84 percent. The pandemic shock caused many production activities to close and exacerbated poverty and inequality levels across low-income earners and those without safety nets. The productivity collapse is reflected in the output growth decline from 3.75 to 0.80 percent.

Table 4.1. The summary of key variables prior and during the pandemic outbreak

Panel A: Five variables for sampled countries (2018–2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
Fiscal balance (% of GDP)	42	-5.035	3.163	-10.265	2.281
Revenues (% of GDP)	42	21.044	8.429	9.786	43.257
Expenditure (% of GDP)	42	26.079	9.337	11.702	52.362
Debt (% of GDP)	42	58.565	25.806	14.778	113.554
Growth	42	3.752	3.252	-6.307	9.472

Panel B: Five key variables for sampled countries (2020–2021)

Variable	Obs	Mean	Std. Dev.	Min	Max
Fiscal balance (% of GDP)	42	-7.313	4.519	-17.756	3.827
Revenues (% of GDP)	42	20.893	8.733	8.748	50.367
Expenditure (% of GDP)	42	28.205	9.995	12.511	53.389
Debt (% of GDP)	42	70.84	33.027	15.937	147.575
Growth	42	.779	6.749	-19.598	11.867

Source: Data from WDI; *Author's own computation*. *The sample excludes Tunisia, Algeria, Egypt, and Morocco, which have incomplete data*

Table 4.2 provides the names, definitions and sources of variables used in this essay.

Table 4.2. A glossary of variables used to estimate Essay 3 results

Variable	**Definition**	**Source**
Fiscal balance	Budget deficits (% of GDP)	International Monetary Fund
Economic growth	The rate of change of GDP annually	World Bank Indicators
Population	Total population (imputed in log for analysis)	World Bank Indicators
Real interest rate	Real interest rate (%)	International Monetary Fund
Expenditure	Gross national expenditure (% of GDP)	World Bank Indicators
COVID death (cases)	The log of number of people recorded who contracted COVID-19 or died due to it.	World Health Organization
Stringent index (containment)	The index is a composite measure of the strictness of policies that limit people's behaviour[52]	World Health Organization
Institutions	Five measures collected[53]	World Bank Indicators
Democracy index	Include electoral process, pluralism, functioning of government, political participation, political culture, and civil liberties.	World Data
Polity-V	Democracy polity index which range from -9 to 10	World Data

[52] Computed from a set of nine indicators of government containment and closure policy ("including school and workplace closures, restrictions of public gatherings, stay at home requirements and domestic and international travel control" (Hale et al., 2021).

[53] The variables include corruption control, rule of law, government effectiveness, political stability, and voice accountability.

4.7 Results and discussion

4.7.1 Preliminary results

Table 4.3 summarises the entire sampled data. The sample spans the 2000 to 2021 period. The standard deviation of the number of deaths and cases is greater than their averages, which implies potential outliers and non-normality of the sample. The skewness and Kurtosis of these variables corroborate this possibility, hence the choice of the MMQ method for analysis. The same is true for the dependent variable, fiscal balance, the institutional variables, real interest rate, expenditure, and population. The average fiscal balance is -3.023, while the average number of deaths and cases recorded annually in logs are 0.621 and 0.988, respectively. The average expenditure and debt are 23.81 and 52.17 percent of GDP. Voice accountability, corruption control and government effectiveness, rule of law, and political stability have the average of -0.295, -0.339, -0.382, -0.348 and -0.278 units, respectively. Polity-V has a mean of 3.06 and a standard deviation of 5.49, calling for more investigation to assess whether it suffers from extreme values and whether it will require further transformation.

Table 4.3. Descriptive statistics for the entire sample (2000–2021)

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Fiscal balance	543	-3.023	4.321	-17.84	16.913	-14.74	10.325	.471	5.678
Cases	550	.988	3.18	0	15.053	0	12.937	2.999	10.292
Deaths	550	.62	2.064	0	11.419	0	8.933	3.257	12.37
EMV index	550	2.125	5.232	.263	22.632	.263	22.632	3.184	11.787
Stringency index	50	54.429	11.413	18.48	73.87	18.48	73.87	-.86	4.114
Aid (ODA)	546	20.054	1.43	10.82	22.778	16.243	22.33	-1.145	5.837
Growth	525	3.979	4.383	-19.442	19.435	-13.248	13.645	-1.362	8.648
Expenditure	465	23.81	1.513	20.499	26.833	20.656	26.704	-.047	2.308
Debt	506	52.165	49.978	2.551	429.738	3.278	344.935	3.769	23.757
Real Interest rate	436	7.331	12.786	-81.132	52.437	-33.553	47.147	-1.307	15.173
Voice accountability	525	-.339	.731	-1.675	.983	-1.539	.955	.03	1.774
Corruption control	525	-.295	.646	-1.592	1.6	-1.518	1.142	.206	2.581
Government Effectiveness	524	-.382	.605	-1.841	1.15	-1.719	.917	.078	2.693
Rule of law	525	-.348	.628	-1.87	1.024	-1.821	.941	-.313	2.879
Political stability	525	-.278	.821	-2.474	1.283	-2.213	1.104	-.313	2.579
Polity-V	456	3.055	5.491	-9	10	-9	10	-.525	1.949
Population (log)	550	16.182	1.731	11.304	18.605	11.335	18.499	-1.003	3.372
Time	550	2010.5	6.35	2000	2021	2000	2021	0	1.795

Source: Author's own compilation

Table 4.4 presents the summary statistics of the variables used in estimating the study's results for the period of 2020 to 2021. These statistics show that the budget balance (deficit) for the 25 selected countries

decreased on average by 2.13 percentage points in 2021 (-5.26 percent of GDP) compared to 2020 (-7.39 percent of GDP). While the external debt stock as a percentage of GDP decreased on average by 6.37 percentage points from 2020 (77.96 percent of GDP) to 2021 (71.63 percent of GDP). During the 2020 pandemic, the expansionary fiscal policy resulted in government expenditures increasing by an average of 0.15 percentage points. This is expected since many governments stepped up their public spending in wage subsidies, tax deferrals, transfers to firms and households, relaxed regulations, postponements of loan repayments, and other steps such as government guarantees (Emenike, 2021). Moreover, the unemployment rates increased on average by 0.29 percentage points for all countries in the sample. This is expected since many firms in these countries had to close and lay off workers in compliance with lockdown restrictions. The real interest rate increased on average by 0.48 percentage points during the pandemic, which is expected during periods of high economic uncertainty. These results reflect the prevailing economic conditions during the crisis in the sample studies.

Table 4.4. Descriptive statistics for the variables for the 2020 and 2021 periods

	2020			2021		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Fiscal balance	25	-7.394	4.744	25	-5.26	3.19
Cases (log)	25	9.852	2.001	25	11.886	1.174
Deaths (log)	25	5.774	2.25	25	7.861	1.436
Stringency index	25	55.868	11.963	25	52.99	10.887
ODA	24	20.5	1.284	25	20.072	2.274
Growth	25	-4.367	5.641	25	5.243	2.552
Expenditure	23	24.121	1.517	22	24.273	1.469
Real interest rate	20	4.491	22.601	18	4.973	13.56
Voice accountability	25	-.29	.751	25	-.281	.747
Corruption control	24	-.236	.675	25	-.257	.708
Government effectiveness	24	-.389	.612	25	-.392	.606
Rule of law	24	-.32	.582	25	-.35	.604
Political stability	24	-.297	.774	25	-.384	.819
Population (log)	25	16.375	1.813	25	16.394	1.819

Source: Author's own compilation

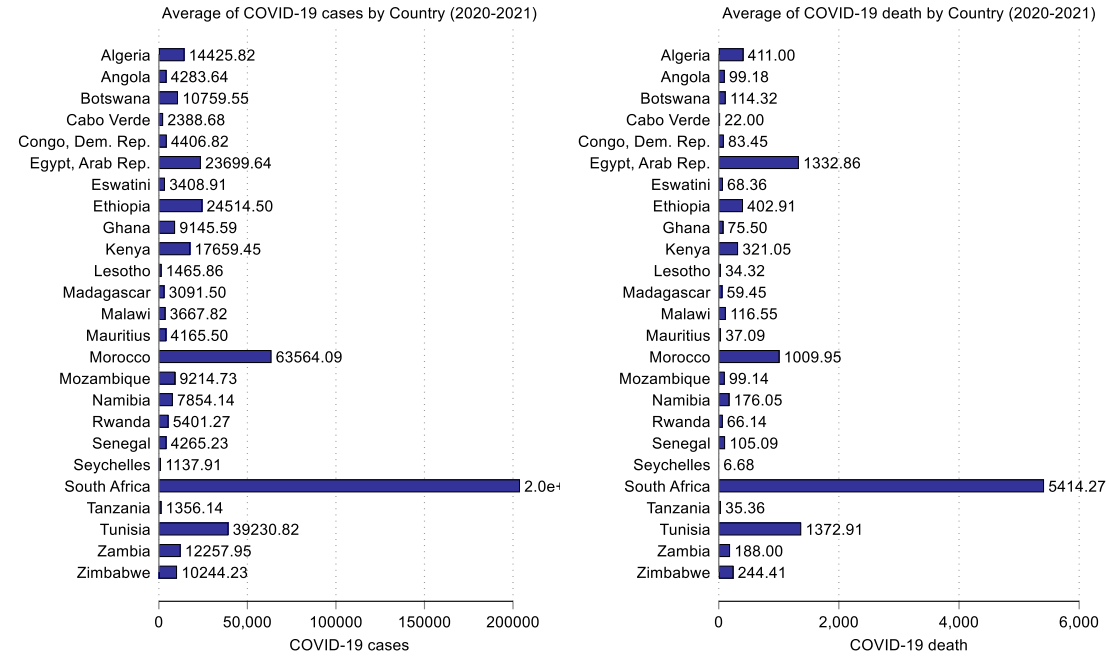
Table A4.1 in *Annexure A.3* presents the pairwise correlation results, where the number of cases and number of deaths due to the COVID-19 pandemic are negatively correlated with the fiscal balance. There is an extremely high correlation between reported cases of COVID and the number of deaths, which is expected. Polity-V is a measure for democracy, which is also highly correlated with voice accountability; therefore, it is not included in the estimation. All institution variables (political stability, voice accountability,

government effectiveness, rule of law, and corruption control) are highly correlated. An index[54] was developed using principal component analysis and used to proxy institutions instead. Fiscal balance is also negatively correlated with official donor assistance (aid), government expenditure, and real interest rates (not significant), and positively correlated with economic growth. Population is also positive and highly significantly correlated with aid and government expenditure.

Figure 4.3 shows the average number of cases and number of deaths caused by the COVID-19 pandemic for the 2020 and 2021 periods. In terms of cases, South Africa recorded the highest number of cases, as high as 200000 cases, followed by Morocco with an average of 63564 reported cases. Tunisia reported the third largest number of cases. Tanzania reported the least number of cases; however, Tanzania's data should be treated with caution since the government restricted data collection and reporting during the pandemic (Lihiru et al., 2023). In terms of death, the average number of deaths approximately mirrored the average number of cases. Figure A1.3 in *Annexure A.3* depicts the stringency index averages for the sample countries. Morocco has the highest average containment index (72.2), while Tanzania has the least (21.9). Nevertheless, COVID-19 report figures are likely to be underestimated due to under-reporting of COVID-19 cases and deaths; hence, our analysis should be treated with caution.

[54]*Annexure A.3* contains a section that discusses briefly the construction of the institutional variable index using principal component analysis and the scree plot of eigenvalues after pca.

Figure 4.3. The average number of cases and deaths due to COVID-19 used in this study



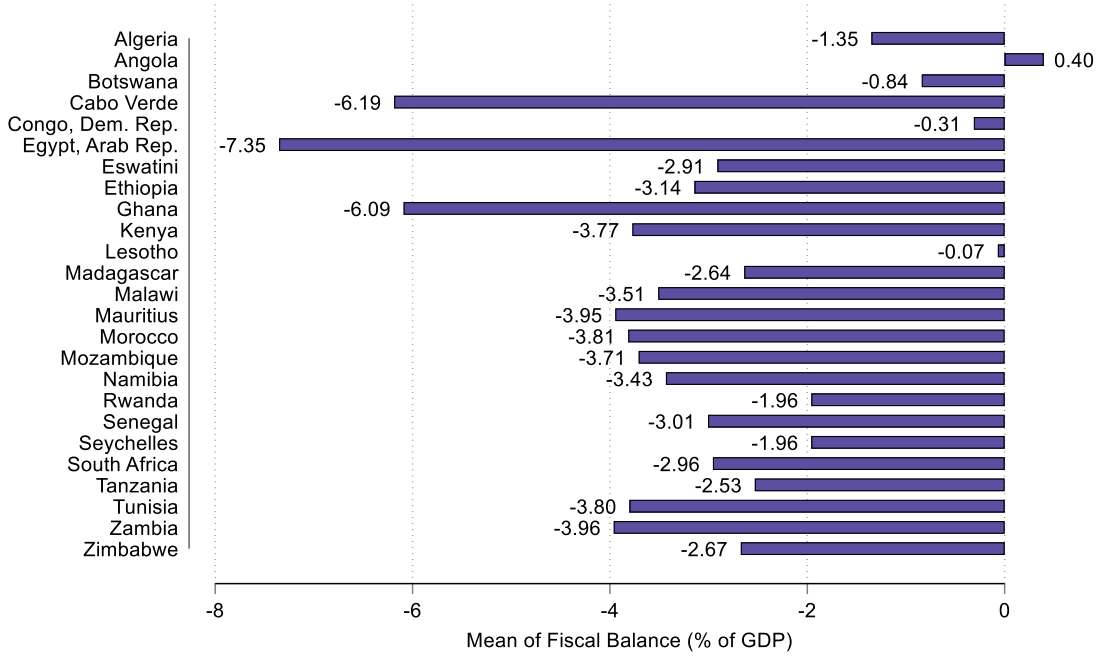
Data Source:WDI (2000-2021), Author's own compilation

Figure 4.4 depicts the fiscal balance (deficit) for the entire sample for the entire period of the study. Egypt has the largest average fiscal balance (deficit). Cape Verde and Ghana follow with the average fiscal deficit of 6.19 and 6.09 percent of GDP. Lesotho and DRC have the lowest averages of fiscal deficits, whereas Angola is the only country with a positive average fiscal balance. As usual, the sample exhibits significant heterogeneity across countries. The Egyptian Ministry of Finance report for the 2020–2021 financial year reported a budget deficit of 6.8 percent of GDP and a gross debt to GDP of 106 percent (El Husseiny, 2023). The political uprising of 2011 and 2013 could be attributed to the fiscal indiscipline registered for Egypt. El Husseiny (2023) asserts that the current structure of government spending in Egypt is unfavourable for counter-cyclical fiscal policy and has adverse consequences for fiscal deficit management. Ghana is one of the four countries that have experienced fiscal crisis episodes recently, besides Zambia and Ethiopia, of which Ethiopia is the latest on the continent to default on its debt.

The IMF report on the fiscal condition in Africa suggests that the funding squeeze is still a problem due to growing borrowing costs, and rolling over of debt remains a challenge for many developing countries (IMF, 2023). The COVID-19 pandemic resulted in the median fiscal deficit expansion to 8.2 percent of GDP in SSA (IMF, 2023). Romer and Romer (2019) in their study of the fiscal space in the aftermath of the GFC of 2008–2009, suggested that for "a given degree of fiscal expansion, the resulting deficit will be larger when the prior surplus is smaller". To that effect, countries that implemented expansionary fiscal policy to

reduce the adverse effects of the pandemic while starting with higher levels of fiscal deficits, are likely to experience higher levels of deficit afterwards.

Figure 4.4. Average of the fiscal balance to GDP ratio by country (%)



Data Source:WDI (2000-2021), Author's own compilation

4.7.2 Cross-sectional dependence test of the panel residuals

Before estimating the main results, a preliminary test for cross-sectional dependence was conducted to ensure that the estimators obtained from the panel sample are both consistent and unbiased. The cross-sectional dependence test proposed by Pesaran (2015) was used, which checks the average correlation between panel units, with the null hypothesis suggesting either cross-sectional independence or weak cross-sectional dependence (Pesaran, 2015). This test is appropriate for the current study's sample since N=25 and T=21, satisfying the condition that N>T. The p-value from the residual test is 0.172, meaning the null hypothesis of weak cross-sectional dependence was not rejected, concluding that the residuals exhibit strong cross-sectional independence. As a result, we can infer that the estimates derived from this sample are both consistent and unbiased.

4.7.3 Main results and discussion

The following section discusses the results obtained using the Blundell and Bond (1998) and Arellano and Bond's (1991) methods of the dynamic linear GMM technique. Table 4.5 presents the results of the specified Equation 4.5. The first column presents the COVID-19 dummy variable alone. The second column presents

the macroeconomic variable and its interactions with the COVID-19 dummy variables, the third column introduces the demographic variable (population), the fourth column introduces the institution variable, political stability, and the last column shows the results with a composite index of all institutional variables (political stability, government effectiveness, voice accountability, corruption control, and rule of law).

The COVID-19 dummy variable is negative and statistically significant. This implies that fiscal deficits increased during the pandemic outbreak compared to other periods. This is consistent with our expectation that the COVID-19 outbreak did upend fiscal planning for many countries. All macroeconomic indicators in the model are statistically significant in all four models specified, with the expected signs the same as those found by Maltritz and Wüste (2015). The impact of lagged fiscal balance is positive and statistically significant. This confirms the persistence of fiscal balance effects observed in previous literatures. The impact of the economic growth rate is positive and statistically significant, as expected, since higher output growth tends to improve the fiscal balance in the short run. This finding is consistent with those of Gupta et al. (2005), Bose et al. (2007), and Taylor et al. (2012), as well as our estimates in the previous chapter.

The total expenditure as percentage of GDP is negative and statistically significant; it has an adverse effect on the fiscal balance in Africa. This means that as government expenditure increases, fiscal deficits increase. In the case of real interest rate, the coefficient is negative and statistically significant; this means that increases in real interest rate increase the fiscal deficit. Tevdovski et al. (2021) argue, "Higher longer-term interest rates on debt instruments also implies less revenues and worsening budget balance." The IMF fiscal report for 2023 assigned high global interest rates, elevated spreads, and growing exchange rate volatility as the main cause of the experienced funding squeeze in many countries (IMF, 2023). Matimuthu et al. (2021) find that interest rates have a moderating effect on fiscal deficit in ASEAN countries. They argue that changes in interest rates can influence the flow of capital and cause exchange rate instability, bringing about external imbalance.

For the political institution's variable, the coefficients of political stability and the index constructed to proxy institutions were interpreted using principal component analysis. The positive coefficient of political stability implies that the more stable a country, the better its fiscal balance. The index coefficient also validates the results obtained for political stability, that functioning institutions limit the discretion of policymakers from unscrupulous spending and hence reduce fiscal deficits. In the case of the effect of the COVID-19 pandemic on macroeconomic variables, the result shows that the COVID-19 pandemic had a downward moderating effect on the effect that economic growth has on fiscal balance; that is, the combined effect of economic growth and the pandemic resulted in increased fiscal deficits. The interactive variable of COVID-19 and growth is negative and statistically significant (see column 3, Table 4.5). Recall from Equation 3.4, the coefficient quantifies how the pandemic alters the relationship between economic growth

and fiscal balance. The negative sign suggests that the COVID-19 outbreak weakened the link between economic growth and fiscal balance. Policy interventions or revenue shocks during COVID-19 are likely to crater growth and elevate the fiscal deficits. This confirms Gnimassoun and Do Santos' (2021) suggestions that fiscal deficit is influenced by external shocks.

In the case of the expenditure variable interaction with COVID-19, both coefficients are negative, which suggests that pandemics have a reinforcing effect of expenditure on fiscal balance. That is, the COVID-19 pandemic increased the effect expenditure had on fiscal balance. Thus, a sharp decrease in economic activities during the pandemic and a rise in government expenditures result in a higher budget deficit. This is what one should expect since, as the economy is ailing from the pandemic effect, many countries in the sample had to provide support to both the health sector and other sectors of the economy, resulting in the deterioration of their fiscal position. Gnimassoun and Do Santos (2021) find that deficits are lower in countries that manage their expenditures when experiencing revenue volatility. Murwirapachena et al. (2013) find a long-run negative association between government investment expenditure and fiscal deficit in South Africa data.

In the case of population (log), one would expect it to contribute positively to the fiscal balance. This is because the majority of the sample population is young and, therefore, unlikely to require larger spending on health than those in countries with an aged population. The coefficient of the population variable is positive and significant, and its interaction with the COVID-19 pandemic is also positive. This implies that the combined effect of the pandemic outbreak and population in the study's sampled countries has a moderating effect on fiscal balance. Thus, a younger population is likely to be less affected by COVID-19 than an older one; therefore, budgetary spending is also likely to be lower than in countries with an older population, suggesting that a younger population shields the fiscal balance in the event of a pandemic outbreak. Artés and Jurado (2018) find a positive sign, but an insignificant relationship between population and primary balance in Spain, whereas Woo (2003) finds that a population aged 65 and above has a negative influence on budget deficit in less developed economies.

The interaction between the institutional proxy (index) and the pandemic dummy is insignificant, implying that the pandemic had no moderating effect on institutions' effect on fiscal balance. However, the index alone is positive and significant, implying that strong institutions are fiscal balance enhancing. This is confirmed by the joint effect of political stability and the COVID-19 dummy variable being significant.

The real interest rate is negative and statistically significant. This implies that an increase in real interest rate will decrease (increase) the budget balance (budget deficit). Countries with higher real interest rates are likely to have high debt service costs and thus struggle to manage their budget deficits. If the demand

for loanable funds by the government is outpaced by the supply of loanable funds, the interest rates will rise as the government's borrowing levels and deficit increase. This finding aligns with previous studies (c.f. Bangura et al., 2016; Gnimassoun and Do Santos, 2021; Shehu and Adamu, 2021). The lag of budget balance is positive and significant, and it is below one, exhibiting persistent stability. The result implies that for every one percent increase in the previous year's budget balance, the current budget balance changes by 0.46, 0.34, 0.56, and 0.52 percent, respectively. Al-Qudah and Jaradat (2018) and Shehu and Adamu (2021) find similar results.

Table 4.5. Estimated results using COVID-19 dummy variable and other variables

VARIABLES	(COVID-alone) System GMM	(Macro) System GMM	(Demographic) System GMM	(Political) System GMM	(Index) System GMM
L. Fiscal balance	0.5495***	0.4614***	0.3425***	0.5611***	0.5220***
	(0.004)	(0.033)	(0.045)	(0.136)	(0.144)
Real interest rate		-0.3408***	-0.2889***	-0.5840***	-0.5369***
		(0.010)	(0.032)	(0.113)	(0.111)
Growth		0.5483***	0.5050***	0.3705**	0.4663***
		(0.083)	(0.045)	(0.143)	(0.128)
Expenditure		-2.3078***	-7.4629***	-4.8577	-4.2978**
		(0.326)	(1.947)	(9.925)	(2.024)
Population (log)			20.9342***	10.5012	8.3941**
			(2.747)	(24.565)	(3.955)
Growth*COVID		-0.3283	-0.5834***	-0.1297	0.0689
		(0.223)	(0.161)	(0.904)	(0.887)
Expend*COVID		-0.0595	-2.1819***	-8.2745***	-6.6796***
		(0.047)	(0.511)	(1.419)	(1.762)
Pop*COVID			3.1292***	12.5610***	10.0663***
			(0.750)	(2.168)	(2.511)
Political stability				8.9923**	
				(3.918)	
Political stability*COVID				15.8609**	
				(6.430)	
COVID	-7.5451***				
	(0.322)				
Index					6.4583*
					(3.409)
Index*COVID					6.5881
					(5.184)
Constant	-1.1563***	53.7465***	-166.9092**	-50.5129	-33.4182
	(0.032)	(8.099)	(59.297)	(164.329)	(50.725)
Observations	518	362	362	348	348
Countries	25.0000	20.0000	20.0000	20.0000	20.0000
No. of instruments	23.0000	23.0000	23.0000	23.0000	24.0000
AR1 p-value	0.0077	0.0373	0.0454	0.0056	0.0050
AR2 p-value	0.2819	0.3522	0.3112	0.9722	0.8337
Hansen p-value	0.5485	0.6720	0.6539	0.7060	0.9159

*Source: Author's own computation, Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10*

Table 4.6 present results for all models with the log of the number of deaths due to the COVID-19 pandemic instead of a dummy variable. Note that a positive sign implies that the increase of such variables increases the fiscal balance, whereas a negative sign indicates that the increase of such variables worsens the fiscal

balance (or the fiscal deficit is increasing). The coefficient of the COVID-19 pandemic (deaths) variable is positive and statistically significant (columns 1 and 2, Table 4.6). This means that the pandemic crisis resulted in an improvement in fiscal balance in these countries[55]. Many countries rescheduled their debt repayment during the pandemic, which could explain the improved fiscal balance. As discussed in the methodology section, the observed effect at the mean for variables that are not normally distributed could be misleading, as the effect could be muted at the mean for such variables. The results in Table 4.13, which account for group-level heterogeneity, confirm this effect, where death cases become negative at the higher end of the distribution, which is consistent with our expectations.

The inclusion of political stability and composite index in columns 3 and 4 (Table 4.6) does not alter the macroeconomic coefficients; however, the effect of the COVID-19 pandemic becomes insignificant. Institutions' variable effects remain positive and significant, as observed previously. Notably, the COVID-19 crisis initially lessens the fiscal deficits in these countries, but the implication going forward is that many countries will experience increasing fiscal strains. Gnimassoun and Do Santos (2020) found that external shocks have positive and significant influences on fiscal balance as a percentage of GDP, consistent with the current study's findings.

The inclusion of a demographic variable in the model strengthens the predictive power of the expenditure, COVID-19 shock, official donor assistance, and output growth variables (column 2, Table 4.6.). Their estimated effect maintains the level of significance and their signs. The interest rate remains consistently negative, but somewhat smaller than before; however, it maintains the level of significance. An increase in population improves fiscal balance, holding all else constant.

Other variables maintain the signs and the levels of significance observed in previous studies, such as those of Gnimassoun and Do Santos (2021), who show that external shocks, debt ratios, financial development and democracy, and government spending all have a significant influence on fiscal deficit. In terms of economic growth, Al-Qudah and Jaradat (2018) find that output has a negative effect on budget deficit, contrary to the current study's finding. Bangura et al.'s (2016) study of the Sierra Leone economy finds that real output, interest rate, and exchange rate have a negative influence on the budget deficit, while inflation and investment have a positive effect. Again, a higher level of interest is likely to drive up the cost of servicing government debt. As interest rates rise, the government must pay more interest on debt issues to finance fiscal deficits. The rise in interest payment obligations will result in a larger fiscal deficit if the government continues borrowing to meet its financial obligations.

[55] Note that a positive sign implies that the fiscal balance is improving, whereas a negative sign indicates that the fiscal balance is worsening (or the fiscal deficit is increasing).

Table A4.2 in *Annexure A.3* presents the results when the log of COVID-19 cases is used instead. The coefficient of the log of cases is positive and significant under the macroeconomic and demographic variable specification (column 2). However, the variable is not significant when the institution variable is included in the model. Other variables maintain the signs and level of significance as those reported in Tables 4.8 and 4.9. The inclusion of official donor assistance gives a negative and significant coefficient, which is expected. Over-reliance on external aid makes governments less frugal with their expenditures. The necessary diagnostic tests of instrument validity, overall model fit, and first and second order serial correlations are all valid.

Table 4.6. Estimated results with COVID-19 death cases and other variables

VARIABLES	(Macro) System GMM	(Demographic) System GMM	(Institutions) System GMM	(Index) System GMM
L. Fiscal balance	0.4765***	0.3778***	0.4035***	0.4962***
	(0.027)	(0.063)	(0.062)	(0.050)
Real interest rate	-0.4103***	-0.3324***	-0.4529***	-0.5012***
	(0.037)	(0.050)	(0.086)	(0.065)
Growth	0.1788***	0.1870***	0.3979***	0.3774***
	(0.058)	(0.021)	(0.054)	(0.049)
ODA	-0.8341***	-2.7642***	-1.6442**	-0.5669
	(0.240)	(0.349)	(0.638)	(0.612)
Expenditure	-2.4684*	-11.2431***	-14.6531**	-6.8156**
	(1.210)	(2.178)	(5.371)	(2.777)
Population (log)		27.6905***	32.4748*	11.7356***
		(8.162)	(17.272)	(2.227)
COVID-19 deaths (log)	0.1279*	0.1321**	0.1232	0.1328
	(0.064)	(0.056)	(0.112)	(0.101)
Political stability			10.6742***	
			(2.384)	
Index				8.8643***
				(1.050)
Constant	76.0118**	-124.5244	-141.0677	-15.9233
	(30.284)	(91.397)	(162.185)	(46.723)
Observations	359	359	345	345
Countries	20	20	20	20
No. of instruments	23	23	23	24
AR1 p-value	0.0255	0.0433	0.0261	0.0187
AR2 p-value	0.4319	0.5256	0.5552	0.5854
Hansen p-value	0.5063	0.8555	0.7101	0.7184
F p-value	0.0000	0.0000	0.0000	0.0000

*Sources: Author's own computation: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.10*

Table 4.7 presents the result when the stringency index (containment) is used instead of death cases or the time dummy. The expenditure variable is omitted since its inclusion distorts the results, by omitting the AR1 and AR2 estimates, making the estimates unreliable. The stringency index, which is the primary variable of interest, interacts with the macroeconomic, institutional, and demographic variables. The increase in the country's level of containment during the pandemic causes the fiscal balance to worsen (increase the fiscal deficit). The magnitude of the level of containment increases substantially with the inclusion of its interactions with other variables in the model (column 5, Table 4.7). The real interest rate,

output and official donor assistance, population, and institutional proxy (index) are also statistically significant. The increase in real interest rate worsens the fiscal balance under all specifications, whereas the increase in economic growth, official donor assistance, and the presence of strong institutions improve the fiscal balance. The demographic variable is positive and statistically significant when the institutional index is included in the model (column 4, Table 4.7).

In terms of the interactive variables, stringency restrictions reinforce the negative effect the real interest rate has on fiscal balance. Stringency restrictions exacerbate the negative effect real interest has on fiscal balance. Recall, higher interest rates tend to crowd out private investment, slow growth, and impair government revenues, subsequently undermining the state's ability to meet its debt obligations and, therefore, worsening the country's fiscal balance position. The joint effect of containment restrictions and official donor assistance improves the fiscal balance. This suggests that the introduction of restrictions on recipients of external donor assistance has less adverse effect on fiscal balance. Thus, ODA cushions countries from severe restrictions shocks during the pandemic.

Economic growth and population coefficients are positive and significant, suggesting that both economic growth and population dividend are correlated with fiscal balance surpluses in the sampled countries. However, their interaction with the restriction index is negative and insignificant. Therefore, the effect of restrictions on fiscal balance through the macroeconomic and demographic variables was not observed when the stringency index and system GMM method were used.

The joint impact of containment restrictions and the institutional proxy (index) worsen the fiscal balance, however, it is not significant. The influence of institutions alone (index) seems to have a positive effect on fiscal balance (see the coefficient of the index column 4, Table 4.7). A pattern emerged in the analysis. The interaction with containment results suggests that the introduction of restrictions in countries with weak institutions can result in authoritative practices which limit businesses' production and halt supply chain, causing a fall in government revenues and intensified government expenditure, worsening the fiscal balance.

AR1 is statistically significant, and AR2 is statistically insignificant. The joint significance of the model shown by the F-statistics is statistically significant. The Hansen-p values establish whether the instruments are valid and if the model is correctly specified. The null hypothesis is that the selected instruments are valid and satisfy the over-identifying restrictions. The alternative hypothesis is that at least one of the IVs is invalid, thus they are correlated with the error term, and the over-identification restrictions are not met.

The p-values of the Hansen test[56] are all above 5%; therefore, we fail to reject the null hypothesis was not rejected thus the instruments are valid.

Table 4.7. Estimated results with stringency index used instead of proxy for COVID-19

VARIABLES	(1) System GMM	(2) System GMM	(3) System GMM	(4) System GMM	(5) System GMM
L. Fiscal balance	0.4871***	0.3924***	0.4323***	0.5288***	0.4300**
	(0.035)	(0.068)	(0.050)	(0.081)	(0.154)
Real interest rate	-0.3000***	-0.3541***	-0.4509***	-0.4860***	-0.4100***
	(0.023)	(0.041)	(0.047)	(0.059)	(0.112)
Growth	0.3910***	0.1979***	0.1463***	0.4006***	0.2782
	(0.023)	(0.032)	(0.036)	(0.065)	(0.211)
ODA	0.4459*	-0.1164	0.7185*	1.4136**	-3.3245
	(0.226)	(0.481)	(0.414)	(0.503)	(2.087)
Population (log)		-0.3114	-1.0924	2.7453**	-13.2861
		(7.108)	(4.396)	(1.101)	(20.064)
Index				4.8473***	6.0946
				(1.240)	(5.063)
Containment	-0.5980***	-0.2750	-0.6606**	-0.7051***	-18.3560**
	(0.058)	(0.166)	(0.256)	(0.096)	(7.345)
Containment*real interest rate					-0.1514**
					(0.057)
Containment*Growth					-0.0129
					(0.059)
Containment*ODA					1.2785**
					(0.481)
Containment*population					-0.3761
					(0.429)
Containment*index			-0.0439		
			(0.399)		
Constant	-9.6120**	7.7659	4.2526	-72.3619**	280.2274
	(4.219)	(109.723)	(73.020)	(25.810)	(348.316)
Observations	412	412	394	394	394
Countries	22	22	22	22	22
No. of instruments	23	23	23	24	23
AR1 p-value	0.0135	0.0310	0.0231	0.0041	0.0002
AR2 p-value	0.4362	0.6322	0.5189	0.3787	0.5560
Hansen p-value	0.4596	0.3281	0.3941	0.4151	0.2035
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000

*Source: Author's own computation: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.10*

A pandemic is an infrequent event; therefore, to estimate the impact it has on the economic fundamentals in isolation is challenging and thus, to substantiate the earlier results, the same model was estimated with the time series constructed index of infectious diseases equity market volatility (EMV) index by Baker et al. (2020) to proxy COVID-19 uncertainty instead. The EMV variable is negative and significant under all specifications considered. Therefore, a rise in infectious diseases EMV tends to increase (decrease) the fiscal deficit (balance), holding all else constant. Under the macroeconomic specification (column 1), a unit

[56] The Hansen J test is robust to heteroskedasticity, unlike the Sagan test, which assumes homoskedasticity.

increase in EMV results in a 0.21-unit worsening in fiscal balance. The inclusion of the demographic variable (population) reduces the impact marginally to 0.17 units; however, the effect remains the same. When the institutional variable is included (column 3), the coefficient decreases significantly to 0.10 units but maintains the negative sign. However, the inclusion of the institution proxy (index) increases the size of the EMV coefficient substantially to -9.9 units. Thus, institutional effect is critical in determining the effect of EMV on fiscal balance.

When considering the joint effect, the macroeconomics, demographics, and institutional variable has on fiscal balance, the EMV reinforces the negative effect real interest rate has on fiscal balance as shown by the interaction between EMV and the real interest rate (EMV*rrate); that is, a rise in interest rate coupled with EMV worsens the fiscal balance further. Thus, EMV has a reinforcing effect of real interest rates on fiscal balance and worsens the budget balance. However, institutions have a moderating effect of EMV on fiscal balance as shown by the interaction between the index and EMV (EMV*index) variables, which is positive and statistically significant at the 10 percent level. The output growth and population interactions with EMV are not significant; therefore, their joint effect on fiscal balance is not clear in this instance.

Considering other factors, the increase in output growth provided countries with a stable source of revenue, which can be used to finance the deficit. The output growth variable is positive and statistically significant for all specifications, with the exception of one, when the results are estimated using the constitution index (column 5). The real interest coefficient is negative and significant, thus a rise in interest rate worsens the fiscal position of the countries as the debt repayment cost increases and budget deficits widen. Political stability has a positive influence on fiscal balance; thus, countries that are politically stable benefit from having a lower budget balance, as indicated by the positive coefficient of the political stability variable.

Thus, the pandemic volatility index has a moderating effect in terms of the macroeconomics variable (interest rate) and institutional variable (index). This is an interesting and important result because institutions are persistent and endogenous; therefore, the pandemic influences mean that the exogenous shock affects endogenous factors and could have a significant influence on future economic outcomes.

Table 4.8. Results which use infectious diseases Equities Market Volatility (EMV) index for COVID-19

VARIABLES	(1) System GMM	(2) System GMM	(3) System GMM	(4) System GMM	(5) System GMM
L.Fiscal balance	0.5546***	0.4616***	0.5255***	0.4732***	0.5869***
	(0.095)	(0.104)	(0.092)	(0.112)	(0.144)
Real interest rate	-0.4557***	-0.4370***	-0.4891***	-0.3905***	-0.3523**
	(0.111)	(0.109)	(0.087)	(0.111)	(0.138)
Growth	0.2429***	0.0963*	0.1789***	0.1885**	0.0998
	(0.050)	(0.052)	(0.054)	(0.088)	(0.413)
ODA	0.9902***	0.7126	0.7824	0.6936	-3.3908
	(0.151)	(0.517)	(0.652)	(0.580)	(3.445)
Population (log)		-5.1555	-4.0055	-0.1494	-9.6960
		(3.735)	(7.525)	(1.201)	(18.051)
index				1.0589	2.1080
				(1.322)	(7.638)
EMV	-0.2090***	-0.1658**	-0.0992*	-0.1639*	-9.8891**
	(0.073)	(0.064)	(0.054)	(0.088)	(4.665)
EMV*index	0.2380*	0.0656	-0.0066	-0.0034	0.6685**
	(0.117)	(0.131)	(0.092)	(0.189)	(0.319)
EMV*rrate					-0.0573*
					(0.033)
EMV*Growth					0.0053
					(0.029)
EMV*ODA					0.4042
					(0.314)
EMV*population					0.1246
					(0.133)
Political stability			4.9271***		
			(0.988)		
Constant	-18.0973***	70.1990	51.4215	-11.1625	223.7727
	(2.766)	(62.468)	(121.581)	(28.481)	(345.602)
Observations	394	394	394	394	394
Countries	25	25	25	25	25
No. of instruments	23	23	23	24	23
AR1 p-value	0.0124	0.0207	0.0109	0.0294	0.0004
AR2 p-value	0.4341	0.4814	0.4573	0.3706	0.9116
Sargan p-value	0.0728	0.0506	0.0714	0.0843	0.3200
Hansen p-value	0.2741	0.3028	0.2835	0.4944	0.3851
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Author's own computation. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.10

4.7.4 Comparative analysis of exogenous and endogenous shocks effects on fiscal balance

Rare events are unlikely to carry similar size effects on economic outcomes compared to events engendered in macroeconomic fundamentals. The size effects of the financial market shock of 2008–2009 and the COVID-19 shocks on the fiscal balance for the study's sample were compared. To compare the size effect of the two shocks, the results were estimated at level without controlling for both shocks, and when controlling for both shocks and the interactions with macroeconomics, demographic, and institutional variables. Table 4.9 depicts the results when the model is estimated at level with the exogenous shock dummy (COVID-19) and the endogenous shock dummy, GFC. Before proceeding to estimate the results, a two independent sample means t-test was performed to establish whether the fiscal balance average differs during the two periods, during the pandemic (2020–2021) and other periods. The assumption is that all observations are identically independent and normally distributed. This test uses a continuous variable (fiscal balance) and a categorical variable (COVID-19 and GFC dummy variables.

The t-statistics were estimated to test for a significant difference between the two means. The null hypothesis is that there is no difference between the two averages of fiscal balance. According to the test results, the probability of observing a t-value greater than 5.307 or less than -5.307 is 0.000; therefore, the null hypothesis was rejected, concluding that there is a statistically significant difference in the average fiscal balance between the two periods. Similarly, for the financial crisis dummy variable, the probability of observing t-values greater than 1.614 or less than -1.614 is 0.05; therefore, the null hypothesis is rejected. The estimated Cohen's d-value, which gives the effect size based on the average comparison, was 1.08 for the COVID-19 pandemic variable and 0.2 for the GFC variable. Therefore, the size effect based on the average is larger during the pandemic than during the financial crisis.

The lagged fiscal balance coefficient result suggests that shocks during the GFC had more long-lasting effects compared to the COVID-19 and normal periods, possibly because financial shocks that affect financial markets have long-lasting effects, meaning businesses and consumers take time to recover from lost capital, bankruptcies, and reduced lending. The GFC also caused structural economic damage, such as debt overhang and tighter financial regulations, that also slowed economic recovery, contrary to the COVID-19 shock, which was met with warp speed policy response, helping to mitigate long-term scarring of the fiscal balance.

Moreover, the results show that the real interest rate, economic growth, and political stability variables are statistically significant and carry the correct signs, as discussed in the initial results. The population and political stability variables are only statistically significant for the estimations at levels and with the COVID-19 pandemic shock. In the case of the interaction's coefficients, under COVID-19 shock, economic growth has a positive and significant coefficient; however, the interaction with the COVID-19 pandemic is negative and insignificant; therefore, the influence of the COVID-19 pandemic on growth in explaining fiscal balance is indeterminate in this instance. For the expenditure variable and its interaction with COVID-19, the coefficients are statistically significant and carry the same signs; therefore, the COVID-19 pandemic has a reinforcing effect on the expenditure effect on fiscal balance. This implies that during the COVID-19 pandemic shock, the negative effect of expenditure on fiscal balance was amplified. Similarly, the population coefficient and its interaction with the COVID-19 pandemic have a positive and significant sign. This implies that the COVID-19 pandemic shock magnified the positive influence the population has on fiscal balance. Lastly, the institutional variable (political stability) and the interaction with the pandemic shock is positive and statistically significant. The positive influence institutional setting has on fiscal balance is reinforced during the pandemic.

Considering the influence of the GFC on the fiscal balance, the results in column 3 (Table 4.9) are mixed. The growth coefficient (significant) and its interaction with the financial crisis shock are insignificant; therefore, the direction of the effect that the GFC has on growth in explaining fiscal balance is inconclusive. The same is true for expenditure, population, and political stability. Thus, there is no evidence of the GFC crisis dampening or reinforcing the macroeconomic, demographic, and institutional effects on fiscal balance in the short run. However, the results show a negative joint effect of population and financial crisis, which is statistically significant. Thus, despite the demographic effect being muted independently, it has a significant influence on fiscal balance when interacting with the financial crisis shock. However, in comparison, the results show that the fiscal deficit was substantially more elevated during the financial crisis than during the COVID-19 pandemic outbreak.

Table 4.9. System GMM estimation for the results at level, with COVID-19 and GFC dummies

VARIABLES	Level	COVID (2020-2021)	GFC (2008-2009)
L.Fiscal balance	0.5193***	0.5660***	0.6258***
	(0.030)	(0.148)	(0.082)
Real interest rates	-0.4391***	-0.5974***	-0.4007**
	(0.039)	(0.102)	(0.159)
Growth	0.4176***	0.3490**	0.6462***
	(0.035)	(0.141)	(0.137)
Expenditure	-4.7007***	-3.6816*	18.8660
	(1.475)	(2.104)	(17.557)
Population (log)	7.0537***	8.3184*	-47.0830
	(1.348)	(4.326)	(30.783)
Political stability (ps)	6.1095***	9.1141*	10.0889**
	(0.563)	(4.746)	(3.794)
Growth*COVID		-0.1819	
		(0.904)	
Expend*COVID		-8.0397***	
		(1.690)	
Pop*COVID		12.1737***	
		(2.536)	
Ps*COVID		14.4751*	
		(7.379)	
Growth*GFC			0.3909
			(0.547)
Expend*GFC			12.5140*
			(6.634)
Pop*GFC			-18.8336*
			(9.809)
Ps*GFC			-12.2918
			(15.545)
Constant	-0.1594	-43.5435	312.2096**
	(14.970)	(48.053)	(140.606)
Observations	348	348	348
Countries	20	20	20
No. of instruments	24	24	24
AR1 p-value	0.0152	0.0032	0.0262
AR2 p-value	0.5163	0.9757	0.0637
Hansen p-value	0.8377	0.7857	0.6011
F p-value	0.0000	0.0000	0.0000

*Source: Author's own computation: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10*

4.7.5 Method of Moment Quantile regression results

To ensure robustness of our results, the results using the MMQ model were replicated as an alternative identification strategy. This approach provides a granular analysis at the quantile level, which could have been masked at the aggregate level. Heterogeneous effects within the sample might not be clear in aggregate, but clear at various quantile levels. Before estimating the quantile result, Westerlund's (2007) test of cointegration was performed. The null hypothesis is no cointegration, and the alternative hypothesis is that all panels are cointegrated. The test statistic coefficient obtained is 10.3732, with a p-value of 0.000; therefore, the null hypothesis is rejected, concluding that all panels are cointegrated. Normality tests of all the variables using Shapiro-Wilk (Shapiro and Wilk, 1965) and Shapiro-Francia (Shapiro and Francia, 1972) tests were performed before estimating the MMQ results. Table 4.10 presents the normality test results, with p-values below 1%; therefore, the null hypothesis that all variables are normally distributed is rejected.

Table 4.10. The results of tests for the two normal distribution tests

Shapiro-Wilk test	z	Prob>z	Shapiro-Francia test	z	Prob>z
Fiscal Balance	6.901	0.00000	Fiscal Balance	6.537	0.00001
Real interest rate	9.663	0.00000	Real Interest rate	9.011	0.00001
Growth	8.735	0.00000	Growth	8.187	0.00001
Expenditure	4.046	0.00003	Expenditure	3.564	0.00018
Population	8.772	0.00000	Population	8.140	0.00001
Cases	8.588	0.00000	Cases	2.980	0.00144
Deaths	8.658	0.00000	Deaths	3.480	0.00025
Stringency index	8.652	0.00000	Stringency index	3.516	0.00002
ODA	7.823	0.00000	ODA	7.357	0.00001
COVID	7.926	0.00000	COVID	-63.311	1.00000

Source: Author's own computation

To check for the sensitivity of the results, the estimation was performed by adding the covariates one at a time into the model. The results obtained are similar to those in the initial models under the system GMM technique.

The MMQ regression results, including the COVID-19 dummy variable and its interactions with other covariates, which determine fiscal balance, are given in Table 4.11. The real interest rate decreases (increases) fiscal balance (deficit) at the 75th and 95th quantiles. This suggests that interest rate effects might only influence fiscal balance in the long term. The economic growth variable is positive and statistically significant at all quantile levels, which implies that output growth influences fiscal balance (deficit) in both the short and long run. The expenditure coefficient is negative and significant at the 10th, 25th, and 50th quantiles. This suggests that the expenditure effect on fiscal balance is a short-term phenomenon. The population coefficient's influence on fiscal balance is positive and statistically significant

at the 10th and 25th quantiles; however, in the long run (95th quantile), the coefficient sign changes, which could be that the population has an inflection point in its effect on fiscal balance. This implies that in the long term, a larger population increases fiscal deficit, holding all else constant. Cifuentes-Faura et al. (2022) found similar results for Spanish municipalities' data for the population above 65 years old. The political stability coefficient is negative and significant at the 75th and 95th quantiles, suggesting that the positive effect of institutional quality on fiscal deficit observed earlier is a short-term phenomenon peters out in the long run. As expected, the institutional effect is more highly pronounced in the long run than in the short run. This finding is consistent with Agnello and Sousa (2013), who argue that political instability is positively correlated with higher deficit volatility.

In terms of the influence the exogenous shock (COVID-19 pandemic) has on these covariates, a COVID-19 dummy was interacted with these variables. Recall, from Equations (4.2) and (4.3), the signs of the macroeconomic variable and its COVID-19 interactions indicate whether COVID-19 has a reinforcing (dampening) effect of the macroeconomic (institutional) variable on fiscal balance. In the case of the COVID-19 and growth interactions, the signs of the growth variable and that of its interaction with the COVID-19 dummy are only significant; however, their signs are opposite, suggesting that the COVID-19 shock has had a dampening effect of economic growth on fiscal balance (deficit). In the case of the expenditure variable and its interaction (expend*COVID), the signs are negative and significant. This suggests that the pandemic shock has a reinforcing effect of the expenditure variable on fiscal balance.

In the case of the population and COVID-19 interactions, there is notable variation in the severity and persistence of the joint effect of COVID-19 on fiscal balance. Both variables have a positive sign, implying that the COVID-19 pandemic has a long-run reinforcing effect of population on fiscal balance. That is, population increases (decreases) fiscal balance (deficit) in the long term. Whereas, in terms of institutions, the interactive coefficient is not significant, suggesting that the COVID-19 shock has no moderating effect of institutions on fiscal balance. Except for the political stability variable, the other variables show interaction effects.

Moreover, the inclusion of political stability as an institutional variable shows that, in a shorter horizon (lower quantiles), on itself the effect is only negative and significant at the 75^{th} and 95th quantiles. However, its joint effect with the COVID-19 shock is insignificant.

Table 4.11. MMQ regression results with the COVID-19 dummy and interactions

	Quantile levels				
	10%	25%	50%	75%	95%
Real interest rate	0.002(0.027)	-0.017(0.022)	-0.033(0.023)	-0.052**(0.028)	-0.093**(0.049)
Growth	0.231*(0.087)	0.240*(0.071)	0.246*(0.072)	0.255*(0.090)	0.272**(0.155)
Expenditure	-1.934*(0.371)	-1.376*(0.300)	-0.948*(0.305)	-0.386(0.384)	0.757(0.731)
Population(log)	1.544*(0.406)	0.788*(0.326)	0.207(0.332)	-0.554(0.418)	-2.102*(0.731)
Political stability(ps)	0.612(0.483)	0.003(0.391)	-0.464(0.397)	-1.077**(0.500)	-2.323*(0.866)
Growth*COVID	-0.370(0.251)	-0.349**(0.204)	-0.332(0.208)	-0.310(0.261)	-0.265(0.448)
Expend*COVID	-1.080(0.791)	-1.528**(0.644)	-1.872*(0.655)	-2.324*(0.824)	-3.241**(1.416)
Pop*COVID	1.437(1.185)	2.070**(0.964)	2.556*(0.981)	3.194***(1.234)	4.490**(2.120)
ps*COVID	-1.306(2.273)	-0.937(1.852)	-0.653(1.883)	-0.281(2.370)	0.475(4.065)
Constant	12.782*(5.367)	14.155*(4.371)	15.210*(4.446)	16.594*(5.594)	19.407**(9.598)

*Source: Author's own computations, standard errors in brackets, *, **, *** show significance at 1%, 5%, 10% level, respectively.*

Table 4.12 presents the results when the logarithm of the number of COVID-19 cases recorded is used instead of a dummy variable. The coefficient of cases is negative and statistically significant for the 25th, 50th, 75th, and 95th quantiles. This means that the exogenous shock of the pandemic has a long-run negative influence on fiscal balance. This result is different to that obtained under the system GMM, which only analysed the effect of COVID-19 cases in the short run. The MMQ method provides the short- and long-run effect of the pandemic on fiscal balance. The inclusion of real interest in the analysis shows that the effect quantitatively increases in size and becomes statistically significant in higher quantiles. Thus, the interest rate impact on lower quantiles is likely to be muted by the sample size.

All other variables have the expected signs and levels of significance, as observed previously. Real interest still has a long-run negative effect on fiscal balance, as observed earlier. The population variable is positive and significant in the short run (10th to 50th quantiles). The population variable changes sign in the 95th quantile; however, it is not significant. The population effect is quantitatively higher and statistically significant in the shorter horizons but decreases and becomes insignificant in the longer horizons. The expenditure coefficient is negative and significant at the 10th, 25th, and 50th quantiles, suggesting that expenditure effect on fiscal balance is a short-run phenomenon.

Table 4.12. MMQ regression model to explain fiscal balance with COVID-19 cases

	Quantile level				
	10%	25%	50%	75%	95%
Real Interest rate	-0.009(0.023)	-0.026(0.019)	-0.042**(0.020)	-0.064**(0.026)	-0.104**(0.045)
Growth	0.247*(0.065)	0.252*(0.055)	0.255*(0.057)	0.261*(0.075)	0.270**(0.128)
Expenditure	-1.577*(0.326)	-1.264*(0.273)	-0.965*(0.285)	-0.575(0.374)	0.158(0.647)
Population (log)	1.137*(0.289)	0.793*(0.241)	0.464***(0.251)	0.036(0.330)	-0.769(0.575)
Cases(log)	-0.066(0.069)	-0.121***(0.058)	-0.173*(0.061)	-0.241*(0.080)	-0.370*(0.137)
Constant	10.997**(4.550)	11.453*(3.850)	11.889*(4.014)	12.457**(5.286)	13.525(9.014)

*Source: Author's own computations, standard errors in brackets, *, **, *** show significance at 1%, 5%, 10% level, respectively*

Table 4.13 presents the results when the logarithm of the number of deaths is used instead of the number of cases. Again, the variable (log of number of deaths) is negative and significant for the 50th, 75th, and 95th quantiles, suggesting that the COVID-19 pandemic has a long-run effect on fiscal balance (deficit). The population coefficient is positive and significant at the 10th, 25th, and 50th quantiles, implying that population contributes to deficit reduction in the short run. The dynamic system GMM model estimation presented in Table 3.6 suggests that the pandemic shocks have a positive impact on the fiscal balance; however, estimating the results using the MMQ method reveals that over different quantiles, the pandemic shocks have a negative and significant effect on fiscal balance, as shown in Table 4.13 for the death coefficient in the 50th, 75th, and 95th quantiles. This suggests that the COVID-19 pandemic increases fiscal deficit across the distribution, which is not observable in the aggregated sample. Growth, population, real interest rate, and expenditure maintain their signs and levels of significance, as discussed for Table 3.6.

Table 4.13. MMQ regression model to explain fiscal balance with COVID-19 number of deaths

	Quantile levels				
	10%	25%	50%	75%	95%
Real Interest rate	-0.009(0.023)	-0.026(0.019)	-0.043**(0.020)	-0.065**(0.027)	-0.106**(0.046)
Growth	0.261*(0.064)	0.264*(0.055)	0.267*(0.057)	0.271*(0.076)	0.278**(0.130)
Expenditure	-1.586*(0.325)	-1.268*(0.273)	-0.954*(0.287)	-0.552(0.379)	0.216(0.660)
Population(log)	1.148*(0.288)	0.801*(0.241)	0.459***(0.253)	0.020(0.334)	-0.817(0.587)
Deaths(log)	-0.041(0.100)	-0.138(0.084)	-0.234*(0.088)	-0.357*(0.117)	-0.591*(0.204)
Constant	10.930**(4.559)	11.313*(3.864)	11.692*(4.048)	12.178**(5.366)	13.104(9.229)

*Source: Author's own computations, standard errors in brackets, *, **, *** show significance at 1%, 5%, 10% level, respectively*

Table 4.14 shows the result with the containment index used as a pandemic shock proxy instead. The real interest rate is negative and significant at the 50th, 75th, and 95th quantiles; the size of the coefficient

increases in the higher quantiles as well. The output growth is positive and statistically significant in all quantiles and maintains a relatively stable size effect throughout. Expenditure as a percentage of GDP is negative and significant and has a larger effect in magnitude in lower quantiles than in higher quantiles. Moreover, the expenditure coefficient changes sign in the 95th quantile and becomes also insignificant. Thus, population has a positive and statistically significant influence at the lower end of the distribution, and the magnitude effect is larger in the lower quantiles, as well. This suggests that population effect on fiscal balance is a short-run phenomenon.

In the case of the containment index, which is another variable of interest, its effect on fiscal balance is negative and statistically significant at the 25th, 50th, 75th, and 95th quantiles; the size of the influence also increases marginally in the upper end of the distribution. These results suggest that containment measures put in place during the pandemic are likely to have a long-term effect on the fiscal balance of the sampled countries.

Table 4.14. MMQ regression model to explain fiscal balance with containment index

	Quantile levels				
	10%	25%	50%	75%	95%
Real Interest rate	-0.008(0.023)	-0.026(0.019)	-0.043**(0.020)	-0.063***(0.026)	-0.106**(0.046)
Growth	0.245*(0.066)	0.247*(0.056)	0.248*(0.059)	0.250*(0.076)	0.254**(0.133)
Expenditure	-1.580*(0.324)	-1.276*(0.271)	-0.987*(0.283)	-0.635***(0.367)	0.103(0.650)
Population(log)	1.142*(0.288)	0.802*(0.240)	0.479**(0.251)	0.085(0.325)	-0.739(0.579)
Containment index	-0.015(0.014)	-0.024*(0.012)	-0.033*(0.012)	-0.043*(0.016)	-0.065*(0.028)
Constant	10.991***(4.525)	11.614*(3.818)	12.203*(3.996)	12.923*(5.181)	14.431(9.076)

*Source: Author's own computations, standard errors in brackets, *, **, *** show significance at 1%, 5%, 10% level, respectively*

Additionally, the results using the MMQ method with the infection diseases EMV were estimated, which is a series spanning 2000–2021. Table 4.15 presents the results, which show that real interest rate increases the budget deficit at the 75th and 95th quantiles. This implies that the interest rate impact on real fiscal balance is a long-term phenomenon. In terms of economic growth, the coefficient is positive and statistically significant at all quantile levels (10th to 95th). Thus, the growth impact on the budget balance is a short-run and long-run phenomenon. Expenditure is only negative and statistically significant at the 10th, 25th, and 50th quantiles; therefore, the influence of expenditure is a short-term phenomenon for the current study's sample.

The population variable is positive in the first two quantiles (10th and 25th) and changes to negative at the 75th and 95th quantiles, which is similar to the results presented in Table 4.11 using the COVID-19 dummy variable. To establish the impact the EMV and the macroeconomic, demographic and institutional variables have on fiscal balance, EMV growth, expenditure, population, and political stability were interacted.

EMV*growth and growth variables at the 25th, 50th, and 75th quantiles have opposite signs; therefore, EMV has a damping effect of the output growth on fiscal balance. The EMV*expend and expenditure variables are both negative and statistically significant under the 25th and 50th quantiles. This suggests that EMV reinforces the negative effect that expenditure has on fiscal balance. In the case of the demographic variable, the EMV*pop and population variables are significant at the 25th, 75th, and 95th quantiles. At the 25th quantile, EMV reinforces the positive effect population has on the budget balance; however, at the 75th and 95th quantiles, where the population variable reaches inflection, the EMV dampens the effect population has on the fiscal balance. The political stability coefficients are only significant at the top end of the distribution (75th and 95th quantiles), suggesting that political stability worsens the fiscal balance in the long run, which is inconsistent with the expectation that institutions are persistent so one would have expected an improvement in budget balance to benefit from stable countries politically in the long term, contrary to the current study's finding.

Real interest rate is only negative and statistically significant at the top end of the distribution, suggesting that the effect of real rates on fiscal balance is a long-run phenomenon. Economic growth is positive and significant throughout the distribution, and the positive influence it has on fiscal balance is maintained. The demographic variable (population) is positive and significant at the lower quantiles (10th and 25th quantiles); however, the sign changes to negative at the top end of the distribution (75th and 95th quantiles). This suggests that, in the short run, demographic dividends have a positive effect on fiscal balance, whereas in the long run, demographic pressures increase government expenditure, increasing the budget deficit.

Table 4.15. MMQ regression results using EMV instead of other pandemic measures

	Quantile levels				
	10%	25%	50%	75%	95%
Real interest rate	0.004 (0.028)	-0.017(0.023)	-0.034(0.023)	-0.055**(0.028)	-0.096**(0.048)
Growth	0.277*(0.094)	0.283*(0.076)	0.289*(0.076)	0.295*(0.094)	0.308**(0.159)
Expenditure	-1.847 *(0.391)	-1.278*(0.312)	-0.809*(0.311)	-0.251(0.387)	0.895(0.657)
Population (log)	1.396 *(0.431)	0.646**(0.343)	0.027(0.341)	-0.708 ***(0.426)	-2.220*(0.723)
EMV*Growth	-0.009(0.008)	-0.011**(0.006)	-0.012**(0.006)	-0.013***(0.008)	-0.015(0.013)
Expend*EMV	-0.016(0.032)	-0.047***(0.026)	-0.073*(0.026)	-0.104*(0.032)	-0.168*(0.054)
EMV*pop	0.020 (0.048)	0.065***(0.039)	0.101*(0.039)	0.145*(0.048)	0.235*(0.082)
Political stability	0.640(0.518)	0.025(0.416)	-0.484(0.415)	-1.087**(0.515)	-2.327*(0.874)
EMV*political stability	-0.096 (0.078)	-0.054(0.063)	-0.019(0.063)	0.022(0.078)	0.108(0.132)
Constant	12.912 (5.507)	13.982(4.448)	14.865(4.459)	15.913(5.507)	18.069(9.331)

*Source: Author's own computations, standard errors in brackets, *, **, *** show significance at 1%, 5%, 10% level, respectively*

4.8 Concluding remarks and policy implications

This essay's major objective was to investigate the effect that the COVID-19 pandemic shock has had on fiscal balance in 25 selected African countries. The effects of an exogenous shock on fiscal balance and its consequences to the economy were empirically examined. The management of fiscal balance (deficit) is still a complex challenge despite the sources of revenue and policymakers' knowledge of spending items. It is, therefore, vital to understand the role that an exogenous risk has on fiscal balance (deficit) since persistent deficits tend to cause excessive accumulation of public debts, which could stifle economic growth.

Since countries have various heterogeneous characteristics, the effect of exogenous shocks is likely to differ across the sample distribution; therefore, the results were estimated using dynamic GMM and MMQ regressions. The results show that the COVID-19 shock has short- and long-run moderating effects on macroeconomic and demographic variables; however, it has only a short-run moderating effect on the effect of institutional variables on fiscal balance (deficit). The containment index and the number of cases have an adverse effect on the deficit, as it increases the budget deficit at all quantiles except the 10 percent quantile. The number of deaths coefficient also increases the fiscal deficit at all quantiles with the exception of 10th and 25th. Thus, the MMQ results highlight the hidden effects not captured by the GMM model across the sample distribution.

The COVID-19 shocks reinforce the negative effect of expenditure on fiscal balance. The pandemic shock dampens the positive effect that economic growth has on fiscal balance. In terms of population, the COVID-19 pandemic reinforces the positive effect the population has on fiscal balance, both in the short and long run. The impact of the COVID-19 shock on the institutional effect on the fiscal balance is only significant in the short run. The real interest rate variable is negative and statistically significant, validating the fact that higher interest rate plays a significance role in deficit growth and hence excessive debt for countries with high real interest rates.

Stringency (containment) measures, number of deaths, and number of cases all have both short- and long-run effects on fiscal balance. Similarly, output growth, expenditure, and population have short- and long-run effects on fiscal balance. The real interest rate's impact is only significant in the long run. Moreover, the pandemic reinforces the long-run effect of demographic variables and expenditure on fiscal balance. The joint effect of the pandemic and output growth is only a short-run phenomenon.

Across the number of estimations, most of the estimated coefficients have a positive sign for the COVID-19 death cases, economic growth, political stability, the institutional variable index, lag of fiscal balance and the population. The real interest rate, official donor assistance, and expenditure coefficients are all

negative. The former contributes to the improvement of the fiscal balance, while the latter accentuates the fiscal deficit. Indeed, using a range of measures (both singly and in combination), macroeconomic, demographic, institutional, and the exogenous shock of the COVID-19 pandemic tend to punctuate (attenuate) the correlation between those indicators and the fiscal balance (deficit). These results suggest that spending that boosts economic growth, improves health care provisions, robust monetary policy, and the quality of institutions are essential for moderating the impact of an exogenous shock on the fiscal balance (deficit). Moreover, developing countries will benefit from having budgetary planning that is engendered with structural reforms and subject to strict monitoring conditions all the time.

Chapter 5

5.0 General conclusion

This study had three objectives. First, to explore the potential effects of both the informal economy and economic complexity on tax effort in 25 selected African countries. Second, to examine the effects of political regimes and election proximity on fiscal balance in the 25 selected African countries. Third, to determine the direct and indirect effects of the COVID-19 pandemic on the fiscal balance in the 25 selected African countries.

5.1 Tax effort and capacity, informality, and economic complexity in Africa

In Chapter 2, tax effort in 25 selected African countries over the 2000–2021 period was investigated by exploring the influence the shadow economy and the complexity structure of the economy have on tax mobilisation in these countries. Two new variables were introduced to tax effort literature: economic complexity and informal economy, which are considered empirically important for tax effort in developing economies. The stochastic frontier model was formulated and estimated while building on the work of Fenochietto and Pessino (2013), Ndiaye and Korsu (2014), Mawejje and Sebudde (2019), and Chigome and Robnson (2021). The model specification was partitioned to include mineral rent and governance quality to show the contribution of informality and economic complexity to tax effort in these countries.

The study found that 48 percent of sampled countries' tax efforts decrease when accounting for informality in the analysis. The inclusion of economic complexity increased tax effort for the entire sample from the initial baseline estimates (see Table 2.10, Columns 1, 3, and 5). However, the economic complexity results are sensitive to model specification. Nevertheless, the results suggest that these countries still have room to mobilise additional tax revenues for development goals. Thus, efforts toward the reduction of informality levels are likely to yield positive results in terms of increased productivity, increased income levels, and a wider tax base. By leveraging the advent of the technological wave to digitise the tax system and accelerate economy formalisation through the provision and strengthening of property rights, the formalisation of local and missing markets, and the reduction of state bureaucracy in tax management, these economies can raise more revenues over time.

Additionally, initiatives to increase technological infusion in the production processes of these economies are likely to increase exports and income level, subsequently increasing the taxable base. To achieve this, government need to invest in sufficient energy production and adopt industrial policies that promote the manufacture of export goods. A rise in export goods produces much needed foreign currency to finance the growing external, thus reducing fiscal deficits, increasing domestic purchasing power, raising consumption, and driving tax collection. In summary, the unique aspect of this essay is that it tracks tax effort at an

aggregate level, while also relating tax revenue and revenue potential to the informal and complexity economy using stochastic frontier analysis. The study's finding suggests that inclusion of informality and economic complexity in tax mobilisation analysis contribute meaningfully to our understanding of how the structure of the economy influences the ability to collect tax.

5.2 Election proximity, political regimes, and fiscal balance

In Chapter 3, the election proximity, political regimes, and fiscal balance in 25 selected African countries over the 2000–2021 period were investigated. The central objectives were determining the effect of political regimes on fiscal balance, assessing the impact of time path and election year on fiscal balance and lastly, examining the effect of institutions and election cycles on fiscal balance. To achieve these objectives, a time path around election period was constructed and polity was partitioned into regime types. The dynamic GMM model was formulated and estimated, building on the work of Nordhaus (1975) and Cifuentes-Faura et al. (2022). The model specification was designed to include the interaction between election and regime types and governance quality to quantify their contribution to fiscal balance in these countries.

The results suggest that gullible voters, coupled with irrational politicians, are recipe for fiscal dislocations in these countries. Political opportunism and election timing undermine the fiscal balance. The nature of the prevailing regime (either democratic, anocratic, or autocratic) has a significant influence on fiscal balance in these countries. At the same time, the effect of democracy on fiscal policy is nonlinear. Furthermore, the results show that fiscal outcomes vary across regime types in terms of the magnitude of the effect, moderated by the type of governance quality in place. However, an autocratic regime is found to be noisy and sensitive to model specification, which could be due to the low number of authoritarian countries in the sample. With the rise in populist politics around the world, which fosters authoritarianism that threatens democracy and compromises elections, there is a high potential for even higher fiscal imprudence in the future in these economies.

5.3 COVID-19 shock and fiscal balance

In Chapter 4, how the COVID-19 pandemic moderated the influence of macroeconomic, demographic, and institution factors on fiscal balance in 25 selected African countries over the 2000–2021 period was investigated. The central objective was to examine the effect of the COVID-19 pandemic shock on fiscal imbalances in the selected countries. Specifically, the moderating role of the pandemic outbreak on macroeconomic, demographic, and institutional settings on fiscal imbalance in these countries was investigated. The number of cases and deaths were normalised using logarithmic transformation, and they were interacted with other variables before implementing the analysis.

The MMQ, which helps to capture the heterogenous characteristics of countries that are either muted or masked in mean-estimation, was formulated and estimated, leveraging the work of Alesina and Perotti (1997) and Artés and Jurado (2018). Four proxies were used to measure the COVID-19 pandemic (i.e., year dummy, number of deaths, number of cases, and EMV index for the pandemic) to model the effect of exogenous shock on fiscal balance in these countries.

The results presented in Chapter 4 suggests that economies suffering from external shocks and experiencing severe or prolonged low productivity would come under political pressure to suspend fiscal prudence, running the risk of accumulating excessive debt and rising inflation. Both scenarios are inimical to economic growth. Moreover, the results suggest that the COVID-19 pandemic outbreak increased fiscal deficit across the distribution, which is not observable in the partial slopes mean estimates, thus the use of MMQ technique is important in the analysis. Whether one borrows from the Minsky Moment analogy of "stability begets instability" or the famous saying of "failure comes from failure to imagine failure", the COVID-19 pandemic exposed the complacency of these economies in preparedness and lack of risk management.

The results show that the COVID-19 pandemic outbreak compromised the fiscal policies of these countries, raising fiscal deficits and ending many developmental projects. Specifically, the COVID-19 pandemic is found to have amplified the macroeconomics, demographic, and institutional effects of fiscal balance in the sampled countries at the mean and the different levels of distributions. Even though planning for the uncertain future is hard, these countries can build reserves funds to cushion the economy in the event of similar shocks.

5.4 Policy implications and future research

The policy implication here is that the pervasiveness of the informal sector tends to undermine the social contract between the public and the state, and that countries characterised by a larger share of informal sector struggle to build their fiscal space given the significant size of the informal sector in their economies. Therefore, for countries with tax effort less than unity, the policy implications are clear. Consorted efforts are needed to broaden the tax base, as well as apply and enforce rates of tax, bringing more stable revenues with the traditional tenets of taxation: administrative convenience, equity, and efficiency. Since the study's results suggest that informal markets distort tax effort, these countries will benefit from policies that encourage the formalisation of businesses, even on small scales. This can be achieved through the provision of incentives, such as free cost of registration or subsidised resources, such as energy, electricity, internet, and water access to small, medium, and large business that are tied to formalisation.

Additionally, the results for economic complexity influence on tax effort suggest that the infusion of knowledge density in the production process coupled with strong institutions enhances taxable income and hence widen the tax base. Therefore, countries could put in place policies which promote industrial development to grow manufacturing sector, which is easy to tax. Future research can explore the link between informality and economic complexity at firm levels in both urban and non-urban areas in influencing the dynamics of tax efforts in developing economies.

In the case of fiscal balance, the study found evidence of political business cycles under different regime types, implying fiscal slippages are not only driven by fundamental macroeconomic events but also the political aspirations of incumbents. Thus, policymakers need to pay special attention to historical evidence of election cycles and regime types, which accentuate budget deficits. The policy implication of these results is that strong budgetary and other political institutions are vital in managing fiscal policy. To achieve these goals, governments should execute their fiscal operations with a high level of transparency. In the event of any surplus, government should allocate such surplus in a diverse portfolio of productive investments that generate more revenue for the state, rather than putting it into wasteful expenditures. In the case of exogenous shocks, the implication is that, in an environment of high uncertainty, understanding the nature of the shocks is a precondition for getting the baseline prediction right and the correct response. In the future, the extra revenue cushions the state in the event of exogenous shocks.

Future research can expand this study in various ways; for the first essay (in Chapter 2), one can introduce the digitisation data upon its availability in the literature to understand whether digitalisation contributes to tax mobilisation in a meaningful way. For the second essay (in Chapter 3), one can examine how the rise in populism politics influences fiscal policies in developing countries. For the third essay (in Chapter 4), one can investigate the persistent differences in magnitude between exogenous and endogenous shocks on fiscal policy across countries and at the country level, both in developed and developing economies.

5.5 Study limitations

Due to the nature (i.e., empirical) of this study, which investigated the influence of informal economy and economic complexity on tax effort, the effect of election proximity and regime types on fiscal balance and the COVID-19 pandemic effects on fiscal balance (deficit) in 25 selected African economies, several limitations are to be expected. These limitations are as follows:

Data patchiness limits the scope of what can be achieved in performing empirical studies. Many countries in Africa still lack enough data for the variables of choice, hence the selection of 25 countries. The factors used in this study, such as economic growth, population, unemployment rate, budget deficit, tax revenues, expenditure, total revenues, economic complexity, informal economy, etc, are all macroeconomics, which

were obtained from international organisations such as the IMF, the World Bank, the World Health Organisation, the International Foundation for Electoral System, the Electoral Institute for Sustainable Democracy in Africa and the Central Bank databases of the countries studied or the national statistical bureaus of these countries. The data sourced from these agencies is not under the control of the researcher. Therefore, the accuracy of the data and the estimation techniques used in their estimation and presentations are assumed consistent and obtained with the highest scientific rigour. Any deviation from these assumptions would be treated as an uncontrollable limitation to this study. This study is also limited by the inherent characteristics of the chosen countries it intended to test for the influence of the COVID-19 pandemic on fiscal balance (deficits), tax management, and political structure in terms of election practices. The findings of this study may not be applicable to countries with different economic and political conditions to those found in the studied countries.

6. References

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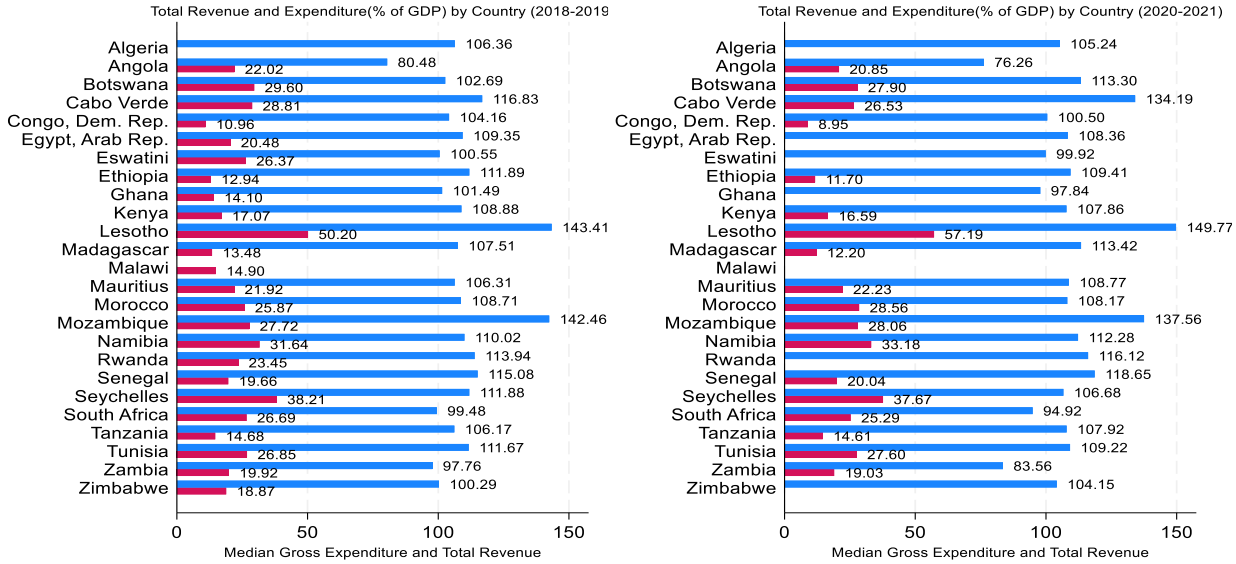
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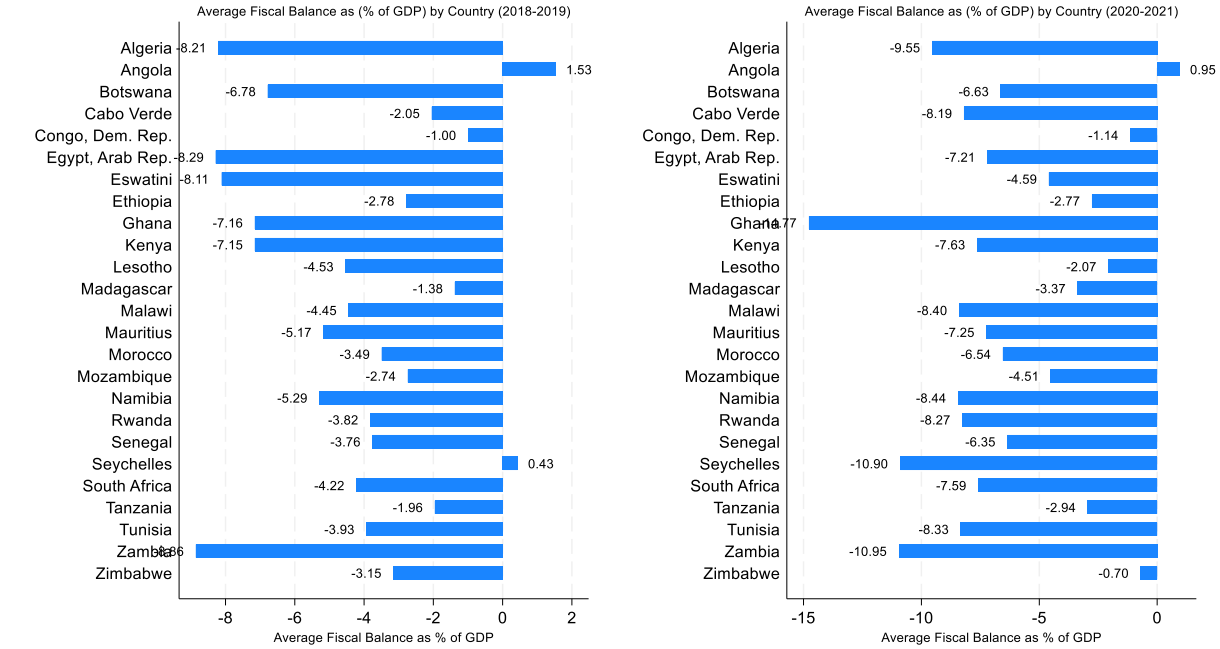
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7.0 Annexure A.1



Data Source:WDI (2000-2021), Author's own compilation

Figure A1.1. Total Revenue and Gross national Expenditure for (2018-2019) and (2020-2021) period for sampled countries (Total expenditure - blue, and total revenues - red colour)



Data Source:WDI (2000-2021), Author's own compilation

Figure A1.2. Fiscal balance as a % of GDP for (2018-2019) and (2020-2021) period

Table A2.1. Robust check results for the first essay

VARIABLES	(1) DK-CR	(2) DK-VA	(3) FE-CR	(4) FE-VA	(5) System GMM-CR	(6) System GMM-VA
lnTOP	0.130	0.116	0.203**	0.210**	0.372	0.526
	(0.102)	(0.0959)	(0.0799)	(0.0765)	(0.495)	(0.424)
lnAGRI	-0.159***	-0.191***	-0.137	-0.139	0.753	0.669
	(0.0402)	(0.0496)	(0.0994)	(0.103)	(0.877)	(0.408)
lnPOP	-0.0321	-0.0516	-0.0181	-0.00636	1.911	1.435
	(0.0274)	(0.0362)	(0.223)	(0.208)	(1.783)	(1.259)
lnGDPP	1.455**	1.527***	3.054**	3.028**		
	(0.568)	(0.476)	(1.219)	(1.269)		
lnGDPP2	-0.0875**	-0.0944***	-0.197**	-0.197**	-0.0460	-0.110
	(0.0371)	(0.0318)	(0.0745)	(0.0777)	(0.0890)	(0.105)
lnMAN	0.171***	0.141***	-0.146	-0.147	0.562	0.454
	(0.0508)	(0.0481)	(0.135)	(0.136)	(0.765)	(0.601)
lnREMI	0.0122	0.0234*	0.0258**	0.0261*	0.00447	0.00839
	(0.0126)	(0.0127)	(0.0122)	(0.0131)	(0.0114)	(0.0112)
lnDEBT	-0.0411	-0.0269	-0.0215	-0.0161	-0.167	0.0259
	(0.0356)	(0.0338)	(0.0360)	(0.0370)	(0.272)	(0.187)
lnAID	0.0262	0.0427	0.0893**	0.0825**	0.00561	0.0691
	(0.0250)	(0.0285)	(0.0399)	(0.0386)	(0.102)	(0.101)
lnPE	0.307***	0.288***	-0.0441	-0.0500	0.0265	0.209
	(0.102)	(0.0951)	(0.0469)	(0.0466)	(0.331)	(0.301)
lnFDI	0.0689*	0.0576	0.0482**	0.0500***	-0.00673	-0.0164
	(0.0361)	(0.0334)	(0.0170)	(0.0159)	(0.0161)	(0.0169)
lnMIMIC	-0.0667	-0.194***	-0.976	-1.049	-2.893	-5.750
	(0.0415)	(0.0454)	(0.721)	(0.700)	(3.550)	(4.320)
lnECI	-0.322***	-0.346***	-0.178	-0.193*	0.343	0.404
	(0.0970)	(0.0926)	(0.116)	(0.107)	(0.448)	(0.370)
lnINF	-0.0144	-0.0137*	0.00828	0.00674	0.000590	0.0102
	(0.00870)	(0.00672)	(0.00861)	(0.00857)	(0.0238)	(0.0239)
lnCOR	-0.0978		-0.0524		0.316	
	(0.0653)		(0.149)		(0.882)	
lnVA		-0.209***		0.124**		0.456
		(0.0508)		(0.0584)		(0.395)
L.lnTTAX					0.544*	0.669**
					(0.302)	(0.294)
Constant	-3.868*	-3.668**	-7.222	-6.688	-21.63	-2.344
	(2.001)	(1.417)	(4.962)	(5.272)	(29.00)	(25.91)
Observations	227	227	227	227	227	227
R-squared	0.726	0.745	0.515	0.523		
Number of id			19	19	19	19

Source: Author's own computation, Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A2.2. Tax revenue stochastic frontier estimation with DGE alone

	Model 1	Model 2	Model 3	Model 4
Trade openness	0.223***	0.212***	0.369***	0.203***
	(3.90)	(3.91)	(6.47)	(3.66)
Agriculture	-0.110*	-0.128*	-0.0121	-0.128*
	(-2.07)	(-2.26)	(-0.28)	(-2.26)
Population	-0.169*	-0.0592	-0.0657	-0.0743
	(-2.47)	(-1.17)	(-1.78)	(-1.52)
Per capita GDP	3.556***	2.853***	2.224**	2.874***
	(4.81)	(5.49)	(2.78)	(5.60)
Sq. Per capita GDP	-0.229***	-0.179***	-0.137**	-0.179***
	(-4.66)	(-5.20)	(-2.64)	(-5.28)
Manufacturing	-0.0460	-0.0553	0.180***	-0.0508
	(-0.67)	(-0.93)	(3.65)	(-0.87)
Personal remittances	0.0133	0.0193	-0.00530	0.0184
	(1.28)	(1.94)	(-0.51)	(1.83)
External debt stock	-0.00195	-0.0396	-0.0318	-0.0425
	(-0.08)	(-1.74)	(-1.61)	(-1.87)
Net official development assistance	0.115***	0.0673**	0.0539*	0.0687***
	(4.73)	(3.28)	(2.30)	(3.37)
Government expenditure on education	-0.0823*	-0.0354	-0.00346	-0.0318
	(-2.13)	(-0.90)	(-0.08)	(-0.81)
Foreign direct investment	0.0490***	0.0443***	0.0301*	0.0447***
	(4.21)	(3.87)	(2.21)	(3.90)
Informal Economy Index (DGE)	-0.140	-0.178	-0.505***	-0.204
	(-0.63)	(-1.00)	(-4.23)	(-1.16)
Mineral rents	0.00139		-0.0160*	
	(0.22)		(-2.06)	
Inflation	-0.00365	0.00906	-0.00926	0.00882
	(-0.35)	(0.84)	(-0.82)	(0.82)
Voice and Accountability	0.0510	0.0449		
	(0.82)	(0.69)		
Control of Corruption			-0.203*	-0.107
			(-2.06)	(-1.04)
Constant	-9.349**	-7.932**	-5.615	-7.862**
	(-2.66)	(-3.14)	(-1.76)	(-3.24)
Sigma	-2.347***	-2.558***	-2.030	-2.660***
	(-5.54)	(-7.98)	(-1.58)	(-8.74)
Inefficiency				
Gamma	2.338***	1.806***	2.517	1.676***
	(4.65)	(4.58)	(1.80)	(4.40)
mu	0.929***	0.677***	-0.196	0.647***
	(4.61)	(3.68)	(-0.25)	(3.64)
eta	0.00733*	0.00670	0.0354***	0.00676
	(2.20)	(1.56)	(3.49)	(1.50)
Observations	181	221	181	221

Source: Author's own computation, Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

7.1 Annexure A.2

Table A3.1. Regression results with total revenue as % of GDP as a dependent variable

VARIABLES	(1) Difference GMM	(2) Difference GMM	(3) Difference GMM	(4) Difference GMM	(5) System GMM	(6) System GMM	(7) System GMM	(8) System GMM
L.Total Revenue	0.3390***	0.3429***	0.3214***	0.2849***	0.9695***	0.9557***	0.9405***	0.9572***
	(0.010)	(0.013)	(0.018)	(0.021)	(0.008)	(0.011)	(0.011)	(0.008)
Financial Crisis	1.1313***	1.1174***	0.9500***	1.3205***	-0.0055	0.1295	0.0017	-0.0038
	(0.095)	(0.129)	(0.066)	(0.145)	(0.072)	(0.140)	(0.121)	(0.140)
Growth	0.1955***	0.1995***	0.1465***	0.2100***	0.0334**	0.0855***	0.0120	0.0298**
	(0.014)	(0.013)	(0.010)	(0.015)	(0.014)	(0.015)	(0.015)	(0.012)
before1	-0.1745				-0.1935			
	(0.155)				(0.159)			
before2		-1.6708***				-3.1013***		
		(0.198)				(0.341)		
before3			2.4309***				1.4360***	
			(0.187)				(0.177)	
Election				0.9120***				0.7039***
				(0.187)				(0.193)
Constant					0.7403***	1.4492***	1.2154***	0.8856***
					(0.188)	(0.293)	(0.255)	(0.176)
Observations	403	403	403	420	427	427	427	427
Countries	24	24	24	24	24	24	24	24
No. of instruments	23	23	24	22	26	25	25	25
AR1 p-value	0.0085	0.0073	0.0038	0.0047	0.0100	0.0072	0.0087	0.0086
AR2 p-value	0.7465	0.8859	0.9553	0.6017	0.9257	0.7191	0.9847	0.9026
Hansen p-value	0.3572	0.2536	0.3503	0.2883	0.3738	0.4155	0.4305	0.2960
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Author's own computation: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.10

Table A3.2. Regression results with total expenditure as % of GDP as a dependent variable

VARIABLES	(1) Difference GMM	(2) Difference GMM	(3) Difference GMM	(4) Difference GMM	(5) System GMM	(6) System GMM	(7) System GMM	(8) System GMM
L.Expenditure	0.3592***	0.3473***	0.4094***	0.2347***	1.1931***	1.2459***	1.2354***	1.2463***
	(0.048)	(0.059)	(0.034)	(0.047)	(0.016)	(0.016)	(0.021)	(0.026)
Financial crisis	1.8923***	1.3265**	1.8743***	1.0828***	2.6916***	2.0833***	2.2849***	3.0847***
	(0.188)	(0.485)	(0.384)	(0.299)	(0.537)	(0.559)	(0.621)	(0.458)
Growth	-0.3098***	-0.3147***	-0.2562***	-0.3651***	-0.1857***	-0.2338***	-0.2382***	-0.2792***
	(0.052)	(0.057)	(0.069)	(0.054)	(0.046)	(0.052)	(0.038)	(0.052)
before1	-0.2102				-0.7876			
	(0.245)				(0.531)			
before2		1.9051***				-0.6638		
		(0.534)				(0.914)		
before3			-1.6489***				1.3520	
			(0.304)				(0.897)	
Election				1.0064***				-1.0792
				(0.189)				(0.802)
Constant					-20.0372***	-25.7893***	-24.8966***	-25.7613***
					(1.808)	(1.685)	(2.244)	(2.775)
Observations	376	376	376	406	400	400	400	400
Countries	23	23	23	24	23	23	23	23
No. of instruments	23	23	24	23	26	25	25	25
AR1 p-value	0.0087	0.0175	0.0043	0.0036	0.0065	0.0056	0.0056	0.0052
AR2 p-value	0.2911	0.3503	0.2344	0.2541	0.2801	0.3061	0.3047	0.3103
Hansen p-value	0.4329	0.4353	0.3895	0.3268	0.7320	0.6816	0.7663	0.4599
F p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Author's own computation: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.10

Table A3.3. Electoral influence on public spending; theoretical predictions and empirical studies

Theoretical Predictions			
Authors	**Models**	**Variables**	**Electoral Impacts**
Rogoff (1990)	Competence signalling	Current expenditures (% total expenditures)	Positive
		Capital expenditures (% total expenditures)	Negative
Drazen and Eslava (2005)	Pork barrel cycles	Current expenditures (% total expenditures)	Negative
		Capital expenditures (% total expenditures)	Positive
		Infrastructure expenditures (% total expenditures)	Positive
Empirical studies			
authors	**sample**	**Variables tested**	**General findings**
Block (2002)	69 developed countries (1975-1990)	Current expenditures (% total expenditures)	Positive
		Capital expenditures (% total expenditures)	Negative
Schuknecht (2000)	24 developing countries (1973-1992)	Current expenditures (% GDP)	Positive (not significant)
		Capital expenditures (% GDP)	Positive
Khemani (2004)	India (1960-1992)	Current expenditures (% total expenditures)	Negative
		Capital expenditures (% total expenditures)	Positive
		Public service delivery (road construction)	Positive
Eslava (2005)	Colombia (1987-2000)	Current expenditures (% total expenditures)	Negative
		Capital expenditures (% total expenditures)	Positive
Vergne (2009)	42 Developing countries (1975-2001)	Current expenditures (% total expenditures)	Positive
		Capital expenditures (% total expenditures)	Negative
		Infrastructure expenditures (% total expenditures)	Negative

Source: Author's own compilation.

Table A3.4. Fiscal balance (% of GDP) by World Bank's Regions (2000-2021)

	Region	Mean	Median	Min	Max	sd
EAP	East Asia and Pacific	-1,37	-1,38	-55,41	47,83	9,22
ECA	Europe and Central Asia	-1.67	-1,9	-10,93	21,76	4,15
LAC	Latin America and the Caribbean	-2,65	-2,54	-18.68	11,59	9,29
MENA	Middle East and North Africa	-0,34	-2,61	-35,4	43,17	10,95
OECD	OECD	-2,16	-2,32	-32,12	18,53	4.30
SAS	South Asia	-4,47	-3.97	-23,48	2,93	3.85
SSA	sub-Saharan Africa	-2,29	-2,65	-37,98	125,14	7,1
SC	Sampled countries	-3,02	-2,96	-17,44	16,91	4,32
World		-1,94	-2,34	-55,41	125,14	6,74

Source (WDI,2023): Author's own compilation.

Table A3.5. Categorisation of regime types for sampled countries

Country	Regime type	Number of Years under such regime	Number of elections
Algeria	anocratic	19	3
Angola	anocratic	17	3
Congo, Dem. Rep.	anocratic	19	3
Egypt, Arab Rep.	anocratic	14	4
Ethiopia	anocratic	19	3
Ghana	anocratic	1	1
Kenya	anocratic	2	0
Madagascar	anocratic	5	1
Malawi	anocratic	3	1
Morocco	anocratic	8	2
Mozambique	anocratic	19	3
Rwanda	anocratic	19	4
Tanzania	anocratic	19	4
Tunisia	anocratic	13	2
Zambia	anocratic	8	2
Zimbabwe	anocratic	19	4
Angola	autocratic	2	0
Egypt, Arab Rep.	autocratic	5	0
Eswatini	autocratic	19	3
Morocco	autocratic	11	2
Botswana	democratic	19	3
Cabo Verde	democratic	19	4
Ghana	democratic	18	4
Kenya	democratic	17	4
Lesotho	democratic	19	4
Madagascar	democratic	14	3
Malawi	democratic	16	3
Mauritius	democratic	19	4
Namibia	democratic	19	3
Senegal	democratic	19	3
South Africa	democratic	19	3
Tunisia	democratic	6	1
Zambia	democratic	11	3

Source (World Data,2023): Author's own compilation.

7.2 Annexure A.3

Table A4.1. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) FB	1.000															
(2) cases	-0.229*	1.000														
(3) deaths	-0.210*	0.991*	1.000													
(4) aid	-0.148*	0.065	0.085	1.000												
(5) growth	0.229*	-0.208*	-0.172*	0.205*	1.000											
(6) expend	-0.181*	0.116	0.147*	0.582*	0.042	1.000										
(7) DEBT	-0.098	0.128*	0.107	0.115*	-0.163*	-0.143*	1.000									
(8) urate	0.078	0.022	0.022	-0.505*	-0.187*	-0.134*	-0.219*	1.000								
(9) rrate	-0.049	-0.064	-0.067	0.105	0.122	-0.092	0.033	-0.223*	1.000							
(10) va	-0.115*	0.012	-0.007	-0.271*	-0.098	-0.222*	0.057	0.164*	0.032	1.000						
(11) cor	-0.058	0.006	-0.019	-0.521*	-0.070	-0.472*	-0.117*	0.475*	-0.061	0.643*	1.000					
(12) ge	-0.088	-0.012	-0.028	-0.454*	-0.065	-0.201*	-0.101	0.386*	-0.158*	0.641*	0.850*	1.000				
(13) rl	-0.159*	-0.004	-0.019	-0.408*	-0.081	-0.266*	-0.098	0.366*	-0.022	0.736*	0.872*	0.898*	1.000			
(14) ps	-0.051	-0.042	-0.064	-0.544*	-0.088	-0.506*	-0.004	0.334*	0.042	0.693*	0.768*	0.708*	0.793*	1.000		
(15) pop	-0.054	0.067	0.097	0.828*	0.151*	0.843*	-0.026	-0.406*	0.061	-0.435*	-0.690*	-0.539*	-0.556*	-0.707*	1.000	
(16) polity	-0.052			-0.102	-0.038	-0.145*	0.101	-0.069	0.146*	0.837*	0.354*	0.341*	0.429*	0.423*	-0.268*	1.000

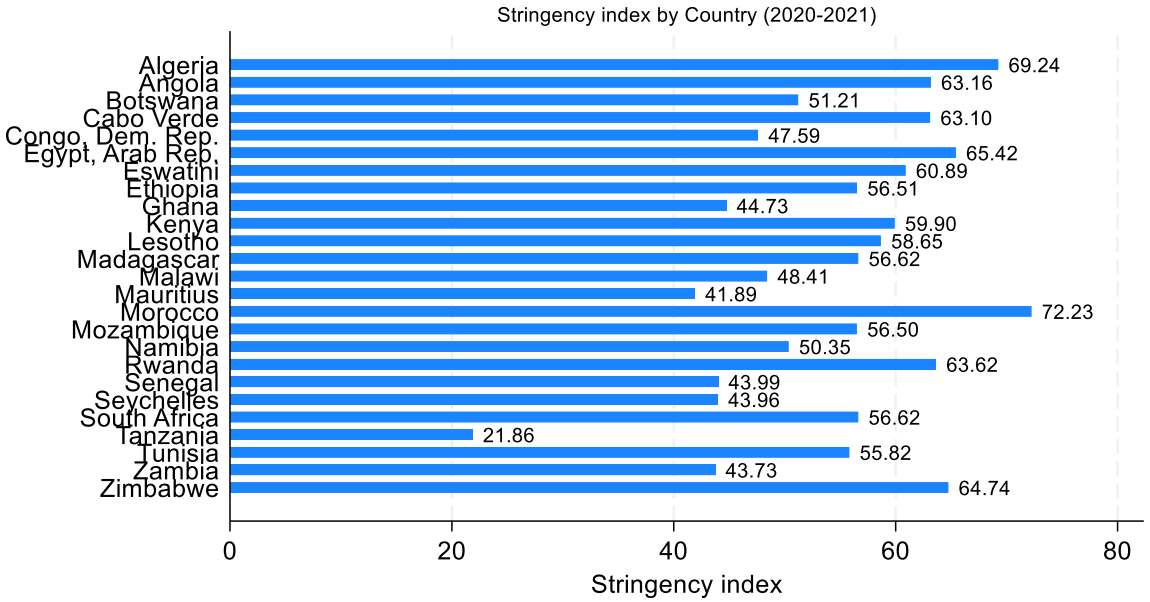
*Source: Author's own computation: p-value statistics: *** p<0.01, ** p<0.05, * p<0.1*

Table A4.2. Estimated results with log number of COVID-19 cases instead

VARIABLES	(1) System GMM	(2) System GMM	(3) System GMM	(4) System GMM
L.Fiscal Balance	0.4827***	0.3736***	0.3709***	0.5043***
	(0.028)	(0.064)	(0.058)	(0.049)
Real interest rate	-0.4125***	-0.3270***	-0.3967***	-0.5066***
	(0.038)	(0.052)	(0.073)	(0.065)
Growth	0.1800***	0.1966***	0.3539***	0.3795***
	(0.063)	(0.021)	(0.041)	(0.049)
ODA	-0.7954***	-2.7967***	-1.9589***	-0.4678
	(0.242)	(0.369)	(0.573)	(0.596)
Expenditure	-2.2868*	-11.5682***	-16.2291***	-6.4870**
	(1.190)	(2.270)	(5.033)	(2.728)
Population (log)		28.8577***	36.7318**	11.2966***
		(8.239)	(16.733)	(2.161)
COVID-19 Cases (log)	0.0715	0.0815**	0.0754	0.0724
	(0.043)	(0.034)	(0.071)	(0.064)
Political stability			8.4392***	
			(1.794)	
Index				8.6521***
				(1.028)
Constant	70.9065**	-135.0552	-167.1197	-18.4716
	(29.230)	(90.294)	(165.292)	(46.185)
Observations	359	359	345	345
Countries	20	20	20	20
No. of instruments	23	23	23	24
AR1 p-value	0.0246	0.0467	0.0391	0.0187
AR2 p-value	0.4279	0.5210	0.5671	0.5896
Hansen p-value	0.5084	0.8680	0.5871	0.7054
F p-value	0.0000	0.0000	0.0000	0.0000

Source: Author's own computation. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.10

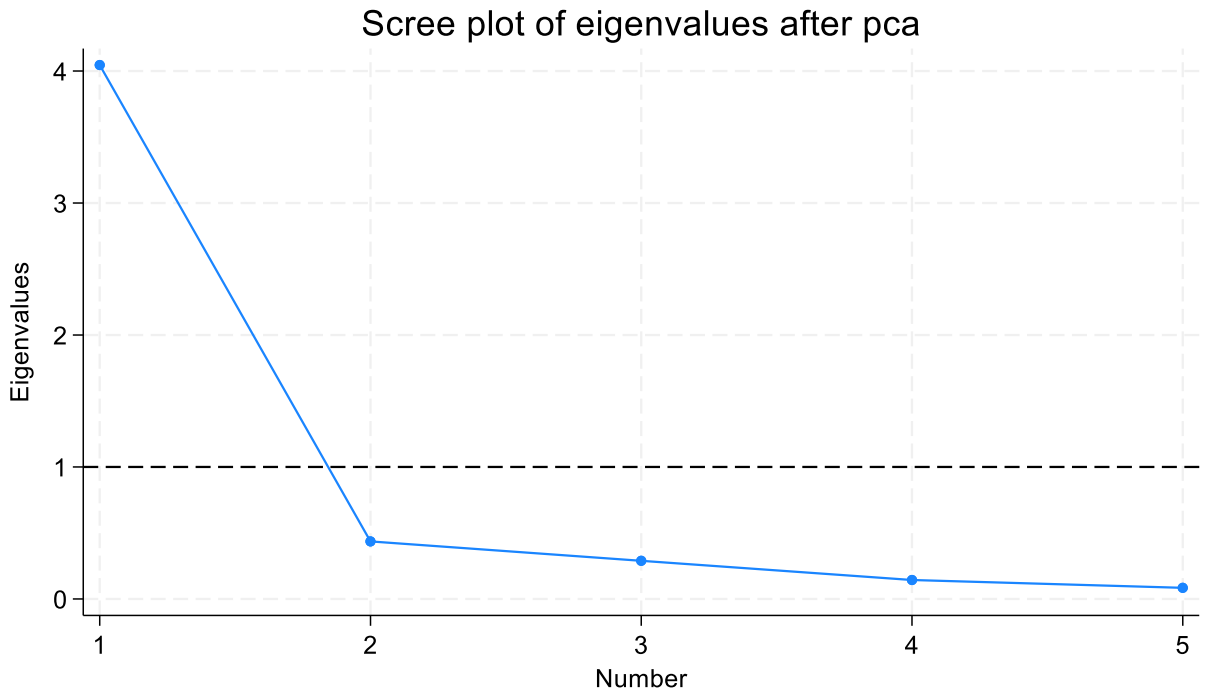
Figure A1.3. Containment index for all sampled countries



Data Source:WHO (2020-2021), Author's own compilation

Construction of institutional quality index

Since the institutional quality variables are highly correlated (see Table A4.3: Annexure A.3), we develop an index to proxy institutional quality variables using the principal component analysis using 5 variables (corruption control, political stability, rule of law, voice accountability and government effectiveness). We find that the fist component has an eigenvalue of 4.05 (see figure below) explain 81 percent variation among the 5 variables. Therefore, we use weighting scores from the first component to generate the index.



The correction matrix of the index and the 5 variables used to construct it, shows a relatively higher correlation between them, thus confirm the suitability of the index as a proxy for them.

Table A4.3. Correlation matrix between the Index and other institutional variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Index	1.000					
(2) corruption	0.923	1.000				
(3) Political stability	0.877	0.766	1.000			
(4) Rule of law	0.958	0.873	0.786	1.000		
(5) Voice Accountability	0.819	0.643	0.693	0.736	1.000	
(6) Government effectiveness	0.914	0.849	0.704	0.898	0.641	1.000

Author owns computation.