Journal of Economics and Business Review
ISSN 3065-176X
Vol. 2, No. 2, 2025
Published by STSL Press

Original Paper

Do Budget Deficits Benefit or Harm Economic Growth? Evidence from African countries Using Threshold Analysis

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Abstract

The fundamental purpose of the study is to analyze how budget deficits affect the economic growth of the selected African countries. Economic expansion in recent years has been linked to a sharp increase in budget deficits. It is, therefore, imperative to cross-check their relationship. The study uses system GMM, quasi maximum likelihood, and bias-corrected dynamic panel estimator for estimation from 1996 to 2022. The findings display that budget deficits and economic growth have a statistically significant positive association in the short run. Moreover, the study uses several control variables, such as the real interest rate, terms of trade, general government debt, and foreign direct investment, all of which are negatively statistically significant, except foreign direct investment, which is positively statistically substantial.

The study also determines a threshold value through a dynamic panel threshold model to gauge the effect of budget deficits on economic growth. The results indicate a single threshold impact that produced a threshold level of 14.3%, thus confirming the prevalence of a nonlinear relationship. The findings show that budget deficits significantly destroy the upper régime of economic growth and show mean-reverting behavior over the threshold amount. The results recommend that public policymakers in African countries improve their economic growth by reducing budget deficits. Also, governments should expand their tax base for government revenue by prioritizing strengthening revenue authorities and reducing government spending or recurrent budgets.

Keywords: Economic growth, budget deficits, dynamic panel threshold model, system GMM, and quasi maximum likelihood estimator

1. Introduction

Countries have recently expanded their expenditures in various sectors to foster economic growth following the Millennium Development Goals (MDG). Additionally, nations everywhere aim to preserve sustainable economic growth and macroeconomic stability. In this sense, rising government spending above and beyond government revenue is primarily responsible for growing budget deficits. The global economic crisis that persisted from mid-year 2007 to early 2009 and the response to COVID-19 also appeared to blow up government spending as governments attempted to comprehend the economic effects of the lockdowns, further aggravating the fiscal imbalance (Okwoche & Nikolaidou, 2022; Leshoro, 2022). The two significant events motivated the introduction of a stimulus package to rescue the economic crises.

In many African and developing nations, a continuous and steadily growing government deficit and debt are major issues (Leshoro, 2022). However, it is believed that budget deficits are not necessarily bad, primarily when utilized according to plans. However, they are a controversial topic due to their steady increase in developed and developing nations. The increased pressure on government expenditure, which did not correspond to government revenue, created budget deficits in developing countries, including African countries. Many African countries have opted for external and internal borrowing as a means to finance their budget, which has resulted in a further accumulation of debts, as well as higher interest payable on loans being secured. By the middle of the 1990s, the majority of African nations had been urged through the Bretton Woods institutions to implement liberalization

policies, sound economic management practices, and plans to combat poverty. Many African nations participating in the Highly Indebted Poor Countries (HIPC) project saw debt alleviation due to adopting the policies.

Debt cancellation by the Highly Indebted Poor Countries (HIPC) program increased budgetary flexibility and gave African countries much-needed funding. Improvements in human development results, including longer life expectancy, lower death rates, and a narrowing of the infrastructure gap, made it noteworthy. Apart from attaining desired government spending, the governments have used various means of financing their budget deficits, such as printing money, internal borrowing, and external borrowing.

Awolaja and Esefo (2020) have exposed the outcome of various means of financing government budget deficits. Interest rates will increase if funding the budget deficit requires borrowing from commercial banks. The ultimate consequence of higher interest rates will be the flight of private investors. Inflation would most likely result if the deficit were funded by central bank borrowing or money printing. Utilizing external financing is expected to result in currency appreciation due to the foreign exchange inflow, which will worsen the current account balance and reduce exports. The building of external debt stock resulting from the poor utilization of funding from all sources may ultimately lead to a debt crisis.

During recessions, governments are urged to run deficits because they will help stabilize the economy, by referring to the Keynesian school of thought, which maintains that budget deficits and economic growth are positively correlated. Conversely, the liberal theory asserts the contrary. The monetarist theory has challenged the Keynesian finance and budget deficit policies because they prioritized debt and taxes. It has been shown that financing budget deficits through taxes negatively affect investment demand and private consumption, while funding through debts raises interest rates, thus dampening private investments.

In determining the presence of a nonlinear linkage between budget deficits and economic growth for the chosen African nations, the threshold model for dynamic panel data has been employed that was developed by Seo and Shin (2016), which was later redefined by Seo et al. (2019). It is essential to trace the threshold value that might enable policymakers to avoid or minimize the detrimental effects of government deficits. The threshold value denotes the maximum government deficit that should be avoided while using budget deficits to boost economic expansion. Among the thresholds set in the national context and others in the country grouping are the following studies: Leshoro (2022) established a deficit threshold of 3% of GDP for South Africa, Iqbal et al. (2017) found a deficit threshold value of 5.57% of GDP for Pakistan, Slimani (2016) and Adam and Bevan (2005) established a budget deficit threshold level of 4.8% and 1.5% respectively for particular developing nations.

In further enrichment of the study, we employ a nonlinearity model to examine the threshold impact and concentrate solely on African nations since it considers region-specific factors; the study complements the corpus of information about growth and budget deficits in Africa. Lastly, the work aims to address any endogeneity and cross-section dependence difficulties because research on Africa has not thoroughly explored the usage of system GMM, quasi-maximum likelihood estimator, and bias-corrected. This study aims to determine which of the three philosophical systems is most appropriate for Africa. However, the study's target is to trace out the highest number of fiscal deficits that will favor economic expansion.

The remainder of this document has been structured as follows: The corpus of current literature is discussed in Section 2. Section 3 presents the model based on the study's underlying theoretical framework. The regression findings are also shown and discussed in Section 4. Section 5 wraps up and provides some suggestions and conclusion remarks.

2. Literature review

2.1 Theoretical literature

The effects of budget deficits on macroeconomic variables are explained by the following schools of thought: the Neo-classical School, the Ricardian Equivalence School, and the Keynesian School.

According to the "crowding-in" effect, a budget deficit boosts the economy, according to the Keynesian School of thought. The theory posits the role of budget deficits to stimulate aggregate demand "increases market size" in the economy, especially during periods of recessions and depressions. It stimulates the economy through multiplicative spillover effects.

There are several studies whose results support the Keynesian School of thought, among others, including the following: Leshoro (2022), Aragaw (2021), Awolaja and Esefo (2020), Bhari et al. (2020), Slimani (2016) Mohanty (2013), Odhiambo et al. (2013), Buscemi and Yallwe (2012), Adam and Bevan (2005), and Al-Khedair (1996). As long as they stay below the threshold and are a temporary occurrence, budget deficits positively affect economic growth, referring to these literary works.

The following school of thought, the Ricardian equivalency argument, contends that a budget deficit does not directly impact the economy. Awolaja and Esefo (2020) assumed that an equal rise essentially matches lower taxes in the current year and future taxes' current value because higher public spending must be paid to maintain the same interest rates and public consumption level. According to the hypothesis, households consider it when determining how much to invest and save, and they choose to increase their savings to balance out the possible tax increase. Consumption in the economy thus falls, and the economy is unaffected by the rise in government spending financed by a deficit. The findings offering credence to the Ricardian Equivalence theory include the following (Kelikume, 2016; Darrat, 1990; Findlay, 1990; and Ostrosky, 1990).

The neo-classical school of thought holds that budget deficits discourage private investment and raise real interest rates, which impede economic progress. There are fewer funds available for private sector investments, and borrowing becomes more costly (because interest rates are higher) due to the selling of government bonds, which frequently boosts interest rates and incentivizes the private sector to spend more on bonds. It reduces the amount of output and resource use over time, which is harmful to economic expansion. Some studies offering evidence on the theory include Pamba (2022), Mwigeka (2016), Asogwa and Okeke (2013), Cebula and Cuellar (2010); Furceri and Sousa (2009); Krueger (2003); and Cebula (1985).

2.2 Empirical literature

Leshoro (2022) revealed a nonlinear correlation with a threshold value of -3.6 percent in South Africa's economy using the quarterly dataset (1996Q3 to 2021Q2) with the application of the threshold autoregressive (TAR) techniques and autoregressive distributed lag (ARDL). With a threshold value of 0.152 percent, Aragaw (2021), using a dynamic panel threshold analysis, found similar results for emerging countries. A threshold value of 5.57 percent of the gross domestic product harms Pakistan's economic growth, claim Iqbal et al. (2017).

Sliman et al. (2016) adopted Hansen's (1999) method to determine the threshold effect of fiscal policy on economic growth for forty developing countries from 1990 to 2012. The data observed a double threshold impact, with a budgetary deficit of approximately 4.8% and a fiscal surplus of 3.2% of GDP. Adam and Bevan (2005) established evidence of a threshold value of about 1.5 percent of GDP for 45 developing countries, indicating that a fiscal deficit below that level would damage economic growth.

Gyasi (2020) examined the budget deficits' long-term significant effects on the Moroccan economy using the ARDL cointegration approach. The following studies give evidence on the prevalence of the positive short-run impact of budget deficits on economic growth for studies conducted in Sub-Saharan Africa and Malaysia, such as Bhar et al. (2020) and Awolaja and Esefo (2020), respectively. These studies have appeared to be supported by the Keynesian school of thought with an assumption that budget deficits foster economic growth.

The Keynesian theory was confirmed by Kanchori (2020), who exposed a high linkage between economic growth and budget deficits for Kenyan data spanning 2001 to 2019. Nayab (2015) examined Pakistan's economy using the vector error correction model (VECM) and vector autoregressive (VAR), and the results are in line with the conclusion from Kanchori (2020). The role of budget deficits in the Eurozone was also studied by Eroğlu et al. (2014) using panel ARDL and quarterly data from 2000Q1 to 2011Q4; insignificant long-term results were displayed along with a positive short-term impact.

Odhiambo et al. (2013) used the error correction model (ECM) to investigate the impact of budget deficits on Kenyan growth and discovered that they have a positive effect. By obtaining comparable results utilizing data covering 1990 to 2009 for several BRICS member states using a general method of moments (GMM) technique for dynamic panel member states, Buscemi and Allwe (2012) supported the Keynesian premise. Concurrently, Kimaro et al. (2017), using the generalized method of moments (GMM), demonstrated a positive connection between government spending and economic growth in Sub-Saharan Africa.

Empirical studies show that public investment expenditure gives a positive outcome but less evident effect on growth, while public consumption spending substantially impedes it (Saleh and Harvie, 2003). Regarding industrialized countries, France, Germany, and Italy saw notable growth due to budget deficits. Moreover, Al-Khedair (1996) depicted that the budget deficit appeared to significantly and positively affect economic growth in the seven leading industrialized nations.

Furthermore, Aworinde (2013) found comparable results regarding the effect of budget deficits on economic performance in twelve (12) African countries using the ARDL and VAR models. Finally, a 2007 study by Bose et al. that used panel data from 30 rising nations to assess the association between public spending and economic growth showed that budget deficits inhibit economic advancement.

Kelikume (2016) found that interest rates were neutral and insensitive to budget deficits, using data from the VAR panel for sub-Saharan Africa and the impulse response function (IRF). The findings suggest evidence for the Ricardian as unchanged interest rates do not affect investment. Interest rate neutrality also indicated that economic growth was neutral. Rahman (2012) suggests no evidence of a long-term relationship between budget deficits and economic growth. The study examined quarterly data from Malaysia from 2000 to 2011 and applied the ARDL approach.

The prevailing empirical research presents inconsistent results about how the budget deficit threshold affects economic growth due to variations in threshold estimate techniques and the countries included in the sample. The budget deficit threshold effects are reexamined in this paper using a novel estimate technique that permits heterogeneity and a smooth transition of regression coefficients between régimes. A country's or region's level of development dictates the direction of association between budget deficits and economic growth, and regional characteristics have altered the type of association between the variables.

3. Data and Methodology applied in the Study:

3.1 Description of Data and Sources

The analysis uses data from 30 African countries over 27 years (1996–2022), resulting in 810 observations (i.e., panel data, where T= 27, and N = 30). The countries included have solely been determined by data availability; countries with little data on the variables were excluded. The primary data sources include the International Monetary Fund and the World Bank (World Development Indicator). The rest of the explanatory variables to be included in the study are the real interest rate, inflation rate, trade openness, real exchange rate, terms of trade, foreign direct investment, government spending on education, and total government debt.

The application of panel data has depicted various advantages, including shields for biased sample selection, owing to omitted variables, Lucas et al. (2017). Panel data has increased precision in estimation, controlling for individual effects, modeling heterogeneity across individuals, and modeling dynamic behaviors of individuals (Bond, 2002; Greene, 2012).

Table 1. Data sources and their respective measurements

Variable names	Description	Expected sign	Measurement	Source
Economic growth	gdpgrowth	Nill	GDP per capita as a proxy for economic growth	World bank
Budget deficit	BD	Positive/Negative	Overall balance as % of GDP	World bank
Trade openness	TOGDP	Positive	Export plus import as a ratio to GDP	World bank
Interest rate	R_INTR	Negative	Real interest rate (%)	World bank
Inflation rate	CPI	Negative	Laspeyres formula (proxied by CPI) CPI (2010 = 100)	IMF
Real exchange rate	EXCH	Positive/Negative	Domestic Currency per US Dollar (US$)	World bank
Terms of trade	ToT	Negative	The ratio of the price of exports to the price of imports (US$)	World bank
Foreign direct investment (FDI)	FDI	Positive	FDI, net inflows (BoP, current US$)	World bank
Government expenditure on education	GEEGDP	Positive	Government expenditure on education measured as a percentage of GDP	World bank
General government debt	GGDGDP	Negative	General government debt as the percentage of GDP	World bank

Source: Author compilation from different literature.

3.2 System GMM Model

Aisen and Hauner (2008) suggest using the system GMM, given its superiority over other models, as it provides efficient estimation. System GMM expands difference GMM by estimating simultaneous levels and differences, the two distinctly instrumented equations. More rigorous assessments of the instruments' validity significantly address the issue of weak instruments and offer the possibility of increased efficiency (Aisen and Hauner, 2008).

Based on these assumptions, the system GMM estimator proposes using differences $\Delta d_{i,t-1}$ as a new set of tools for the lagged dependent variable's levels $d_{i,t-1}$. As a result, it uses a fresh set of internal tools that were unavailable to the earlier GMM estimators (Acemoglu et al., 2008). Arellano and Bover (1995), and further modification by Blundell and Bond (1998), introduced the system GMM as an enhancement of the standard or fundamental difference GMM estimator. As seen below, it estimates using both levels (original) and difference equations.

Level equation: $y_{i,t} = \delta y_{i,t-1} + \alpha x_{i,t} + \mu_i + \varepsilon_{i,t}$ (1)

Differenced equation: $y_{i,t} - y_{i,t-1} = \delta\left(y_{i,t-1} - y_{i,t-2}\right) + \alpha\left(x_{i,t} - x_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)$

$$\Delta y_{i,t} = \delta \Delta y_{i,t-1} + \alpha \Delta x_{i,t} + \Delta \varepsilon_{i,t} \quad (2)$$

Somewhat than subtracting the prior observation from the current or contemporaneous value, the system GMM employs orthogonal deviations. It takes the mean for all observations of a variable and gets subtracted. In contrast to difference GMM estimators, it minimizes information loss because it can be computed for all observations except for the final one for each individual.

Estimating dynamic panel data, such as the system GMM estimator, uses all the different moment conditions and this extra set of level moment criteria. Achieving the desired outcome merges the level

and difference equations into a larger set of equations (Roodman, 2009). The following is the specification's functional form:

Starting with defining the growth rate:

$$logGDP\_capita_{it} - logGDP_{capita_{it-4}} = \Delta logGDP_{capita_{it}} = gdpgrowth_{it} \quad (3)$$

Growth rate = $gdpgrowth_{it}$

It then follows the system GMM equations at levels equation (4) and at difference equation (5):

$$gdpgrowth_{it} = \delta_i logGDP\_capita_{it-1} + \gamma_{1i} BD_{it-1} + \gamma_{2i} R\_INTR_{it-1} + \gamma_{3i} \ln ToT_{it-1} + \gamma_{4i} \ln TOGDP_{it-1} + \gamma_{5i} \ln GGDGDP_{it-1} + \gamma_{6i} \ln CPI_{it-1} + \gamma_{7i} \ln FDI_{it-1} + \gamma_{8i} GEEGDP_{it-1} + \gamma_{9i} \ln EXCH_{it-1} + \emptyset_i + \mu_t + \varepsilon_{it} \quad (4)$$

$$gdpgrowth_{it} = \delta_i \Delta logGDP\_capita_{it-1} + \gamma_{1i} \Delta BD_{it-1} + \gamma_{2i} \Delta R\_INTR_{it-1} + \gamma_{3i} \Delta \ln ToT_{it-1} + \gamma_{4i} \Delta \ln TOGDP_{it-1} + \gamma_{5i} \ln GGDGDP_{it-1} + \gamma_{6i} \Delta \ln CPI_{it-1} + \gamma_{7i} \Delta \ln FDI_{it-1} + \gamma_{8i} \Delta \mathrm{GEEGDP}_{it-1} + \gamma_{9i} \Delta \ln EXCH_{it-1} + \Delta\mu_t + \varepsilon_{it} \quad (5)$$

where y_{it} denotes the dependent variable in the country i in period t; x_{it} is a vector of regressors; $v_{it}$is the error term δ_i is the country-specific effect, and μ_t is the time-specific effect that captures global shocks.

The connection between fiscal deficits and economic growth has been shown to have an endogeneity problem. In this instance, the GDP per capita change has been measured for four years (all lags are four years; hence, the lagged figures for 2000 are derived from 1996). Utilizing the four-year averages of the data assures roughly that the short-run cyclical simultaneity between fiscal performance and economic development can be removed, as suggested by Adam and Bevan (2003) and Devarajan et al. (1996). Furthermore, it considers that growth effects frequently have an unknown lag before being apparent.

Baum et al. (2003) have pinpointed that efficient GMM has the advantage of consistency besides heteroskedasticity. However, when sample sizes are present, this benefit has been demonstrated to be associated with less-than-ideal performance. The system GMM can resolve the endogeneity of some explanatory variables, serial correlation, and heteroskedasticity (Leitao, 2010). Furthermore, using a system GMM estimator significantly lowers the finite sample bias while increasing precision (Arellano and Honore, 2001; Blundell et al., 2000).

Arellano and Bond (1991) claim a broken link between the explanatory factors and the consequences unique to a nation. Furthermore, the endogeneity between the dependent and explanatory variables is removed by instrumenting the differenced variables with their available lags in levels (Blundell and Bond, 1998). The instruments are called internal instruments since they are developed within the designated econometric model.

3.3.1 Quasi Maximum Likelihood Estimator

According to Kripfganz (2016), if all presumptions are satisfied and the time horizon is short, the QML estimate may assist in resolving the endogeneity of a lagged explained variable in the employed linear dynamic panel data models. Including time-invariant variables and using full-information maximum likelihood to handle missing data are two benefits of the model: dynamic panel data using maximum likelihood and structural equation modeling. Because it additionally incorporates lagged endogenous regressors, it guarantees the potential to account for confounders and unobserved variables. The following function form represents the setup for the equation to be estimated:

$$y_{it} = \lambda y_{it-1} + x'_{it}\beta + w'_i\delta + \alpha_i + \xi_t + v_{it} \qquad (t = 1..., T) \ (i = 1..., N)$$

Whereby;

x'_{it} is a vector of sequentially exogenous time-varying variables $(k \times 1)$, y_{it} is the value of y for an individual i at time t, β is a $k \times 1$ vector of unknown coefficients, $w'_i$is a vector of time-invariant, strictly exogenous variables, ξ_t captures unobserved common factors across units in the panel, α_i is the unobservable time-invariant fixed effect, and v_{it} is the time-varying error term (assumed to be independently distributed across i and t.

Using Monte Carlo experiments, Phillips (2017) and Hayakawa et al. (2018) discovered that quasi-maximum likelihood estimators have significantly fewer biases and, thus, smaller root mean squared errors than difference and system GMM. The QMLE models may account for both time-varying and time-invariant covariates, and they provide flexible potential correlations between incorporated unobserved individual effects and regressors. With substantial standard errors and cross-sectional heterogeneity, the quasi-maximum likelihood estimator has shown promise in accounting for serial correlation (Falk et al., 2023).

Furthermore, it has been shown that by modeling the initial observations of the explained variable as a function of changes in the future values of the exogenous variables for which the coefficients are to be estimated, quasi-maximum likelihood estimation diminishes the issue of Nickel bias (correlation between the lagged dependent variable and the error term) as noted from scholars such as Falk et al., (2023), and Oliveira et al. (2024). Nevertheless, resilience and efficiency are traded off. The method becomes inconsistent if the lagged explained variable is not excluded from the regressors, which is the strictly exogenous assumption. Additionally, Oliveira et al. (2024) have demonstrated that the consistency of the estimators is jeopardized if serial correlation is not considered after the first-order autoregressive term.

3.3.2 Bias-Corrected Method of Moments Estimator

In addressing the weak-instrument issue with the GMM approach, the study also uses an alternative model, which is an extension of maximum likelihood (ML) estimators created by Hayakawa and Pesaran (2015) and Hsiao et al. (2002), among others. Both fixed and random impacts of dynamic panel models can be estimated using this approach. It also includes time-invariant regressors and orthogonality assumptions. The findings of the Monte Carlo trials indicate that the estimator outperforms previous iterations of dynamic panel models (such as bias-corrected within-groups (WG) estimators and GMM techniques) in terms of efficiency and suitably sized tests.

Chudik and Pesaran (2017) demonstrated that, compared to alternative estimators, a straightforward bias-corrected technique of moments has good power performance and is free from size distortions. The approach works accordingly if the size of panel units tends to endlessness and the temporal horizon is fixed. Its function form is comparable to that of a quasi-maximum likelihood estimator.

3.4 Dynamic Panel Threshold Regression Model

It is unclear how the fiscal deficit affects economic growth, as evidenced by several research that support the Keynesian hypothesis (positive link) and others that support the neoclassical theory (negative correlation) (Iqbal et al., 2017). This makes it helpful in determining the likely occurrence of a nonlinear linkage amidst economic growth and fiscal deficit. Therefore, a threshold level of budgetary deficits is proposed, providing the amount of fiscal expansion to stimulate economic growth.

The perseverance of the lagged outcome variable in the earlier version, a static technique created by Hansen (1999), has drawn criticism for being inconsistent and potentially leading to erroneous results due to endogeneity bias. Moreover, problems with collinearity or multicollinearity may often arise when the square term is applied to the threshold variable (Dalmar et al., 2024). Later, Seo & Shin (2016) modified Hansen's 1999 model to include dynamic panels. By applying the first difference to the general form of the GMM, Seo and Shin (2016) created a first difference two-stage least square (2SLS). They found that this approach was quite reliable.

Seo et al. (2019) have provided the most detailed current form of the dynamic panel threshold technique, which employs a time-efficient bootstrapping mechanism. The GMM system, which tackles endogeneity and simultaneity in the context of the link between explained and explanatory factors, is the foundation of the Seo et al. (2019) technique (Hu and Wang, 2024). According to Seo et al. (2019), it is the only threshold technique that permits the treatment of one threshold variable in a model and does not consider multiple thresholds. The current model, created by Seo and Shin (2016) and then improved by Seo et al. (2019), has been used by numerous researchers, such as Alam and Anwar (2018), Gong and Seo (2023), and Hu and Wang (2024). It takes the following functional form:

$$y_{it} = (1, x'_{it}, c'_{it})\beta_1 I(q_{it} \leq \gamma) + (1, x'_{it}, c'_{it})\beta_2 I(q_{it} > \gamma) + \varepsilon_{it}; \quad \varepsilon_{it} = \alpha_i + v_{it}$$

$n = 1, \dots, n;\ \ t = 1, \dots, T$

It can also be expressed as follows;

$$y_{it} = \begin{cases} \alpha_i + \beta_1' x_{it} + v_{it} & q_{it} \leq \gamma \\ \alpha_i + \beta_2' x_{it} + v_{it} & q_{it} > \gamma \end{cases}$$

The panel has to be balanced where $\{y_{it};\ q_{it}, x_{it} : 1 \leq i \leq n, 1 \leq t \leq T\}$

where c_{it}' encompasses a vector of control variables, x_{it} is the $k_t \times 1$ vector of time-varying explanatory variables of interest, which may include the lagged explained variable and y_{it} is a scalar stochastic variable of interest. q_{it} is the threshold (transition) variable, γ is the threshold parameter that divides the equation into two régimes with coefficients β_1 and β_2, and $I\{\cdot\}$ is an indicator function that can be either equal to 1 or 0 depending on the condition term as applied by Gong and Seo (2023) and Hu and Wang (2024). The error term ε_{it} is made up of two error components: v_{it} is a zero mean idiosyncratic random disturbance that is assumed to be identically and independently distributed (iid) of zero mean and constant variance and α_i is an unobserved individual fixed effect that accounts for time-invariant country-specific characteristics as applied by Gong and Seo (2023) and Hu and Wang (2024).

In fitting data of our interest to the model described above, it generates the following basic model for analysis:

$$EG_{it} = (1, BD_{it})\beta_1 I(q_{it} \leq \gamma) + (1, BD)\beta_2 I(q_{it} \geq \gamma) + \alpha c_{it} + \varepsilon_{it}\ \ n = 1, \dots n;\ t = 1, \dots, T$$

Where c_{it} represent other regressors applied in the model (real interest rate, terms of trade, trade openness, general government debt, consumer price index, foreign direct investment, government expenditure on education, and real exchange rate), and α is the vector of parameters. Noteworthy, Olaoye et al. (2023) have shown that the lagged explained variable and explanatory factors are also permissible to be endogenous when endogeneity problems occur in a dynamic panel threshold.

4. Presentation of the Results and Discussion

4.1 Descriptive analysis of the variables

The descriptive output of the skewness statistics shows that most variables are favorably positively skewed when foreign direct investment, terms of trade, the consumer price index, and the real interest rate are excluded. Additionally, the distribution of GDP growth, terms of trade, budget deficits, consumer price index, general government debt, real interest rate, foreign direct investment, and government spending on education is considered as leptokurtic (greater than three) nature, according to the results of the kurtosis statistic. Conversely, variables like trade openness and the real exchange rate are regarded as platykurtic since their values are less than three.

Table 1. Summary statistics of the variables

Actual variables names	Variables	Obs	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
GDP growth rate	gdpgrowth	180	.065	.15	-.637	1.164	1.165	21.214
Budget deficits as % GDP	BDGDP	180	-1.918	5.789	-29.3	27.7	.702	11.13
Real interest rate	R INTR	180	5.666	13.014	-93.513	48.033	-2.88	24.965
Log of terms of trade	lnToT	180	27.068	2.822	11.481	36.288	-.68	11.02
Log of trade openness as % GDP	lnTOGDP	180	4.119	.453	3.071	5.403	.343	2.9
Log of general government debt as % GDP	lnGGDGDP	210	3.869	.681	1.985	6.298	.124	4.438

Log of consumer price index	lnCPI	180	4.332	.799	-3.516	5.398	-5.798	54.426
Log of foreign direct investment	lnFDI	180	18.767	2.28	10.708	23.014	-.909	4.334
Government expenditure on education as % GDP	GEEGDP	180	4.253	1.768	.393	12.329	1.36	7.222
Log of real exchange rate	lnEXCH	180	3.875	2.21	-2.055	8.137	.064	2.096

Source: Author computation through STATA

4.2 Correlation matrix analysis

The findings in Table 2 show how the explanatory variables and economic growth (GDP growth) are related, as supported by the theories and additional research. Growth and the budget deficit have been demonstrated to be strongly positively correlated. Growth is also significantly positively correlated with trade openness and foreign direct investment. Government investment in education has been found to correlate positively with growth; however, this relationship is not statistically significant. The other factors that have shown a negative relationship with growth are the real interest rate, total government debt, consumer price index, real exchange rate, and terms of trade. Additionally, as shown in Table 2, the study's findings demonstrate that the variables used do not exhibit multicollinearity because their correlation coefficient values are less than 0.7.

Table 2. Correlation Matrix (Pairwise correlations)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) gdpgrowth	1.000									
(2) BDGDP	0.137*	1.000								
	(0.095)									
(3) R_INTR	-0.022	-0.180*	1.000							
	(0.788)	(0.016)								
(4) lnToT	-0.022	-0.043	0.145*	1.000						
	(0.793)	(0.569)	(0.052)							
(5) lnTOGDP	0.137*	0.176*	-0.072	-0.227*	1.000					
	(0.094)	(0.018)	(0.334)	(0.002)						
(6) lnGGDGDP	-0.012	-0.161*	-0.079	-0.067	-0.113	1.000				
	(0.881)	(0.030)	(0.290)	(0.370)	(0.133)					
(7) lnCPI	-0.001	-0.062	0.529*	0.041	0.031	-0.140*	1.000			
	(0.993)	(0.407)	(0.000)	(0.589)	(0.677)	(0.060)				
(8) lnFDI	0.145*	0.160*	-0.031	0.113	0.245*	-0.291*	0.080	1.000		
	(0.077)	(0.032)	(0.678)	(0.130)	(0.001)	(0.000)	(0.287)			
(9) GEEGDP	0.071	0.022	-0.078	-0.175*	0.283*	-0.124*	0.062	-0.090	1.000	
	(0.388)	(0.773)	(0.296)	(0.019)	(0.000)	(0.097)	(0.409)	(0.228)		

(10) lnEXCH	-0.010	-0.152*	0.264*	0.448*	-0.482*	0.017	0.236*	-0.212*	-0.242*	1.000
	(0.900)	(0.041)	(0.000)	(0.000)	(0.000)	(0.825)	(0.001)	(0.004)	(0.001)	

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

Source: Author computer through STATA

4.3 Scatter plot diagram

In supplementing the above estimation, the study applies a scatter plot for budget deficits against GDP growth, our dependent variable. Since the diagrammatic association between the two variables under examination does not reflect a pattern of their direction relationship, whether positive or negative, the scatter plot (Figure 1 is attached in the appendix) suggests that there is most likely a nonlinear relationship between them. Based on the dynamic panel threshold model, the estimation and description appear to coincide.

4.4 Panel Unit Root Test Analysis

In the first place, the study inspects the possibility of stationarity for the data under consideration, and it employs testing methods such as the Levin, Lin, and Chu (LLC) and Harris-Tzavalis (HT) unit root test. The outputs presented in Table 3 advocate that the null hypothesis of the presence of unit root in the variables in levels could be rejected (reject H_0) at 1 percent significance level, thus demonstrating that the variables are stationary in levels exempt from variables such as the consumer price index. However, it was established to be stationary at the first difference (became stationary after taking the first difference) using the Levin, Lin, and Chu (LLC) unit root test. Furthermore, the Harris-Tzavalis (HT) unit root test indicated most variables to be stationary at levels of 1 percent level of significance, excluding government expenditure on education, which was stationary at 10 percent. In comparison, the consumer price index and exchange rate were stationary at the significant level of 10 and 1 percent, respectively, after being subjected to the first difference.

Table 3. Presents Panel Unit Root Tests Results

Variables	LLC			HT		
	Level	Istdiff.	decision	Level	Istdiff.	decision
gdpgrowth	-13.281***	NA	I(0)	-7.080***	NA	I(1)
BDGDP	-18.257***	NA	I(0)	-7.350***	NA	I(1)
R_INTR	-20.070***	NA	I(0)	-5.596***	NA	I(0)
lnToT	-7.558***	NA	I(0)	-5.550***	NA	I(0)
lnTOGDP	-28.990***	NA	I(0)	-2.613***	NA	I(0)
lnGGDGDP	-10.571***	NA	I(0)	-3.853***	NA	I(0)
lnCPI	10.564	-12.911***	I(1	3.8112	-1.376*	I(1)
lnFDI	-11.229***	NA	I(0)	-5.126***	NA	I(0)
GEEGDP	-3.058***	NA	I(0)	-1.514*	NA	I(0)
lnEXCH	-9.401***	NA	I(0)	0.771	-4.585***	I(1)

Note: */**/*** denotes significance level at 10%, 5% and 1% respectively

Source: Author's computation through STATA

4.5 Panel Cointegration Analysis

The study employs cointegration tests, such as those developed by Pedron (2004), Persyn and Westerlund (2008), and Kao (1999), to ensure the accuracy of the analysis by looking for long-term correlations between macroeconomic variables. The findings provide compelling evidence against the null hypothesis, which postulated the absence of cointegration among macroeconomic variables, as the p-value for every statistic is below the conventional significance level (0.05 or 5%).

Table 4 shows the outcomes of cointegration equations that show how budget deficits and economic growth, along with other specific macroeconomic parameters, are related. According to the findings of the Kao, Pedroni, and Westerlund tests, cointegration results confirm that the variables being studied exhibit a long-term equilibrium. The research then looks at any long-term connections between economic growth and the control variables.

Table 4. Panel Cointegration Test Results

Kao test		Pedroni test		Westerlund test	
	Statistic		Statistic		Statistic
M. Dickey-Fuller	-0.0960	M.Phillips–Perron test	7.4768 ***	Variance ratio	13.0297 ***
Dickey-Fuller test	-6.5466 ***	Phillips–Perron test	-18.099***		
Augment D-F test	- 1.6161*	Augment D-F test	-542.900***		
Unadjusted M. D–F	-1.1285				
Unadjusted D–F	-7.1598***				

Note: */**/*** denotes significance level at 10%, 5% and 1% respectively

Source: Author's computation through STATA

Whereby: M. Dickey-Fuller =modified Dickey-Fuller; D-F= Dickey-Fuller; M.Phillips–Perron test =Modified Phillips–Perron.

4.6 Cross-sectional Dependence

The study also looks at the possibility of cross-sectional dependency (CD) in the presented data. One of the reasons that has been shown to lead to interdependencies for cross-section units (global standard shocks) with varying repercussions across countries is the growing economic and financial integration of nations and the integration of financial institutions. The size and kind of the cross-section units determine the influence. According to De Hoyos and Sarafidis (2006), they are usually caused by the presence of standard components that are undiscovered but uncorrelated with the included regressor; as a result, their effect is experienced through the disturbance term.

If no corrective action has been made in the estimation techniques, the presence of CD typically impacts the true parameters of the estimate. Cross-sectional dependence (CD) in economic variables is a plausible outcome of economic actions or events, which usually exhibit interconnectedness across economies. According to Pesaran (2006), the common correlated effects mean group estimator (CCEMGE) generates residuals, which are further submitted to Pesaran's (2004) CD test and average correlation coefficients. Pesaran (2006) proposes the common correlated effects (CCE) estimate process, which uses the cross-section averages as appropriate proxies for the unobserved components to remove cross-sectional dependence.

The study failed to accept the null hypothesis at the 1% level of significance, which asserted the presence of cross-sectional independence. The CD test's p-values of 0.0000 (<0.01) for the other variables and 5% for the real interest rate variable from Table 5 confirmed the presence of cross-sectional dependence in each variable. As we advance, all estimating techniques utilized in this

study must account for the presence of CD in the variables.

Table 5. Cross-sectional dependence test for the panel

Variable	CD-test	p-value	Corr	abs(Corr)
gdpgrowth	7.310	0.000	0.157	0.454
BDGDP	8.130	0.000	0.174	0.470
R_INTR	2.370	0.018	0.051	0.470
lnCPI	42.070	0.000	0.902	0.902
lnFDI	17.920	0.000	0.384	0.565
lnEXCH	24.220	0.000	0.519	0.635

Notes: Under the null hypothesis of cross-section independence, CD ~ N (0,1)

Source: Author's computation through STATA

4.7 System GMM, Quasi-Maximum Likelihood Estimator, and Bias-corrected Dynamic Panel Estimator Estimation Results and Discussion

The results for the second-order autocorrelation test have appeared to be statistically insignificant, demonstrating the absence of second-order autocorrelation in the disturbance component. The study tests for the legitimacy of instruments using the Sargan and Hansen test, and the statistical results depict the appropriate estimates as statistically significant. The output shows how well the instrumental variables fit the estimation; the actual result is presented in Appendix Table A1. The coefficients for the lagged dependent variables were statistically significant at the 1 and 10 percent significance levels using the quasi-maximum likelihood estimator and the system GMM, respectively. Regression results on the dependent variable (economic growth) employing dynamic measures like quasi-maximum likelihood estimation, system GMM, and bias-corrected dynamic panel method are displayed in Table 5. The results demonstrated a statistically significant positive correlation between economic growth and budget deficits for the given dataset and chosen countries.

All else being equal, a percentage change in the budget deficit is linked to an average rise in economic growth of 0.01 percent at the 1 percent level, as shown in Table 5 with their accompanying estimators. The Keynesian school of thinking, which supports the idea that fiscal deficits promote domestic investment and, as a result, enhance economic growth or conditions, is supported by the results in this case. Similar results have been seen in numerous research studies. For example, Mohanty (2013) and Buscemi and Yallwe (2012) found comparable outcomes for the short-run phenomenon for Asian countries and emerging economies, respectively. Also, Al-Khedair (1996) studied fiscal deficits' influence on industrial countries' growth and concluded that deficits generally enhance growth. According to Awolaja and Esefo (2020), budget deficits seemed to have a short-run positive effect on growth and a long-run negative impact on Sub-Saharan Africa. According to Bhari et al. (2020), budgetary deficits stimulated economic growth in Malaysia. Similar findings were presented by Aragaw (2021) for a few chosen African nations and Odhiambo et al. (2013) for the Kenyan economy.

Research has demonstrated that deficits create a destructive long-term impact on economic growth, which lends credence to the neoclassical school of thought. Neoclassical Keynesian economists contend that budget deficits discourage private investment by raising interest rates, which momentarily lowers the output of national income. Long-term economic growth appears to be severely hampered by chronically high deficits, according to studies like Awolaja and Esefo (2020), Manamba (2017), and Dao (2013).

Except for the system GMM, which is not statistically significant, it has been shown that all estimates of real interest rates possess a substantial and adverse connection with growth. According to the other

estimations, if all other things stay the same, a percentage increase in interest rates will, on average, result in a 0.002 percent decrease in growth. The results coincide with the conventional theoretical explanations in economics on the connection between interest rates and economic development. Among other researchers, Khan and Senhadj (2001) and Buscemi and Yallwe (2012) had comparable findings. In attempting to achieve sustainable economic growth, nations must implement a monetary and fiscal mix with low and comparatively steady interest rates. Interest rates are a key factor in economic development; low interest rates (low cost of borrowing for capital accumulation) are typically linked to higher investment, boosting output growth.

System GMM analysis indicates a negatively statistically significant relationship between growth and the terms of trade (TOT) coefficient. A given percentage rise in terms of trade will result in a 0.01 percent decrease in economic growth, assuming all else is equal. Therefore, to increase productivity and thereby lower imports, the African government must increase both public and private sector investment and form partnerships (public-private partnerships). Unfavorable terms of trade are shown by the acquired data, which suggest that imports are more significant than exports to the rest of the globe. However, Mputu (2016) found that trade terms positively affected the economies of sub-Saharan countries. A drop in TOT indicates a drop in the buying power of exports and, consequently, a drop in the size of a country's trade gains. Additionally, a drop in TOT might make it harder to fund the trade and current account deficits, leading to a large external debt load.

In a regression model, the total amount of government debt would rise proportionately to the existing deficit and vice versa if the budget deficit variable had a significant positive coefficient. However, the system GMM result indicates that the general government debt variable estimate is statistically insignificant despite a converse relationship with economic growth. For alternative estimators, government debt and economic growth had a statistically significant negative connection. Growth is slowed by an average of 0.04 percent for every percentage increase in general government debt, assuming other things are constant. The findings confirm the debt overhang theory, which postulates a nonlinear relationship between debt and growth, by reaffirming that a large and growing public debt is detrimental to the growth process, as referred to by Okwoche and Makanza (2023).

Government debt has been demonstrated to have an adverse short- and long-term relationship with economic growth, as Asteriou et al. (2021) and Attard (2019) explain. Nduricimpa's (2020) research demonstrated that high governmental debt levels are invariably detrimental to economic growth. According to research by Okwoche and Makanza (2023), Odhiambo (2018), Cecchetti et al. (2011), and Reinhart and Rogoff (2010), government debt is either neutral or encourages economic growth, is also detrimental above a certain GDP level. In this way, the outcomes support the conclusions of the study.

For every estimator, the estimates of foreign direct investment have shown a positive correlation with growth, and they all seem statistically significant. A percentage rise in foreign direct investment is equivalent to an average increase of 0.02 percentage points in economic growth, assuming all other factors remain constant. Foreign direct investment stimulates growth by applying new knowledge to industry, improving quantity and quality. It also enhances investment levels by launching new projects and renewing old ones (improvement of investment capital growth), boosting production, and creating jobs. In rich and developing nations, it closes the gap between supply and demand for capital investment and guarantees steady economic growth in the host nation (country of destination). Scholars such as Ayenew (2022), Nguyen (2020), Dinh et al. (2019), Yao (2019), and Borensztein et al. (1998) have all come to similar conclusions that foreign direct investment enhances economic growth.

Borensztein et al. (1998) emphasized key elements for the absorption of foreign direct investments to substantially affect economic growth, including the low cut-off for stock of human capital and adequate capacity to absorb cutting-edge technology. Alfaro et al. (2004) assert that well-developed financial markets are another crucial component in enhancing the influence of foreign direct investment in spurring economic growth. The goals of foreign direct investment to the recipient nation include technology transfer, competitiveness, export growth, job creation, and human capital development (Ayenew, 2022). Foreign direct investment (FDI) not only enhances private investment crowding but also has a direct stimulus on economic growth through capital accumulation and an indirect impact via the spillover effect, according to Yao (2019).

Although they were determined to be statistically insignificant for all estimations, the remaining factors employed have demonstrated the expected association with economic growth. Considering the African countries chosen during the study period, variables such as real exchange rate, trade openness, consumer price index, and government spending on education have shown no statistical association with economic growth.

Table 5. Presents the results for the two-step system GMM, quasi-maximum likelihood estimator, and bias-corrected dynamic panel estimator.

	(1)	(2)	(3)
VARIABLES	two-step GMM	xtdpdqml	xtdpdbc
L.gdpgrowth	-0.185*	-0.164***	-0.158
	(0.110)	(0.0596)	(0.0986)
BDGDP	0.00456**	0.00698***	0.00697***
	(0.00200)	(0.00154)	(0.00236)
R_INTR	-0.00131	-0.00170*	-0.00179**
	(0.00130)	(0.00100)	(0.000844)
lnToT	-0.00658*	-0.00356	-0.00354
	(0.00365)	(0.00348)	(0.00374)
lnTOGDP	0.0282	0.00478	-0.00533
	(0.0312)	(0.0428)	(0.0429)
lnGGDGDP	-0.0149	-0.0421**	-0.0490***
	(0.0163)	(0.0175)	(0.0176)
lnCPI	-0.00998	-0.0223	-0.0344
	(0.0965)	(0.0539)	(0.0911)
lnFDI	0.0139***	0.0186**	0.0191*
	(0.00337)	(0.00914)	(0.0100)
GEEGDP	0.00301	0.00503	0.00417
	(0.00544)	(0.00673)	(0.00545)
lnEXCH	0.0150	0.0119	0.0259
	(0.00949)	(0.0445)	(0.0598)
year	-0.00327	-0.00119	-0.00141
	(0.00606)	(0.00387)	(0.00700)
Constant	6.521	2.417	2.934
	(11.81)	(7.496)	(13.67)
Observations	120	120	120
Number of ID	30	30	30

Standard errors in parentheses

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

4.8 Dynamic Panel Threshold Model Estimation

The study's estimates demonstrated that although a budget deficit encourages economic growth, it can also work against it if it exceeds the threshold of 14.3 percent of GDP. When budget deficits surpass the predetermined threshold value level, Table 6 shows the reverting behavior of the control variable coefficients. Nonetheless, studies indicate that the extent and impact of budget deficits differ between nations and periods. According to the study, the current threshold level for budget deficits in a few African nations is 14.3 percent; any amount above this barrier substantially impacts growth.

Below the given threshold, the dynamic threshold model estimation findings showed that the coefficient's signs resembled those of the previously estimated models. The coefficient of budget deficits is determined to be statistically significant and positively correlates with economic growth. All other things being equal, a 10 percent increase in budget deficits is linked with an average 0.07 percent rise in economic growth. The consumer price index was the sole control variable shown to be statistically significant and negatively correlated with growth in the régime below. Economic growth will fall by 0.2 percent for every unit increase in the consumer price index, assuming all other things remain constant.

Over the threshold amount, the data demonstrate a negative correlation between budget deficits and economic growth. It indicates that an average 0.13 percent decline in economic growth occurs for every 10 percent increase in budget deficits, provided all other factors remain constant. Indicators of the link between economic growth and the control variables have also changed as budget deficits have increased beyond the threshold level. The consumer price index and real interest rate were also statistically significant in the abovementioned régime. The consumer price index has appeared to spur economic, whereas the real interest rate damages economic growth.

In terms of the sign of the connection, these results are inversely connected to those from the system GMM, quasi maximum likelihood estimator (QMLE), and bias-corrected dynamic panel estimator, except for general government debts, which have displayed a negative sign in both régimes. These findings illustrate the scenario in which budget deficits exceed the threshold. For the chosen African nations, the findings indicate a mean reverting u-shaped association between economic growth and budget deficits.

Table 6. Results for dynamic panel threshold estimation

Variables	**Below limit**		**Above limit**	
Lag_y	-0.466	(0.112)***	-0.979	(0.689)
R_INTR	0.003	(0.003)	-0.015	(0.006)***
lnToT	-0.001	(0.006)	0.010	(0.028)
lnTOGDP	0.093	(0.085)	-0.168	(0.251)
lnGGDGDP	-0.077	(0.055)	-0.084	(0.112)
lnCPI	-0.233	(0.091)***	0.503	(0.289)*
lnFDI	0.004	(0.024)	-0.029	(0.049)
GEEGDP	0.015	(0.013)	-0.013	(0.021)
lnEXCH	0.149	(0.092)	-0.026	(0.032)
BDGDP	0.007	(0.002)***	-0.013	(0.009)***
Constant (d)				-0.602
Threshold estimates (r)				0.143***
Number of moment conditions = 66				

The bootstrap p-value for linearity test = 0

Significance level: *** p<0.01, ** p<0.05, * p<0.1

4.9 Post-Estimation Results for Quasi-Maximum Likelihood Estimation

Following the application of other model estimations, the post-estimation regression was conducted. Z statistics, p-values, point estimates, confidence intervals, and standard errors are calculated for (potentially) nonlinear combinations of the estimated parameters using a nonlinear combination of estimated parameters (nlcom). Budget deficits, real interest rates, foreign direct investment, and general government debt are all statistically significant, as shown by the results in Table A5. As a result, they are thought to have nonlinear correlations with economic growth that are consistent with economic theories. Trade, trade openness, the consumer price index, government spending on education, and the exchange rate are examples of variables that are thought to possess a linear association with economic growth since they are statistically insignificant.

5. Conclusion

The study used a panel dataset from 1996 to 2022 to study the impact of budget deficits on the economic growth of the chosen African countries. All estimators displayed a statistically significant relationship between economic growth and budget deficits. Prolonged budget deficits, nevertheless, have been shown in numerous studies to impede economic growth eventually. Except for the total amount of government debt, it has also been demonstrated that the influence of control variables varies as the policy régime changes. However, after adopting the dynamic panel threshold model developed by Seo and Shin (2016) and Seo et al. (2019), which tackles the potential endogeneity of budget deficits, the results revealed a budget deficit threshold value of 14.3%. In the upper régime, budget deficits hinder growth, whereas, in the below régime, they have a beneficial effect. Government policymakers should consider this while determining the threshold for budget deficits in their nation to experience the negative consequences of such deficits.

In addition to increasing tax collection, the government should monitor and enhance the indirect tax to direct tax ratio. The economy's tax base should be widened to align with the increased government expenditure. In attaining sustainable economic growth, African governments must direct more of their spending to capital projects or income-generating projects rather than recurrent expenditure, which is made up of the wage bill and non-income-generating spending, which has no substantial positive impact on sustainable economic growth.

The régimes should continue making extra efforts to create a favorable atmosphere for the decline in interest rates and prices as they have appeared to be negatively related to economic growth. Policymakers should set up policies to attract more foreign direct investment and public-private partnerships to increase productivity and sources of government revenue through taxation. The increase in investment spurs the output level, which eventually lowers the price levels (decline in consumer price index) and leads to an increased level of export, thus improving the terms of trade, which both appeared to be conversely correlated to growth.

Sound macroeconomic policies guarantee the precision of sustainable economic growth in tandem with low and stable inflation rates and unemployment. However, prudent macroeconomic policies emanate from research works. Thus, the study enhances its role by adding knowledge to the existing literature. The existence of relevant and prudent macroeconomic policies tends to ensure a good standard of living in society, which is the ultimate goal of economic growth. The study results offer valuable information for comprehending and taking suitable policy measures.

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Appendices

Table A1: for system GMM estimation results

gdpgrowth	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
L. gdpgrowth	-.185	.11	-1.68	.093	-.4	.031	*
BDGDP	.005	.002	2.28	.023	.001	.008	**
R_INTR	-.001	.001	-1.00	.316	-.004	.001	
lnToT	-.007	.004	-1.80	.072	-.014	.001	*
lnTOGDP	.028	.031	0.90	.367	-.033	.089	
lnGGDGDP	-.015	.016	-0.91	.361	-.047	.017	
lnCPI	-.01	.096	-0.10	.918	-.199	.179	
lnFDI	.014	.003	4.13	0	.007	.021	***
GEEGDP	.003	.005	0.55	.58	-.008	.014	
lnEXCH	.015	.009	1.58	.113	-.004	.034	

year	-.003	.006	-0.54	.589	-.015	.009	
Constant	6.521	11.809	0.55	.581	-16.625	29.666	
Mean dependent var	0.082		SD dependent var	0.116			
Number of obs	120		Chi-square	69.471			
*** p<.01, ** p<.05, * p<.1							

Table A2: Presents results for quasi-maximum likelihood estimator

gdpgrowth	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
L1. gdpgrowth	-0.164	0.060	-2.750	0.006	-0.280	-0.047
BDGDP	0.007	0.002	4.540	0.000	0.004	0.010
R_INTR	-0.002	0.001	-1.700	0.089	-0.004	0.000
lnToT	-0.004	0.003	-1.020	0.306	-0.010	0.003
lnTOGDP	0.005	0.043	0.110	0.911	-0.079	0.089
lnGGDGDP	-0.042	0.018	-2.400	0.016	-0.076	-0.008
lnCPI	-0.022	0.054	-0.410	0.679	-0.128	0.083
lnFDI	0.019	0.009	2.030	0.042	0.001	0.036
GEEGDP	0.005	0.007	0.750	0.455	-0.008	0.018
lnEXCH	0.012	0.045	0.270	0.789	-0.075	0.099
year	-0.001	0.004	-0.310	0.759	-0.009	0.006
_cons	2.417	7.496	0.320	0.747	-12.276	17.110

Table A3: Presents results for the bias-corrected method of moments estimator

gdpgrowth	Coefficient	std. err.	t	P>t	[95% conf.	interval]
L1. gdpgrowth	-0.158	0.099	-1.600	0.120	-0.360	0.044
BDGDP	0.007	0.002	2.950	0.006	0.002	0.012
R_INTR	-0.002	0.001	-2.120	0.043	-0.004	0.000
lnToT	-0.004	0.004	-0.950	0.351	-0.011	0.004
lnTOGDP	-0.005	0.043	-0.120	0.902	-0.093	0.083
lnGGDGDP	-0.049	0.018	-2.790	0.009	-0.085	-0.013
lnCPI	-0.034	0.091	-0.380	0.709	-0.221	0.152
lnFDI	0.019	0.010	1.910	0.066	-0.001	0.040
GEEGDP	0.004	0.005	0.770	0.450	-0.007	0.015
lnEXCH	0.026	0.060	0.430	0.668	-0.096	0.148
year	-0.001	0.007	-0.200	0.841	-0.016	0.013
_cons	2.934	13.670	0.210	0.832	-25.024	30.892

Table A4: Dynamic Panel Threshold Estimation Results

gdpgrowth	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Lag_y_b	-0.466	0.112	-4.160	0.000	-0.685	-0.246
R_INTR_b	0.003	0.003	0.770	0.444	-0.004	0.009
lnToT_b	-0.001	0.006	-0.110	0.910	-0.012	0.010
lnTOGDP_b	0.093	0.085	1.100	0.273	-0.074	0.260
lnGGDGDP_b	-0.077	0.055	-1.400	0.162	-0.184	0.031
lnCPI_b	-0.233	0.091	-2.570	0.010	-0.411	-0.055
lnFDI_b	0.004	0.024	-0.160	0.870	-0.051	0.043
GEEGDP_b	0.015	0.013	1.100	0.272	-0.011	0.041
lnEXCH_b	0.149	0.092	1.620	0.106	-0.032	0.329
BDGDP_b	0.007	0.002	3.400	0.001	0.003	0.011
cons_d	-0.602	1.308	-0.460	0.645	-3.166	1.961
Lag_y_d	-0.979	0.689	-1.420	0.155	-2.330	0.372
R_INTR_d	-0.015	0.006	-2.600	0.009	-0.027	-0.004
lnToT_d	0.010	0.028	0.340	0.734	-0.046	0.065
lnTOGDP_d	-0.168	0.251	-0.670	0.503	-0.660	0.324
lnGGDGDP_d	-0.084	0.112	-0.750	0.452	-0.304	0.135
lnCPI_d	0.503	0.289	1.740	0.082	-0.063	1.069
lnFDI_d	-0.029	0.049	-0.590	0.557	-0.125	0.067
GEEGDP_d	-0.013	0.021	-0.640	0.521	-0.054	0.027
lnEXCH_d	-0.026	0.032	-0.790	0.428	-0.089	0.038
BDGDP_d	-0.013	0.009	-1.420	0.154	-0.030	0.005
r	0.143	0.054	2.660	0.008	0.038	0.248

Table A5: The table presents post-estimation results for quasi-maximum likelihood estimation

gdpgrowth	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
_nl_1	0.006	0.001	4.500	0.000	0.003	0.009
_nl_2	-0.001	0.001	-1.680	0.093	-0.003	0.000
_nl_3	-0.003	0.003	-1.020	0.306	-0.009	0.003
_nl_4	0.004	0.037	0.110	0.911	-0.068	0.076
_nl_5	-0.036	0.015	-2.380	0.017	-0.066	-0.006
_nl_6	-0.019	0.046	-0.410	0.680	-0.110	0.072
_nl_7	0.016	0.008	2.010	0.045	0.000	0.032
_nl_8	0.004	0.006	0.750	0.453	-0.007	0.016

_nl_9	0.010	0.038	0.270	0.789	-0.065	0.085

_nl_1: _b[BDGDP]/(1 - _b[L.gdpgrowth])
_nl_2: _b[R_INTR]/(1 - _b[L.gdpgrowth])
_nl_3: _b[lnToT]/(1 - _b[L.gdpgrowth])
_nl_4: _b[lnTOGDP]/(1 -_b[L.gdpgrowth])
_nl_5: _b[lnGGDGDP]/(1 - _b[L.gdpgrowth])
_nl_6: _b[lnCPI]/(1 -_b[L.gdpgrowth])
_nl_7: _b[lnFDI]/(1 - _b[L.gdpgrowth])
_nl_8: _b[GEEGDP]/(1 -_b[L.gdpgrowth])
_nl_9: _b[lnEXCH]/(1 - _b[L.gdpgrowth])

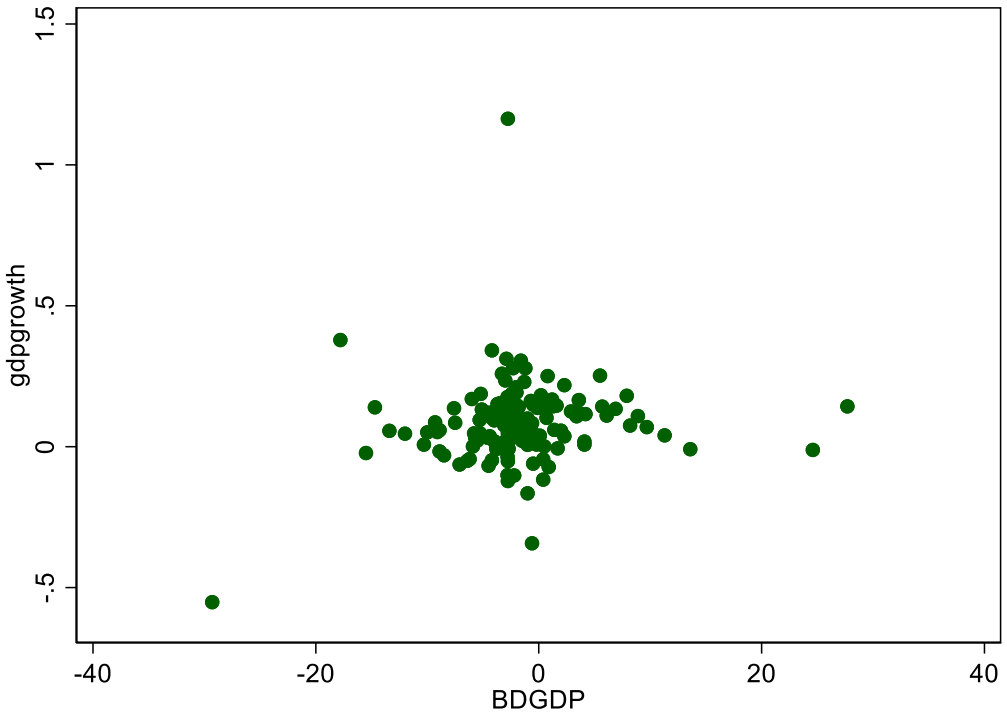

Figure 1: Scatter plot for gdpgrowth versus BDGDP