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THE TWIN DEFICITS AND ECONOMIC GROWTH IN SELECTED AFRICAN COUNTRIES

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ABSTRACT

Purpose- The purpose of this paper is to examine the twin deficit hypothesis and its effect on economic growth for selected African countries using panel data ranging from 1988 to 2018.
Methodology- bootstrap panel Granger causality tests and dynamic panel threshold analysis are applied to find out the budget deficit and current account deficit causal relationships and their effect on economic growth.
Findings- Results of the bootstrap panel Granger causality tests confirmed mixed results. Out of 27 countries, results of 16 countries support the Ricardian equivalence hypothesis; this shows that there is no Granger causality running from budget deficit to current account deficit and vice versa. In addition, the results of the dynamic panel threshold model show that the budget deficit-GDP per capita relationship is not linear. Thus, a budget deficit of less than 0.152 percent has a significant positive effect on economic growth. Besides, regime-independent regressors such as current account deficits and government debt have a significant negative impact on GDP per capita. Investment spending, broad money, and political stability, on the other hand, have a significant positive effect.
Conclusion- To sum up, bootstrap panel Granger causality results support no Granger causality running from budget deficit to current account deficit and vice versa. In addition, the dynamic panel threshold analysis suggests that a budget deficit of less than 0.152% and a lower current account deficit growth-enhancing.

Keywords: Twin deficit hypothesis, Granger causality, budget deficit, current account deficit, economic growth, threshold analysis.
JEL codes: E12, H60, H62

1. INTRODUCTION

A tendency for the budget deficit and current account deficit to move in the same direction or simultaneous occurrence of budget and current account deficit is the twin deficit. Twin deficits captured the attention of politicians, economists, and academic Scribblers since the 1980s, and they considered it as a major macroeconomic concern in any economy (Cavallo, 2005).

Theoretically, the budget deficit has a widespread effect on macroeconomic variables. Initially, budget deficit reduces national savings and rounds all over macroeconomic variables. The lower national saving triggers lower investment and lower capital accumulation and results in lower economic growth (Ball & Mankiw, 1995). Most importantly, persistent budget deficit retards capital accumulation and economic growth, even when the economy is at a full-employment level (Friedman, 2005; Zuze, 2016). Conversely, Keynesians argued that budget deficit results from higher government spending increases domestic output and motivates the economy in the short run through its effect on private and public consumption expenditures. Some empirical studies (Erkin, 1988; Cinar et al., 2014; Taylor et al., 2012) also found support to a Keynesian view, positive relationship between budget deficit and economic growth. On the contrary, the Ricardian equivalence hypothesis argued that deficit is merely a postponement of taxes and has no significant effect on aggregate demand. In this setting, the budget deficit is neither good nor bad concerning its impact on economic growth. For example, Rangarajan and Srivastava (2005) and Nelson and Singh (1994) reached a conclusion that budget deficit has an insignificant effect on aggregate demand if households are perfect-foresight.

Furthermore, developing countries fail to cover the costs of technology transfers, import of intermediate goods, and investment goods from the export revenues. For that matter, they are persistently in a current account deficit, and the deficit is regarded as one of the causes for unsteady growth because it is external debt used to finance the gaps (Cural, 2010). However, current account deficits or trade deficits are not always a reflection of an economic problem. When a transition is made from poor agricultural economies into modern industrial economies, fixed costs are financed by foreign borrowing. In such cases, the current account deficit or trade deficit is a sign of economic development (Mankiw N. G., 2010).

On the other hand, the theoretical and empirical studies that examined the causal relationship between budget deficit and current account deficit are categorized into four groups. The first group is the follower of the Keynesian view, which stated that budget deficit has a statistically significant impact on the current account deficit. They argued that budget deficit causes current account deficit through the interest and exchange rate channels. In a small open economy IS-LM framework, an increase in the budget deficit would cause interest rates to rise, resulting in capital inflows. This again leads to an appreciation of the exchange rate due to the higher demand for domestic financial assets (capital inflows) and eventually increases the current account deficit (Baharumshah et al., 2006).

The second group of the literature failed under the Ricardian Equivalence Hypothesis, which states no causal relationship between the two deficits. In other words, there is no budget deficit led Granger causality and vice versa. Barro (1988) indicated that changes in government revenues or expenditures have no real effects on the real interest rate, investment, and the current account balance. The third group argued that the causality runs from current account deficit to budget deficit (reverse causality), especially to those limited domestic resource and commodity-based exporter countries (Sobrino, 2013; Aloryito & Senadza, 2016). While the fourth group argued as there is bidirectional causality (feedback) running from budget deficit to current account deficit, and vice versa. With this regard, several studies are conducted under the subject twin deficit hypothesis: the majority of these studies were for higher-income countries using the time series approach, and it was the US budget deficit that motivated them. This paper, however, investigates the overlooked African economy. Perhaps most importantly, the ambiguous issue of past literature is using static panel data models for causality and co-integration studies. But by definition, Granger causality occurs when past values of covariates influence the present value of endogenous variables (See Granger, 1969; Konya 2006; Dumitrescu and Hurlin, 2012; Tekin, 2012; Kar et al., 2011).

The debate, however, is not only on the channel of causation between the budget deficit and the current account deficit, and their effect on economic growth alone. Thus, finding the appropriate estimation technique for macroeconomic panel data models is also a contentious topic. To this end, this paper tests whether the twin deficit hypothesis, reverse causality, no causality, and bidirectional causality holds for selected African countries employing three different bootstrap panel Granger causality tests. Results of panel Granger causality tests vary from country to country. Out of 27 countries, test results from 16 countries support the Ricardian equivalence hypothesis for all Granger causality testing methods. However, for some countries, the test results provide mixed results. In addition, the current account deficit and budget deficit- economic growth nexus is examined using a dynamic panel threshold model. Accordingly, results prove that the budget deficit-economic growth relationship is nonlinear, and the point estimate of the budget deficit threshold is 0.152%. The rest of the paper is organized as follows: Section two discusses a review of empirical studies. Section three deals with the data, variables, and methodology used. Section four presents empirical results, and the fifth section concludes.

2. REVIEW OF EMPIRICAL STUDIES

Neaime (2008), Lau & Tang (2009), Perera & Liyange (2012), and Zengin (2000) explored the twin deficit hypothesis separately for different countries, such as Lebanon, Cambodia, Sri Lanka, and Turkey using annual time series data and reached the same conclusion. The estimation results confirmed unidirectional short-term causality running from budget deficit to current account deficit, and they recommend governments to take a correction action over the budget deficit. Osoro et al. (2014) and Njoroge (2014) for Kenya and Sakyi&Opoku (2016) for Ghana investigate the long-mooted twin deficit hypothesis, and they placed themselves under the Keynesian umbrella.

Moreover, Mukhtar et al. (2007) and Ganchev (2010) investigate the causality and co-integration between the twin deficits for Pakistan and Bulgaria, respectively. Results in both countries confirmed a stable long-run relationship between the twin deficits, and consequently, bidirectional causality is detected. Using annual time series data ranging from 1980 to 2009 and the OLS estimation technique, Rauf & Khan (2011) checked the twin deficit hypothesis for Pakistan and proved that the current account deficit is the source of a budget deficit. As a result, to curb the budget deficit, the current account deficit should be minimized first. In contrast to unidirectional and bidirectional Granger causality results of the twin deficit hypothesis, studies conducted by Dewald& Ulan (1990) , Enders & Lee (1990), and Winner (1993) for US and Australia respectively confirmed the Ricardian equivalence hypothesis. Dewald& Ulan (1990) conclude as there is no systematic relationship between budget deficit and current account deficit. Moreover, Enders & Lee (1990) utilized a two-country micro-theoretic model, and results support the Ricardian equivalence hypothesis.

Coming to the effect of twin deficits on economic growth, Genevieve (2020) analyses the short-run and long-run relationships between budget deficit and economic growth using ARDL bound test for Morocco. Findings reveal that budget deficit has a significant negative effect on the Moroccan economy. The same result is found by Fatima et al. (2011) for Pakistan, and it is the poor tax collection and share of defense and debt servicing that causes the budget deficit. Conversely, Cinar et al. (2014) ARDL model estimates support the Keynesian view, a significant positive effect of budget deficit on economic growth.

Deviating from the linear relationships, Slimani (2016) investigates a nonlinear relationship between budget deficit and economic growth. Findings show that budget deficit greater than 4.8% and budget surplus greater than 3.2% have a negative significant effect on developing countries economy. In the same vein, Aero & Ogundipe (2016) analyze the effects of budget deficit on Nigeria's economic growth from 1981 to 2014. Threshold Autoregressive model results confirmed a negative nonlinear relationship between fiscal deficits and economic growth in Nigeria. Accordingly, the threshold estimate which is conducive for economic growth is 5%. Lastly, Şahin & Mucuk (2014) analyze the effect of the current account deficit on economic growth for Turkey using a vector autoregressive regression model. Findings corroborate that the current account deficit affects economic growth negatively for the Turkish economy.

3. RESULTS AND DISCUSSION

3.1. Data and Variables

The panel dataset used in this paper is extracted from IMF world economic outlook, World Bank, and African development bank and covers a period ranging from 1988 to 2018. Using this data the twin deficit hypothesis and their relationship with economic growth is investigated for selected African countries. Variables under the study are selected considering the economic theory and empirical studies (Perera& Liyange, 2012; Mukhtar et al., 2007; Boubtane et al., 2013). The main variables are explained below. Budget deficit (%GDP): calculated as total government expenditures minus total tax revenues. A budget deficit occurs if government spending exceeds the tax revenue in a given period of time, usually a year. Current account deficit (%GDP): calculated as net export plus net transfer payments. A current account deficit occurs when the difference between revenues and costs from trade plus net transfers to the country is negative. Investment spending (% GDP): expressed as a ratio of total investment in current local currency to GDP in current local currency. Real GDP per capita: GDP is expressed in constant international dollars per person and computed by dividing constant price purchasing power parity GDP by total population. Gross government debt (%GDP): measures the gross debt of the government as a percentage of GDP. Broad money (%GDP): measures money supply that includes currency, deposits with an agreed maturity of up to two years, money market fund shares, and debt securities up to two years. Political stability and absence of violence: measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism.

3.2. The Econometric Model

As Hsiao (2006) articulates employing Panel data helps to construct and test more complicated behavioral models and to tackle particular forms of unobserved heterogeneity, than a single cross-sectional or time-series data set would allow. In addition to that, with panel data models, it is possible to exploit more degrees of freedom, more sample variability, higher efficiency, and accurate inference of model parameters.

Panel data models can be static panel data models or dynamic panel data models. The static panel data models like first differencing, fixed effect and random effect models practice OLS, LSDV, and GLS estimators, respectively. However, objectives like causality and co-integration need dynamic modeling. Because dynamic panel data models unraveled the more complex causal relationships through incorporating lag of the dependent variable, contemporaneous and lagged values of covariates (Baltagi, 2008). But, the dynamic panel is not also free from problems. Nickell bias and cross-sectional dependence are the common problems of dynamic panel models. To overcome these problems, Anderson & Hsiao (1981) employed the maximum likelihood estimation technique, Gaibulloev et al. (2014) used the least square dummy variable, and Arellano & Bond (1991) employed GMM estimation technique. Lastly, countries under this panel have similar economic conditions, regional integration, and social interactions, so they have something in common. Moreover, as Nickell (1981) articulated within-group estimator provides inconsistent and biased estimates when there is an endogenous covariate. Considering both cross-sectional dependence and Nickell bias, this study examines the direction of causality and the effect of covariates employing the dynamic panel model presented below.

3.3. The Dynamic Panel Model

Assume a dynamic panel model that depicts the relationship of the dependent variable y_{it} and a single covariate x_{it} with certain assumptions. Where, ηi denotes unobserved time-invariant heterogeneity, ε_{it} denotes idiosyncratic error term and x_{it} in equation (1) could also be a vector containing both contemporaneous and the lag of the covariates.

$$y_{it} = \alpha y_{it-1} + \beta x_{it} + \eta_i + \varepsilon_{it}; \quad i = 1 \ldots \ldots . N, t = 1 \ldots \ldots \ldots . T \ldots \ldots \ldots . (1)$$

$$\begin{cases} E(\varepsilon_{it}, \varepsilon_{js}) = 0 \ \ i \neq j \ t \neq s \\ E(\eta_i, \varepsilon_{jt}) = 0 \ \ for \ all \ i, j, t \\ E(x_{it}, \varepsilon_{js}) = 0 \ \ for \ all \ i, j, t, s \end{cases}$$

The above autoregressive model could have different problems if the individual specific effect η_i is correlated with x_{it},y_{it-1} and when the lag of the idiosyncratic error term is correlated with contemporaneous and lag of covariates (Kar et al., 2011). Using equation(1) to test the twin deficit hypothesis, Konya (2006) bootstrap panel Granger causality test, Dumitrescu and Hurlin (2012) heterogeneous panel Granger causality test (hereafter DH), and Emirmahmutoglu and Kose (2011) Granger causality test (hereafter EK) for heterogeneous mixed panels are employed. This helps us to check the sensitivity and robustness of results for different methods. The Bootstrap panel Granger causality analysis requires two preconditions. These are the cross-sectional dependence test and individual-specific heterogeneity test. The cross-sectional dependence test is checked using three different test statistics: the Breusch and Pagan (1980) LM test, the Pesaran (2004) CD test, and Pesaran et.al. (2008) LM adjusted test. Moreover, to test the null hypothesis of slope coefficient homogeneity against the alternative hypothesis, the standardized version of Swamy's (1970) test for slope homogeneity proposed by Pesaran and Yamagata (2008) is employed. Lastly, the optimal lag length is determined through Akaike information criterion (AIC) and Schwarz information criterion (SIC).

In particular, the bootstrap panel Granger causality test following Konya's (2006) method has various advantages. First, with this method no needs to pre check whether series are stationary or not. Second, it captures both cross-sectional dependence and individual heterogeneity. Third, this method provides panel Granger causality test results for each individual country. Investigation of the twin deficit hypothesis based on Konya (2006) bootstrap panel Granger causality method uses the bivariate SUR system equation below:

$$\left.\begin{aligned} CAB_{1,t} &= \eta_{1,1} + \sum_{l=1}^{mlCAB_1} \alpha_{1,1l} CAB_{1,t-1} + \sum_{l=1}^{mlBudget_1} \beta_{1,1l} Budget_{1,t-1} + \varepsilon_{1,1,t} \\ CAB_{2,t} &= \eta_{1,2} + \sum_{l=1}^{mlCAB_1} \alpha_{1,2l} CAB_{2,t-1} + \sum_{l=1}^{mlBudget_1} \beta_{1,2l} Budget_{2,t-1} + \varepsilon_{1,2,t} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (2) \\ CAB_{N,t} &= \eta_{1,N} + \sum_{l=1}^{mlCAB_1} \alpha_{1,Nl} CAB_{N,t-1} + \sum_{l=1}^{mlBudget_1} \beta_{1,Nl} Budget_{N,t-1} + \varepsilon_{1,N,t} \end{aligned}\right\}$$

$$i = 1 \ldots \ldots . N, t = 1 \ldots \ldots \ldots . T$$

$$\left.\begin{aligned} Budget_{1,t} &= \eta_{2,1} + \sum_{l=1}^{mlBudget_2} \alpha_{2,1l} Budget_{1,t-1} + \sum_{l=1}^{mlCAB_2} \beta_{2,1l} CAB_{1,t-1} + \varepsilon_{2,1,t} \\ Budget_{2,t} &= \eta_{2,2} + \sum_{l=1}^{mlBudget_2} \alpha_{2,2l} Budget_{2,t-1} + \sum_{l=1}^{mlCAB_2} \beta_{2,2l} CAB_{2,t-1} + \varepsilon_{2,2,t} \quad \ldots \ldots \ldots \ldots \ldots \ldots (3) \\ Budget_{N,t} &= \eta_{2,N} + \sum_{l=1}^{mlBudget_2} \alpha_{2,Nl} Budget_{N,t-1} + \sum_{l=1}^{mlCAB_2} \beta_{2,Nl} CAB_{N,t-1} + \varepsilon_{2,N,t} \end{aligned}\right\}$$

$$i = 1 \ldots \ldots . N, t = 1 \ldots \ldots \ldots . T$$

Where CAB, is the current account deficit, $Budget$ is budget deficit, ηi is unobserved heterogeneity and εit is an idiosyncratic error term. Estimation of equations (2) and (3) hinges on the properties of the idiosyncratic error terms; if there is no contemporaneous correlation among countries; OLS estimation for each country separately works. Albeit if there is any contemporaneous correlation among countries, it is the SUR estimation carried out. Therefore in this paper, the SUR system equations are estimated. With respect to the SUR systems, in the country (I), there is one-way Granger causality running from $Budget$ to CAB if in equation (2) one of the slope parameters attached to $Budget$ (βs) are different from zero, by the same token, there is one-way Granger causality running from CAB to $Budget$ if in equation (3) one of the slope parameters attached to CAB (βs) are different from zero. DH heterogeneous panel Granger causality test is based on vector autoregressive regression model and assumes no cross-sectional dependency. However, a recent development through the use of Monte Carlo simulation shows that even under the conditions of cross-sectional dependency, the DH test produces strong results. In addition, bootstrap critical values are used in alleviating problems related to cross-sectional dependence. Suppose a dynamic panel model that depicts the relationship of the budget deficit and current account deficit, observed for N countries and T periods with certain assumptions. Lag orders (K) are identical for all countries involved in the study, and the panel is balanced. Besides, the slope parameters of both current account deficit and budget deficit vary for each country.

$$\begin{cases} CAB_{i,t} = \sum_{K=1}^{K} \alpha i^k CAB_{i,t-k} + \sum_{K=1}^{K} \beta i^k Budget_{i,t-k} + \eta_i + \varepsilon_{it} \\ Budget_{i,t} = \sum_{K=1}^{K} \alpha i^k Budget_{i,t-k} + \sum_{K=1}^{K} \beta i^k CAB_{i,t-k} + \eta_i + \varepsilon_{it} \end{cases} ---------- (4)$$

$$i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T \quad E(\varepsilon_{it}, \varepsilon_{js}) = 0 \;\; i \neq j \; t \neq s$$

$$E(\eta_i, \varepsilon_{jt}) = 0 \text{ for all } i, j, t \quad E(x_{it}, \varepsilon_{js}) = 0 \text{ for all } i, j, t, s$$

In the equation, K ,αi^k and βi^k indicate lag length, autoregressive parameter, and slope parameter, respectively. The null hypothesis indicates no Granger causality from budget deficit to current account deficit in all countries, while the alternative hypothesis indicates that there is Granger causality from budget deficit to current account deficit in at least one country. Technically speaking,

$$\text{H0}: \beta_i = 0 \text{ for all } i = 1,2 \dots \dots \dots N \text{ and } \text{H1}: \beta_i \neq 0 \text{for all } i = 1,2 \dots \dots \dots N$$

$$\text{H1}: \beta_i \neq 0 \text{ for all } N1 + 1, N1 + 2, \dots \dots . . N$$

The EK Granger causality test extends the LA-VAR approach of Toda & Yamamoto (1995) for heterogonous mixed panels. It can be applied for stationary, non-stationary, co-integrated, and non-integrated series. In short, it is a bivariate Toda & Yamamoto (1995) time series causality approach adapted to heterogeneous mixed panels. It considers both issues of cross sectional dependence and heterogeneity. To fix the estimation issues of cross-sectional dependency, and to have valid fisher test statistic, bootstrap critical values are used. We consider the level VAR model with $k_i + \text{ d max}_i$ lags in heterogeneous mixed panels:

$$\begin{cases} CAB_{i,t} = \sum_{j=1}^{k_i + \text{d max}_i} \alpha_{11}, \text{ij} CAB_{i,t-j} + \sum_{j=1}^{k_i + \text{d max}_i} \alpha_{12}, \text{ij} Budget_{i,t-j} + \eta^y{}_i + \varepsilon^y{}_{\text{i,t}} \\ Budget_{i,t} = \sum_{j=1}^{k_i + \text{d max}_i} \alpha_{21}, \text{ij} Budget_{i,t-j} + \sum_{j=1}^{k_i + \text{d max}_i} \alpha_{22}, \text{ij} CAB_{i,t-j} + \eta^x{}_i + \varepsilon^x{}_{\text{i,t}} \end{cases} --- (5)$$

$$i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T \quad E(\varepsilon_{it}, \varepsilon_{js}) = 0 \;\; i \neq j \; t \neq s$$

$$E(\eta_i, \varepsilon_{jt}) = 0 \text{ for all } i, j, t \quad E(x_{it}, \varepsilon_{js}) = 0 \text{ for all } i, j, t, s$$

Where $\text{d max}_{i,}$ is maximal order of integration suspected to occur in the system for each$i$, andk_i is the lag structure. In simplicity, we focus on testing causality from budget deficit to current account deficit and vice versa.

$$\text{H0}: \beta_i = 0 \text{ for all } i = 1,2 \dots \dots \dots N \text{ and } \text{H1}: \beta_i \neq 0 \text{for all } i = 1,2 \dots \dots \dots N$$

$$\text{H1}: \beta_i \neq 0 \text{ for all } N1 + 1, N1 + 2, \dots \dots . . N$$

From the above three Granger causality test methods, DH and EK methods require a unit root test as a preliminary check. Moreover, the dynamic panel threshold model needs stationary series. This paper, therefore, utilizes the Levin– Lin–Chu (2002) and Fisher-type (Choi 2001) unit root tests. The fisher-type unit-root test mimics the augmented Dickey-Fuller test, and it does not require a balanced panel, as in the case of the Im–Pesaran–Shin (2003) unit root test (Choi 2001). Additionally, one can use different lag lengths in the individual ADF regression. To deal with cross-sectional dependence both the Levin–Lin–Chu (2002) and Fisher-type (Choi 2001) unit root tests are performed with the demean option. Furthermore, in this empirical application to investigate the effect of twin deficits on economic growth, the dynamic panel threshold model is adopted. The economic growth model is borrowed from Adam & Bevan (2005).

$$y_{it} = y_{it-1} + \beta_1 x_{it}(q_{it} < \emptyset_1) + \beta_2 x_{it}(\emptyset_1 \leq q_{it} \leq \emptyset_2) + \beta_3 x_{it}(q_{it} \geq \emptyset_2) + \eta_1 z_{it} + \varepsilon_{it} \dots \dots (6)$$

Where ε_{it}=$\mu_{it} + \gamma_{it}$, includes the fixed effect.

Equation (6) can be re write as follows:

$$y_{it} = \alpha y_{it-1} + \beta_1 x_{it}(\text{qit} < \emptyset_1) + \eta_1 z_{it} + \varepsilon_{it} \dots \dots \dots \dots (7).$$

Where x_{it} is;

$$x_{it}(q_{it}, \emptyset) = \begin{cases} x_{it} I(q_{it} < \emptyset_1) \\ x_{it} I(\emptyset 1 \leq q_{it} \leq \emptyset_2) \\ x_{it} I(q_{it} \leq \emptyset) \end{cases}$$

The dependent variable, y_{it} (real GDP per capita in logarithm) is scalar, the threshold variable, q_{it} (budget deficit) is scalar and the regressor x_{it} (budget deficit) is explanatory variable which is threshold dependent and z_{it} is a vector of explanatory variables which are not dependent on a threshold variable. The vector of z_{it} is consist of regime independent variables like current account deficit (%GDP), public debt (%GDP), investment spending (%GDP), political stability and absence of violation or terrorism, broad money (%GDP) and lags of the dependent variable as instrument. While, ε_{it} is white noise idiosyncratic error term with zero mean and finite variance (σ^2), and $I(.)$ is the indicator function. As a first step, the linearity test is conducted through Wald tests, fisher tests, and likelihood ratio tests.

Once the threshold model is validated, in the second step, the dynamic panel threshold model has estimated through the Arellano & Bover (1995) generalized method of moment (GMM) technique. Because estimating equation (6) or equation (7) with LSDV provides biased and incorrect inferences. However, this problem is deciphered by using the forward orthogonal deviations transformation suggested by Arellano & Bover (1995), which avoids fixed effects and serial correlation in the transformed errors simultaneously. Instead of first differencing, the fixed effect is eliminated by subtracting the average of all future available observations of a variable.

4. RESULTS AND DISCUSSION

4.1. Data Driven Stylized Facts

This study covers 27 African countries. The main variables of interest are budget deficit, current account deficit, and economic growth. The budget balance and current account balance in these countries are persistently negative: they are in a deficit arena for more than two decades. Table (1) presents the mean values of budget balance, current account balance, and real GDP per capita for six periods. Each period contains the mean value of the variables for five years. Period (1) registered -3.6%, -5.97%, and $2475.383 budget balance, current account balance, and real GDP per capita, respectively. In period (2), both the budget deficit and current account deficit surpass 5% of the GDP (-5.67% and -6.59%) and whereas real GDP per capita drops from $2475.38 to $1995.23. Even if the current account deficit is continually increasing (except in period three), the budget deficit falls in the third, fourth, and fifth periods. Consequently, the real GDP per capita reached $3091 in period six, with a higher current account deficit (-8.5%).

Table 1: Summary of Main Variables

Period	GDP	Budget	CAB
1988-1992[1]	2475.3832	-3.613908	-5.9724742
1993-1997[2]	1995.2363	-5.6682003	-6.5900534
1998-2002[3]	2059.8243	-3.8243845	-4.3239778
2003-2007[4]	2293.0452	-3.0744694	-5.1621111
2008-2012[5]	2753.3262	-1.3005926	-5.9650667
2013-2018[6]	3091.7654	-3.7508254	-8.5893968

Source: Author’s computation (2020) using world economic outlook (2019) data.

Table (2) presents the descriptive statistics of variables: the mean, standard deviation, minimum values, and maximum values of each variable are displayed. For the panel understudy, a maximum of 40% budget surplus, a minimum of 53% budget deficit, and -3.5% mean value of budget balance are recorded within the research period (1988 to 2018). Additionally, 40.8%, 98.8%, and -6.2% of current account surplus, deficit, and mean value are recorded within the research period. Real GDP per capita varies between $406.66 and $11869.53, with a mean value of $2485.51.

Table 2: Descriptive Statistics

Variable	Mnemonic	Mean	Std	Min	Max
Budget deficit (%GDP)	Budget	-3.549989	4.746069	-53.00001	40.34
Current account deficit (%GDP)	CAB	- 6.265217	8.656515	98.889	40.863
Investment (%GDP)	INV	20.74122	10.81672	2.323	82.478
Broad money (%GDP)	M3	28.72185	20.56682	0.99024	119.348
Political stability	PS	-0.8360701	0.7528189	-2.844653	1.04893
Debt (%GDP)	Debt	77.70033	62.62148	8.366	723.0097
Real GDP per capita	GDP	2485.518	2266.886	406.663	11869.53

Source: Author's computation (2020) using IMF, WB and AFDB data

4.2. Econometrics Estimation Results

4.2.1. Cross- Sectional Dependence, Slope Homogeneity and Unit Root Tests

The cross-sectional dependence tests deployed in this study are the LM, CD, and LM adjusted, and all of them are complementary, not competing. Results displayed in a table (3) are the outputs of cross-sectional dependence tests and slope homogeneity tests. The first segment of the table shows the result of cross-sectional dependence tests. Accordingly, the null hypothesis of no cross-sectional dependence is rejected with all methods. This indicates that any shock that occurred in one of the selected African countries transmitted to others. The second segment of the table (Δ and Δ adj test) shows Pesaran and Yamagata's (2008) slope homogeneity test results. According to the test results, the null hypothesis of slope homogeneity is rejected. Then results enforce to consider the heterogeneity in estimating the causation between budget deficit and current account deficit.

Table 3: Cross- Sectional Dependence and Slope Homogeneity Test

Cross-sectional dependence test		
Method	Test statistics	p-value
CD test	1.98	0.0478
LM test	660.2	0.0000
LM adjusted	31.85	0.0000
Slope homogeneity test		
Δ	7.862	0.000
Δ adj	8.272	0.000

Source: Author's computation (2020).

4.2.2. Unit Root Tests

As explained in the methodology part, DH and EK bootstrap panel Granger causality testing methods require stationary series as an initial requirement. Additionally, the dynamic panel threshold analysis also provides non-spurious estimates when the variables are stationary. For this matter, unit root test methods such as the Levin– Lin–Chu (2002) and Fisher-type (Choi 2001) are performed with a demean option.

Table 4: Levin-Lin-Chu and Fisher-Type (ADF) Unit-Root Tests

Variables	Levin-Lin-Chu unit-root test	Fisher type (ADF) unit-root test
Budget	-6.6174***	24.0555***
CAB	-6.7817***	21.1601***
INV	-5.4134 ***	14.8397***
M3	-1.9114**	12.4113***
PS	0.2047	9.2571***
Debt	-4.7997***	13.0194***
GDP	-1.8563 **	11.0212***

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

Source: Author's computation (2020).

Accordingly, a panel unit root test based on Levin et al. (2002) and Fisher-type unit-root test results are presented in table (4) column 2&3, respectively. Results show that both methods reject the null hypothesis (variables are non-stationary) for all variables under study. That means the mean and variance of variables do not vary systematically with time. Finally, in all the methods, the optimal lag length is determined through the information criterion, and bootstrap critical values for 1000 replications are used (Poi, 2004).

4.2.3. Panel Data Granger Causality Test Results

Tables (5) and (6) present the results of the bootstrap panel Granger causality tests performed using the Konya (2006) method. The null hypothesis in both tables asserts that no Granger causality running from budget deficit to current account deficit, and vice versa. According to table (5), for many of the countries studied, the results do not reject the null hypothesis of no Granger causality running from budget deficit to current account deficit. Significant causation from budget deficit to current account deficit is recorded only for a single country, Cote d'Ivoire.

Table 5: Konya Granger Causality Test Results (H0: Budget Does Not Cause CAB)

	Bootstrap Critical Values			
Country	Test statistics	1%	5%	10%
Angola	27.375	759.098	315.733	181.546
Burundi	0.540	831.677	423.479	278.620
Benin	1.249	860.399	411.343	248.050
Burkina Faso	3.265	817.410	328.946	208.577
Central African Rep	0.308	576.758	252.007	146.428
Cote d'Ivoire	231.576**	472.347	231.250	166.004
Congo, Dem. Rep.	8.521	744.586	321.768	214.999
Egypt	0.003	1672.720	590.436	351.912
Ethiopia	24.070	1169.609	490.939	317.407
Ghana	2.155	827.914	420.126	305.170
Guinea	61.602	758.098	341.012	240.785
Guinea-Bissau	8.255	692.688	332.235	202.280
Kenya	21.520	700.332	352.576	260.756
Morocco	0.302	948.978	454.314	293.590
Madagascar	0.934	813.124	351.130	244.536
Mali	0.806	2198.707	376.298	199.347
Mauritania	1.617	819.609	396.927	263.882
Malawi	0.111	730.434	410.379	277.767
Niger	5.749	736.613	283.329	177.936
Rwanda	24.204	760.500	285.850	169.712
Sudan	22.224	821.347	350.318	210.593
Sierra Leone	0.123	948.878	343.547	220.814
Chad	0.696	1007.746	347.378	247.752
Togo	2.435	1119.416	393.662	282.213
Tunisia	29.421	764.602	409.897	272.273
Tanzania	55.338	772.208	339.915	232.864

Uganda	34.951	535.263	279.172	181.205

Source: Author's computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1.

Results from table (6) also revealed that no Granger causality is running from current account deficit to budget deficit, except for Kenya. To sum up, there is not sufficient evidence to reject the null hypothesis, even at a 10% level of significance, for countries such as Angola, Burundi, Benin, Burkina Faso, Central African Rep, Congo, Dem. Rep, Egypt, Ethiopia, Ghana, Guinea, Guinea-Bissau, Morocco, Madagascar, Mali, Mauritania, Malawi, Niger, Rwanda, Sudan, Sierra Leone, Chad, Togo, Tunisia, Tanzania, and Uganda. And we noted that the Granger causality results of Konya's method are lopsided to the Ricardian equivalence hypothesis and contrasts with findings by Lau & Tang (2009), Rauf & Khan (2011), and Mukhtar et al. (2007). But, it supports the findings of Odim et al. (2014), Ogbonna (2013) and Ncanywa&Letsoalo (2019).

Table (7) and (8) successively report DH heterogeneous panel Granger causality test results and EK extended LA-VAR Granger causality test results. Table (7a) presents the one-way Granger causality recorded from budget deficit to current account deficit for countries such as Cote d'Ivoire, Guinea, and Tanzania. Similarly, table (7b) presents the one-way Granger causality recorded from current account deficit to budget deficit for countries such as Central Africa, Kenya, Mauritania, and Uganda, and bidirectional Granger causality recorded for Sudan. The remaining 16 countries support the Ricardian equivalence hypothesis.

Table 6: Konya Granger Causality Test Results (H0: CAB Does Not Cause Budget)

	Bootstrap Critical Values			
Country	**Test statistics**	**1%**	**5%**	**10%**
Angola	8.346	955.157	351.955	224.658
Burundi	0.022	749.253	368.169	255.158
Benin	0.763	786.046	291.622	186.692
Burkina Faso	1.886	460.630	208.162	134.773
Central African Rep	123.102	743.524	282.053	196.867
Cote d'Ivoire	2.711	694.624	292.082	192.767
Congo, Dem. Rep.	2.302	823.458	423.096	282.466
Egypt	12.734	766.840	340.436	218.843
Ethiopia	0.643	689.035	377.768	234.709
Ghana	24.451	794.029	361.825	246.776
Guinea	9.256	710.871	344.396	240.655
Guinea-Bissau	2.049	566.291	272.233	185.594
Kenya	228.715*	707.828	290.274	210.427
Morocco	0.335	692.474	280.021	165.651
Madagascar	2.563	563.387	301.442	207.156
Mali	9.275	701.609	299.660	218.913
Mauritania	60.412	846.367	364.536	229.048
Malawi	0.146	645.064	314.010	196.257
Niger	8.714	451.617	263.075	197.097
Rwanda	0.287	735.663	375.086	239.524
Sudan	32.785	1114.258	351.826	216.786
Sierra Leone	0.390	706.322	279.549	171.979
Chad	1.736	933.051	393.669	239.780
Togo	0.414	1071.230	548.077	381.160
Tunisia	7.168	487.661	283.624	209.017
Tanzania	17.705	582.400	304.949	204.592
Uganda	20.168	527.317	270.502	174.258

Source: Author's computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1.

Table (8a) presents budget deficit-led Granger causality test results. Results corroborated that budget deficit-led Granger causality results are found for Angola, Cote d'Ivoire, Guinea, Guinea-Bissau, Tanzania, and Uganda. Table (8b) presents current account deficit-led Granger causality test results. And thus, significant Current Account deficit-led Granger causality is recorded for central Africa and Tunisia alone. While for Sudan, a bidirectional Granger causality result is reported.

Table 7: DH Granger Causality Test Results

	Budget does not cause CAB (a)		CAB does not cause Budget (b)	
Country	**Test statistics**	**P value**	**Test statistics**	**P value**
Angola	1.686	0.194	0.522	0.47
Burundi	0.000	0.988	0.303	0.582
Benin	0.73	0.393	0.002	0.967
Burkina Faso	0.078	0.78	0.010	0.921
Central African Rep	0.069	0.792	3.976	0.046**
Cote d'Ivoire	12.016	0.001***	0.089	0.765
Congo, Dem. Rep.	0.562	0.453	0.015	0.902
Egypt	0.172	0.678	1.075	0.3
Ethiopia	1.443	0.23	0.196	0.658
Ghana	0.098	0.754	1.350	0.245
Guinea	8.782	0.003***	0.022	0.882
Guinea-Bissau	0.815	0.367	0.019	0.891
Kenya	0.77	0.38	30.835	0.000***
Morocco	0.006	0.939	0.157	0.692
Madagascar	0.007	0.934	0.338	0.561
Mali	0.503	0.478	0.526	0.468
Mauritania	0.474	0.491	4.595	0.032**
Malawi	0.009	0.924	0.009	0.925
Niger	0.05	0.824	0.070	0.791
Rwanda	2.074	0.15	0.063	0.803
Sudan	7.643	0.006***	6.038	0.014**
Sierra Leone	0.153	0.696	0.116	0.733
Chad	0.158	0.691	0.028	0.866
Togo	0.61	0.435	0.003	0.958
Tunisia	1.042	0.307	2.134	0.144
Tanzania	3.445	0.063*	1.045	0.307
Uganda	1.692	0.193	3.879	0.049**
Panel Z_NT	2.462	0.014***	4.139	0.000***
Bootstrap cv (10%)	1.941		1.915	
Bootstrap cv (5%)	2.504		2.525	
Bootstrap cv (1%)	4.058		3.806	

Source: Author’s computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1

Generally, results of 17 countries for all panel Granger causality testing methods speak the same result. Out of 17 countries, 16 countries support the Ricardian equivalence hypothesis, and a single country, Cote d'Ivoire, supports budget deficit-led Granger causality. Whereas test results for nine countries are consistent for two methods. Specifically, Guinea and Tanzania causality test results support the Keynesian hypothesis (budget deficit-led Granger causality), Sudan and Kenya causality test results support bidirectional Granger causality, and Central Africa causality test results support the reverse Granger causality for DH and EK Granger causality test methods. While results for Angola and Guinea-Bissau confirm the Ricardian equivalence hypothesis for both Konya and DH Granger causality test methods. No significant causality was again recorded in Mauritania and Tunisia for Konya and EK Granger causality test methods. Moreover, a single country Uganda has different results for all testing methods. More or less, the findings of bootstrap panel Granger causality are mixed and lopsided to the Ricardian equivalence hypothesis and are consistent with Enders & Lee (1990), Winner (1993), and Emirmahmutoglu et al. (2014) findings.

Table 8: EK Granger Causality Test Results

	Budget does not cause CAB (a)		CAB does not cause Budget (b)	
Country	**Test statistics**	**P value**	**Test statistics**	**P value**
Angola	5.89	0.015**	1.073	0.300
Burundi	0.05	0.823	0.937	0.333
Benin	0.186	0.666	1.685	0.194
Burkina Faso	0.149	0.700	0.382	0.536
Central African Rep	0.915	0.339	4.379	0.036**
Cote d'Ivoire	3.349	0.067*	0.256	0.613
Congo, Dem. Rep.	0.08	0.777	0.122	0.727
Egypt	0.054	0.816	0.137	0.711
Ethiopia	1.06	0.303	2.366	0.124
Ghana	0.414	0.520	0.495	0.482
Guinea	7.552	0.006***	0.503	0.478
Guinea-Bissau	8.744	0.003***	1.388	0.239
Kenya	4.004	0.045**	19.917	0.000***
Morocco	1.05	0.305	0.107	0.744
Madagascar	0.02	0.887	0.125	0.724
Mali	0.361	0.548	0.114	0.736
Mauritania	0.938	0.333	2.044	0.153
Malawi	0.005	0.946	0.040	0.842
Niger	0.004	0.947	0.018	0.893
Rwanda	0.101	0.75	1.307	0.253
Sudan	31.546	0.000***	49.668	0.000***
Sierra Leone	0.017	0.896	0.044	0.833
Chad	0.005	0.942	0.826	0.363
Togo	0.844	0.358	0.138	0.711
Tunisia	0.093	0.76	3.666	0.056*
Tanzania	5.009	0.025**	1.576	0.209
Uganda	3.767	0.052*	0.821	0.365
Panel Fisher	108.944	0.000***	128.469	0.000 ***
Bootstrap cv (10%)	72.562		73.359	
Bootstrap cv (5%)	78.992		78.773	
Bootstrap cv (1%)	100.014		95.446	

Source: Author’s computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1.

4.2.4. Twin Deficits and Economic Growth Results

The dynamic panel threshold model stated in equation (6) is estimated to capture twin deficits- economic growth relationships. As a preliminary step, table (9) presents linearity test results because threshold analysis assumes a nonlinear relationship between variables. Results of the linearity test show that the null hypothesis is rejected for the entire three test statistics. Thus, the relationship that exists between budget deficit and economic growth is nonlinear.

Table 9: Linearity Test

Method	Test statistics	p-value
Wald Tests (LM)	12.81245	0.0768*
Fisher Tests (F)	1370.932	0.0000***
LRT Tests (LM)	12.91844	0.0741*

Source: Authors computation (2020) using R software. Note: *** p<0.01, ** p<0.05, * p<0.1

Tables (10) and (11) show the results of the dynamic panel threshold model. Table (11) reports the estimated budget deficit threshold level (0.152%), and any deviations below this level have a significant positive effect, whereas deficits above 0.152% do not affect economic growth. More specifically, a 1% increase in budget deficit increases real GDP per capita by about 0.62%. On the contrary, the result nullified the budget deficit- real GDP per capita nexus for a budget deficit above 0.152%. Even though the magnitude is lower, in comparison, our result is consistent with the results of Akosah (2013) and Slimani (2016). The budget deficit is detrimental if it surpasses 4% and 4.8%, respectively, for Akosah (2013) and Slimani (2016).

Table 10: Threshold Estimates

Threshold estimates	
γ	0.1522852
95% confidence interval	(0.0000761, 1.55893)
Effect of budget deficit	
β_1	0.0062165 **
	(0.0030005)
β_2	0.0049876
	(0.0033088)

Source: Author's computation (2020) using R software. Note: *** p<0.01, ** p<0.05, * p<0.1

Table (11) presents the effect of regime-independent regressors on economic growth. Current account deficits and government debt have a significant negative effect. A 1% increase in current account deficit and government debt decreases real GDP per capita by about 0.4% and 0.17%, respectively. Furthermore, a significant positive effect is reported for the lag value of real GDP per capita, investment spending (%GDP), broad money (%GDP), and political stability. Other things constant, 1% increase in a lag of real GDP per capita, investment spending, political stability, and broad money increases real GDP per capita by about 1.47%, 0.51%, 0.56%, and 0.4%, respectively. Thus, the result from the dynamic panel threshold model is against the conventional budget deficit growth-enhancing strategy and consistent with the findings of Adam & Bevan (2005) and Şahin & Mucuk (2014), for the effect of the budget deficit and current account deficit, respectively.

Table 11: Effect of regime independent regressors

Covariates	Coefficients	Standard error	P-value
Initial	0.0147048	0.0065160	0.0240257 **
CAB	-0.0039256	0.0018559	0.0344163 **
INV	0.0051700	0.0013685	0.0001582 ***
M3	0.0040562	0.0010748	0.0001607 ***
PS	0.0593146	0.0209092	0.0045572 ***
Debt	-0.0016962	0.0001938	0.000 ***
δ	0.0525698	0.0189732	0.005593 **
N= 27		Observations= 837	

Source: Authors computation (2020) using R software. Note: *** p<0.01, ** p<0.05, * p<0.1

5. CONCLUSION

This paper examines the twin deficit hypothesis and its effect on economic growth for selected African countries covering the period 1988 to 2018. For this purpose, Granger causality tests are performed using the seemingly unrelated regression model, vector autoregressive model, and lag augmented vector autoregressive model. Results of three different panel Granger causality test methods presented mixed results; results vary from country to country, out of 27 countries, results of 16 countries support the Ricardian equivalence hypothesis for all Granger causality testing methods. That means there is no Granger causality running from budget deficit to current account deficit and vice versa. As if a budget deficit led Granger causality holds for Cote d'Ivoire in all methods, for the remaining countries, reverse causality, no causality, and bidirectional causality results are confirmed for two test methods. Results for nine countries are consistent for two methods, not for all. Specifically, Guinea and Tanzania test results support the conventional Keynesian hypothesis, Sudan and Kenya test results support bidirectional causality, and Central Africa test results support the reverse causality, for two Granger causality test methods. Whereas Angola, Guinea-Bissau, Tunisia, and Mauritania test results support the Ricardian equivalence hypothesis for two Granger causality test methods.

Additionally, the dynamic panel threshold model is estimated to detect the effect of the twin deficits and other explanatory variables on economic growth. Results revealed that the relationship between the budget deficit and real GDP per capita is nonlinear. The budget deficit threshold level is 0.152%, and any deviation below 0.152 percent has a significant positive effect on economic growth. Furthermore, findings indicate that current account deficit and debt have a detrimental effect on economic growth. On the other hand, enhancing investment spending, promoting financial institutions, and stable politics are beneficial in assuring economic growth. To sum up, this paper presented a straightforward answer to the research questions laid down. The bootstrap panel Granger causality results support the Ricardian equivalence hypothesis for many of the countries, allowing policymakers to gain new insights into the twin deficit hypothesis. Additionally, the dynamic panel threshold model suggests a budget deficit of less than 0.152 percent and a lower current account deficit. These findings are consistent with Buchanan (1976) with specific differences. Buchanan (1976) argued that aggregate spending might increase by the straightforward issue of money than a tax cut.

Finally, this paper cast light on the fiscal and trade policy of African countries. For decades, both budget deficit and current account deficit are the hallmarks of African economies. Africans, therefore, should carefully revise their fiscal policy either to restore the ever-lower tax income or to invest in productive ventures and minimize the budget deficit. Along with productive investments, big emphasis should be given to public debt and current account deficits because they have a detrimental effect on the economy. Lastly, switching from fiscal policy instruments to monetary policy instruments, for example, increasing the broad money supply is necessary. However, this all needs stable politics.

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APPENDIX: List of Countries Understudy

Burundi	Morocco	Chad	Guinea-Bissau
Benin	Madagascar	Togo	Kenya
Burkina Faso	Mali	Cote d'Ivoire	Mauritania
Congo, Dem. Rep	Malawi	Sudan	Tunisia
Egypt	Niger	Angola	Tanzania
Ethiopia	Rwanda	Central African Rep	Uganda
Ghana	Sierra Leone	Guinea	