Budget Deficit and Inflation among ECOWAS Countries: An Econometric Modeling

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Abstract
Using ECOWAS as a focal point, the paper sets out to empirically investigate the relationship between budget deficit and inflation. According to theory, fiscal imbalances result in inflation problem as shown by Nigerian experience of the late 90s. The findings from the empirical studies reveals a strong evidence that a budget deficit financed through monetarisation and a rising money supply will always lead to inflation. The inflationary effect of budget deficit depends on the means by which the deficit is financed and its impact aggregate demand. In this study, annual budget deficits and inflation relationships are studied by utilizing the Larsson et al, (2008) test approach for fifteen ECOWAS countries (i.e. Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo) over the period 1980 - 2011. Apart from the traditional studies, this paper evaluates the relationship by using panel data cointegration analysis. First and foremost, LLC, IPS and Hadri tests are employed to test the presence of unit roots among the selected variables. Thereafter, a cointegration analysis was carrtied out. The results from our findings suggests that budget deficit and inflation has long-run positive significant relationship in some of the countries, while it has negative relation in other countries. At the end, we conclude that there is a difference in tendency toward budget deficit and inflation relationships in both developed countries and less developed countries (ECOWAS).
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Introduction
In the recent past decades, the impact of fiscal policies on inflation has been the subject of discourse among scholars. Several studies were carried out on closed economies in the early 1990s and 2000s. The fiscal theory of price level was being discussed within the context of Economic Community of West African States (ECOWAS) member States. In the study of this monetary system's sustainability, the public finance phenomenon has gained relevance. Adopting the ECOWAS criteria (ECOWAS treaty, 1975), while defining the basic conditions to enter ECOWAS area for the new entries, the finance of fiscal deficits is prioritized by ECOWAS countries. Therefore, one can argue that the fiscal policy and inflation (FPI) has been dominating the literature recently. It is argued that the monetization of deficits is the fundamental reason for the high inflation problems in developing countries. ECOWAS member States as a developing country, experienced very high inflations in the 1990s. The underlying reasons for such a tremendous amount of inflation can be miscellaneous. But to large extent, economists concluded that the main cause of inflation is high budget problems. The restriction of government to Central Bank resources which is implemented with the liberalization program of the early 1980s, made governing authorities to focus more on domestic debt financing (i.e. the government avoided compensating the deficits through corresponding money supply). As a result, the domestic banks became the major source of domestic debt financing that resulted in an increase in the assets of banking system. Thus, the interrelationship of budget deficit and inflation is very crucial for the economy of ECOWAS States, despite the fact that the direction of relationship is uncertain. The esssence of this paper therefore, is to evaluates the relationship between price level and fiscal imbalances among ECOWAS member States. The remainder paper is devided into 4 parts. Section two is the theoretical framework and empirical literature. Section three is methodology and discussion of results while the last section conclusion's the paper.

Theoretical framwork and literature review
Theoretical framework
Budget deficit is opeartionally defined as the difference between budget revenue and budget expenditure. Budget revenue includes three vital components such as tax revenue, tax-exempt revenues and private revenues. Of these three items, the most significant component of the budget revenue is *tax revenue*. This notwithstanding, it must be noted that budget expenditure involves four salient elements. These are current expenditure, investment expenditure, real expenditure and transfer payments. Current expenditure is related to nondurable goods and it is usually used for short term expenses. Investment expenditure is the expenses that are related to investment as well as the efficient use of available resources. On the other hand, transfer payment is the unrequited payment that has an indirect effect on GDP while real expenditure is compose of production expenditures as well as

factors of production. Therefore, if budget deficit shows the disharmony and imbalance between revenue and expenditure then the both sides of the budget should be analyzed. Solomon et al, (2004) opined that there is a significant difference between developed and developing countries about budget balances. According to them, the developed countries do not have budget deficit problem because of their strong fiscal structure beacuse their low level of foreign indebtment prevents the debt payment to be a burden on the budget. Furthermore, most developed countries have a trade surplus as a result of having more export than import. Conversely, developing countries usually have high inflation, lower per capita income compared to developed countries, high current account deficit and high public expenses which in turn causes increases in budget deficit as well as a deterioration of macroeconomic stability of less developed countries (LDCs). LDCs (ECOWAS countries) have four different ways to finance their high budget deficit which are printing money, running down foreign exchange reserves, borrowing from abroad and domestic markets.

From the foregoing, ECOWAS countries have more budget deficit problems compared to developed countries. The reasons for budget deficit in LDCs can be seen as unstable public revenue, low degree of economic development, low acceleration of public revenue, deficient government auditing as well as the high regulatory role of government in their economy. As such, countries that have low degree of economic development, have high level of budget deficit owing to three vital reasons: high spending pressure, deficient tax revenue and low private savings. A high employment cost is a crucial problem of public economy among ECOWAS countries and these governments do not have any chance to reduce it. Moreso, deficient public revenue leads to increase in budget deficit. In ECOWAS, private saving level is so low and deficits are financed by borrowing. This in turn cause to borrowing-interest spiral by increasing budget deficit more. This scenario leads to inflation. Similarly, inflation has raising effect on budget deficit by raising nominal interest rate. Using Fischer effect, nominal interest rate consist of real interest rate and expected inflation rate. Therefore, if the expected inflation increases, it leads to rising nominal interest rate which leads to the public debt to go up. Also, interest payment constitute a large sunk of public payment among ECOWAS countries. Therefore, if the interest rate increases because of inflation, it would lead to a rise in interest payment as well as budget deficit. Thereby causing the ratio of Debt to GDP to increase. Hence, it could be argued that high interest rate and high interest payment could lead to instability between budget and public deficit acceleration as well as tax revenue acceleration. Therefore, budget and public deficit always increase faster than public revenue so budget deficit increase as well. Despite a positive relationship between inflation and budget deficit as x-rayed, it must be noted that situation arises where inflation and budget deficit move in oposition direction. If inflation tax is higher than normal level, as inflation increase people avoid holding money because the cost of holding money is high. Hence, real monetary base tends to decrease as inflation tax increases correspondingly. As such, holding money could be a very costly activity. Inflation tax could be a type of tax revenue which makes the budget deficit to decline. Another type of negative relation between inflation and budget deficit occurs as a result of the level or stock of public borrowing. For ECOWAS countries to reduce budget deficit and inflation, its borrowing must be indexed to the inflation rate, hence, as the inflation rate rise the real value of public borrowing stocks will decline. And as the public borrowing level declines, the budget deficit is also expected to fall.

The classical economists attached much importance to a balanced budget, yet they did not evaluate its impact on the price levels. Keynes saw the fiscal imbalances and budget deficits as internal components of aggregate national demand (Corsetti and Roubini,1997). The underlying reason is that when budget expenditures increase, aggregate demand curve responds it by shifting right, leading to an increase in both prices and prduction. Anusic (1991), observed that the increasing nominal income will come up with rising transactional demand for money, that is compensated by speculative demand for money (i.e. increasing real interest rates). In the Keynesian approach, the budget deficits can be tolerable in the crisis times. However, Keynes saw the budget deficits as an indicator of the impact of fiscal policy on aggregate demand. But due to the fact that the budget deficit can affect economic performance, it has been perceived as an endogenous factor (Blanchard et al, 2013 and Barro et al, 2004). Also, Altıntas et al, (2008) held that in the Keynesian theory, the main aim of the governments is to sustain high overall economic performance in the long run, the budget deficits can be acceptable to some degree.

The debate of Sargent et al, (1981) is a neoclassic theory which enlightens the debate on the relationship among fiscal imbalances and inflation. They identified two types of coordinations between monetary and fiscal authorities that are effective in controlling inflation. The first type of coordination is the monetary authority's dominant. Here, the monetary authorities announce the growth in monetary base as well as the fiscal policy sets of its budget by considering the revenue created by monetary policy. The second type of coordination is the dominant of the fiscal authorities. Here, the monetary authorities sets the fiscal policy of its budget and announces the amount of money needed for monetary authorities through seignorage and bond sales. The latter type of coordination provides an insight to inflation problem which is led by fiscal imbalances. Therefore, since the fiscal authorities sometimes demand more revenue than tolerable amounts which creates inflation as shown in the literature. The fiscal theorists view of inflation has been especially prominent in ECOWAS country and

other LDCs in the literature which has long recognized that less efficient tax collection, political instability and more limited access to external borrowing tend to lower the relative cost of seignorage and increase dependence on inflation tax. Hence, we argue that the neoclassicals theory view of the effect of fiscal theory on budget deficit and inflation is significant especially in this LDCs (Catao and Torrentes, 2003). Also, the neoclassicalist believed that increasing budget deficit is compensated by borrowing instead of taxes which results in incrementing private sector wealth, consumption as well as aggregate demand, in the logn–run. İt is worthy to note that the rising wealth is accompanied with a misperception by private sector about which the budget deficit would be paid or offset by taxes in the future. Buiter, (1983) observed that if deficits are financed by printing money, it would lead to inflationand if they are financed by borrowing it could put upward pressure on interest rates thereby leading to crowding out of interest sensitive spending and this this kind of financing rises the real interest rates. The neoclassicals therefore believed that increasing budget deficit can lead crowding out of investment and capital (Audu, 2010). The above view were opped by the neoclassicalists when they observed that such an assumption is inconsistent with the rational expectation theory (i.e. the demand for goods is based on expected present value of the future taxes). Fiscal policy can influence the price level through aggregate demand changes. It should change the expected value of the future taxes, which occurs by altering the spending. Barro, (2011) observed that budget deficits and taxation have equivalent effects on the economy (also known as the Ricardian equivalence theorem). Hence, there is no change in national saving, since an increase in private saving is faced by an equivalent decline in public saving. Because national savings in turn reduces investment while aggregate demand remains the same. We can therefore can argue that budget deficit does not affect price levels (Audu, 2012). From the foregoing, it is clear that the various school thought agreed that the financing of fiscal deficits has a key role in inflationary effects of ECOWAS member State economies. Conclusively, the type of deficit it can finance can either be bond-financing or monetization. If we adopt the monetarist approach (monetization), the price levels are directly affected but if we adopt deficit financing (borrowing or bonds selling) then the interest rates must be lower than the monetary base growth rate to prevent the unexpected inflationary effects. This suggest that budget deficits is a core policy tool to be considered in curbing inflation targeting policies.

Literature Review

Several discourse are abound among economists on the relationship between budget deficit and inflation. Different economists have investigated the relationship among these variables by adopting different econometric methods. Some economists found negative relationship while others found positive relationship between the two variables. Anthony et al, (2009) in his study of Brazil found an inverse relationship between budget deficit and inflation in Brazil. Fischer, (1989) evaluated the relationship between budget deficit and inflation in different countries and found that the countries with high inflation have strong relationship among inflation and budget deficit. He observed that high inflation rate has reducing effect on tax revenue as well as increases budget deficit by reducing seignorage revenue. Kıvılcım, (1998), assessed the long–run relationship between budget deficit and inflation in the Turkish economy and concluded that a change in budget deficit lead to a change in inflation in the same direction. He also opined that this budget deficit–inflation gap is one of the most vital problems mitigating against the Turkish economy. Also, Tiwari et al, (2011) and Agha, et al (2006) in their separate studies about imbalance between public spending and public revenue in Pakistan and India respectively, observed that the government finances budget deficit by using short-term advance money. This results in an increase money supply that leads to an increase in inflation rate. They concluded that high budget deficit leads high inflation in Turkish economy. The study by Hondroyiannis et al, (1997) on the direct and indirect effect of budget deficit on inflation in Greece observed that budget deficit has an indirect rising effect on inflation but added that an increase in inflation results in an increase in budget deficit.

The study by Solomon et al (2004) on Tanzania showed a strong positive relationship between inflation and budget deficit. They stated that budget deficit has a significant effect on inflation and concluded that developing countries should attach more importance to inflation because inflation tends to be affected from many economic shocks such as high budget deficit. İn their view inflation should be controlled by efficient fiscal policies. Catao et al, (2000) in their work on the relationship between inflation and budget deficit from different countries observed a weak relationship between the variables in developed countries and a strong positive relationship in LDCs. Sen, (2003) investigated the relationship between tax revenue and inflation and observed that high inflation leads to a decrease in tax revenue in times of crisis. According to him, low level of tax revenue is a cause to tax loss that leads to high budget deficit. He also evaluated the time of tax collection and concluded that short-term tax collection is better than long-term tax collection. In the long-run the real value of tax revenue tends to fall due to high inflation. Tanzi, (2000), in his study of Latin American countries on the relationship between tax revenue and budget deficit opined that even though the tax revenue rises, the budget deficit and public deficit also increase. He stated that this imbalance results from the deficient and inefficient social programs of government. Egeli, (1999) studied relations among inflation tax, budget deficit and public spending

observed that a reverse relation exist between inflation tax and budget deficit. He also said that increasing public spending would lead to increase in budget deficit. He concluded that this disequilibrium results from governments' wrong policies such as using borrowing to finance the deficit.

Methodology

Panel unit root test

In recent time, the involvement of macroeconomic applications in the panel data analyzes has been growing and unit root tests such as: the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests are required to be extended for testing stationarity in panel data analysis. When dealing with panel data, the procedure is more complex, the ADF and DF tests can result in inconsistent estimators. Therefore, the stationarity of the series should be tested by using three different types of test: Im, et al, 2003 (IPS), Levin, et al, 2002 (LLC) and Hadri, (2000). In our analysis, the *LLC test* is employed to test the stationarity. Levin et al (2002) method allows heterogeneity of individual deterministic effects and heterogeneous serial correlation structure of the error terms assuming homogeneous first order autoregressive parameters ((Nyong et al, 2012; Barbieri, 2005). Furthermore, this method provides a two-way fixed effects, one of which comes from the term α_i and the other one emanates from δ_t. Moreover, these two parameters allow for heterogeneity, as the coefficient of lagged Y_i is limited to be homogenous through all individual units of the panel (Adenikenji, et al (2009).

$$\varpi Y_{i,t} = \beta_i + \pi Y_{i,t-1} + \sum_{k-1}^{n} \eta_k \varpi Y_{i,t-k} + \phi_i t + \hbar_t + \psi_{it} \qquad i = 1,..........,N \qquad t = 1,............,T$$

LLC model tests the hypothesis for the presence of unit roots. That is,

$$H_0 : \lambda_1 = \lambda_2 = \lambda_3 = ... = \lambda_N = \lambda = 0$$

$$H_1 : \lambda_1 = \lambda_2 = \lambda_3 = ... = \lambda_N = \lambda < 0$$

According to Barbieri, (2004) the LLC test is criticized for two main reasons. (a). That it relies on the assumption of the independence across units of panel where a cross sectional correlation may be present. (b). That the autoregressive parameters are considered to be identical across the panel in this model and thsi ios the most crucial.

Im, et al, (2003) in his model, widened the LLC test to overcome the second limitation of it by presenting a more flexible and computationally simple test structure that permits the λ, λ to differ among individuals variables (by allowing for heterogeneity). The IPS test made the estimation for each of the *i* section possible. As a result their model is put this:

$$\varpi Y_{i,t} = \beta_i + \pi Y_{i,t-1} + \sum_{k-1}^{n} \eta_k \varpi Y_{i,t-k} + \phi_i t + \hbar_t t + \psi_{it} \qquad i = 1,..........,N \qquad t = 1,............,T$$

Im et al, (2003) tests the null of non-stationarity thus: $H_o = \lambda_i = 0$ for all *i*

$$H_1 \begin{cases} \lambda_i < 0 \ \ for \ \ i = 1,2,................,N_1 \\ \lambda_i = 0 \ \ for \ \ i = N_1+1,..........,N_1 \end{cases}$$

This test clarifies that a fraction of the panel can have unit roots. This is the point of convergence between the IPS and LLC. The IPS model is constructed under the restrictive assumption that T should be the same across individuals. That is to say, there should be a *t-bar* statistic which is the mean of *ADF t-statistics* for testing ☐ = 0 for all *i* such that

$$\frac{1}{N} \sum_{n-1}^{i} t\lambda_i$$

Asteriou, (2005) $t\lambda_i$ converges to a statistics denoted as $t\lambda_i$ which is assumed to be *iid* and has finite mean and variance. Also, it is worthy to note that this procedures are very vital in balanced panels, since it is based on collecting test statistics.

Celik, et al, (2008) and Brabrieri, (2004) in their separate studies observed that the Hadri, (2000) panel unit root test is quite different from the LLC and IPS tests for testing the absence of unit roots (variance of the random walk equals to zero). In his study, proposes a parameterization that provides an adequate representation for both

stationary and non-stationarity variables. This model permits an easy formulation for a residual based Lagrange-Multiplier (*LM)* test of stationarity. In the Hadri model, the disturbance terms are hetoroskedastic across *i* and it provides for a LM where the series are stationary thus:

$$Y_{it} = \chi_{i0} + \sigma_i t + \psi_{it} \quad \text{where} \quad \psi_{it} = \sum_{t-1}^{t} u_{it} + \psi_{it} \quad t = 1, \ldots\ldots T \quad i = 1, \ldots\ldots N$$

Panel Cointegration Tests

Theoretical and empirical literature are abound which showed that differencing the data is a useful transformation which capable of avoiding the spurious regression problem. İt also causes the loss of the long–term information that the series include (Udah, 2012 and Nyong et al, 2012). Despite this, it is worthy to note that the cointegration analysis that provides such a robust result, even though the series themselves may be non-stationary, they could nevertheless move together over time and the difference between them would be stationary stable. Nyong et al, (2012) used this test to examine the long-term convergence between some selected variables among some selected ECOWAS countries. These tests would be conducted using the Pedroni as well as Larrson et al (2001) tests respectively. Asteriou, (2005) observed that the initial Pedroni test concentrated on the homogeneity of the two simple variables for his first analysis even though there was some setbacks. In his second study, Pedroni adopted multi-regression approaches. According to Asteriou, (2005) the good tenet of this test is that it allows both cointegration vectors to vary and heterogeneity in the errors across cross sectional units but the shortfalls in his earlier test led Pedroni, (1999) to develop a new test with seven test statistics to test the null of no cointegration between two variables.

The Panel v statistics

$$T^2 N^{1.5} Z_{\hat{v}N,T} \equiv \frac{T^2 N^{1.5}}{\left[\left(\sum_{t-1}^{N}\right)\left(\sum_{t-1}^{T}\right)\overline{L}_{11i}^{-1}\overline{e}_{i,t-1}^{2}\right]}$$

The panel σ statistics

$$T\sqrt{N} Z_{\hat{\sigma}N,T} \equiv \frac{T\sqrt{N}\left[\left(\sum_{t-1}^{N}\right)\left(\sum_{t-1}^{T}\right)\overline{L}_{11i}^{-1}\left(\overline{e}_{i,t-1}\Delta\overline{e}_{i,t} - \overline{\beta}_i\right)\right]}{\left[\left(\sum_{t-1}^{N}\right)\left(\sum_{t-1}^{T}\right)\overline{L}_{11i}^{-1}\overline{e}_{i,t-1}^{2}\right]}$$

The Non-parametric panel t statistics

$$Z_{tN,T} \equiv \frac{\left(\sum_{i-1}^{N}\right)\left(\sum_{t-1}^{T}\right)\overline{L}_{11i}^{-2}\left(\overline{e}_{i,t-1}\Delta\overline{e}_{i,t} - \overline{\beta}_i\right)}{\sqrt{\left(\overline{\sigma}_{N,T}^{2}\sum_{i-1}^{N}\sum_{t-1}^{T}\overline{L}_{11i}^{-2}\overline{e}_{i,t-1}^{2}\right)}}$$

The parametric panel t statistics

$$Z_{tN,T}^{*} \equiv \frac{\left(\sum_{i-1}^{N}\right)\left(\sum_{t-1}^{T}\right)\overline{L}_{11i}^{-2}\left(\overline{e}_{i,t-1}^{*}\Delta\overline{e}_{i,t}^{*}\right)}{\left[\overline{S}_{N,T}^{*2}\left(\sum_{i-1}^{N}\right)\left(\sum_{t-1}^{T}\right)\sum_{t-1}^{T}\hat{L}_{11i}^{-2}\overline{e}_{i,t-1}^{*2}\right]}$$

The parametric group σ statistics

$$TN^{-1/2}\tilde{Z}_{\tilde{\rho}N,T-1} \equiv \frac{\sum_{t-1}^{T}\left(\bar{e}_{i,t-1}\Delta\bar{e}_{i,t}-\bar{\beta}_i\right)}{\sqrt{TN}\left(\sum_{i-1}^{N}\right)\left(\sum_{t-1}^{T}\bar{e}\right)\left(\bar{e}_{i,t-1}^{*2}\right)}$$

The non-parametric group t statistic

$$\frac{\bar{Z}_{tN,T-1}}{\sqrt{N}} \equiv \frac{\sum_{t-1}^{T}\left(\bar{e}_{i,t-1}\Delta\bar{e}_{i,t}-\bar{\beta}_i\right)}{\sqrt{N}\left(\sum_{i-1}^{N}\right)\sqrt{\left(\bar{\sigma}_i^2\sum_{t-1}^{T}\bar{e}_{i,t-1}^2\right)}}$$

The parametric group t statistics

$$\frac{\bar{Z}_{tN,T}^{*}}{\sqrt{N}} \equiv \frac{\sum_{i-1}^{N}}{\sqrt{N}\left(\sum_{t-1}^{T}\bar{S}_i^{*2}\bar{e}_{i,t-1}^{*2}\right)\sum_{t-1}^{T}\left(\bar{e}_{i,t-1}^{*}\Delta\bar{e}_{i,t}^{*}\right)}$$

Larrson, et al (2001) developed a variance for the Johansen's (1988) maximum likelihood estimator tests for a panel extension of vector autoregression (VAR) cointegration analysis. This model permitted to avoid from unit root tests on residuals, widening the unique cointegrating vector assumption. The construction of this test statistic is similar to to that of Im, et al (2003). As a result of this, the test statistic is given by a suitably centered and scaled version of the cross-sectional average of the individual trace statistics (Wagner and Hlouskova, 2006; Asteriou, 2005). We present the Larrson, et al (2001) model thus:

$$\Delta Y_{i,t} \equiv \pi_i Y_{i,t-1} + \sum_{k-1}^{n} H_{ik}\Delta Y_{i,t-k} + \psi_{i,t}$$

This model above is separately for each cross-sectional unit by adopting the maximum likelihood methods to calculate the trace for each variable. To achieve this goal, null hypothesis would be stated as follows:

$$H_0 \equiv rank\left(\pi_i\right) \equiv r_i \leq r \text{ for all } i \equiv 1,\ldots\ldots\ldots,N$$
$$H_1 \equiv rank\left(\pi_i\right) \equiv p \quad \text{ for all } i \equiv 1,\ldots\ldots\ldots,N$$

where p is the number of variables we used to test cointegration among them.

Celik, et al (2008) observed that the Larsson et al (2001) process is calculated in two phases. At the initial stage of the computation of trace statistics, the rank trace statistic LR_{NT} will be solved by taking the average of N cross-sectional units. Then the LR_{NT} statistics is used to solve for the Y_{LR} using the formula:

$$Y_{LR} \equiv \frac{\sqrt{N}[LR_{NT} - E(Z_k)]}{\sqrt{Var(Z_k)}}$$

From the aforementioned formula, it is clear that at any point in time when the value of Y_{LR} is greater than the critical value of *1.96*, it moves to the upper cointegration vector number by rejecting the one it has.

Discussion of results

We evaluated the relationship between budget deficit and inflation among the fifteen (15) countries that make constitute ECOWAS. The countries are: Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. These countries come together to converge and seek improvements in their economy. All ECOWAS member States under scrutiny in this paper are all developing African countries. Therefore, it is vital to examine budget deficit and inflation relationship among them. The data for this analysis was sourced from ADB, IMF, ECOWAS statistics, Penn World data as well as from OECD statistics extracts. Government lending and or borrowing statistics were employed. The data are divided into gross domestic product to understand the real meaning of those deficits for a particular country. Also, inflation variable such as consumer price index for each country was adopted. These

panel data set was employed all through our analysis.

Panel Unit Root Tests

As a precondition for panel cointegration tests, panel unit root tests, including LLC (2002), IPS (2003) and Hadri (2000), was adopted at their individual intercept as well as their intercept and trend for budget deficit (BDGDP) and inflation (INF) variable. LLC process tests the common unit root process under the null of non-stationarity. The result presented in Table 1 reveals that the presence of unit root could not be rejected. However, when we take their first differences of the variables, it can be seen that both variables have unit root in both individual intercept cas as well as the intercept and trend case. Also, IPS test has the same null hypothesis of having unit roots as LLC test but it assumes individual unit root process as indicated in Table 1. In addition, it suggests a positive result when testing for the presence of unit roots of the series like the results provided by the LLC tests. Apart from the LLC and IPS tests, the Hadri test is also conducted. The Hadri test has a very distinctive null hypothesis which claims the stationarity of the series. As indicated in Table 1, at the level of the variables, the null of having no unit roots is rejected while at their first differences, this hypothesis approached to not rejecting their null hypothesis. From the foregoing, the results so obtained from the panel unit root tests would allow us to carry out a cointegration tests.

Table 1: Panel unit root tests

Variables	Situation	Levels			1st difference		
		Common unit root		Individual unit root	Common unit root		Individual unit root
		LLC	Hadri	IPS	LLC	Hadri	IPS
$\frac{BD}{GDP}$	Individual	1.53589 (0.9377)	4.22316 (0.0000)	2.76264 (0.9971)	- 3.20933 (0.0007)	2.69603 (0.0035)	-2.34620 (0.0095)
	Individual Intercept and Trend	-0.97053 (0.1659)	4.42301 (0.0000)	-0.12854 (0.4489)	-2.277626 (0.0027)	4.91060 (0.0000)	-2.34396 (0.0095)
INF	Individual	-1.12632 (0.1300)	2.15772 (0.0155)	-2.21688 (0.0414)	2.33739 (0.0097)	7.17155 (1.0000)	1.57407 (0.0577)
	Individual Intercept and Trend	-1.97753 (0.0240)	2.53203 (0.0057)	-0.49716 (0.3095)	-325908 (0.0006)	4.33983 (0.0000)	-3.17304 (0.0004)

Note: (1) In this study, the modified-Swartz criteria's automatic selection of lags was adopted. (2) The values in brackets represents probabilities.

Source: Author's own computation using Eviews 7

The panel unit root tests in Table 1, reveals that the variables used in the series are indeed integrated as a result, the stage is now set to carryout the Pedroni balanced panel cointegration tests to ascertain the long-run relationship among the variables used in the study.

Pedroni balanced panel cointegration test

Pedroni developed seven statistics to enable him test the null hypothesis of no cointegration among series. For these series, the critical value is -1.64 except *v*-statistics which has 1.64. That is to say that when the test statistics is lower then -1.64 or it is greater than 1.64 for *v*-statistics, then the null hypothesis is rejected. Table 2 reports these seven statistics for budget deficit and inflation relationship in ECOWAS. As it can easily be understood from the table, there is no strong cointegration between two variables in both *individual intercept and individual intercept and trend* situations. On the other hand, Table 2 points out a remarkable cointegration between two variables.

Table 2: Pedroni Panel Cointegration Test

Type of test	Individual Intercept	Individual Intercept & Individual Trend
Within-dimesion tests		
Panel v-statistic	0.783966 (0.7835)	19.09976 (0.0000)
The panel rho (ρ) statistic	-0.683511 (0.7529)	0.472836 (0.6818)
The panel PP statistic	3.533907 (0.0088)	-3.782176 (0.0071)
The panel ADF statistic	-6.088646 (0.0000)	-4.234139 (0.0086)
Between-dimension tests		
The group rho (ρ) statistic	1.577435 (0.9427)	1.126124 (0.8699)
The group PP statistic	1.432655 (0.9240)	-5.791194 (0.0002)
The group ADF statistic	1.877856 (0.9698)	3.027879 (0.0086)

Note: We adopted a 5% significance level.
Source: Author's own computation using Eviews 7

We equally deemed it fit to evaluate whether cointegration relationship exists in each individual country under investigation. To achieve this goal, we employed the Johansen cointegration test among the ECOWAS countries one by one. The result is presented in Table 3. The results from the Table indicates that three out of fifteen (15) countries accept the null hypothesis which states that there is no cointegration (i.e. Liberia, Niger and Sierra Leone). This might be attributed to the unstable economy as well as insurgency in the country. Conversely, the remaining fourteen (14) ECOWAS member countries such as Benin, Burkina Faso, Cape Verde, Cote D'voire, Gambia, Ghana, Guinea, Guinea Bisau, Mali, Nigeria, Senegal, and Togo accept the alternate hypothesis which affirms that there is at most one long-run relationship between BDGDP and INF. When we combined the results obtained from two separate tests (Pedroni and Johansen tests), we can then conclude that in most ECOWAS countries like Nigeria, Ghana, Gambia, etc as earlier mentioned suggests that they indeed have a long-run relationship between the selected variables (budget deficit and inflation). As depicted on Table 3, the Johansen test shows that there is no certain cointegration between the variables used in this analysis. This result is in consonance with the result of the Pedroni test in Table 2. Finally, the findings of our result reveals that ECOWAS member States are more prone to have a long-run relationship between inflation (price level) and budget deficits (fiscal imbalances). This finding is in line with Gilles et al, (2005) and Akinyemi et al, (1984).

Table 3: Johansen cointegration test for individual country

Countries	None	At most 1
Benin	15.67704	0.200872
Burkina Faso	20.62679	1.043774
Cape Verde	19.46006	2.368144
Cote D'voire	17.34531	0.002865
Gambia	29.07789	0.043888
Ghana	16.40592	0.097704
Guinea	15.53597	2.992873
Guinea Bissau	26.10268	0.119890
Liberia	14.48640	1.611515
Mali	18.12320	2.777359
Niger	9.551063	0.791346
Nigeria	15.87413	4.600393
Senegal	18.36951	0.721677
Sierra Leone	8.883916	1.256919
Togo	16.46431	0.557136
Y_{LR}	11.27202	2.238103
5% level of Significance	*15.49471*	*3.841466*
N	15	15

Conclusion

The study area is ECOWAS member States which are all less devloping countries. Data on fiscal imbalance (BDGDP) and inflation (CPI) were collected for all the fifteen countries that make up ECOWAS. These variables were subjected to various test. This was done by employing panel data in order to test for long-run relationship between budget deficit and inflation through panel cointegration tests. The panel data used in this paper include annual consumer price index (CPI) and the ratio of budget deficit to GDP (BDGDP) data from 1980 to 2012 for the various countries. The unit root test was carried out in order to test the series for stationarity. Having ascertained their stationarity status of the variables, the cointegration tests was equally conducted. The result of the Pedroni cointegration test reveals that there was no cut clear cointegration between the variables in the long-run. The focus of this study are ECOWAS countries for the purpose of comparism. Although in some ECOWAS countries, long-run relationship do exist between inflation and budget deficit. Nevertheless, on the whole, our cointegration tests suggests that there is no siginificant relationship between the variables (budget deficit and inflation) employed in the analysis in the long-run as indicated in column 3 of Table 3. This is because the changes in these variables are based on the level of development of ECOWAS countries (that is the structural characteristics that are inherent in such economies).

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