

Spending Cuts or Tax Adjustments: How Can UEMOA Countries Control Their Budget Deficits?

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Abstract

This paper uses cointegration and Granger causality tests to examine the relationship between government revenue and government expenditure for seven African countries over the period 1980 to 2007. Using the bounds testing approach to cointegration, our empirical results suggest that for six out of the seven countries the two fiscal variables are cointegrated. Our results on the direction of causation support the fiscal synchronization hypothesis for Benin, Burkina Faso, Niger, and Senegal in the long-run and for Côte d'Ivoire and Mali in both the short- and long-run. Burkina Faso and Niger are in conformity with the tax-and-spend hypothesis in the short-run while Senegal and Togo follow a spend-and-tax scheme. Our findings suggest that, to control their budget deficits, Burkina Faso, Mali, and Niger should look for ways to raise revenues, while policymakers in Benin, Côte d'Ivoire, and Senegal should curtail expenditures. Togo should try to raise revenues and control public spending simultaneously.

Key words: government revenues; government expenditures; budget deficit; cointegration; causality

JEL classification: E62; H62; C32; O55

1. Introduction

Budget deficits have been a subject of great interest and debate among macroeconomists for many years. The debate has traditionally revolved around two issues. The first relates to whether budget deficits affect economic growth, and the second relates to how to reduce budget deficits. A large body of literature has emerged, both at the theoretical and empirical level, attempting to answer the above questions. However, no clear consensus has been reached on either issue. For the

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first issue, four schools of thought emerge from the theoretical literature, revealing the complex relationship that exists between budget deficits and macroeconomic variables. The Keynesian view supports the idea that budget deficits have, by the working of the fiscal policy multiplier, a positive effect on aggregate demand and macroeconomic activity. According to this view, spending cuts reduce the pace of short-term economic activity. Within the framework of endogenous growth models, budget deficits can have positive long-term impacts on economic growth if they are used to finance growth-enhancing expenditures on, for instance, public infrastructure, research and development, education, and health (Barro, 1990; Romer, 1990; Lucas, 1988). In contrast with this view, neoclassical theory argues that public deficits erode savings and reduce private investment, thus inhibiting long-term economic growth. The Ricardian equivalence view holds that budget deficits are neutral to economic growth because economic agents are forward looking (Barro, 1974). More recently, some economists argue that under certain conditions, large fiscal contractions can stimulate rather than retard economic growth (see Bertola and Drazen, 1993; Sutherland, 1997; Perotti, 1999). These conflicting views have made less attractive the use of fiscal policy in stimulating economic activity. Nowadays, the conventional wisdom seems to be that deficits are bad for economic growth. This belief has led the international community to attach great importance to a country's fiscal deficit.

Control of budget deficits has become a major challenge for most African countries since 1980. Various measures have been proposed in attempts to restrict the size of budget deficits. While some of these measures focus on spending, others target tax revenues, and still others target both tools. The question of which of these measures is the most appropriate tool for improving budget balances has recently received considerable academic attention. Empirical investigations are based on the identification of the causal relation between public revenues and expenditures. Indeed, if the causality runs from government revenues to government spending, then simply raising taxes to restrict the size of the deficit would be counter-productive. However, if the causality runs from expenditures to revenues, then one can rely on the containment of public expenditure to remedy a budget deficit.

A vast empirical literature of public finance has been accumulated concerning the interdependence between public revenues and expenditures. Most empirical studies are carried out for Latin America, the US, Europe, and Asia. There is little empirical attention for Sub-Saharan African countries. The experience of African countries is very different from that of industrialized and Asian countries. For instance, African countries are generally plagued with deficient infrastructure, restrictive regulations in the financial sector, and political uncertainty. Under these conditions, there could be wide disparities in the macroeconomic dynamics governing the budgetary process between developing and developed economies.

This study aims to contribute to the discussion on public finances for the member countries of the West African Economic and Monetary Union (UEMOA). We focus on UEMOA countries for two reasons. First, faced with the vicious circle of escalating external debt and persistent budget deficits, these countries have

adopted in 1994 convergence criteria aiming at explicit targets for public debt and deficits to monitor their fiscal situation. To meet the convergence criteria, they should increase tax revenues over 17% of GDP and keep public deficits at a minimum of 0% of GDP. Despite some efforts of budgetary consolidation, most countries fail to achieve balanced budgets. Second, it is widely recognized that saving plays a crucial role in economic development. However, a striking feature of Sub-Saharan African countries is the low levels of domestic savings rates (Loayza et al., 2000). This situation condemns them to an uncomfortable choice between low investment and growth or excessive reliance upon foreign saving, which makes them vulnerable to financial crises. Eliminating budget deficits in these countries is essential to ensure debt reduction and the availability of domestic saving for private investment and growth. It is therefore the aim of this paper to offer policy actions that can be implemented to reduce and eventually eliminate the budget deficits in UEMOA countries. Although the countries under investigation are members of a common currency union, they show differences in institutional, social, and economic structures. Hence, a common deficit-reduction rule may not apply to all of them. By conducting individual country time-series analysis, our study provides insights into an effective strategy that could be adopted to achieve greater fiscal discipline in each country.

Apart from filling the gap in the empirical literature, the study also makes some important contributions to the existing literature. First, we employ the Zivot and Andrews (1992) unit root test to determinate the order of integration of the time series under investigation before embarking on the bounds testing approach to cointegration proposed by Pesaran et al. (2001). Our study is an advance over most existing works using the Zivot and Andrews (1992) test and the bounds testing approach because, for these two tests, we compute exact critical values specific to our sample size using Monte Carlo simulations. In doing so, we ensure that our inferences regarding stationarity and cointegration are correct. Second, recognizing that cointegration does not indicate the direction of causality, we use the standard Granger causality test within an error correction model as well as the causality test suggested by Toda and Yamamoto (1995) to underpin the causal ordering of the two variables.

The remainder of the article is organized as follows. The next section reviews the theoretical and empirical literature regarding the causal relationship between government revenues and expenditures. Section 3 describes the data used, and Section 4 explains the empirical methodology. Section 5 discusses the empirical results, while Section 6 summarizes the major findings of the study and gives some policy implications.

2. Literature Review

The sequencing of government's taxing and spending plans has been a much debated issue within public finance over the past two decades. The debate pertains to whether the government has to raise tax revenue first and then spends or vice-versa.

The theoretical underpinnings of the causal link between government revenues and expenditures are diverse since they are associated with the different schools of economic thought. Four main hypotheses have been advanced in the literature. The first hypothesis is known as the tax-and-spend hypothesis. This hypothesis postulates a unidirectional causality running from government revenues to government spending. The most well known advocate of this thought is Friedman (1978). According to Friedman, public expenditures adjust up or down to whatever level that can be supported by revenues. Under this hypothesis, raising taxes will simply lead to more spending and hence to fiscal imbalances. Cutting taxes is, therefore, the appropriate remedy to budget deficits. Buchanan and Wagner (1978) share the view of tax-and-spend but argue that the causal relationship is negative. Their point of view is that, with a cut in taxes, the public will perceive that the cost of government programs has fallen. As a result they will demand more programs from the government, which if undertaken will result in an increase in government spending. Higher budget deficits will then be realized since tax revenue will decline and government spending will increase. Their remedy for budget deficits is therefore an increase in taxes.

The second school of thought, known as the spend-now-and-tax-later hypothesis, suggests that governments spend first and then increase tax revenues as necessary to finance expenditures. This view was supported by Peacock and Wiseman (1979), who argue that increased spending created by some special events, such as natural, economic, or political crises, compel governments to increase taxes. From a Ricardian equivalence perspective, Barro (1979) argues that increased government expenditures financed by borrowing will translate into higher future tax liability for the public. As higher spending now will lead to higher taxes later, this hypothesis suggests that spending cuts are the desired solution to reducing budget deficits. The third hypothesis indicates bidirectional causation between revenue and spending. This fiscal synchronization hypothesis postulates that a government simultaneously chooses the desired package of spending programs and the revenues necessary to finance such spending programs. Musgrave (1966) and Meltzer and Richard (1981) are proponents of this view of the budgetary process. The fourth hypothesis emphasizes the possibility of independent determination of revenues and spending due to institutional separation of allocation and taxation functions of government (Buchanan and Wagner, 1978). This could be the case if, for instance, the budget process was seriously affected by divergent interests and agendas.

In an attempt to provide guidance to policymakers on the choice of corrective measures, an extensive amount of empirical investigations have been conducted to test for the four theoretical hypotheses. The empirical findings vary in terms of data sets, econometric techniques, and countries and often produce conflicting results within the same country. Many empirical works provide evidence supporting the tax-and-spend hypothesis. Some of these include Blackley (1986), Manage and Marlow (1986), Marlow and Manage (1987), and Bohn (1991) for the US; Owoye (1995) for Japan and Italy; Baffes and Shah (1994) for Brazil; Darrat (1998) for Turkey; Ahiakpor and Amirkhalkhali (1989), Joulfaian and Mookerjee (1991), and

Payne (1997) for Canada; Ewing and Payne (1998) for Colombia, Ecuador, and Guatemala; Park (1998) for Korea; Koren and Stiassny (1998) for the UK, Germany, and the US; Cheng (1999) for Columbia, the Dominican Republic, Honduras, and Paraguay; Chang et al. (2002) for Taiwan, South Korea, the UK, and Japan; Darrat (2002) for Lebanon and Tunisia; Fasano-Filho and Wang (2002) for Bahrain, Oman, and the United Arab Emirates; Chang and Ho (2002a) and Fuess et al. (2003) for Taiwan; Tijerina-Guajardo and Pagan (2003) for Mexico; AbuAl-Foul and Baghestani (2004) for Egypt; Sobhee (2004) for Mauritius; and Narayan (2005) for Indonesia, Singapore, Sri Lanka, and Nepal in the short-run.

Evidence supporting the spend-and-tax hypothesis has been found by Anderson et al. (1986), von Furstenberg et al. (1986), Ram (1988a), Jones and Joulfaian (1991), and Islam (2001) for the US. In a study of OECD countries, Joulfaian and Mookerjee (1990) found results supporting the spend-and-tax hypothesis in the US, Japan, Germany, France, the UK, Austria, Finland, and Greece. Additionally, findings of Koren and Stiassny (1998) for France; Mithani and Khoon (1999) for Malaysia; Hondroyiannis and Papapetrou (1996) and Vamvoukas (1997) for Greece; and Dhanasekaran (2001) for India describe dynamics consistent with the spend-and-tax hypothesis. In studying nine Asian countries, Narayan (2005) also reported findings in conformity with the spend-and-tax hypothesis for Indonesia and Sri Lanka in the long-run.

Evidence of bidirectional causality between government revenue and expenditures was found by Miller and Russek (1990) for the US; Bath et al. (1993) for India; and Baffes and Shah (1994) for Argentina and Mexico. Hasan and Lincoln (1997) also reported evidence in favor of the fiscal synchronization hypothesis for the UK. Empirical studies providing support to this view also include Ewing and Payne (1998) for Chile and Paraguay; Cheng (1999) for Chile, Panama, Brazil, and Peru; Li (2001) and Chang and Ho (2002b) for China; Fasano-Filho and Wang (2002) for Kuwait, Qatar, and Saudi Arabia; and AbuAl-Foul and Baghestani (2004) for Jordan.

Hoover and Sheffrin (1992) and Baghestani and McNown (1994) provide evidence which is consistent with the independence hypothesis for the US economy. They concluded that neither the tax-and-spend nor the spend-and-tax hypothesis accounts for budgetary expansion in the US. Instead, they show that both the expansion in revenue and spending is determined by long-run economic growth. With respect to developing countries, Ram (1988b) provides empirical evidence for the institutional separation hypothesis for India, Panama, Paraguay, and Sri Lanka. Narayan (2005) concludes in favor of this hypothesis in the cases of India, Malaysia, Pakistan, Thailand, and the Philippines.

As can be seen from the brief review of the empirical findings, the evidence on the direction of causality between public revenues and spending is mixed. As noted by Park (1998), in a number of previous studies that investigated the issue addressed in this paper, important statistical properties of the data have not been taken into account when the causality tests were implemented. Some of these studies directly considered variables in level or first difference without performing a unit root test

and testing for the possibility of cointegration (see, for example, Manage and Marlow, 1986; Ram, 1988a). It is well known that the presence of integrated variables invalidates the blind application of ordinary least squares (Granger and Newbold, 1974). Others used short data spans and failed to derive robust inference using appropriate critical values. To circumvent those shortcomings, this study first performs unit roots tests and then uses the bounds testing approach to cointegration to examine the government expenditure-government revenue nexus for a group of seven African countries. After a brief description of data in the next section, we explain in detail our econometric methodology.

3. Data Description

This study uses annual data covering the period 1980–2007 for seven member countries of UEMOA, namely Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, and Togo. Following Bohn (1991), Hondroyannis and Papapetrou (1996), AbuAl-Foul and Baghestani (2004), and Narayan (2005), we consider overall government revenues and expenditures expressed as ratios of GDP. While controlling for GDP, this treatment alleviates the question of whether the revenue and spending variables should be in nominal or real terms. This transformation also decreases the dependency of fiscal variables upon nominal income dynamics. On the other hand, in the context of the treaty of convergence, criteria for the fiscal indicators are expressed in terms of GDP ratios rather than in nominal or real terms. All data are obtained from the Selected Statistics on African Countries (2002 and 2008) published by the African Development Bank. Throughout this study R_t is the logarithm of the government revenues to GDP ratio and E_t is the logarithm of the government expenditures to GDP ratio. Before presenting the econometric methodology, a few words about the data are in order. Table 1 displays the levels of revenues, expenditures, and deficits as percentages of GDP.

Table 1. Government Revenue, Expenditures, and Budget Deficits, 1980–2007

Country	Revenue		Expenditures		Deficits	
	1980–94	1995–07	1980–94	1995–07	1980–94	1995–07
Benin	18.05	18.15	22.17	19.20	4.11	1.04
Burkina Faso	13.99	18.46	18.22	21.95	4.23	3.48
Cote d'Ivoire	25.95	18.80	34.39	20.46	8.44	1.66
Mali	5.64	20.60	24.28	23.13	18.63	2.53
Niger	14.57	15.63	18.56	18.17	3.98	2.53
Senegal	19.80	20.07	23.30	21.83	3.50	1.75
Togo	25.46	16.22	31.20	18.63	5.74	2.40

As can be seen from the Table 1, the general budgetary situation within UEMOA is characterized by persistent deficits. This means that revenues always lie below expenditures. Over the period 1980–1994, Mali, Cote d'Ivoire, and Togo had the highest average deficit ratios of 18.63%, 8.44%, and 5.74%, respectively. The

budget deficit ratios in the remaining countries have averaged less than 5% of GDP over that period. After the signing of the UEMOA treaty of convergence and the devaluation of the common currency in 1994, the period 1995–2007 saw improvements in the general budgetary position with declines in the budget deficits. In contrast with the previous period, the average budget deficit emanating from government policies over the period 1995–2007 ranged between 1% and 3.5% of GDP. We can also observe that the public sector was downsized in the majority of countries. Given such trends within UEMOA, it would be difficult to ascertain whether all the member countries will achieve a surplus in a few years. Also, one cannot directly ascertain whether fiscal policymakers have been using a policy of tax-and-spend, spend-and-tax, or whether spending and taxing decisions were jointly determined.

4. Econometric Methodology

To formulate the appropriate model for investigating the causal relationship between public revenues and expenditures, our econometric methodology follows a three-stage procedure. We begin by testing for unit roots to ascertain the order of integration of the variables. The second step examines whether or not they are cointegrated. The third step tests for the dynamic causal relationship between the two variables.

4.1 Unit Root Test

Given that we are dealing with time series data, the possibility of non-stationarity of variables cannot be ruled out. The Augmented Dickey and Fuller (ADF) test is a widely used test to examine unit roots in time series data. However, Perron (1989) pointed out that the standard ADF tests show low power for variables that may have undergone structural changes. Hence, it might be misleading to conclude that the variables are non-stationary just on the basis of the results from the standard ADF tests. Furthermore, several authors structured their models by allowing stationarity around an endogenously estimated structural break point under the alternative hypothesis. In this study we apply the Zivot and Andrews (1992) test because in practice one never selects a date to test for a break point without prior information about the data. The null hypothesis in the Zivot and Andrews (1992) method is that the variable under investigation contains a unit root with a drift that excludes any structural break, while the alternative hypothesis is that the series is a trend stationary process with a one-time break occurring at an unknown point in time. The Zivot and Andrews test involves estimating the following augmented Dickey- Fuller regression:

$$\Delta H_t = \mu + \beta t + \theta DU_t + \gamma DT_t + \alpha H_{t-1} + \sum_{j=1}^k \phi_j \Delta H_{t-j} + e_t, \quad (1)$$

where DU_t and DT_t are dummy variables for a mean shift and a trend shift,

respectively, $DU_t = 1$ if $t > T_b$ and 0 otherwise, and $DT_t = t - T_b$ if $t > T_b$ and 0 otherwise. The k extra regressors are included to address the problem of autocorrelation in the error term e_t . The selected break point for each series is that T_b for which the t -statistic t_α for α is minimized. Since the choice of lag length k may affect the test results, the lag length was selected according to the procedure suggested by Perron (1989).

4.2 Cointegration Test

Once the order of integration of each variable is determined, the concept of cointegration pioneered by Engle and Granger (1987) is used to examine the existence of a cointegrating relationship between the variables. The residual-based test of Engle and Granger (1987) and the system-based approach pioneered by Johansen (1988) are two widely used econometric tools for cointegration analysis. Although these approaches are well documented in the empirical literature, they are not immune to criticism. They require that all the system's variables are integrated of the same order. As long as there exist both I(1) and I(0) variables, these tests will produce biased results because the probability of finding cointegration increases with the presence of I(0) variables. The Johansen (1988) method, being a full information technique, is exposed to the problem that parameter estimates in one equation are affected by any mis-specification in other equations. In addition, these tests do not have good small sample properties (Banerjee et al., 1993; Cheung and Lai, 1993; Gonzalo and Pitarakis, 2002).

To overcome these problems, we employ the bounds testing approach to cointegration proposed by Pesaran et al. (2001) within the autoregressive distributed lag framework. The main advantage of this method is that it can be applied irrespective of whether the regressors are purely I(0), purely I(1), or mutually cointegrated. Hence, it rules out the uncertainties present when pre-testing the order of integration of the series. Another advantage is that the test is relatively more efficient in small sample data sizes in which the order of integration is not well known or may not be necessarily the same for all variables of interest. It has been shown that this technique generally provides unbiased estimates of the long-run model and valid t -statistics even when some of the regressors are endogenous (Inder, 1993). The bounds test for cointegration involves estimation by ordinary least squares the following unrestricted error correction model considering each variable in turn as the response variable:

$$\Delta E_t = \alpha_1 + \beta_1 D_t + \pi + \phi_1 E_{t-1} + \phi_2 R_{t-1} + \sum_{i=1}^p \theta_{1i} \Delta E_{t-i} + \sum_{i=0}^q \gamma_{1i} \Delta R_{t-i} + e_{1t}, \quad (2)$$

where D_t denotes a vector of dummy variables controlling for macroeconomic events experienced by the country, p and q are the number of lagged differences of ΔE_t and ΔR_t , respectively, and t is a time-trend variable. In practice there is no reason why p and q need to be the same. Therefore we allow for the possibility of different lag lengths. Thus (2) can be interpreted as an autoregressive distributed lag,

or ARDL (p, q), model. The lag lengths p and q are selected according to the Akaike Information Criteria (AIC). The bounds test for cointegration is conducted by restricting the lagged levels variables, E_{t-1} and R_{t-1} , in (2). Therefore, the null hypothesis of no cointegrating relation is $H_0 : \phi_1 = \phi_2 = 0$. This hypothesis is tested by the mean of the F -test. However, the F -statistic has an asymptotic non-standard distribution. Its distribution under the null depends upon: (i) the order of integration of the regressors, (ii) the number of covariates, (iii) the sample size, and (iv) the inclusion of an intercept and a trend variable in the equation.

Pesaran et al. (2001) discusses five cases with different restrictions on the trends and intercepts. For each case, they tabulate two sets of asymptotic critical values for the F -statistics. The lower bound critical values assume that all the regressors are $I(0)$ series while the upper bound critical values assume that they are $I(1)$. When the computed F -statistic is greater than the upper bound critical value, the variables are cointegrated. Otherwise the variables are not cointegrated. We are aware of the fact that the critical values provided by Pesaran et al. (2001) are not suitable for our small sample size, and hence we will derive the appropriate critical values from the stochastic simulations procedure suggested by the authors. If cointegration is found, the long run coefficients from (2) are computed as the coefficient of the one lagged level explanatory variable divided by the coefficient of E_{t-1} and multiplied by negative one (Bardsen, 1989). Unlike other alternative cointegration tests, the bounds test can distinguish response and covariate variables in the cointegrating relationship. For instance, by taking say variable E_t as the response variable and R_t as the covariate, if one finds evidence of cointegration based on the bounds F -test, this implies that E_t is the response variable in this cointegrating relationship.

4.3 Granger Causality Analysis

The use of Granger causality tests to trace the direction of causality between two economic variables is not uncommon in empirical work. Following Granger (1969), a variable Y causes a variable X if the observations of Y up to time t ($Y(\tau) : \tau \leq t$) can help to predict X_{t+1} when the corresponding observations on X are available ($X(\tau) : \tau \leq t$). The statistical procedure for testing non-causality is performed within a vector autoregressive (VAR) model. However, when cointegration exists among the variables, the temporal causality should be modelled within an error correction representation in which an error correction term is incorporated into the model (Engle and Granger, 1987; Johansen, 1988). Accordingly, the Granger causality tests will be based on the following regressions:

$$\Delta E_t = \alpha_1 + \sum_{i=1}^p \beta_{1i} \Delta E_{t-i} + \sum_{i=1}^p \gamma_{1i} \Delta R_{t-i} + \lambda_1 e_{t-1} + \pi_1 D_t + \mu_{1t}, \quad (3)$$

$$\Delta R_t = \alpha_2 + \sum_{i=1}^p \beta_{2i} \Delta E_{t-i} + \sum_{i=1}^p \gamma_{2i} \Delta R_{t-i} + \lambda_2 e_{t-1} + \pi_2 D_t + \mu_{2t}, \quad (4)$$

where e_{t-1} stands for the lagged error correction term derived from the long-run

cointegrating relationship (this term is not included if the variables are not cointegrated). An error correction model enables one to distinguish between long- and short-run Granger causality and to identify two different sources of causality. The long-run causality is performed by testing the significance of the coefficient on e_{t-1} while the short-run causality examines the significance of the lagged dynamic terms. For example, in (3), to test whether R_t does not cause E_t in the short-run, we test the null hypothesis $H_0 : \gamma_{11} = \dots = \gamma_{1p} = 0$ using the F -test. The rejection of this hypothesis suggests evidence for the tax-and-spend hypothesis. Finally, we can also test for the joint significance of both the lagged dynamic terms and e_{t-1} . The joint test does not distinguish between the short-run and long-run causality, but it indicates which variables bear the burden of short-run adjustment to re-establish long-run equilibrium following a shock to the system.

Evidence abounds in the literature (e.g., Toda and Phillips, 1994; Toda and Yamamoto, 1995; Zapata and Rambaldi, 1997) that the Granger causality tests still contain the possibility of incorrect inference due to the uncertainties present when pretesting unit root and cointegration in finite samples. Toda and Yamamoto (1995) propose the modified Wald test for testing Granger non-causality, allowing causal inference to be conducted in a VAR in which variables appear purely in their level form. This approach has the advantage of not requiring pre-testing for cointegration properties of the system and can be implemented irrespective of whether the underlying variables are stationary, integrated of different orders, cointegrated, or non-cointegrated. The Toda and Yamamoto (1995) procedure essentially involves the determination of the maximum likely order of integration (d_{\max}) of the series in the model and estimation of the following system:

$$E_t = \alpha_0 + \phi t + \eta D_t + \sum_{i=1}^{p^*} \alpha_{1i} E_{t-i} + \sum_{i=1}^{p^*} \alpha_{2i} R_{t-i} + u_{1t}, \quad (5)$$

$$R_t = \beta_0 + \phi' t + \eta' D_t + \sum_{i=1}^{p^*} \beta_{1i} E_{t-i} + \sum_{i=1}^{p^*} \beta_{2i} R_{t-i} + u_{2t}, \quad (6)$$

where $p^* = k + d_{\max}$. The above system of equations is estimated by seemingly unrelated regression, and a standard Wald test is applied to the first lagged k explanatory variables to make causal inference. The last lagged d_{\max} coefficients are ignored because the inclusion of extra lags is to ensure that the computed Wald-statistic has an asymptotic chi-square distribution with the degree of freedom equal to the number of constraints.

5. Empirical Results

5.1 Unit Root and Cointegration Tests Results

We begin our empirical analysis by testing for unit roots in the government revenue and expenditure to GDP ratios for each of the seven countries. This is to ensure that none of the variables is I(2), so as to avoid spurious results in the bounds

test for cointegration. The bounds test is based on the assumption that the variables are $I(0)$ or $I(1)$. We first apply the standard ADF and Phillips-Perron (PP) unit-root tests. The results (not reported here) indicate that the series under study are $I(1)$ non-stationary series in all countries except for Burkina Faso and Mali. For Burkina Faso, results point to the stationarity of the two series. For Mali, both the ADF and PP unit root tests suggest stationarity of the expenditure series and non-stationarity of the revenue series.

To account for structural changes, we employ the Zivot and Andrew (1992) one-break unit root test. The study involves a small sample size ($T = 28$). As such, the asymptotic critical values reported in Zivot and Andrews (1992) may differ substantially from the finite-sample critical values. This possibility is investigated by computing the finite-sample distribution of the test statistic using the simulation method suggested by Zivot and Andrews (1992). The test statistics together with the exact critical values are reported in Table 2. First, we can observe that the exact critical values computed from Monte Carlo techniques are larger in absolute value than the asymptotic critical values reported in Zivot and Andrews (1992). Second, except for Benin and Mali, the test results do not show evidence against the existence of a unit root even though structural changes are allowed, suggesting that both variables exhibit behavior consistent with unit root non-stationarity. In the cases of Benin and Mali, the revenue series is found to be stationary about a broken trend while the expenditure series is $I(1)$ non-stationary.

Table 2. Zivot and Andrew (1992) Unit Root Test Results

Country	Series	Model	k	T_b	ZA	Exact critical values for t_{α}	
						1%	5%
Benin	E_t	B	1	1998	-5.861	-6.587	-5.945
	R_t	C	4	1990	-7.422*	-7.326	-6.329
Burkina Faso	E_t	A	0	1988	-6.280	-8.382	-7.235
	R_t	B	0	1987	-6.160	-11.352	-9.339
Cote d'Ivoire	E_t	B	0	2001	-4.777	-7.902	-6.690
	R_t	A	1	1988	-3.714	-5.886	-4.998
Mali	E_t	A	0	1994	-4.605	-7.522	-6.522
	R_t	C	0	1994	-6.990*	-6.187	-5.436
Niger	E_t	A	0	1991	-3.785	-6.193	-4.932
	R_t	C	2	1991	-3.299	-6.507	-5.451
Senegal	E_t	B	3	2001	-4.062	-5.716	-4.827
	R_t	B	1	2001	-4.526	-6.248	-5.201
Togo	E_t	C	0	2000	-4.608	-6.277	-5.404
	R_t	C	0	1992	-4.390	-6.374	-5.440

Notes: The lag length k was determined using the general-to-specific approach proposed by Perron (1989). Working backwards from $k_{\max} = 4$, the optimal value of k was chosen such that its t -statistic was greater than 1.60 in absolute value. Critical values are calculated from Monte-Carlo simulation with 5,000 replications following Zivot and Andrews (1992). * denotes the rejection of the null hypothesis at the 5% significance level.

Given the results of the unit root tests, we next look at a long-run relationship between the two variables. As mentioned earlier, our test for cointegration is based on the bounds testing approach. An important innovation in our application of the bounds test is that we calculate critical values specific to our sample size via stochastic simulations using $T = 28$ and 40,000 replications for the F -statistic as described in Pesaran et al. (2001, p. 301). The results of the bounds test F -statistics together with the exact critical values are reported in Table 3.

Table 3. Bounds Test Results for Cointegration

Country	F_F	F_R	Cointegration?	
Benin	5.658 ^{**3}	7.163 ^{*4}	Yes	
Burkina Faso	26.950 ^{*4}	19.903 ^{*4}	Yes	
Cote d'Ivoire	8.579 ^{*3}	9.363 ^{*3}	Yes	
Mali	10.252 ^{*3}	6.367 ^{**3}	Yes	
Niger	9.604 ^{*4}	4.312 ⁴	Yes	
Senegal	5.832 ^{**3}	10.560 ^{*3}	Yes	
Togo	4.780	4.520	No	

	Exact critical values for F -statistics ($T = 28$)			
	5%		10%	
	I(0)	I(1)	I(0)	I(1)
Case III	5.456	6.372	4.342	5.120
Case IV	5.441	6.020	4.495	5.014

Notes: ³ and ⁴ denote models III and IV in Pesaran et al. (2001). Critical values for F -statistics are calculated using stochastic simulations specific to the sample size $T = 28$ based on 40,000 replications. * and ** denote statistical significance at the 5% and 10% levels, respectively.

An important observation at the outset is that our upper bound critical values for a sample size of 28 observations are higher than those reported in Pesaran et al. (2001). According to the F -statistics, we find evidence of a cointegration relationship between government revenue and expenditure in six countries. This implies that government expenditures and revenues do not move too far away from each other in the long run. Togo is the only country where there is no evidence of cointegration since the calculated F -statistics are less than the upper bound critical values. For Niger, evidence of cointegration finds support only when government expenditure serves as the response variable. In Benin, Burkina Faso, Côte d'Ivoire, Mali, and Senegal, government revenues and expenditures can be modelled as a long-run relationship regardless of the variable used as the response.

5.2 Long-Run Coefficients

Given that for six countries the bounds test indicates cointegration, we now estimate the long-run coefficients. We use three different methods, namely the ARDL model from Pesaran et al. (2001) bounds test equation, the dynamic ordinary least squares (DOLS) method proposed by Stock and Watson (1993), and the widely

used ordinary least squares approach. Our use of more than one technique is crucial, for the sign on the coefficients on government revenue and expenditure will help us to correctly and fully interpret the Granger causality results. The results on the long-run coefficients are reported in Table 4.

Table 4. Long-Run Estimates

Country	Response variable	ARDL	DOLS	OLS
Benin	E_t	1.210 (2.517)	1.158 (3.576)	0.661 (3.063)
	R_t	0.331 (1.729)	0.305 (2.118)	0.332 (2.579)
Burkina Faso	E_t	0.627 (7.287)	0.643 (3.098)	0.387 (4.481)
	R_t	1.081 (6.899)	0.835 (3.540)	0.793 (3.435)
Cote d'Ivoire	E_t	2.572 (3.208)	1.710 (5.352)	0.538 (3.663)
	R_t	0.247 (2.287)	0.240 (3.098)	0.282 (3.860)
Mali	E_t	0.340 (3.407)	0.315 (4.041)	0.326 (4.555)
	R_t	2.664 (2.715)	1.756 (3.707)	1.388 (4.555)
Niger	E_t	0.480 (2.494)	0.566 (4.047)	0.407 (3.499)
Senegal	E_t	1.793 (2.541)	3.411 (6.495)	1.879 (5.226)
	R_t	0.256 (4.730)	0.252 (4.258)	0.293 (6.257)

Notes: DOLS is the OLS of $y_t = \alpha + \beta x_t + \sum_{i=-m}^m \phi_i \Delta x_{t-i} + u_t$; m is the length of lead and lag of the regressor Δx_t . Equations were estimated including up to $m = \pm 3$ leads and lags; insignificant lags and leads were dropped. Figures in parenthesis are t -statistics.

As can be seen from Table 4, all variables enter the long-run equation significantly at the 5% level with positive signs. Thus, revenues and expenditures are positively related in the long-run. In six countries, government revenue has a statistically significant positive effect on government expenditure. Except Niger and Togo, results also show that an increase in government expenditure has a statistically significant and positive effect on government revenue. This implies that the revenue and spending decisions are intertwined in the same direction, that is, higher revenue leads to higher spending and vice versa.

5.3 Causality Test Results and Discussion

Given the results from the cointegration tests, we conduct the Granger causality test within the error correction model for the countries for which the two variables show evidence of cointegration. Otherwise, we perform the standard VAR approach using variables in first differences. Results are displayed in Table 5. Interestingly, the error correction coefficient has the expected negative sign and reinforces the finding of a long-run relationship between the variables in the model.

Table 5. Results of Granger Causality Tests

Country	$H_0 : R_t \rightarrow E_t$			$H_0 : E_t \rightarrow R_t$		
	Source of causation (response variable)					
	Short run	Long run		Short run	Long run	
	ΔR_t	e_{t-1} (t)	ΔR_t and e_{t-1}	ΔE_t	e_{t-1} (t)	ΔE_t and e_{t-1}
Benin	0.135 (0.716)	-0.428* (0.009)	10.397* (0.005)	0.000 (0.999)	-0.584 (0.000)	10.471 (0.000)
Burkina Faso	13.678* (0.000)	-1.611* (0.000)	11.902* (0.000)	1.096 (0.309)	-0.759* (0.001)	9.238* (0.002)
Cote d'Ivoire	3.164** (0.067)	-0.295* (0.001)	6.025** (0.005)	8.228* (0.009)	-0.406* (0.016)	8.057* (0.002)
Mali	29.164* (0.000)	-0.257** (0.085)	25.407* (0.000)	5.736* (0.027)	-0.276** (0.058)	3.537** (0.051)
Niger	5.660* (0.012)	-1.001* (0.000)	12.828* (0.000)	0.323 (0.574)	—	—
Senegal	0.964 (0.337)	-0.387* (0.003)	5.526* (0.011)	9.583* (0.005)	-1.100* (0.000)	15.176* (0.000)
Togo	0.004 (0.947)	—	—	4.178** (0.057)	—	—

Notes: The lagged e_{t-1} is the error-correction term. In short-run dynamics, the values in parentheses are p -values for the test that there is no Granger causal relationship between the two variables. The coefficients of e_{t-1} are tested using t -statistics to test whether the coefficient is zero. * and ** indicate significance at the 5% and 10% levels, respectively.

Beginning with short-run causality, the F -statistics show a bidirectional causality between revenue and expenditure for Côte d'Ivoire and Mali. Burkina Faso and Niger show evidence of causality running from revenue to expenditure. Thus, growth in government expenditures in Burkina Faso and Niger has been influenced greatly by the availability of funds to finance these expenditures. Governments first mobilize the necessary revenues to make up their spending later. Therefore, the persistent budget deficits in these countries are the outcome of increased government spending led by revenues. Under this scheme, raising taxes or revenues to deal with the problem of public deficits would not be completely effective.

Governments should try to control spending in order to restore fiscal discipline and decrease the size of their public deficits. Senegal and Togo exhibit evidence supporting the spend-and-tax paradigm in the short-run; that is, governments of these countries first engage in spending and then raise taxes to pay for this spending. This fiscal policy is likely to be perceived negatively by potential investors and to encourage capital flight for fear of paying higher taxes.

With respect to the long-run causality, there is strong evidence of bidirectional causality between revenues and spending in Benin, Burkina Faso, Côte d'Ivoire, Mali, and Senegal. The results for Niger exhibit unidirectional Granger-causality running from revenue to expenditure. Concerning the issue of burden of adjustment towards the long-run equilibrium in response to a short-run deviation, results show that both revenue and expenditure are important in Benin, Burkina Faso, Côte d'Ivoire, Mali, and Senegal, whereas in Niger it is mainly government expenditure that takes the brunt of the shock to the system to restore the long-run equilibrium. Thus, any movement of revenues away from their previous long-run equilibrium creates short-run deviations which are corrected through changes in spending.

To complement these findings, causality tests were also carried out using the Toda and Yamamoto (1995) procedure. The results reported in Table 6 indicate bidirectional causality for Burkina Faso and Niger. There is evidence of causality running from revenue to expenditure for Benin and Mali, while for Côte d'Ivoire and Senegal causality is running in the reverse direction. For Togo, there is no causal relationship between expenditure and revenue.

Table 6. Results of Toda and Yamamoto (1995) Causality Tests

Country	k	d_{\max}	R causes E		E causes R		Causality
			Wald	p -value	Wald	p -value	
Benin	1	1	4.103*	0.043	1.431	0.231	$R \rightarrow E$
Burkina Faso	4	1	46.799*	0.000	21.348*	0.000	$R \leftrightarrow E$
Cote d'Ivoire	2	1	4.374	0.112	8.541*	0.014	$R \leftarrow E$
Mali	3	1	13.700*	0.003	4.476	0.214	$R \rightarrow E$
Niger	3	1	7.564**	0.055	13.119*	0.004	$R \leftrightarrow E$
Senegal	2	1	3.670	0.159	13.580*	0.001	$R \leftarrow E$
Togo	2	1	0.026	0.986	3.128	0.201	—

Notes: k is the lag length of the level VAR and d_{\max} is the maximal order of integration of the series in the system. Lag length selection was based on AIC. * and ** denote statistical significance at the 5% and 10% levels, respectively. $y \rightarrow x$ means that y Granger-causes x .

In light of these findings, we can conclude that Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, and Senegal follow fiscal synchronization schemes. This result is found to hold both in the short-run and the long-run for Côte d'Ivoire and Mali, while it holds only in the long-run for Benin, Burkina Faso, Niger, and Senegal. This outcome suggests that fiscal policymakers in these countries do not make spending decisions in isolation from revenues decisions. They make simultaneous revenue and spending decisions while designing their budget. The

joint determination of revenues and expenditures is appealing as long as it effectively restrains the budget deficit. To break away from this strategy, efforts to enhance sources of revenue should be accompanied with reductions in spending.

6. Conclusion

In this study we investigate which expenditure or revenue items may be addressed to achieve permanent reductions in budget deficits. We examine this issue for seven UEMOA member countries which face big challenges to consolidate their budgetary situations in accordance with the objectives of the pact of convergence adopted in 1994. Our empirical analysis was conducted with data covering the period 1980 to 2007 in the framework of the Pesaran et al. (2001) bounds test and the Toda and Yamamoto (1995) causality analysis approach.

The main findings of our analysis can be summarised as follows. First, we found evidence of cointegration relationships between government revenue and expenditure in six of the seven countries following the bounds test results. Results based on the long-run estimates showed that the two fiscal variables are positively related in the long-run. Second, upon investigating the direction of causality, the empirical findings show clear evidence supporting the tax-and-spend hypothesis for Burkina Faso and Niger and the spend-and-tax hypothesis for Senegal and Togo. The fiscal synchronization hypothesis found support in the case of Côte d'Ivoire and Mali.

In the long-run, we find evidence of bidirectional causality between government revenue and government expenditure in all countries except Togo. This empirical evidence implies that the government in each of these six countries simultaneously chooses the desired package of expenditures along with the revenues necessary to finance the spending. This means that higher revenue leads to higher spending and vice versa. It follows that any attempt to reduce deficits by only raising revenues without paying attention to the level of spending would generate fiscal imbalances. However, given that for Burkina Faso, Mali, and Niger the elasticity on revenue is less than one, it follows that to attack the problem of budget deficits the governments of each of these countries should look for ways to raise revenues. Meanwhile, policymakers in Benin, Côte d'Ivoire, and Senegal should try to control their public expenditures. Results for Togo suggest that government should control public spending and try to raise revenues simultaneously.

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