Full Length Research Paper

Budget balance through revenue or spending adjustments? An econometric analysis of the Ivorian budgetary process, 1960 - 2005

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This paper uses annual data for the period of 1960 - 2005 to investigate the causal relationship between government revenues and spending in Côte d'Ivoire. The empirical findings reveal a positive long-run unidirectional causality running from revenues to expenditures. This implies that achieving fiscal consolidation should focus more on reducing government spending rather than raising revenues.

Key words: Government expenditures, government revenues, cointegration, causality, Côte d'Ivoire.

INTRODUCTION

In the field of public finance, budget deficits have been a subject of an intensely debated issue around the world. At the heart of this debate arise two questions: are deficits bad for growth? If so, how to remedy to persistent budget deficits? These two questions have contributed to a growing body of literature and remain unresolved issues theoretically as well as empirically (A survey of the literature is provided by Hemming et al. (2002) and Briotti (2005). Three major opposite views can be distinguished. Keynesian economics suggests that budget deficit has, by the working of the multiplier, a positive effect on the macroeconomic activity. Recently, within the framework of endogenous growth models, budget deficits can impact long-term growth positively 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). Contrary to this positive view, neoclassical economists argue that budget deficits have detrimental effects on long-term economic growth by competing with private sector. Finally, the Ricardian equivalence approach demonstrated by Barro (1974) argues that variation in budget deficit is neutral to economic growth.

These contrasting views have made less attractive the use of public expenditures for stimulating economic activity and created a common fear of deficits. Today, the conventional

conventional wisdom seems to be that deficits are not desirable because of their adverse macroeconomic effects. This belief serves as the major driving force behind a country's pursuit of "prudent fiscal policies" aimed at reducing the deficits. This was evident in the International Monetary Fund's prescriptions for the developing countries during the 1980s and 1990s. In Europe, the Maastricht Treaty envisages explicit targets for public debt and deficits. In West Africa, criteria have been introduced to achieve macroeconomic convergence. Among these criteria budget deficit must not exceed zero percent of nominal GDP.

Budget deficits reduction could be achieved through either spending cuts or raising taxes. However, one cannot be sure which of these options will lower deficits for long time. To know which is likely to be the most efficient strategy to achieve permanent reductions in budget deficits, the analysis of the direction of causality between public revenues and expenditures can offer a relevant guideline. It helps us to understand the dynamics behind the formation and the persistence of budget deficits and how to deal with them. Despite the burgeoning empirical literature on this topic, there are not many time series studies that have been carried out for Sub-Saharan African countries. This study seeks to contribute to the discussion on public finances by examining the Ivorian case over the period 1960 - 2005 in order to assess the validity of the claims that raising taxes will unambiguously lower deficits and provide an insight to the strategy that could be adopted towards greater fiscal discipline. Our attention for Côte d'Ivoire is motivated by the fact that this country faces with the vicious circle of

vicious circle of escalating external debt and persistent budget deficits. After the signing in 1994 of the treaty of convergence and stability (This treaty is very similar to that of Maastricht in Europe) within the West African Economic and Monetary Union, Ivorian authorities are under pressure to achieve fiscal discipline in the interest of macroeconomic stability within the union. Despite some efforts of budgetary consolidation, Côte d'Ivoire shows deficits in its finance. Eliminating the budget deficit in Côte d'Ivoire is essential to ensure the availability of domestic saving for private investment. This issue is also important because of the macroeconomic consequences of fiscal deficits and the economic wisdom that public debt results from a need to finance budget deficits.

Apart from filling the gap in the literature, our empirical analysis uses recent developments in modelling long-run relationships which remedy some of the methodological issues ignored in most previous empirical studies. First, we employ the Zivot and Andrew (1992) unit root test to investigate the stationarity of the time series before undertaking the multivariate testing for cointegration proposed by Johansen (1988) and the bounds test approach due to 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 computed exact critical values specific to our sample size. By computing finite critical values, we ensure that our inferences regarding stationarity and cointegration are correct. Second, recognizing that cointegration does not indicate the direction of Granger-causality we use a vector error correction model as well as the Granger causality test suggested by Toda and Yamamoto (1995) to uncover the direction of Granger-causality between revenue and spending using GDP as control variable. Finally, we use variance decompositions analysis to provide an indication of the relative contribution of each of the variables in explaining the variance of the others.

The rest of this article is organized as follows. Section 2 discusses the theoretical and empirical literature regarding the causal link between government revenues and expenditures. Section 3 presents the data and the econometric methodology and discusses the results, and section 4 concludes.

THEORETICAL AND EMPIRICAL LITERATURE REVIEW

The causal relationship between government revenues and spending has motivated a vast literature both at the theoretical and empirical level. An understanding of this causal link might contribute to the formulation of specific policies with regard to deficits management for countries running large fiscal imbalances. The theoretical underpinnings of the causal link between government revenues and expenditures are diverse as they are associated with different schools of economic thought.

Four main hypotheses have been advanced to characterize the causal relation between the two fiscal variables. The first hypothesis is known as the *tax-and-spend* hypothesis. It postulates a causal relation running from revenue to spending. This implies that spending adjust in response to changes in revenues. This hypothesis was initially formulated by Friedman (1978) and Buchanan and Wagner (1978), but these authors differed in their perspectives. While Friedman (1978) argues that the causal relationship is working in a positive direction, Buchanan and Wagner (1978) postulate that the causal relationship is negative. According to Friedman raising taxes will lead to more government spending and hence to fiscal imbalances. Cutting taxes is, therefore, the appropriate remedy to budget deficits. On the contrary, Buchanan and Wagner (1978) propose an increase in taxes as remedy for deficit budgets. 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.

The second view relies on the reverse causal relation, suggesting that governments spend first and then increase tax revenues as necessary to finance expenditures. This view was supported by Peacock and Wiseman (1979). The *spend-and-tax* hypothesis is valid when spending hikes created by some special events such as natural, economic or political crises compel governments to increase taxes. As higher spending now will lead to higher tax later, this hypothesis suggests that spending cuts are the desired solution to reducing budget deficits. This hypothesis is also consistent with Barro's (1979) view that today's deficit-financed spending means increased taxes liabilities in the future in the context of the Ricardian equivalence proposition.

The third hypothesis known as fiscal synchronization suggests bidirectional causation between revenues and spending (Musgrave, 1966; Meltzer and Richard, 1981). It postulates that governments take decisions about revenues and expenditures simultaneously by analyzing costs and benefits of alternative programs. The fourth one emphasizes the possibility of independence determination of revenues and expenditures due to institutional separation of allocation and taxation functions of government (Buchanan and Wagner, 1978; Hoover and Sheffrin, 1992). Therefore, this view precludes unidirectional causation from revenue to spending or from spending to revenue.

Many empirical studies have used Granger causality analysis to investigate the empirical relevance of the above theoretical hypothesis. The empirical findings vary across countries, methodologies, public variables involved as well as across time periods within the same same country. Evidence supporting the *tax-and-spend* hypothesis has been found by Manage and Marlow

(1986), Marlow and Manage (1987) and Bohn (1991) for the USA. Empirical works supporting the tax-and-spend hypothesis also include Owoye (1995); Ewing and Payne (1998); Park (1998); Chang et al. (2002); Chang and Ho (2002a); Fuess et al. (2003) and Baghestani and AbuAl-Foul (2004).

Studies providing support to the *spend-and-tax* hypothesis include Anderson et al. (1986), von Furstenberg et al. (1986) and Ram (1988a) for the USA; Hondroyiannis and Papapetrou (1996) and Vamvoukas (1997) for Greece; and Dhanasekaran (2001) for India. Evidence supporting the fiscal synchronization hypothesis was reported by Miller and Russek (1990) for the USA; Bath et al. (1993) for India; Hasan and Lincoln (1997) for the UK; Cheng (1999) for Chile, Panama, Brazil, and Peru; Li (2001) and Chang and Ho (2002b) for China. Ram (1988b) provides empirical evidence for the independence hypothesis for India, Panama, Paraguay, and Sri Lanka. Hoover and Sheffrin (1992) find evidence which is consistent with this hypothesis for the US economy. Baghestani and McNown (1994) conclude that neither the *tax-and-spend* nor the *spend-and-tax* hypothesis accounts budgetary expansion in the US. Instead, they show that both the expansion in revenue and spending is determined by the long-run economic growth. On nine Asian countries, Narayan (2005) concludes in favor of the independence hypothesis for India, Malaysia, Pakistan, Thailand and Philippines.

As can be seen from this literature, the evidence regarding the causal relationship between public revenues and spending is empirically mixed. The absence of unanimity in empirical works may be due to differences in terms of countries, time periods and model specification. On the other hand, several methodological issues have not been appropriately addressed in many of the studies mentioned above and may have contributed to inconsistent empirical inferences. First, the issue of stationarity of the series is not always examined and authors directly consider 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 and Ram, 1988a). It is well known that the presence of integrated variables invalidates the blind application of ordinary least squares (Granger and Newbold, 1974). When stationary tests are carried out, the issue of structural breaks is not taken into account. It is also well known that structural breaks can bias the unit root tests and make the results unreliable (Perron, 1989). Second, some of these studies used short data span and failed to derive robust inference regarding the causality between revenues and spending. Third, since most of the previous studies employed a bivariate framework, they may suffer from the ever-present econometric problem of the third missing variable. Omission or exclusion of relevant variables may lead to incorrectly detecting directions of causality or even uncovering causality when it does not really exist, thus yielding spurious results (Lutkepohl, 1982).

By adopting a multivariate model, it may introduce change in the causal field. An illustrative case is the study by Joulfaian and Mookerjee (1991). They find that spending causes revenue in a bivariate setting. However, when the cyclical position of the economy and inflation are controlled for, result is independence. Blackley's (1986) results again demonstrate the sensitivity of causality results to the inclusion of macroeconomic controls, and they leave open the possibility that GNP changes are the driving force behind budgetary changes). As suggested by Park (1998) it would be interesting to include a control variable such as GDP in the model and perform causality inferences.

Taking into consideration these deficiencies, this study uses recent developments in time series analysis to investigate the causal relationship between revenues and expenditures in Côte d'Ivoire. After a brief description of data in the next section, we explain our econometric methodology and discuss the results.

DATA AND ECONOMETRIC ANALYSIS

Data description

This study uses annual data on total government revenues and expenditures over the period 1960 - 2005. Nominal data are transformed into real variables using GDP deflator. Unlike most of previous studies, our analysis is carried out in a multivariate framework using real Gross Domestic Product (GDP) as a control variable. This mediating variable is related meaningfully to public finance behaviour and mitigates the possibility of distorting the causality inferences due to the omission of relevant variables. Moreover, all the data series were transformed into logarithmic form. Nominal data on revenues and expenditures are from the National Institute of Statistic and the statistics yearbook 2006 published by the Central Bank of West African States (BCEAO, 2006). Data for real GDP and GDP deflator are obtained from the 2007 world development indicators of the World Bank. Throughout this study, y_t, R_t and E_t denote the logarithm of real GDP, real revenues, and real spending, respectively. Before presenting the empirical methodology, a few words about the data and the inclusion of real GDP are in order. Theories of the behaviour of expenditure and revenues point to GDP as a relevant variable to be included in such analysis. "Wagner's Law" links the level of the public expenditure to the degree of economic development, which is approximated by real income. Moreover, revenues and spending respond automatically to the economic cycle as automatic stabilisers.

As can be seen from Figure 1, government revenues and expenditures have been oscillating during the period 1960 to 2005. Upon closer examination, Figure 1 clearly shows that Côte d'Ivoire had a roughly balanced budget
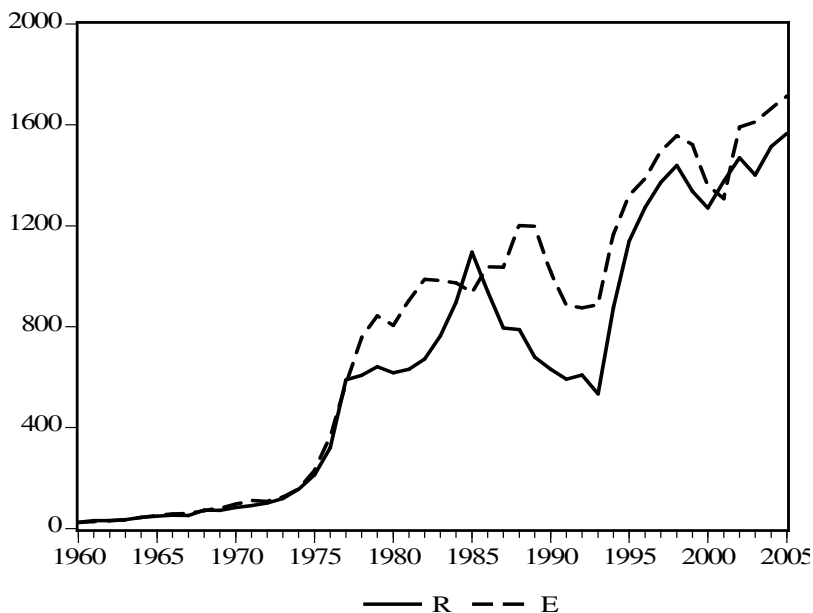
Figure 1. Government revenue (R) and expenditure (E) over time (1960 - 2005).

during the period 1960 to 1977. The government expenditures increased significantly in 1978 exceeding the revenues and the gap between revenues and expenditures, which reflects the extent of saving or disaving of the government has widened and has tended to persist since 1978.

Given the trends depicted in Figure 1, we cannot ascertain whether the government has been using a policy of tax-and-spend or spend-and-tax rule or whether spend and tax decision was jointly determined. The correlation between the expenditure and revenue indicates that the two fiscal variables are positively related. However, correlation does not give any information regarding the direction of causality. The temporal causal relationship between government expenditures and receipts could result in any of the four aforementioned hypotheses.

Unit root test

Seminal work by Granger and Newbold (1974) casts doubt on empirical evidence based on regression analysis using nonstationary variables. Thus, to avoid the problem of the spurious regression, we begin our empirical analysis by performing unit roots tests to investigate the order of integration of each variable. Prior to Perron (1989), most empirical studies used the standard Augmented Dickey-Fuller and Phillip-Perron unit root tests. The results of these tests suggest that the series of real GDP is stationary, while revenue and expenditure are (1) processes. A problem with these tests is that in presence of structural changes they fail to

reject the null hypothesis of a unit root (Perron, 1989). To check the robustness of the results obtained from the ADF and PP tests, we apply the one-break unit root test proposed by Zivot and Andrews (1992) which identifies possible periods of change in the time series based upon a series of dummy variable constructs. This test has the advantage of not requiring the *a priori* specification of the possible timing of structural breaks. It allows the break date to be endogenously determined within the model. The Zivot and Andrews test for a time series H_t involves running the following regression:

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

(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; $DT_t = t - T_b$ 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. A test of the unit root hypothesis has the null $\alpha = 0$. The alternative hypothesis is that the series is trend stationary with one structural break. The searching for breakpoint (T_b) is performed by running a set of regressions and by choosing the breakpoint for which the *t*-statistic t_α for α is minimized.

Whilst Zivot and Andrews report asymptotic critical values for their tests, they warm that with small sample sizes the distribution of the test statistics can deviate substantially from this asymptotic distribution. To

Table 1. Zivot-Andrews unit root test for one break.

Series	Model	k	T_b	ZA	Exact critical values for t_α	
					1%	5%
Y_t	C	3	1975	-4.929	-5.824	-5.076
R_t	C	2	1974	-5.690	-5.987	-5.723
E_t	C	1	1974	-6.014	-6.220	-6.113

Note: The lag length k is selected using the general-to-specific approach proposed by Perron (1989), that is we set $k_{max} = 6$ and use a critical value of 1.60 to determine the significance of the t-statistic on the last lag. Critical values are calculated from Monte-Carlo simulation with 5000 replications following Zivot and Andrews (1992).

Table 2. Results of the Johansen-Juselius tests for cointegration.

H_0	H_1	Statistic	5% unadjusted critical value	Adjusted 5% critical value
Maximum Eigen value test				
$r = 0$	$r = 1$	25.294*	20.97	22.50
$r \leq 1$	$r = 2$	6.172	14.07	15.09
$r \leq 2$	$r = 3$	2.004	3.76	4.03
Trace test				
$r = 0$	$r \geq 1$	33.471*	29.68	31.85
$r \leq 1$	$r \geq 2$	8.177	15.41	16.53
$r \leq 2$	$r = 3$	2.004	3.76	4.03

Notes: r indicates the number of cointegrating vectors. Criterion (AIC) was used to select the number of lags required in the cointegrating test. * indicates the rejection of the null hypothesis of no-cointegration at the 5% level. Adjusted critical values are obtained using the small sample correction factor suggested by Cheung and Lai (1993). Their finite sample correction multiplies the Johansen test critical values by the scale factor of T/(T-pk), where T is the sample size, p is the number of variables, and k is the lag length for the VEC model.

circumvent this problem, they suggest a Monte Carlo method to calculate exact critical values. Following this methodology, we estimate an *ARMA (p,q)* model for each ΔH_t, with p and q selected according to the Schwartz Bayesian Criterion (SBC). The implied ARMA process is then used as the data generating process for generation of 5000 sample specific series under the null hypothesis of a unit root with no structural breaks. The tests statistics together with the exact critical values are reported in Table 1. Clearly, the tests results do not show evidence against the existence of a unit root even when breaks are allowed, suggesting that all the variables exhibit behaviour consistent with unit root non-stationarity.

Cointegration analysis

Given the outcome of unit root tests, we next look for cointegration between the three variables. The residual-based test of Engle and Granger (1987) and the system-based test of Johansen (1988) are two widely used econometric tools for cointegration analysis. Unlike the Engle-Granger procedure which is sensitive to the choice of the dependent variable in the cointegrating regression, Johansen test assumes all variables to be endogenous, and when it comes to extracting the residual from the cointegrating vector, it is insensitive to the variable being normalized. We apply the Johansen test by assuming that there is a deterministic trend in the variables and including a constant term in both the cointegrating equation and the VAR. We also include two dummy variables to control for shifts. Cheung and Lai (1993) demonstrated that the asymptotic critical values of the Johansen test can be biased toward finding cointegration more often in a finite sample. Therefore, they suggested that the asymptotic critical values should be increased, given the sample size and the number of lags used. In so doing, the over-rejection of the null when the hypothesis is true is corrected. We construct the finite-sample critical values for Johansen cointegration test based on the method proposed by Cheung and Lai (1993). According to Table 2, we can reject the null hypothesis of non-

Table 3. Bounds test results.

Dependent variable	F_{III}	F_{II}	Cointegration?
E_t	7.296*	6.111*	Yes
R_t	4.292	3.300	No
Y_t	3.121	3.447	No

Exact critical value bounds for F-statistics

Statistic	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F_{III}	5.780	7.087	4.071	5.197	3.341	4.331
F_{II}	4.650	5.770	3.374	4.212	2.808	3.555

Notes: F_{III} and F_{II} are the F-statistics for cases III and II, respectively (Pesaran et al., 2001). Critical values for F-statistics are calculated using stochastic simulations specific to the sample size T = 46 based on 40 000 replications. *denotes the rejection of the null hypothesis at the 5% significance level.

cointegration based on both trace and maximum eigenvalue statistics.

To determine whether the three variables belong to the cointegrating space, we apply the log-likelihood ratio (LR) test for the exclusion of each variable as discussed in Johansen and Juselius (1990). The test results reject the relationship significantly and, therefore, cannot be ruled out from the analysis.

The Johansen test requires that all the system's variables are integrated of the same order (I(1)). As long as there exist both I(1) and I(0) variables, this test will produce biased results because the probability of finding cointegration increases with the presence of I(0) variables. As a cross check, we also apply the bounds testing approach to cointegration proposed by Pesaran et al. (2001). The main advantage of this approach is that it can be applied irrespective of whether the regressors are purely I(0) or I(1). 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. The bounds test for cointegration involves estimating by ordinary least square the following unrestricted error correction model considering each variable in turn as a dependent variable:

$$\Delta E_t = \alpha + \beta D_t + \phi_1 E_{t-1} + \phi_2 R_{t-1} + \phi_3 y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta E_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta R_{t-i} + \sum_{i=0}^{p} \zeta_i \Delta y_{t-i} + e_{1t}$$

(2)

where $D_t = (D_{1t}, D_{2t})$ denotes a vector of dummy variables capturing the periods of crisis from 1978, post-devaluation and adoption of the convergence criteria in 1994: $D_{1t} = 1$ for $t < 1977$ and zero otherwise;

$D_{2t} = 1$ for $t < 1993$ and zero otherwise.

The bounds test for cointegration is conducted by restricting the lagged levels variables, E_{t-1}, R_{t-1} and y_{t-1} in the Equation (2). Therefore, the null hypothesis of no cointegrating relation is $H_0 : \phi_1 = \phi_2 = \phi_3 = 0$. This hypothesis is tested by the mean of the F-test. However, the F-statistic has an asymptotic non-standard distribution. Pesaran et al. (2001) discussed five cases with different restrictions on the trends and intercepts. For each case, they provided two asymptotic critical values. The lower critical value assumes that all the regressors are I(0), while the upper critical value assumes that they are I(1). If the computed F-statistic is greater than the upper critical value, the null of no cointegration is rejected. Conversely, if the calculated F-statistic is below the lower critical value, then the null hypothesis of no cointegration cannot be rejected. Lastly, if the F-statistic is between the lower and upper critical values, the test is inconclusive unless we know the order of integration of the underlying variables. Pesaran et al. (2001) reported critical values for the bounds F-test for 1000 observations. However, because our study involves relatively small sample size (46 observations), we compute critical value bounds specific to our sample size. We use stochastic simulations for T = 46 and 40 000 replications for F-statistic (For details on the methodology for computing the finite critical values, see Pesaran et al. (2001: 301). Table 3 reports the results of the bounds test F-statistics as well as the exact critical values when each variable is considered as a dependent variable. This table shows that the null hypothesis of no cointegration can be rejected at the 5% significance level only when E_t serves as the dependent variable. Thus, there exits a long-run relationship between the three variables when the regressions are

Table 4. Long-run estimates.

Method	R_t	y_t
OLS	0.505* (5.124)	0.704* (5.170)
DOLS	0.681* (3.745)	0.523* (2.314)
Johansen	0.402* (2.210)	0.756* (3.443)
ARDL	0.414* (2.165)	0.798* (3.330)

Notes: E_t is the dependent variable; DOLS is the OLS of

$$E_t = \alpha + \beta R_t + \gamma y_t + \sum_{i=-2}^{2} a_i \Delta R_{t-i} + \sum_{i=-2}^{2} b_i \Delta y_{t-i} + u_t .$$ In the ARDL

method, the long-run coefficients are computed as the coefficients on y_{t-1} and R_{t-1} divided by the coefficient on E_{t-1} and then multiplied by a negative sign (Bardsen, 1989). Figures in parenthesis are t-statistics. * denotes statistical significance at the 5 % level.

normalized on E_t.

On the basis of both Johansen procedure and Pesaran *et al.* bounds test, one can safely conclude that there is a long-run relationship between government revenues, expenditures and GDP. This implies that real government expenditures, real revenues and real GDP have been moving together over the period 1960 to 2005.

Long-run coefficients

Owing to the fact a long-run relationship exists between the series, we proceed now to provide estimates of the long-run coefficients. We estimate the coefficients using four different techniques, namely the ordinary least squares approach from Engle and Granger's two-step method, the dynamic ordinary least squares (DOLS) estimator suggested by Stock and Watson (1993), the VECM approach of Johansen and Juselius (1990) and the autoregressive distributed lag (ARDL) model from Pesaran et al. (2001) bounds test equation. Our use of more than one technique is crucial for the sign on the coefficient on government revenue will enable us to correctly and fully interpret the Granger causality results. The results on the long-run coefficients are reported in 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. This suggests that an increase in government revenues has a positive effect on government expenditures. On the other hand, the results also show that GDP affects positively public spending, associating the level of public spending to the degree of economic development. Although cointegration suggests the presence of Granger causality of some form between the variables, it does not provide information on the direction of causal relationships.

Granger-causality analysis

When cointegration exists among the variables, the causal relationship should be modelled within a dynamic error correction model (Engle and Granger, 1987). The main purpose of our study is to establish the causal linkages between government revenues and government expenditures with GDP as a control variable. Accordingly, the Granger causality tests within the VECM will be based on the following regressions:

$$\Delta E_t = \alpha_1 + \sum_{i=1}^{p}\beta_{1i}\Delta E_{t-i} + \sum_{i=1}^{p}\gamma_{1i}\Delta R_{t-i} + \sum_{i=1}^{p}\phi_{1i}\Delta y_{t-i} + \lambda_1 e_{t-1} + \pi_1 D_t + \mu_{1t}$$

(3)

$$\Delta R_t = \alpha_2 + \sum_{i=1}^{p}\beta_{2i}\Delta E_{t-i} + \sum_{i=1}^{p}\gamma_{2i}\Delta R_{t-i} + \sum_{i=1}^{p}\phi_{2i}\Delta y_{t-i} + \lambda_2 e_{t-1} + \pi_2 D_t + \mu_{2t}$$

(4)

Where e_{t-1} stands for the lagged error correction term

Table 5. Results of granger causality tests (F-statistics).

Dependent variable	Source of causation (independent variable)						
	Short-run				**Lung-run**		
	ΔE_t	ΔR_t	Δy_t	e_{t-1}	$\Delta E \, / \, e_{t-1}$	$\Delta R_t \, / \, e_{t-1}$	$\Delta y_t \, / \, e_{t-1}$
				(t-statistics)			
ΔE_t	-	0.580	0.147	-0.373[*]	-	4.508[*]	3.287[*]
		(0.451)	(0.703)	(-2.543)		(0.017)	(0.048)
ΔR_t	1.089	-	0.120	0.256	1.596	-	1.495
	(0.303)		(0.730)	(1.686)	(0.216)		(0.237)

Notes: * denotes significant at 5% level. Figures in brackets refer to marginal significance values. Figures beneath the column e_{t-1} refer to coefficients of the lagged error correction term derived from Johansen test, and those in parenthesis are the t-statistics testing the null that the coefficient of the lagged error correction term equal zero.

derived from the long-run cointegrating relationship. An error correction model enables one to distinguish between long-run and short-run Granger causality, and identify two different sources of causality. The short-run dynamics are captured by the individual coefficients of the lagged differenced terms. The statistical significance of the coefficients of each explanatory variable are used to test for short-run Granger-causality while the significance of the coefficients of e_{t-1} gives information about long-run causality. It is also desirable to test whether the two sources of causation are jointly significant.

To complement the causality analysis, we also implement the Granger–causality test proposed by Toda and Yamamoto (1995) as an alternative approach to test for long-run causality. 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, or integrated of different orders, cointegrated or non-cointegrated. The Toda and Yamamoto procedure essentially involves the determination of the maximum likely order of integration (d_{max}) of the series in the model and the estimation of the following VAR:

$$Z_t = \Phi_0 + \sum_{i=1}^{p^*} \Phi_i Z_{t-i} + u_t \qquad (5)$$

Where $Z_t = (E_t, R_t, y_t)'$, $p^* = k + d_{max}$ and Φ_i are (3×3) coefficient matrices. Once this augmented level VAR is estimated, 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.

The results of the Granger causality tests reported in Table 5 indicate that there is no short-run Granger causality between revenue and spending. The error correction coefficient has the expected negative sign and is highly significant in the equation concerning government expenditures E_t. This reinforces the finding of a long-run relationship among the variables. The economic interpretation of these results is that, over time, whenever there is a deviation from the equilibrium relationship, as measured by lagged error correction term e_{t-1}, it is mainly changes in expenditure that adjust to clear the disequilibrium. In other words, it is government expenditure that bears the brunt of short-run adjustment to restore the long-run relationship.

Our findings also indicate that growth exerts a positive and unidirectional causal effect on spending in the long-run. Such evidence is further supported by the results of the strong exogeneity tests which show the overall causality for both short- and long-run. The expansion in expenditures is determined by long-run economic growth. The results of Toda and Yamamoto procedure reported in Table 6 tend to further confirm that there is a positive long-run unidirectional causality running from government revenue to spending. Evidence suggests that spending does not cause revenue.

In light of these findings we can conclude that there is a unidirectional causal link running from revenue to spending, which lends support to the *tax-and-spend* hypothesis for Côte d'Ivoire. This implies that growth in government expenditure in Côte d'Ivoire has been influenced greatly by the availability of funds to finance this spending. Under this scheme, raising taxes or revenues to deal with the problem of persistent budget deficits would not be completely effective since higher revenues would lead to higher government spending. The government should try to control spending in order to

Table 6. Results of Toda and Yamamoto Granger non-causality tests.

		R Causes E			E Causes R			
k	d_{max}	Wald Stat	p-value	Sum of lagged coefficient	Wald Stat	p-value	Sum of lagged coefficient	Causality
1	1	4.740[*]	0.029	0.341	0.016	0.898	-0.024	R→E
2	1	6.806[*]	0.033	0.308	3.501	0.173	0.335	R→E

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. The sum of lagged coefficients represents the summation of the lags excluding the lagged coefficient with one order. Asterisks * denotes statistical significance at the 5% level.

Table 7. Results of variance decompositions.

Forecast period	Percentage of forecast variance of ΔE due to innovations in			Percentage of forecast variance of ΔR due to innovations in		
	ΔE	ΔR	Δy	ΔE	ΔR	Δy
2	36.408	22.073	41.518	0.071	84.518	15.409
4	26.222	29.729	44.048	3.687	81.448	14.864
6	21.622	32.884	45.492	6.524	78.005	15.469
8	18.931	34.637	46.430	7.564	76.717	15.718
10	17.108	35.833	47.057	8.086	76.080	15.832
12	15.779	36.709	47.511	8.428	75.664	15.906
14	14.771	37.372	47.855	8.668	75.371	15.959

Notes: Variance decompositions are computed with the Choleski ordering (y, R, E).

restore fiscal discipline and control the size of its public deficit in the long-term.

Variances decomposition analysis

The Granger causality tests conducted above indicate only the existence of causality. They do not, however, provide any indication on how important is the causal impact that revenue or GDP has on spending. The variance decomposition decomposes the total variance of the forecast-error of each variable into contributions arising from its own and the other variables' variance, and determines how much of this variance each variable explains. We focus on the variance decompositions of expenditures and revenues. These responses are estimated using random generation of the parameters of the VECM in a Monte Carlo study with 100 iterations. Since the innovations are not necessarily totally uncorrelated, the residuals are orthogonalized using Choleski decomposition in order to obtain a diagonal covariance matrix of the resulting innovations.

Table 7 reports the results of the variance decomposition of expenditure and revenue, respectively, within a 14-period horizon. As can be seen from this Table, revenue and GDP together explain approximately up to 85% of the forecast error variance of expenditure. The remaining 15% are explained by changes in expenditure

itself. Looking at the separate contributions of each variable, GDP growth has the highest effect on expenditure with a percentage of 48%. Changes in revenue explain about 37.4% of the future changes in spending growth.

In the case of revenue, the variance is explained in 16% by the GDP growth rate and in 9% by expenditure. Revenue explains up to 75% of its own variance. These out of sample results clearly tend to confirm our initial findings from the causality analysis that revenue and GDP are exogenous, and that revenue and GDP together have had an important impact on growth of government expenditure in Côte d'Ivoire over the period 1960-2005.

Conclusion

Controversy still exists on whether higher government revenue leads to higher spending or vice versa. This issue has important policy implications regarding the strategy of elimination of deficits. This study investigated which expenditure or revenue items may be addressed to achieve permanent reductions in budget deficits in Côte d'Ivoire. For this purpose, it used annual data covering the period 1960 to 2005 to assess the temporal causal relationship between government expenditures and revenues. Instead of using a bivariate model, it conducted cointegration and causality analysis in a multi-

variate framework using real GDP as control variable and by controlling for various macroeconomic events experienced by Côte d'Ivoire. Using the multivariate cointegration test of Johansen and Juselius (1990) and the bounds test approach of Pesaran et al. (2001), it found clear evidence of a long-run relationship among real government revenues, real government expenditures and real GDP. In this cointegrating relationship, revenue and GDP have positive effects on government expenditure. The results from the Granger causality tests based on both the error-correction model and the Toda and Yamamoto (1995) method suggest a long-run unidirectional causality running from government revenues to government expenditures. In light of these findings, the study concludes that Ivorian authorities follows the "tax-and-spend" scheme, that means that government spending decisions are not made in isolation from revenues.

The major policy implication that we draw from this study is that to attack the problem of persistent budget deficits in Côte d'Ivoire, a credible strategy should focus more on spending cuts rather than look for ways to raise revenues. Any attempt to reduce budget deficits by raising taxes or revenues without reducing the level of government spending will be counter-productive. Since 1980, government introduced a series of fiscal policy reforms aiming at increasing tax revenues. These reforms have been intensified from 1994 - 2005. Some of these reforms intend to extend the tax base and reduce exemptions while administrative reforms intend to improve the collecting system by decentralizing the fiscal administration, eliminating fraud, evasion and corruption (An overview of a chronology of fiscal reforms implemented in Côte d'Ivoire from 1960 to 2005 can be found in "Code Général des Impôts, Livre de procedures fiscales, Autres textes fiscaux, 2007", Direction Générale des Impôts, Côte d'Ivoire). To break away from the historical fiscal policy and reverse budget deficits, however, these improvements in tax system should be accompanied with stringent controls in the growth rate of public spending.

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