TAX-AND-SPEND, SPEND-AND-TAX, OR FISCAL SYNCHRONIZATION? EVIDENCE FROM BURUNDI

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Abstract

This paper applies Granger Causality Tests based on Toda-Yamamoto procedure and VECM framework, to determine the relationship between Government Spending and Government Taxes in Burundi using recent monthly data during the period 1996:1-2009:3. The empirical analysis discovered a firm positive unidirectional causality from Government Tax to Government spending, supporting hence the Friedman's (1978) version of Tax-and-Spend Hypothesis for Burundi. The empirical findings suggest therefore that, in Burundi, unsustainable budget deficits can be mitigated by policies that cut government taxes.
Key-words: Tax-and-Spend Hypothesis, Spend-and-Tax Hypothesis, Fiscal Synchronization, Toda-Yamamoto Granger Causality Tests, VECM

I. Introduction

Due to increasing and alarming budget deficits in developed and developing countries, theoretical and empirical studies on the causal link between government taxes and government spending abound now and has led to four competing hypotheses, namely, the tax-and-spend hypothesis, the spend-and-tax hypothesis, the fiscal synchronisation hypothesis and the institutional separation hypothesis; the purpose being of finding out a suitable way of curtailing countries' budget deficits. Regarding the tax-spend nexus, some scholars postulate a unidirectional causal link from government taxes to government spending [negative for Buchanan & Wegner (1977) and positive for Friedman (1978)], others like Barro (1986) advocate a reverse causal link from government spending to government taxes, some others suggest a feedback causality whereby decisions of spending and taxing are made simultaneously (Musgrave, 1966, Meltzer and Richard, 1981). The literature proposes also the institutional separation hypothesis whereby government decisions to spend are independent from decisions to tax.

Burundi like many other countries has not escaped the problem of budget deficits, some efforts have hence to be made so as to try to shrink them. However, this is not an easy task, since there exist some controversies in the literature concerning the tax-spend nexus. Traditionally, budget deficits have been corrected by cutting government spending, cutting government spending and increasing taxes, or by only increasing government taxes. However, it has been argued that tax hikes would rather lead to increase in spending and would not hence reduce budget deficit (Friedman, 1978).
Empirical studies have then to be undertaken so as to know which variable should be given priority in reducing budget deficits. While a vast empirical literature on the tax-spending nexus exists now, studies in that area are rare in some developing countries like Burundi. In fact, insofar as we know, there exists only one study on Burundi that sought to examine the causal link between government taxes and government spending. Wolde-Rufael (2008), analyzing the tax-spending nexus on 13 African countries found no causal link in any direction between government taxes and government spending in Burundi. It is therefore in that perspective that we undertake this study on recent monthly data by assessing the causal link between government taxes and government spending in Burundi, so as to propose some policy implications that would help shrinking budget deficits.

Thus, the present study seeks to examine whether in Burundi, the level of government spending adjusts to the level of government taxes, whether the level of government taxes adjusts to the level of government spending, whether decisions of spending and taxing are made simultaneously or whether government decisions to spend are independent from decisions to tax.

II. The Literature Review

The literature on tax-spending nexus gives four competing hypotheses, namely the tax-and-spend hypothesis, the spend-and-tax hypothesis, the fiscal synchronization hypothesis and the institutional separation hypothesis (independence between government taxes and government spending).

The tax-and-spend hypothesis postulates that governments raise tax before undertaking expenditures. The hypothesis was first introduced by Friedman (1978); according to him, the level of government spending adjusts to the level of government tax revenues available. Thus, an increase in tax will not lead to lower budget deficits, since an increase in government taxes will lead to an increase in government spending. Traditional tax hikes will therefore fail to lower budget deficits because they instead invite more government spending.

Because of that positive relationship between government taxes and spending advocated by Friedman, he suggested tax cuts as a means to reducing budget deficit. According to him, larger budget deficits resulting from tax cuts should lead to mounting public pressure on the government to significantly curtail its spending (Westerlund, Mahdavi & Firoozi, 2009). Buchanan and Wagner (1977, 1978) agree with Friedman (1978) that government taxes cause government spending, but they advocate a negative causal relationship between them. According to those authors, taxpayers suffer from fiscal illusion; tax cuts lower the perceived price of government provided goods and services by the public, which in turn boosts the public demand for these goods and services, increasing hence the government spending. Therefore, Buchanan & Wagner (1998) propose tax increase to resolve budget deficit problem. According to them, tax hikes would raise the cost of government spending perceived by voters, who will then lower their demand of public goods and services. Tax hikes combined with government spending cuts should curtail budget deficits (Darrat, 2002).

The empirical literature shows that Eita & Mbazima (2008) investigated the causal relationship between government revenue and government expenditure for the case of Namibia for the period 1977-2007, using Granger causality; their findings supported the tax-and-spend hypothesis for that country. Sobhee (2004) analyzed the causal link between government revenue and government expenditure in Mauritius for the period 1970-1999 using a VECM. His findings support the evidence of the tax-and-spend hypothesis both in short and long-run.
Moalusi (2004) assessed the causal link between government revenue and government expenditure in Botswana for the period 1976-2000. The empirical results from both bivariate and multivariate frameworks support the tax-and-spend hypothesis. Moreover, the causal relationship was found to be negative, suggesting therefore that budget deficits in Botswana can be mitigated by tax increases.

As far as the spend-and-tax hypothesis is concerned, it says that governments spend first and then increase taxes to finance their expenditures. According to Peacock and Wiseman (1979), external shocks such as wars or natural disasters, cause sudden increases in public spending and taxes are adjusted to pay for them (Westerlund, Mahdavi & Firoozi, 2009). Barro (1986), in his tax smoothing hypothesis, argues that government spending is considered as an exogenous variable to which taxes adjust; and according to the intertemporal budget constraint, any increase in current expenditures has to be matched by future increase taxes (De Castro et al, 2004). Carneiro et al (2005) examined the relationship between government revenue and spending in Guinea-Bissau for the period 1981-2002 and found evidence of the spend-and-tax hypothesis for that country.
As for the fiscal synchronization hypothesis, Musgrave (1966), Meltzer and Richard (1981) advocate that a government

simultaneously chooses the desired package of spending programs and the revenues necessary to finance such spending programs. Regarding that hypothesis, Ndahiriwe & Gupta (2007) investigated the causal relationship between government revenue and government spending for South Africa using quarterly data over the period 1960:1-2006:2. Their findings support the fiscal synchronisation hypothesis for that case.

And lastly, according to the institutional separation hypothesis introduced by Baghestani and McNown (1994), the executive and the legislative branches of the government are different institutions with different functions in taxation and spending process. Therefore, since the decisions over expenditures and revenues are made by independent institutions, there should be no systematic causal relationship between them (Taşdemir & Aslan, 2009).

Wolde-Rufael (2008) examined the Tax-Spending Nexus for 13 African countries using Toda-Yamamoto (1995) version of Granger causality tests in a multivariate framework. The empirical results supported the fiscal synchronization hypothesis (feedback causality between government taxes and spending) for Mauritius, Swaziland and Zimbabwe; the Tax-and-Spend hypothesis for Ethiopia, Ghana, Kenya, Nigeria, Mali and Zambia; the Spend-and-Tax hypothesis for Burkina Faso and independence hypothesis (no causal link in any direction) for Botswana, Burundi and Rwanda.

III.Methods and Procedures Used

1. Unit Root tests with structural breaks

i. Clemente et al (1998) procedure

According to F. Baum (2001), a well-known shortcomings of the "Dickey–Fuller" style unit root test with I (1) as a null hypothesis, is its potential confusion of structural breaks in the series as evidence of non-stationarity. Unlike Andrews & Zivot (1992) and

Perron & Vogelsang (1992) tests, Clemente et al (1998) test is able to deal with more that one structural break in a time series.

It has been in fact, observed that a single break in intercept and trend could not deal satisfactorily with the evolution of some time series. In order to address that problem, Clemente, Montanes & Reyes (1998) built on Perron & Vogelsang (1992) and developed tests that would allow for two events within the observed history of a time series, either Additive Outliers (the AO model, which captures a sudden change in a series) or Innovational Outliers (the IO model, allowing for a gradual shift in the mean of the series).

The double-break Additive Outlier (AO model) involves the following estimation:

$$y_t = \mu + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \tilde{y}_t$$

Where $DU_{mt} = 1$ for $t > T_{bm}$ and 0 otherwise, for m = 1, 2. T_{b1} and T_{b2} are the breakpoints, to be located by grid search. The residuals from this regression, $\tilde{y}_t$, are then the dependent variable in the equation to be estimated. They are regressed on their lagged values, a number of lagged differences and a set of dummy variables needed to make the distribution of the test statistic tractable:

$$\tilde{y}_t = \sum_{i=1}^{k} \omega_{1i} DT_{b1,t-i} + \sum_{i=1}^{k} \omega_{2i} DT_{b2,t-i} + \alpha \tilde{y}_{t-1} + \sum_{i=1}^{k} \theta_i \Delta \tilde{y}_{t-i} + e_t$$

where $DT_{bm,t} = 1$ for $t = T_{bm} + 1$ and 0 otherwise, for m = 1, 2.

No intercept is necessary as $\tilde{y}$ is mean zero. This regression is then estimated over feasible pairs of T_{b1} and T_{b2}, searching for the minimal t–ratio for the hypothesis $\alpha = 1$; that is, the strongest rejection of the unit root null hypothesis. The value of this minimal t–ratio is compared with critical values provided by Perron and Vogelsang (1992).

As far as the Innovational Outlier (gradual change) model is concerned, it expresses the shocks to the series (the effects of δ_1, δ_2 above) as having the same ARMA representation as other shocks to the model, leading to the following formulation:

$$y_t = \mu + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \phi_1 DT_{b1,t} + \phi_2 DT_{b2,t} + \alpha y_{t-1} + \sum_{i=1}^{k} \theta_i \Delta y_{t-i} + e_t$$

where again an estimate of _ significantly less than unity will provide evidence against the I(1) null hypothesis.

In each of these models, the breakpoints T_{b1}, T_{b2} and the appropriate lag order k are unknown. The breakpoints are located by a two–dimensional grid search for the maximal (most negative) t–statistic for the unit root hypothesis ($\alpha = 1$), while k is determined by a set of sequential F–tests.

ii. Saikkonen and Lutkepohl (2002) Procedure

Contrarily to Perron (1990) and Perron & Vogelsang (1992), Saikkonen & Lutkepohl (2002) argue that a shift may not occur in a single period but may be spread out over a number of periods. Moreover, there may be a smooth transition to a new level. They consider shift functions of the general nonlinear form $f_t(\theta)'\gamma$ which are added to the deterministic term.

If there is a shift in the time series, Saikkonen and Lutkepohl (2002) have proposed the following model:

$y_t = \mu_0 + f_t(\theta)'\gamma + u_t$ (1)

where θ and γ are unknown parameters or parameter vectors and the errors u_t are generated by an AR (p) process, $\alpha(L)u_t = \varepsilon_t$ with $\alpha(L) = 1 - \alpha_1 L - \ldots - \alpha_p L^p$

The shift function, $f_t(\theta)'\gamma$, may be based on:

- a simple shift dummy, d_{tTB}, or
- an exponential function which allows for nonlinear gradual shift to a new level starting at time T_b

Saikkonen and Lutkepohl (2002) have proposed unit root tests based on estimating the deterministic term by the generalised least squares (GLS) procedure and subtracting it from the original series. An ADF-type test is then performed on the adjusted series $\hat{u}_t = y_t - \hat{\mu}_0 - f_t(\hat{\theta})'\hat{\gamma}$ (Lutkepohl, 2004).

If the series of interest has seasonal fluctuations, it is also possible to include seasonal dummies in addition in the model (1).

2. Cointegration test with breaks: Saikkonen and Lutkepohl (2000) procedure

Since most of the time series exhibit structural breaks caused by exogenous events that have occurred, Saikkonen & Lütkepohl (2000) have proposed a test for cointegration that allows for possible shifts in the mean of the data-generating process, because structural breaks can distort standard inference regarding the cointegrating rank of the system (Pahlavani, 2005).

Saikkonen and Lütkepohl (2000) suggested a two step approach for cointegration with breaks, basing on Johansen (1995) framework. In the first step all the coefficients for the deterministic variables are estimated. In the second step a normal cointegration analysis is conducted, but where the deterministic components are removed from each time series.

Let y_t be a vector of variables generated by the following process:

$$y_t = \mu_0 + \mu_1 t + \gamma_1 d_{1t} + \gamma_2 d_{2t} + \gamma_3 d_{3t} + \delta_1 DT_{0t} + \delta_2 DU_{1t} + \varepsilon_t$$

Where DT_{0t} and DU_{1t} are impulse and shift dummies, respectively, and account for the existence of structural breaks. DT_{0t} is equal to one, when $t = T_0$, and equal to zero otherwise. The Shift dummy (DU_{1t}) is equal to one when ($t > T_1$), and is equal to zero otherwise.

The parameters $\gamma_i (i = 1,2,3), \mu_0, \mu_1,$ and δ are associated with the deterministic terms. d_{1t}, d_{2t}, and d_{3t} are the seasonal dummy variables used especially for quarterly or monthly data.

According to Saikkonen & Lütkepohl (2000), the term ε_t is an unobservable error process that is assumed to have a VAR (p) representation where the error correction framework is written as:

$$\Delta\varepsilon_t = \prod \varepsilon_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta\varepsilon_{t-j} + u_t$$

where $\varepsilon_t = y_t - D_t$ and D_t are the estimated deterministic trends. According to Saikkonen & Lütkepohl (2000), the rank of $\prod$ is the cointegrating rank of ε_t and hence of y_t.

3. **Granger Causality tests**

i. **Toda-Yamamoto (1995) & Dolado-Lutkepohl (1996) procedures**

Toda-Yamamoto (1995) and Dolado-Lutkepohl (1996) developed a modified version of the Granger causality test based on an augmented VAR with extra lags depending on the order of integration of the variables. Once the optimum lag order of the VAR process, *k*, is selected, Toda-Yamamoto (1995) propose to estimate a VAR (*k+dmax*) model where *dmax* is the maximal order of integration of the variables in the system. As for Dolado-Lutkepohl (1996), they propose to estimate an augmented VAR with the only difference that the augmented lag is equal to one *(dmax=1)*, they hence propose to estimate a *VAR (k+1)* model. The advantage of the proposed procedure is that it doesn't require the pretesting of cointegration though it requires the pretesting of unit root to know the order of integration of the variables.

Thus, in the Toda-Yamamoto framework, the augmented VAR can be specified in a matrix form as follows where *G_sa* and *T_sa* are the monthly seasonally adjusted series of government taxes and government spending (in logarithm) respectively:

$$\begin{bmatrix} G\_sa_t \\ T\_sa_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \alpha_{11i}\alpha_{12i} \\ \alpha_{21i}\alpha_{22i} \end{bmatrix} \begin{bmatrix} G\_sa_{t-i} \\ T-sa_{t-i} \end{bmatrix} + \sum_{i=1}^{d\max} \begin{bmatrix} \alpha_{11i}\alpha_{12i} \\ \alpha_{21i}\alpha_{22i} \end{bmatrix} \begin{bmatrix} G\_sa_{t-i} \\ T-sa_{t-i} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix}$$

To assess the causality relationship between the variables, the Wald restriction test is applied to test for linear restrictions on the parameters of the VAR (*k*) while ignoring the parameters of the VAR (*dmax*) in the model.

ii. VECM-based Granger causality tests

If the null hypothesis of non-cointegration is rejected, a Vector Error Correction Model (VECM) framework is recommended (Toda-Phillips, 1994) in testing Granger causality in a cointegrated system.

In our case, the Granger causality test involves specifying a bivariate p^{th} order Vector Error-Correction Mechanism (VECM) as follows:

$$(1-L)\begin{bmatrix} G\_sa_t \\ T\_sa_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix} \beta_{11i}\beta_{12i} \\ \beta_{21i}\beta_{22i} \end{bmatrix}\begin{bmatrix} G\_sa_{t-i} \\ T-sa_{t-i} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix}\left[ECT_{t-1}\right] + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

where, α_1 and α_2 denote constant terms, $(1-L)$ is the lag operator, ECT_{t-1} represents the lagged error-correction term derived from the cointegrating vector, and ε_{1t} and ε_{2t} are serially independent random errors with mean zero and finite covariance matrix.

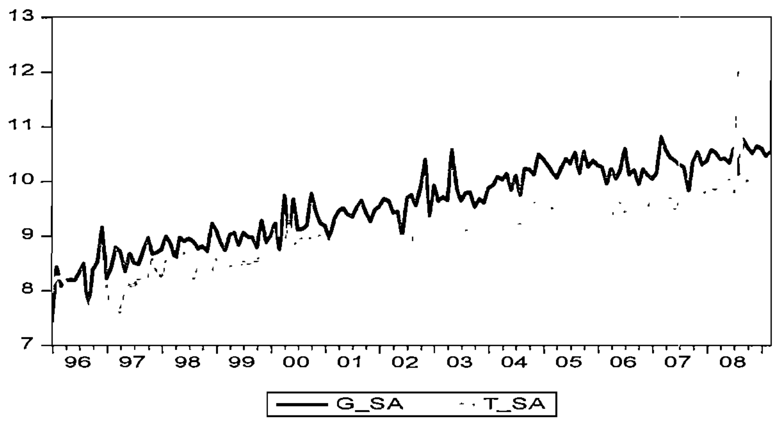
In this VECM framework, Granger causality can be examined either by testing the significance of the coefficients of the lagged differences of the variables through a joint Wald test (short-run causality), or by testing the significance of the Error-Correction Term in the above equations (long-run causality).

IV. EMPIRICAL EVIDENCE

1. Data presentation

We employ in the present study monthly seasonally adjusted data on government taxes (*T_sa*) and government spending (*G_sa*) for Burundi over the period *January 1996 – March 2009*. Data of those variables were obtained from different reports of the Central Bank of Burundi. The following graph plots government taxes and government spending over the period of study. A closer examination of the graph reveals that Burundi experienced budget deficits for all over the period of study except for January 1996, March 1996 and August 2008.

Figure 1: Plot of Government spending and Taxes from 1996:01 to 2009:03 (In logarithm)



2. Presentation of Empirical Results

Prior to testing unit root, we test for the presence of seasonality in the series using US Census Bureau's X-12 seasonal adjustment program (X-12 ARIMA) installed in Eviews 6. This is motivated by the fact that time-series observed at quarterly and monthly frequencies often exhibit cyclical movements that recur every month or quarter and need hence to be seasonally adjusted. Seasonal adjustment refers to the process of removing these cyclical seasonal movements from a series and extracting the underlying trend component of the series. Depending on the methods used, additive or multiplicative, the results of the seasonality tests on the variables are presented in the following table:

Table 1: Results of the seasonality Test

Series	Additive Method	Multiplicative Method
	F-Value	F-Value
LnSpend	4.324***	4.368***
LnTax	4.202***	4.636***

Note: The test is performed in Eviews 6 and (***) denotes that the null hypothesis of no seasonality is rejected at 1 per cent level. LnSpend and LnTax denote logarithm of Total Government spending and Total Government taxes respectively.

Since the null hypothesis of no seasonality is strongly rejected as shown by the results in the above Table 1, the series need therefore to be seasonally adjusted before submitting them to unit root tests. The following table presents the results of Unit root tests on the seasonally adjusted series, obtained using a multiplicative adjustment method. We name *G_sa*, the seasonally adjusted series "LnSpend" and *T_sa*, the seasonally adjusted series "LnTax". Unit root tests used are CLEMAO and CLEMIO unit root tests allowing for one or two structural breaks in the series.

1. Unit Root Tests Results with structural breaks

Table 2: CLEMAO-IO Unit Root Tests with single mean-shift

Series	CLEMAO1		CLEMIO1	
	T-Stat(du1)	T-Stat (ρ^{-1})	T-Stat(du1)	T-Stat (ρ^{-1})
G_sa	**18.652*** **	**-1.343**	**2.082** **	**-2.831**
ΔG_sa	**-0.859**	**-9.074**	**-1.422**	**-8.013** **
T_sa	**13.865*** **	**-1.869**	**2.568** **	**-1.827**
ΔT_sa	**0.074**	**-8.235** **	**-0.097**	**-11.891** **

Note: The Critical value of T-Stat (ρ^{-1}) at 5% for CLEMAO1 and CLEMIO1 is -3.56 and -4.27 respectively. (**) and (***)

denote rejection of the null hypothesis at 5% and 1 % respectively. The tests results are from STATA 9 and STATA routines used are clemao1 and clemio1, developed by Christopher Baum for STATA and are available in Statistical Software Components (SSC) archive.

Whether we consider the additive outlier model or the innovational outlier model, CLEMAO-IO Unit Root Tests results, assuming a single-mean shift, show that the presence of at least one structural break cannot be rejected in our seasonally adjusted variables (*G_sa* and *T_sa*). The results further show that despite the structural break, we are unable to reject the null hypothesis of a unit root in the seasonally adjusted series *G_sa* and *T_sa*. However, applied on differenced series, the same tests reject the null hypothesis of unit root.

Since more than one structural break can occur, we now test for unit root in the series assuming the existence of two structural breaks; the results are presented in the following table:

Table 3: CLEMAO-IO Unit Root Tests with double mean-shift

Series	CLEMAO2			CLEMIO2		
	T-Stat(du1)	T-Stat(du2)	T-Stat (ρ^{-1})	T-Stat(du1)	T-Stat(du2)	T-Stat (ρ^{-1})
G_sa	13.524***	12.615***	-1.524	2.906***	2.722***	-3.796
ΔG_sa	-0.81	-0.109	-7.799**	-	-1.619	-8.075**
T_sa	13.270***	11.246***	-2.943	3.281***	2.559**	-3.155
ΔT_sa	0.565	-0.411	-12.236**	2.655***	-1.886	-12.418**

<u>**Note:**</u> The Critical value of T-Stat (ρ^{-1}) at 5% for CLEMAO2 and CLEMIO2 is -5.49. (*), (**) and (***) denote rejection of the

null hypothesis at 10%, 5% and 1% respectively. The tests results are from STATA 9 and STATA routines used are clemao2 and clemio2, developed by Christopher Baum for STATA and are available in Statistical Software Components (SSC) archive.

The results in the above table show that the presence of two structural breaks in the variables cannot be rejected, whether we consider the additive outlier model or innovational outlier model. Allowing thus for the existence of two structural breaks, CLEMAO and CLEMIO unit root tests fail to reject the null hypothesis of a unit root in the variables. However, applied on first difference of the variables, the tests reject the null hypothesis of a unit root.

We complement CLEMAO-IO unit root tests with another test with a structural break, developed by Saikkonen & Lutkepohl (2002). The results are presented in the following table.

Table 4: SL Unit Root Test with a Structural Break

Variables	Lag	Deterministic Part	Suggested Break date	SL Statistic
G_sa	6	C, SD	1997 M2	-1.36
ΔG_sa	6	C, SD	2003 M6	-3.27**
T_sa	3	C, SD	2008 M8	-1.75
ΔT_sa	1	C, ID	2008 M9	-9.97***

Note: SL denotes Saikkonen & Lutkepohl (2002); optimal number of lags is selected using Hannan-Quinn Information Criterion; C, SD and ID denote Constant, Shift dummy and Impulse dummy respectively. The Critical values are -3.48, -2.88 and -2.58 respectively at 1%, 5% and 10%, and are provided by Lanne et al. (2002). (**) and (***) denote the rejection of the null hypothesis at 5% and 1% respectively. The test results are from the JMulTi software, version 4.23, developed by Lütkepohl & Kratzig (2004); Break dates are as well suggested by the Software used.

As shown in the above table 4, the Saikkonen & Lutkepohl (2002) test statistic fails to reject the null hypothesis of unit root, even at 10 percent, in the levels of the variables. However, the null hypothesis of unit root is rejected at 5 percent level, when the same test is applied to differenced variables. Saikkonen & Lutkepohl (2002) test results corroborate hence with CLEMAO-IO test results. The seasonally adjusted variables used, government spending and government taxes are non-stationary, becoming stationary after one differentiation.

3. Cointegration tests Results

We present in the following table the Saikkonen & Lutkepohl (2000) cointegration tests with a structural break and the small sample Bartlett-corrected Trace test of Johansen (2002).

Table 5: Cointegration Tests Results

Saikkonen & Lutkepohl (2000) test						**Bartlett-Corrected Trace test**		
r0	**LR**	**P. Value**	**Critical Values**			**r0**	**LR**	**C.V (5%)**
			10%	**5%**	**1%**			
0	**13.07****	**0.03**	**10.47**	**12.26**	**16.10**	**0**	**17.85****	**13.43**
1	**0.70**	**0.45**	**2.98**	**4.13**	**6.93**	**1**	**0.67**	**2.71**

Note: r0 is the number of cointegrating vectors to be tested, the test includes an optimal number of lags equal to 2 (searched up to 10), selected using Schwarz Criterion; (**) denotes the rejection of the null hypothesis at 5%. The model includes a constant as a deterministic part, we don't allow for seasonal dummies since the variables were seasonally adjusted. All the computations are performed in JMulTi software, version 4.23, developed by Lütkepohl & Kratzig (2004), the critical values are provided by the same software. Bartlett-corrected trace test is computed using SVAR software, version 0.45-2.

Saikkonen & Lutkepohl (2000) cointegration test rejects the null hypothesis of r0 = 0 but fails to reject the null hypothesis of r0 = 1 at 5 percent level. The Bartlett-corrected trace test rejects as well the null hypothesis of r0 = 0, but fails to reject the null hypothesis of r0 = 1 at 5% percent level. Both Saikkonen & Lutkepohl (2000) test and the Bartlett-corrected trace test conclude that there is one cointegrating vector between government spending and government taxes in Burundi, suggesting that those two variables have not moved too far away from each other, supporting hence a long-run relationship between them.

3. Causality tests Results

We perform here causality tests between government spending and government taxes, basing on Toda-Yamamoto procedure. The results are reported in the following table:

Table 6: Toda-Yamamoto Causality Tests Results

Dependent Variable	k+dmax	$\chi^2(4)$
G_sa	5	8.71* (0.06)
T_sa	5	5.39 (0.24)

Note: k = 4 is the optimum lag length of the VAR, selected using Akaike Information Criterion (AIC); dmax is the maximal order of integration of the variables in the VAR, dmax = 1 in the present case; (*) denotes the rejection of the null hypothesis at 10%.

Toda-Yamamoto causality tests show that on the *G_sa* equation, Wald restriction test rejects the nullity of the first k (4) *T_sa* coefficients at 10 percent level. On the *T_sa* equation however, Wald restriction test fails to reject the nullity of the first k (4) *G_sa* coefficients.

Toda-Yamamoto causality tests support hence that government taxes cause government spending; however, government spending doesn't cause government taxes. Therefore, in Burundi, causality is unidirectional running from government taxes to government spending.

Since government taxes and government spending were found to be non-stationary but cointegrated, it is advised to use a VECM framework in testing causality between them. We hence complement Toda-Yamamoto causality tests by testing causality between government spending and government taxes basing on a VECM model. The following table presents the tests results.

Table 7: Causality tests Results from a VECM

Dependent Variable	k	$\chi^2(3)$	Z-Stat (ECT)	$\chi^2(4)$
ΔG_sa	3	1.68 (0.64)	-3.21***(0.00)	14.45*** (0.00)
ΔT_sa	3	0.34 (0.95)	2.77♠ (0.00)	10.87♠ (0.02)

Note: k is the optimum lag length selected using Akaike Information Criterion (AIC); **(***)** denotes the rejection of the null hypothesis at 1 %; between parentheses are reported the probability values; (♠) though the speed of adjustment is significant, it is positive, which doesn't make sense in an Error Correction Mechanism. All the computations are performed in STATA 9.

The causality tests from the VECM support those from Toda-Yamamoto procedure. On the *G_sa* equation, the significance of the speed of adjustment as well as the joint significance of the coefficients of the lagged differenced of *T_sa* and the speed of adjustment cannot be rejected. However, on the *T_sa* equation, much as the speed of adjustment is significant, it is positive; which does not make sense in an error correction mechanism.

Causality tests results from both Toda-Yamamoto procedure and VECM framework support the Tax-and-spend hypothesis. However, we don't know yet here whether it is Friedman's (1978) version which is validated (positive relationship between government taxes and government spending) or Buchanan &

Wagner (1977, 1978) version (negative relationship between government taxes and spending). We then examine whether the relationship between government taxes and government spending is positive or negative in Burundi so as to know the suitable policy to adopt to reduce budget deficits. But since that relationship can be affected by structural breaks that might have occurred during the period of study, we first test for structural changes in the relation regression, identify and date them in case they exist, and after estimate the relationship taking into account the number of structural breaks.

4. Testing and dating of structural breaks in the long-run relationship

To ensure that there are no structural breaks in the relation regression between government taxes and government spending, we implement multiple structural breaks tests developed by Bai and Perron (2003). We test whether the regression coefficients remain constant or vary over time.

$$G\_sa_t = \alpha + \beta T\_sa_t + \varepsilon_t$$

The null hypothesis of no structural break is written as follows:

$$H_0 : \beta_i = \beta_0 (i = 1,...,t)$$

We perform the structural break test (SupF test) of Bai & Perron (2003) with a trimming parameter h = 0.15 and for the central 70% observations (the breaks are searched for over the range of the sample (0.15T, 0.85T) as proposed by the authors, T being the total number of observations). The breaks are therefore searched from December 1997 to March 2007 and the results are given in the table below:

Table 8: Structural break test results

SupF test	Prob. Value
112.11***	0.00

Note: The computations are performed in R software version 2. 9.1, using "strucchange" package developed by Achim Zeileis et al (2001); (***) denotes the rejection of the null hypothesis at 1 percent level.

The SupF test rejects the null hypothesis of no structural breaks at 1 percent level.

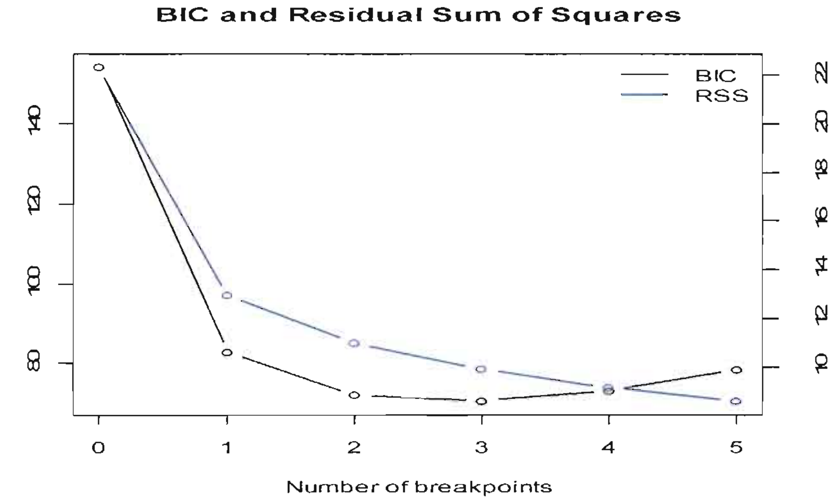
Since the evidence for structural changes in the regression relationship cannot be rejected, we now proceed by testing how many structural breaks occurred and dating them. We apply Bai & Perron (2003) test to the relationship between government spending and government taxes by allowing a maximum of 5 breaks and a trimming parameter h = 0.15. The following table presents the tests results:

Table 9: Identifying and dating structural breaks

Breakpoints at observation number						Corresponding breakdates				
m = 1				98					2004(2)	
m = 2			78	104				2002(6)	2004(8)	
m = 3	23		78	104		1997(11)		2002(6)	2004(8)	
m = 4	23		78	104	134	1997(11)		2002(6)	2004(8)	2007(2)
m = 5	23	51	78	104	134	1997(11)	2000(3)	2002(6)	2004(8)	2007(2)

M	0	1	2	3	4	5
RSS	22.30	12.94	10.98	9.89	9.14	8.58
BIC	154.15	82.82	71.96	70.54	73.12	78.35

Note: m is the number of breaks to be tested, RSS is the Residual Sum of Squares, and BIC is the Bayesian Information Criterion. All the computations are done in R Software version 2.9.1, using "strucchange" package developed by Achim Zeileis et al (2001).



We follow Bai & Perron (2003) and employ two criteria to identify and date structural breaks, RSS and BIC. The plot of RSS and BIC suggest that RSS is minimized at the point where m (number of structural breaks) is equal to 5, and BIC is minimized at the point where m = 3. Bai & Perron (2002) suggested that BIC is the suitable selection criterion in many situations (Achim Zeileis et al, 2002). We hence base on BIC criteria and conclude that m, the number of structural breaks in the relationship between government taxes and spending is equal to 3, and the dates of the breaks are 1997:11, 2002:6 and 2004:8, indicating hence a model of four regimes. We now proceed to estimate the long-run relationship between government taxes and government spending for the four sub-samples, to check whether the presence of structural breaks influence the relationship (negative or positive) between government taxes and government spending.

Table 10: Estimation of the long-run relationship

Estimated coefficients	Full sample [96:1-09:3]	1st Regime [96:1-97:11]	2nd Regime [97:12-02:6]	3rd Regime [02:7-04:8]	4th Regime [04:9-09:3]
α	0.57	8.31	1.92	7.40	9.62
β	1.00***	0.01	0.83***	0.27	0.07

Note: The computations are done in R software version 2.9.1, (**) and (***) denote the rejection of the null hypothesis at 5% and 1% respectively.

We realize that the structural breaks don't affect the relationship between government taxes and government spending, since the relationship remains positive all through the regimes, though the coefficients are insignificant in some regimes. Considering the full sample, the relationship between government taxes and spending is positive, and interestingly, the slope coefficient reveals that an increase in government taxes is accompanied by an increase in government spending of the same proportions.

We conclude therefore that there's no doubt, it's the Friedman's (1978) version of tax-and-spend hypothesis which is validated in Burundi; an increase in government taxes is accompanied by an increase in government spending.

CONCLUSION AND POLICY RECOMMENDATION

Using monthly data, the purpose of this study was to examine the causal relationship between government taxes and government spending in Burundi during the period 1996:1-2009:3. Unit root and cointegration tests were first carried out. Unit root tests used which take into account the presence of structural breaks in the series [CLEMAO-IO and Saikkonen & Lutkepohl (2002)], could not reject the null hypothesis of unit root in government taxes and government spending, despite the presence of structural breaks. For both CLEMAO-IO and Saikkonen & Lutkepohl (2002) tests, government taxes and government spending were found to be stationary after one differentiation. The Saikkonen & Lutkepohl (2000) cointegration tests with a structural break and the small sample Bartlett-corrected Trace test (Johansen, 2002) used supported the presence of one cointegrating vector between government taxes and government spending in Burundi. Causality tests based on Toda-Yamamoto and VECM procedures both supported the tax-and-spend hypothesis for the case of Burundi (unidirectional causality from government taxes to government spending). Bai & Perron (2003) structural change tests further revealed that there were three structural changes in the relationship between government spending and government taxes during the period of study. However, the presence of structural breaks seems not to affect the relationship between government spending and government taxes; the relationship was found to be positive all through the regimes. Without any doubt, the Friedman's (1978) version of tax-and-spend hypothesis was validated in Burundi; an increase in government taxes is accompanied by an increase in government spending. Considering the full sample, the slope coefficient revealed that an increase in government taxes is accompanied by an increase in government spending of the same proportions.

Taking into account the findings of this study, Tax hikes cannot reduce the budget deficit in Burundi since they will lead to an increase in government spending. Unsustainable budget deficits can therefore be mitigated by policies that cut government taxes.
A policy of "starving the beast" would thus be applicable in Burundi so as to discipline government spending and reduce hence the budget deficit. The idea here is that tax cuts would lead to a higher budget deficit which would force legislators to enact spending cuts.

REFERENCES

Tsangyao Chang & Yuan-Hong Ho (2002), Tax or Spend, What Causes What: Taiwan's Experience, in *International Journal of Business and Economics*, 2002, Vol. 1, No. 2, 157-165.

Ali F. DARRAT (2002), Budget Balance through Spending cuts or Tax Adjustments? In Contemporary Economic Policy, Vol. 20, No. 3, July 2002, 221-233.

Antti Moisio (2001), Spend and Tax or Tax and Spend? Panel data evidence from FINNISH Municipalities during 1985 – 1999, in *Government Institute for Economic Research.*

Daniel K. Moalusi (2004), Causal Link between Government Spending and Revenue: A Case Study of Botswana.

Kasai Ndahiriwe & Rangan Gupta (2007), Temporal Causality between Taxes and Public Expenditures: The Case of South Africa, University of Pretoria, *Department of Economics Working Paper Series.*

Francisco G. Carneiro, Joao R. Faria, & Boubacar S. Barry (2005), Government Revenues and Expenditures in Guinea-Bissau: Causality and Cointegration, *Journal of Economic Development 107 Volume 30, Number 1, June 2005.*

Bruce Bartlett (2007), "Starve the Beast" Origins and Development of a Budgetary Metaphor, *The Independent Review, Vol. XII, NO. 1, Summer 2007, ISSN 1086–1653.*

Christina D. Romer & David H. Romer (2007), Do Tax Cuts Starve The Beast?
The Effect Of Tax Changes On Government Spending, *National Bureau Of Economic Research, Working Paper 13548.*

Sobhee, Sanjeev K. (2004), The Causality Between Tax And Spend Of The Public Sector In Mauritius: A VECM Approach, *International Journal of Applied Econometrics and Quantitative Studies* Vol.1-3(2004).

Eita, Joel Hinaunye & Mbazima, Daisy (2008), The Causal Relationship Between Government Revenue and Expenditure in Namibia, *MPRA Paper No. 9154.*

Westerlund J., Mahdavi S. & Firoozi F. (2009), The Tax-Spending Nexus: Evidence from a Panel of US State-Local Governments, *WORKING PAPERS IN ECONOMICS, No 378, University of Gothenburg, School of Business, Economics and Law.*

De Castro F., Gonzalez-Paramo & De Cos (2004), Fiscal Consolidation in Spain: Dynamic Interdependence of Public Spending and Revenues, *Investigaciones Economicas, Vol. XXVIII (1), 2004, 193-207.*

Christopher F. Baum (2001), Stata: The language of choice for time series analysis? *The Stata Journal (2001) 1, Number 1, pp. 1–16*

Joseph P. Byrne & Roger Perman (2006), Unit Roots and Structural Breaks: A Survey of the Literature, *University of Glasgow, Glasgow, UK.*

Suthep Buranakunaporn (2006), Unit Root and Cointegration Testing under Structural Breaks: An Application to Thailand's Energy Demand, *Thammasat Economic Journal, Vol.24, No. 1, March 2006.*

Oscar Bajo-Rubio, Carmen Díaz-Roldán & Vicente Esteve (2006), US deficit sustainability revisited: A Multiple Structural Change Approach.

Helmut Lutkepohl (2004), Recent Advances in Cointegration Analysis, *Department of Economics, European University Institute.*

Pui Sun Tam (2009), Simple tests for the null of no cointegration with structural breaks.

Achim Zeileis, Friedrich Leisch, Kurt Hornik & Christian Kleiber, Strucchange: An R Package for Testing for Structural Change in Linear Regression Models.

Achim Zeilei, Christian Kleiber, Validating multiple structural change models –A case study