



**THE CAUSAL RELATIONSHIP BETWEEN
GOVERNMENT EXPENDITURE AND TAX REVENUE IN
BARBADOS**

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ABSTRACT

Solving the budget deficit problem is a concern for many countries; some economists emphasized tax increases or tax cuts, while others favour spending cuts. This paper investigates the interrelationship between total government expenditure and total tax revenue in Barbados using both bivariate and multivariate cointegrating models. The technique of Granger Causality is also applied to determine the causal relationship in the multivariate model. The results from the multivariate error correction model suggest that government expenditure unidirectional Granger-cause changes in revenue.

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Introduction

Escalating fiscal deficits are known to have adverse effects on an economy, varying from high real interest rates, a decline in private sector investment and an increase in the rate of inflation. Sargent and Wallace (1981) argued that the real driving force behind inflation is not the growth of the money supply but the level of government debt. Government incurs debt when its expenditure exceeds its revenue collections; the budget deficit. Theory postulates that the financing of deficits through the issuance of bonds/securities will also add to or worsen the debt levels of a country.

Given the severe impact deficits have on the development of a country, research literature has focused on solving the problem of when a country spends more than it earns. There is the widely held view that a reduction in government expenditure is the optimal solution to solving the fiscal deficit rather than an increase in taxes. These advocates believe that the more a government receives in taxes the more that government will spend, which in turn could lead to a situation where the deficit is unchanged or have deteriorated. This line of thought is known as the tax-and-spend hypothesis. Others argue against this, and postulated that tax increases will not lead to an expansion in spending; rather they perceived it as a useful approach for reducing the deficit together with a contraction in government expenditure. The casual relationship between government expenditure and government revenues has also been explained by the spend-and-tax hypothesis or fiscal synchronization. Spend-and-tax occurs when government spending is undertaken before revenue is determined, while fiscal synchronization is attained when government revenue and government expenditure is determined at the same time.

Barbados has been recording fiscal deficits since 1920, and then in 1950 it was gradually reduced. However, in recent years the deficit has been growing rapidly as government engaged in substantial capital spending combined with increasing current expenditure. In this regard, analyzing the interrelationship between taxation and government spending brings to the forefront useful information that can provide a possible solution to the deficit situation in Barbados. The size of a fiscal deficit of an economy also plays an important role in determining the level of financial assistance, if any, a country is likely to receive from major financial institutions in times of distress or economic hardships.

The aim of the paper is to identify the casual relationship between taxation and government spending in Barbados. The government sector of Barbados has been growing steadily since 1980, as measured by the ratio of total government expenditure to Gross Nominal Product. In 1980 the government sector expanded from around 27.3% to roughly 39.4% of the economy at the end of 2008. Little attempt was made to raise taxes in lieu of the expanding fiscal deficit of government.

Literature Review

There are varying views on the government taxation and spending nexus. Among these are the views of Wildavsky (1988); stated that in the USA spending and taxation are independent in that when Government makes a decision to undertake capital spending no regard is given to taxation. Similarly, Hoover and Sheffrin (1992) empirical analysis of the tax and spend nexus concluded that in the U.S. government's decision to tax are independent from its decision to spend. This view of independence between taxes and spending is contrary to the views of many researchers whom have found an interdependent relationship between the two variables. One such study was that conducted by Friedman (1982) noted that tax hikes lead to increase government spending; hence the deficit remains unchanged or grows larger. Consequently, Friedman proposed tax cuts as a means of controlling the fiscal deficits in the sense that in light of cutting taxes, the government deficit would be larger, hence placing undue pressure on the Government to reduce the fiscal deficit. Friedman found a positive causal relationship between spending and taxation. Buchanan and Wagner (1977, 1978) also found that taxes cause spending. However, the direction of the relationship was negative. Instead like Friedman who propose tax cuts, Buchan and Wager propose tax increases, in that persons would perceive that the cost of government programs have become more expensive, thus resulting in a reduction in spending, hence their concluded that a tax increase along with reduced spending can curtail the deficit.

In contrast Barro (1979) noted that taxes follow spending. He argued that short-lived increases in government expenditure (arising from natural crises) become long lasting and result in tax increases to finance the excessive spending. Hence Barro suggested that in order for government

to control budget deficits it must cut spending. The final view on the tax and spend nexus was pioneered by Musgrave (1966) and Meltzer and Richard (1981) and suggested that both taxation and spending is determined simultaneously. The studies in this area are contradictory as they found several different rationales for the tax and spend nexus.

Moalusi (2004) examined the casual relationship between government expenditure and government revenue in Botswana. The author then determined whether the fiscal policies in Botswana during the period 1976 to 2000 are determined by tax-and-spend, spend-and-tax or fiscal synchronization. The study was conducted utilizing both a bivariate and multivariate Granger casualty model. The author concluded that in Botswana there is a unidirectional relationship between government expenditure and government revenue running from revenue to spending, which in turn supports the tax-and-spend hypothesis. However, the relationship between expenditure and revenue was found to be negative.

In a similar paper Darrat (1998) investigated the interrelationship between government spending and revenues in Turkey using both bivariate and multivariate co-integrating models. The author found a stable long run relationship between the two variables, where taxes unidirectionally Granger-cause negative changes in spending. As a result it was noted that an increase in taxes in Turkey is the best way to manage budget deficits.

In the Caribbean region work undertaken by Craigwell, Mascoll and Leon (1989) examined government revenue and expenditure causality in Barbados during the period 1973 to 1989. The authors found causality occurred from government expenditure to revenue.

Stylized facts: tax reform in Barbados

There were several reforms undertaken since and after 1995, which served to lessen the tax burden of individuals. Tax reform was also one of the major drivers used to facilitate economic growth and increase employment opportunities. The tax reforms included changes to the basic and marginal tax rates, an increase in the income tax threshold as well as other initiatives, which shifted the bulk of revenue being collected from direct taxation to indirect taxes. Consequently, in 1997 the value-added tax (VAT) was introduced, it replaced approximately 11 taxes and at

the time was deemed to be simple to administer, neutral and an efficient means of collecting revenue. These reforms also acted as a means of reducing the tax burden of residents, businesses and providing incentives to foreign companies wishing to set up business in Barbados.

Several concessions were also made available to the productive sectors of the economy in attempt to make them more viable. With these many concessions and reductions in tax rates the growth of government revenue heavily depended upon the VAT. With VAT being the primary earner of government revenue, it was still not sufficient to curtail the problem of rising budget deficits.

Throughout the late 1980s and early 1990s the Government of Barbados sought financial assistance from the IMF. In this regard, the then Government adopted contractionary fiscal policy to sterilise a rising current account deficit and the fall-off in the net international reserves (NIR). These contractionary measures involved an 8% cut in public sector wages, an 11% reduction in the labour force of the Government as well as a wage freeze in 1992. Additionally, a stabilisation tax on incomes was imposed along with a consumption tax and a tax on luxury imports. Although these policies were harsh, they proved to be successful.

This adoption of contractionary fiscal policy was the most outstanding in the history of Barbados. In the years following the economy experienced steady growth. Nonetheless, at different durations Government engaged in borrowing on the international capital market to invest in lucrative capital projects aimed at boosting economic activity and hence employment.

Data & Methodology

Data

This study utilizes quarterly data on government spending, government revenue, and Gross Domestic Product (GDP). Government expenditure consists of both current and capital expenditure less interest payments, while government revenue is a measure of both direct and

indirect taxes and gross domestic product is a measure of economic output. This data for Barbados (1985-2008) is obtained from the Central Bank of Barbados Economic and Financial Statistics as well as the Annual Statistical Digest. All variables are expressed in real terms (the GDP deflator was used) and logarithms. Throughout this study, T denotes the logarithm of government revenue and G denotes the logarithm of government spending and Y represents the logarithm of gross domestic product.

Methodology

The paper follows the work of Darrat (1998). The methodology to be used in this study is Granger's (1969,1980) notion of causality based on a temporal ordering and incremental predictability criteria. We test for Granger causality between government spending (G), taxes (T) and economic output (Y) in Barbados. A stationary time series (K) is said to Granger-cause another stationary time series (R) if the prediction error from regressing K on T decreases by using past values of K in addition to using past values of T .

In order to perform the causality tests it is necessary to determine the stochastic properties of each time series. Consequently, tests for unit roots were implemented using three standard tests- the Augmented Dickey-Fuller (ADF) test by Dickey and Fuller (1979, 1981), the Philips Perron (PP) (1988) and the KPSS test by Kwiatkowski et al (1992). Both the ADF and the PP test, assumes the series are non-stationary, hence failure to reject the null hypothesis implied the time series has a unit root. In contrast, the KPSS test postulates that the series is (trend) stationary under the null against the alternative of non-stationary of the series.

If each variable is integrated of order (0), $LG_t \sim I(0)$ and $LT_t \sim I(0)$, then the appropriate model is vector autoregressive in levels (VAR-L) as given by [equation 1]

$$\begin{aligned}
 LG_t &= a_{10} + \sum_{i=1} b_{1i} LG_{t-i} + \sum_{j=1} c_{1j} LT_{t-j} + \varepsilon_{1t} \\
 LT_t &= d_{10} + \sum_{i=1} e_{1i} LT_{t-i} + \sum_{j=1} f_{1j} LG_{t-j} + w_{1t}
 \end{aligned}
 \tag{equation 1}$$

If each variable is integrated of order (1), $LG_t \sim I(1)$ and $LT_t \sim I(1)$, and the variables are not cointegrated then the appropriate model is vector autoregressive in first differences levels (VAR-D) as given by [equation 2]

$$\begin{aligned}\Delta LG_t &= a_{20} + \sum_{i=1} b_{2i} \Delta LG_{t-i} + \sum_{j=1} c_{2j} \Delta LT_{t-j} + \varepsilon_{2t} \\ \Delta LT_t &= d_{20} + \sum_{i=1} e_{2i} \Delta LT_{t-i} + \sum_{j=1} f_{2j} \Delta LG_{t-j} + w_{2t}\end{aligned}\quad \text{[equation 2]}$$

In the case each variable is integrated of order (1), $LG_t \sim I(1)$ and $LT_t \sim I(1)$, and the variables are cointegrated then the appropriate model is vector error correction model (VECM) as given by [equation 3]

$$\begin{aligned}\Delta LG_t &= a_{30} + \sum_{i=1} b_{3i} \Delta LG_{t-i} + \sum_{j=1} c_{3j} \Delta LT_{t-j} + \lambda_{11} LG_{t-1} + \lambda_{12} LT_{t-1} + \varepsilon_{3t} \\ \Delta LT_t &= d_{30} + \sum_{i=1} e_{3i} \Delta LT_{t-i} + \sum_{j=1} f_{3j} \Delta LG_{t-j} + \lambda_{21} LG_{t-1} + \lambda_{22} LT_{t-1} + w_{3t}\end{aligned}\quad \text{[equation 3]}$$

To examine the cointegrating properties of the variables before testing for Granger casualty we utilize the maximum likelihood method developed by Johansen (1988). This approach is suited to detect stationary linear combinations or a long-run relationship (i.e. cointegration relationships) between $I(1)$ variables. To avoid the omission-of-variables bias that is present in a two variable model two additional variables are included in the regression. These variables are the interest rate and real gross domestic product, which are critical in the determination of government revenue and spending.

If the variables are found to be stationary in the long run hence they possess a long-run equilibrium relationship. However, if the variables are expressed as first-differences as the stationarity requirement dictates then the long-run relationship would not be captured. Based on the findings of the unit root test, we utilize equation 3, the vector error correction model, as noted by the Granger's (1986) Representation Theorem to investigate the causal relation among the

variables. In this regard the appropriate lag length of the model was determined to acquire the necessary Gaussian error terms. In general the model that minimizes the Akaike Information Criteria (AIC) and the Schwartz Information Criterion (SIC) is selected as the one with the optimal lag length. We then use the chosen equation to determine the direction of Granger causality between taxes and government spending in the multivariate case, in which gross domestic product and the interest rate are added to the bivariate model.

Empirical Results

Table 1. Unit Root Tests

Variable	ADF		PP		KPSS	
	Level	1 st Difference	Level	1 st Difference	Level	1 st Difference
Government Expenditure: G	-2.324*	-10.276***	-4.883***		0.219+++	0.170
Government Taxes: T	-2.113	-3.735**	-2.182	-4.546***	0.146++	0.066++
Interest Rates: R	-2.799	-9.271***	-3.035	-9.190***	0.075	
Gross Domestic Product: Y	-1.805	-10.844***	-1.951	-10.847***	0.149+	0.061

Notes: *, **, *** are the MacKinnon critical values for the rejection of the null hypothesis of a unit root at the 10%, 5% and 1% levels respectively, for both the ADF and PP tests, while +, ++, +++ are the critical values for the LM statistic of the KPSS test and denote rejection of the null hypothesis of stationarity at the 10%, 5% and 1%, respectively (based upon the asymptotic results presented in KPSS(1992) -Table 1, pp.166.

Unit Root and Cointegration Test Results

Table 1 presents the degree of integration of each of the four variables. We conclude that the variables are predominantly stationary when expressed in first differences of the log levels, $I(1)$.

We then check whether the variables are cointegrated. Table 2 reports the results from the Johansen Test in two separate cases. In the bivariate model (panel A) there is no cointegrating relationship between government taxes and expenditure as illustrated by both the trace and the maximal eigenvalue tests.

Table 2. Cointegration Test Results: The Johansen Approach

Null Hypothesis	Max Eigen Test		P-value	Alternative Hypothesis	Trace Test	
	Alternative Hypothesis	Test Statistics			Test Statistics	P-Value
<i>A. Bivariate System (G & T only)</i>						
$r = 0$	$r = 1$	10.627	0.2806	$r \geq 1$	19.352	0.066
$r \leq 1$	$r = 2$	8.724	0.0606	$r = 2$	8.724	0.061
<i>B. Multivariate System (G, T, Y, R)</i>						
$r = 0$	$r = 1$	37.672	0.002	$r \geq 1$	54.079	0.003
$r \leq 1$	$r = 2$	15.678	0.322	$r \geq 2$	35.193	0.248
$r \leq 2$	$r = 3$	8.138	0.531	$r \geq 3$	20.262	0.433
<u>$r \leq 3$</u>	<u>$r = 4$</u>	<u>4.041</u>	<u>0.406</u>	$r \geq 3$	9.165	0.406
Stationary Cointegrating Vector (Normalised on G)						
	G	T	Y	R		
	1.000	0.1977	-2.254	0.0153		

On the other hand, the results in panel (B) within the multivariate case using the maximal eigenvalue and the trace tests denotes the null hypothesis of no cointegrating relationship is rejected at the 5% level. Thus, it can be concluded from both tests that there exist at least one cointegrating vector in the multivariate model after being normalized on G. Thus it can be said that a long-run relationship exists between taxes, government spending, interest rates and real GNP.

In Table 4 we also reported results from testing different hypothesis with regards to the cointegrating relationship among the four variables. These tests are the long run exclusion and the weak exogeneity tests.

Table 3. Cointegration Hypotheses Tests

Variables	Long-Run Exclusion Test	Weak Exogeneity Test
G	18.003***	19.191***
T	2.439	9.281***
R	0.323	1.522
Y	21.439***	0.870

Notes: The statistics are log-likelihood ratios and distributed as χ^2 with d.f. = number of significant cointegrating vectors, in this case r=1. *, **, *** are the critical values for the rejection of the null hypothesis at the 10%, 5% and 1% levels respectively.

The long run exclusion test verifies whether any of the variables in the multivariate cointegrating model does not belong in the cointegrating space and thus can be excluded. From the exclusion test we concluded that taxes and the interest rate could be omitted from the cointegrating relationship. It is quite surprising that the tax variable can be excluded from the cointegrating relationship. However at the 10% level of significance the tax variable is borderline that is it could be considered within the cointegrating space. In determining whether any of the variables were weakly exogenous we found that both income and the interest rate were weakly exogenous. As a result there are two variables in the system, which should be considered endogenous, and these are government spending and taxes.

Granger Causality Test Results

Table 4 reports the Granger Causality results from the multivariate system, where government spending and taxes are the dependent variables. The error correction representation was used to determine the causal relationships among the variables.

Table 4. Likelihood Ratio Tests for Various Granger-Causality Hypotheses

Null Hypotheses	Short-run	Long-Run
Multivariate ECM Models (G, T, X, R)		
Dependent Variable: Taxes (T)		
Government spending (G) does not Granger_cause T	8.508***	5.325**
Real GDP (Y) does not Granger_cause T	0.028	
Interest rate (R) does not Granger_cause T	2.039	
Dependent Variable: Government Spending (G)		
T does not Granger_cause G	0.980	1.693
Y does not Granger_cause G	4.416**	
R does not Granger_cause G	2.182	

The results suggest that causality between taxes and government spending in Barbados is unidirectional from government spending to taxes. This pattern of causality is consistent with the ‘spend-and-tax methodology’, rather than the ‘tax-and-spend’. Furthermore, according to the statistical significance, the null hypothesis of no Granger causality running from government spending to taxes is rejected at the 5% level of significance in both the short-run and long run.

The question remains whether government should raise taxes to control their budget deficit as noted by the Buchanan and Wagner policy; should they reduce taxes in an attempt to control the budget deficit as emphasized by Friedman, or should they reduce government expenditure as noted by Barro (1979) and Peacock and Wiseman (1979). Based on the above empirical findings we noted that the spend-and-tax methodology is found in Barbados, hence in order for Government to reduce or control the fiscal deficit it should reduce fiscal expenditure. Craigwell and Belgrave (1995) found that some components of government expenditure are growth inducing while others are growth retarding. Therefore a detailed review of expenditure patterns

especially in the growth retarding areas should be carefully reviewed and adjustments made where possible.

Conclusion

This paper investigates the causal relationship between government spending and taxes for Barbados. The empirical analysis incorporates the cointegrating properties of the variables and expands the bivariate model to include other theoretically relevant variables. In this light, a multivariate model is estimated which includes real GDP and interest rates. The bivariate and multivariate cointegration models found different results. Nonetheless, more emphasis was placed on the multivariate model due to the omission –of-variables bias that is present in bivariate models. Results from the multivariate cointegrating model supports the existence of one long-run equilibrium relationship among the four variables. Furthermore, evidence from the multivariate error correction model suggests that government spending unidirectional and significantly granger-cause taxes in both the long run and the short run. These results imply rejection of the tax-and-spend hypothesis in favor of the spend-and-tax hypothesis in the case of Barbados. Therefore, from the perspective of policymaking and the deficit solution debate, it appears that reducing expenditure in Barbados should prove an optimal solution to the budget deficit phenomena.

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