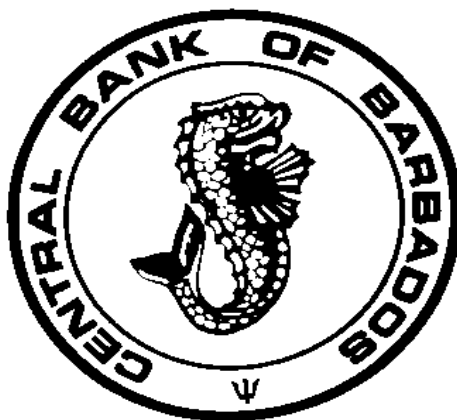


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**ANALYSIS OF TAX BUOYANCIES AND REVENUE
PERFORMANCE IN BARBADOS**

BY

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Analysis of Tax Buoyancies and Revenue Performance in Barbados

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Abstract

Tax systems exist primarily to raise revenue to fund government operations and facilitate economic growth. Unless tax revenues grow sufficiently, governments must reduce expenditures, raise tax rates, or alter other structural characteristics. This paper investigates the impact of tax changes on economic activity in Barbados, as well as addresses the question: does an elastic tax structure provoke greater public spending? We focus our analysis on the derivation of coefficients for short-run buoyancy, long-run buoyancy and the speed of adjustment per tax category. Estimates are derived empirically by applying Error Correction Models (ECM). For the study period 1980-2014, the results indicate that in the short-run all categories of taxes have coefficients that are below unity – taxes are not buoyant. Conversely, in the long-run Income Tax, Excise Duties, Value-Added Tax (VAT) and Company Tax, are buoyant. The speed of adjustment is highest for Excise Duties (41 per cent) i.e., adjustment towards its long-term buoyancy is fast. Our study also finds evidence of the “Please Effect” that is, extra collection of tax revenue can trigger an increase in government consumption expenditure.

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1 Introduction

Public expenditure financed through revenue growth reduces government's appetite for increasing public sector debt. The effectiveness of a government's policy changes on its ability to increase revenue can be determined through an examination of its financial policy. This includes an assessment of the efficacy of the choice of borrowing versus taxation. From a macroeconomic perspective, some policy-makers believe reducing spending should be preferred to raising taxes or borrowing. Fiscal adjustments based on spending cuts and no tax increases are more likely to reduce deficits and debt over gross domestic product (GDP) ratios than those based on tax increases (Alesina and Ardagna (2010)). In addition, adjustments on the spending side rather than on the tax side are less likely to create recessions. For some countries, the lack of austerity - cutting spending in order to reduce a country's debt-to-GDP ratio or to grow a country's economy - means more deficit spending, which likely will trigger large increases in interest rates, debt restructuring and possibly weakness in the banking sector. To reinforce this, Mc Dermott and Wescott (1996) emphasizes that fiscal consolidations focused on reducing expenditure in items such as transfers and government wages, is more likely to reduce the public debt to GDP ratio than increases in revenues.

The popular Wagner's law posits that public expenditure is a natural consequence of economic growth (Demirbas, (1999)). However, expansionary fiscal policy is not always the best approach to increase growth and by extension, tax revenues due to increases in aggregate demand and losses in foreign reserves through increased imports (Worrell et al. (2015)). Additionally, an increase in tax collections by government does not always tackle the budget deficit problem (Friedman, 1978). In fact, governments borrow to fill the finance gap; as a result, debt servicing is increased and the unavoidable outcome is an increase in fiscal deficit. Economic analysis suggests that tax increases would not in general be more harmful to the economy than spending reductions. Tax systems exist primarily to raise revenue to fund government operations. Unless tax revenues grow sufficiently to finance desired services over the long term, governments must reduce expenditures, raise tax rates, or alter other structural characteristics. In the short run, the adverse impact of a tax increase on the economy may be smaller than the adverse impact of a spending reduction, because some tax increases would result in reduced saving rather than reduced consumption and economic activity (Peter Orszag and Joseph Stiglitz, 2001).

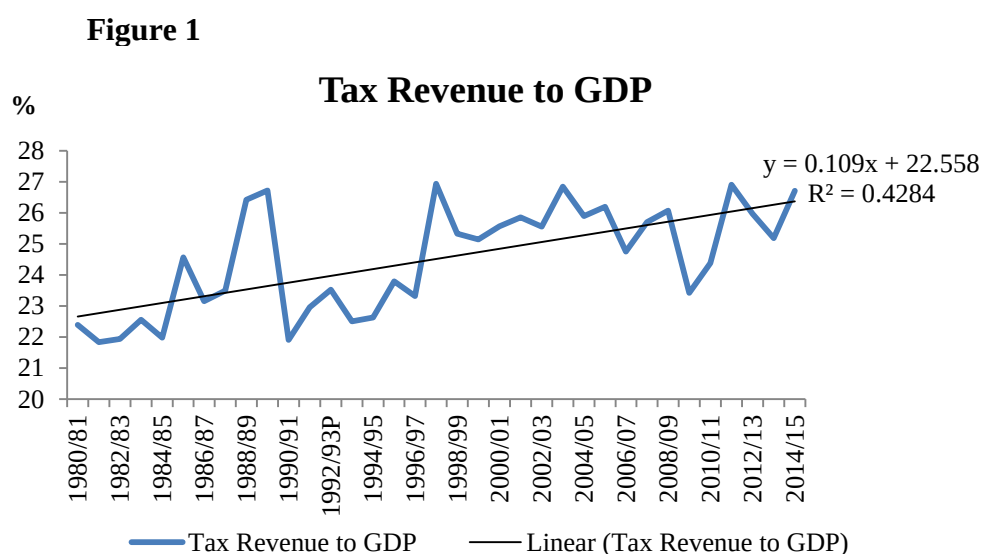
The gains from increased economic activity are also a strong determinant of tax growth and hence reduced fiscal deficits. In fact, it is expected that as a country expands its level of development, the formal sector of the economy increases thereby fostering increased revenue (Castro and Camarillo, (2014)). As a result, many researchers have emphasized that taxes levied on productive sector be reduced to promote increased growth (Ferede and Dahlby (2012), (Engen and Skinner (1996))). Similarly, it is expected that a higher per capita income reflects the ability to pay taxes as well as a greater capacity to levy and collect tax revenue (Chelliah, (1971)).

The relationship between tax revenue and GDP growth can also be bidirectional in that increased government revenue aids in accelerating growth and enhancing projects which can be

transformed into increased income and hence, tax revenues. However, this depends on the economy's institutional quality and level of development.

Previous studies within the Caribbean aimed at analyzing the buoyancy of the tax system, have found that tax revenues tend to be more buoyant than elastic. For one, Cotton (2012), examined the responsiveness of the non-oil taxation system in Trinidad and Tobago to changes in non-oil GDP and found that the tax buoyancy estimates are equivalent to 0.99 while the elasticity coefficient was slightly lower (0.81). The author concluded that direct taxes such as income taxes and corporate taxes were more buoyant than indirect taxes (see also Alleyne, (1999) and Mukarram (2001)). In expanding the analysis to OECD countries and using cointegration and an Error Correction Model, Belinga et al. (2014) also reinforced that personal income taxes, taxes on goods and services and corporate income tends to be more buoyant than property taxes and indirect taxes such as excises. Additionally, in examining the relationship between GDP growth and growth in tax revenues in Jamaica between March 1998 to December 2010, Milwood (2011) concluded that the buoyancy was approximately 1.09 while tax elasticities were approximately 0.95.

Barbados for one, has continuously focused on growth enhancing avenues coupled with a number of tax reforms in an attempt to mitigate increased deficits. The level of growth that stems from these adjustments warrants further analysis as to whether they are conducive for greater revenues. Despite persistent fiscal deficits, the ratio of tax revenue-to-GDP has been moving along a positive trajectory; thereby averaging 24 per cent between 1980 and 2014 (see Figure 1).



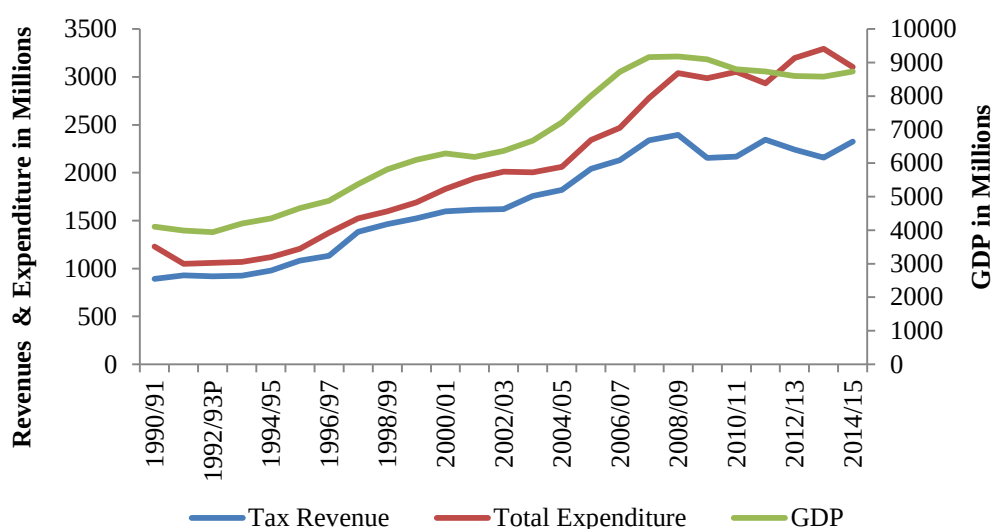
Source: Central Bank of Barbados

Increases in the tax to GDP ratio is mainly attributable to increases in Barbados' major revenue generating items such as income taxes, VAT, excises, and import duties. Spikes in the ratio

seem to manifest in cases where the economy was thriving or due to the implementation of a number of reforms. For instance, the 1990s recession caused the economy's main sectors (manufacturing and tourism) to flounder, thereby causing tax revenue to GDP to fall below 24 percent between 1990 and 1996. In an attempt to counteract the problem, the government implemented countercyclical fiscal policy (increased expenditure), which exacerbated the country's fiscal deficit within that time.

The economy began to thrive once more in 1997 due to the introduction of VAT and other tax reforms coupled with increases in the GDP. However, with the onset of the 2008 global financial crisis, growth began to deteriorate to an average of negative 1 per cent between, 2008 and 2013. Moreover, with the growth in tax revenues averaging 5.61 per cent over the period, expenditures and GDP have been growing along similar trajectories averaging 5.57, and 3 percent respectively (see Figure 2).

Figure 2



Source: Central Bank of Barbados

Given the aforementioned, two questions are of interest to this study: do changes in the level of taxation affect the level of economic activity and does an elastic tax structure provoke greater public spending? Conventionally, the correlation between taxation and economic activity shows that, on average, when economic activity rises more rapidly, tax revenues also are rising more rapidly. Revenue performance assessment has often been done by assessing tax buoyancy and tax elasticity (Prest, 1962; Sohota, 1961; Lavin, 1986; Mansfield, 1972 and Chellah, 1971).

Previous researchers, Skeete, Coppin and Boamah (2003) investigate both elasticity and buoyancy of Barbados' tax system. We focus our analysis on the derivation of buoyancy estimates with the application of the Dummy Variable approach. Estimates are derived

empirically by applying error correction models (ECM). The “Please Effect” hypothesis which was first noted in the 1950s is tested to investigate if growth of Barbados’ tax revenue has provoked an increase its government consumption expenditure. In the remainder of this study we describe the tax structures and revenue performance. The framework is presented in section 2. The data, methodology, model specification, and results are described in sections 3. Summary and conclusions follow in Section 4.

2 Overview/Background of the Tax System in Barbados

Barbados can be characterized as a small open economy that is heavily invested in tourism and offshore financial services. The government is the single largest employer of the small island state which has a rich history of promoting social equity through the provisioning of many welfare inducing programs particularly as it relates to education and health. As such the tax system has aided fiscal policy objectives through the redistribution of income to facilitate those with little means. In addition, the country’s openness and susceptibility to external shocks, creates another avenue through which the tax system becomes beneficial. This has been especially so in recent times as the country continues to undertake fiscal consolidation measures in order to reduce the current macro-economic challenges exacerbated by the Great Recession. In this case, where government revenue is in shortfall, the introduction of new taxes is able to help finance government expenditure (Howard, Public Finance in Small Open Economies: The Caribbean Experience 1992). Furthermore, the emphasis on developing the local export sector has also meant that multiple tax incentives have been offered to encourage Foreign Direct Investment which has led to some associated amount of revenue losses. These factors have cumulatively led to challenges as policy makers seek to increase revenues while maintaining the attractiveness of the business environment.

This is particularly difficult given the already high tax burden of the economy. In fact, because of its narrow tax base (aggravated by its small economic size and population), this economy as well as those in the wider region are known to have some of the largest tax rates as a percentage of income (profits) among high income countries (Inter-American Development Bank 2010). This gives little space for further revenue inducing measures. Instead some attempt must be made to improve the efficiency of the tax system by analyzing the tax structure as well as the elasticities and buoyancies of the current tax system.

The system has historically incorporated income, consumption and international trade taxes. The relative importance of each tax has depended on the historical period as well as the wider economic conditions under assessment. For example, during colonization, the region’s income was generated in large part by the commodity export sector. As such, government revenue was largely tied to taxes on international trade particularly customs duties (Howard 1988) . The narrow tax base however, became constrictive and so indirect taxation proved an insufficient source of principle income. The post-independence ideology of industrialization by invitation

that swept through the region meant that governments placed significant importance on national income. This broadened the tax base and led to an emphasis on income taxation as a potentially viable source of revenue, generating 50% of total revenue in 1976. The emphasis on gaining inflows from such a progressive system however, meant growing burdens within particular income tax brackets. (Howard 1979), deduced that the overall tax effort in Barbados increased from 21.7% in 1964 to 28.8% in 1977. While the tax credit system introduced in 1977 was aimed at reducing the tax burden of low income earners, those in the middle and high income brackets were faced with high marginal tax rates.

Though progressive taxes are effective in redistributing income and by extension welfare effects within an economy, it also distorts the behaviour of economic agents (Rhee 2012). High taxes act as a disincentive for middle and high income earners to save and invest which may have implications for economic growth. (Howard 1979), noted that growth in time and deposit savings in Barbados declined in the 70's amidst high marginal tax rates for those in higher tax brackets. The distortionary effects of such a system could not be sustained and in the following years, the government made a gradual attempt to alleviate the tax burden of the middle class. This was done via an adjustment of the tax bands as well as an increase in deductions and allowances. However this proved insufficient as the marginal rates remained high during the period (Howard 1986).

The 1980's saw a more aggressive stance on tax policy. The 1986 budget introduced a number of income tax reforms that provided a clear shift from a system that was traditionally based on optimality to one that focused on supply side dynamics. Some of the reform measures included a significant reduction of the personal and corporate income tax rates and bands, coupled with the introduction \$15000 threshold of tax exempt income (Economic Commission for Latin America and the Caribbean 2006). The plethora of reforms led to a reduction of the marginal tax rates and contributed positively to economic growth that year (Howard 1992). These effects however, were short lived as the necessary expenditure cuts needed to offset the reduction in revenue fell short of the targeted amounts. This spurred correctional measures as the local authorities acknowledged the impracticality of the budget reforms.

The insufficient level of revenue generated by the tax cuts in the 80's led to a renewed emphasis on indirect taxation during this time. This shift to indirect taxation was in part fueled by a need to accumulate more government revenue; however it also represented the commitment of the authorities to implement supply side tax policy. Additionally, it was also strategically placed during the economic downturn in order to dampen spending on imports, protecting the Balance of Payments Position. Concurrently, the seemingly inelastic nature of consumption taxes to changes in income meant that there would not be a substantial erosion of tax revenues, particularly when compared to its income counterparts (Howard and Alleyne 2004).

The increasing importance of indirect taxation continued into the 90's , however the indirect tax system was complicated and consisted of a myriad of consumption and surcharges that hampered

the effectiveness of tax collection through high administrative costs. As such the VAT was administered in 1997 to simplify the tax system (Craigwell and Dalrymple Kelvin & Moore 1996). Additionally the considerably less progressive nature of this tax meant a reduction of burden amidst the middle income homes. However, because of the regressive effects of the tax, there was a shift in the burden from middle to low income brackets. To counteract this, the government established a list of VAT exempt goods that were considered essential among the lower income brackets. While the VAT rate was established at 15%, it was later revised to allow the tourism sector to benefit from a lower rate of 7.5%. The implementation of the VAT tax faced challenges as arrears became substantial. The growing list of exemptions and zero rating goods increased the administrative costs. Furthermore, small businesses were hampered by auditing and compliance costs which they argued eroded competitiveness (Peters and Bristol 2006).

Direct taxation continued to lose prominence as a major income generator in the 2000's. Instead, it was used as a vehicle to promote equity in the tax system. There were persistent reductions in both Personal and Corporate tax rates during the period, which allowed for more disposable income while ensuring that the tax burden was not levied too heavily on a particular income bracket or subsector of the economy. The basic rate for persons earning \$24,200 or less was reduced from 25% to 20% in 2004 while the marginal rate for those that earned above \$24,200 was reduced from 40% to 37.5% in 2005 then further reduced to 35% in 2006. Simultaneously, there was some effort to improve the investment climate for corporations and small businesses. Corporation tax was reduced by 37.2 to 36% in 2003 and then to 25% in 2006. There were also a slew of tax allowance revisions over the period including an increase in the tax free allowance from \$15,000 to \$17,500 in 2004, to \$25,000 in 2007. Special care was taken to include tax incentives to small businesses as well as those businesses that were involved directly with special development projects in order to motivate productivity.

The Global Financial Crisis led to structural changes in the tax system during the latter 2000's. In light of the prolonged recession and worsening fiscal position due to expansionary policies in previous years, government sought to strengthen revenues in a worsening economic environment by depending on indirect taxation. In 2010, the VAT was raised from 15% to 17.5% in hopes of capturing some much needed income. There were also increases in other taxes including an increase on the excise tax on gasoline in 2010 as well as the introduction of new excise taxes on sweetened beverages and on mobile phones in 2015. Persistent deficits and sluggish recovery in the years following the crisis also led to additional temporary tax measures including a consolidation tax as well as municipal solid waste tax.

3 Framework

This section outlines the conceptual framework that motivates our analysis. We include a comprehensive discussion on the techniques and outline problems with the various approaches.

i. Buoyancy or elasticity

The main considerations for the analysis of tax revenues efficiency are embedded in the elasticity and buoyancy concepts. The “income elasticity” of a tax system measures how fast revenues grow relative to the economy. Tax “elasticity” refers to revenue growth in the absence of any tax policy changes, while tax “buoyancy” refers to growth including the effects of such changes. The fundamental difference between elasticity and buoyancy is that tax buoyancy assumes an unchanged tax system (that is, it is calculated as it would have been if there had not been any change in the tax laws, including the tax rates or base). An elastic tax system is one whose revenues grow faster than the tax base. A tax system is inelastic if revenues grow slower than the tax base. An elastic tax system is a highly desirable system, as it provides the government with a sustained fiscal resource base for financing its outlays. Inelastic tax system forces governments to continuously make discretionary changes, either in the tax bases or in the tax rates or both.

In principle, elasticity is a better measure of the growth potential of the tax structure. In practice, limitations often force analysts to rely on buoyancy data. Tax elasticity and buoyancy originate from the view that tax revenue and GDP/output (Y) are related. Traditionally, the proxy base is taken as output as it captures the critical fact that the rate at which revenues increase over time differs depending on the tax structure, the quality of tax administration, and the pace and nature of economic growth. Other bases are possible, such as personal income, corporate profits, nominal private consumption, imports and export.

Theoretically, tax elasticity is the ratio of the percentage change in tax revenue to the percentage change in income or GDP, assuming no discretionary changes have been made in the tax rate or tax base (Prest, 1962). Formally, tax elasticity is defined as:

$$\epsilon_T = \frac{\% \Delta T}{\% \Delta B} \quad \text{Equation 1}$$

ϵ_T : Elasticity of tax revenue to income or Tax base

ΔT : Change in tax revenue

ΔB : Change in tax base

If $\epsilon_T > 1$ the tax structure is progressive but if the tax structure is regressive, $\epsilon_T < 1$. The value of the tax elasticity gives an indication to policy-makers of whether tax revenues will rise at the same pace as the tax base.

Tax buoyancy captures the overall responsiveness of taxes to overall income and hence measure of the extent of which tax policy is able to increase revenue yield. Statistically, tax (or revenue) buoyancy is represented by:

$$B_T = \frac{\% \Delta AR}{\% \Delta Y} \quad \text{Equation 2}$$

B_T : Tax buoyancy
 ΔR : Change in actual tax revenues
 ΔY : Change in tax base of a given tax

A tax which is buoyant is one whose revenues increase by more than one percent for a one percent increase in national income/output. A low coefficient (below 1%) is an indication of an unsuccessful tax policy in terms of increasing revenue; hence it may also suggest low tax elasticity. The buoyancy of a tax can be obtained by estimating the following using the logarithmic regression:

$$\text{Log}T = \beta_0 + \beta_1 \text{Log}(Y)_t + \varepsilon_t \quad \text{Equation 3}$$

T : Tax revenue
 β_0 : Constant
 β_1 : Buoyancy coefficient
 Y : Tax base

Oftentimes it is difficult to accurately measure the tax base, when estimating elasticity; therefore either a suitable estimation methodology has to be adopted or the time series data on tax revenues need to be adjusted to eliminate the effects of discretionary tax measures. The Proportional Adjustment (PA) method, originally developed by Prest (1962), Constant Rate Structure, Divisia Index and the Dummy Variable approach were designed to take into account the effects of discretionary tax measures.

Prest (1962), argues that since changes in the tax structure can alter elasticity from time to time the adjusted tax series can be computed by estimating the following equation:

$$AT_{k-n} = \frac{T_n}{T_n - D_n} \quad \text{Equation 4}$$

AT_{k-n} : Denotes adjusted series for T_{k-n} where $k=1$

For the n th period, no adjustment is needed, since the tax collection includes discretionary changes. In other words, the tax revenue in the n th period reflects the current tax structure. Three steps are involved in deriving the adjusted revenue series under the (PA) approach. Compile actual tax revenue earned for the study period T_1 T_{n-1} , T_n ; compile data series for discretionary changes $D_1 \dots D_{n-1}$, D_n and adjust the actual tax revenue series using the discretionary change coefficient. Using the modified proportional adjustment in an attempt to reduce the limitation of the above approach, (Cotton and Joseph 2012) for Trinidad and Tobago over the period of 1990 to 2009 and found that the non oil tax system was relatively inelastic(.89) and depended on tax policy to raise revenues.

The Dummy Variable technique suggested by Singer (1968) involves the use of a dummy variable to capture important discretionary changes in tax rates and tax structures for every year when such policy shifts occur. The resulting model is:

$$\text{Log}T = \beta_0 + \beta_1 \log Y + \sum \theta_i D_i + \varepsilon_i \quad \text{Equation 5}$$

Where θ_i = Impact or coefficient of the discretionary change; and D_i = dummy variable as proxy for discretionary tax measures. D_i takes the value of 1 for each year in which there is an exogenous change in the tax policy and a value of zero (0) otherwise. The summation takes account for the possibility of multiple tax changes during a specified period. The dummy variable approach cannot be used if discretionary tax changes have been made frequently in the past, since it leads to an excessive reduction in the degrees of freedom and obstructs the efficiency of the estimators (Milwood, 2011).

The Constant Rate Structure proposed by Andersen (1973) and Choudhry (1975) establishes a constant structure and obtains estimates by assuming the same tax structure has been applied consistently over time. This requires a detailed tax-base series for all the individual taxes. The constant rate method is complex and it is difficult to collate data on the same tax base over years.

Divisia Index is derived from a weighted sum of growth rate of factor inputs; it is an index of factor inputs, for the measurement of technical change. The index of technical change is the ratio of an index of total productivity to an index of factor productivity; the latter measured by the Divisia index. One of the major advantages of the DI over other techniques is that no adjustment of the historical series is necessary. This is because the index in and of itself provides the automatic growth of revenue without “cleansing” the data of discretionary tax changes (Milwood, 2011). The Divisia method has two major limitations. It can underestimate (overestimate) the positive (negative) effect of change. If discretionary changes produce very large revenue effects, this method does not give satisfactory results. Using this methodology for Jamaica from March 1998 – December 2010, found that overall discretionary tax changes positively affected total tax revenues as the elasticity measure (.97) was smaller than the buoyancy measure of 1.11. Similarly (Hamlet 2013) found that while for the tax system of Dominica was relatively elastic, those of St Lucia and Antigua and Barbuda were not. All three countries had relatively buoyant tax structures, indicating, that similar to the Jamaica case study, discretionary tax measures seem to directly affect tax revenue yields.

Divisia index and the dummy variable methods are least demanding in terms of data requirements, since they rely mainly on actual tax collections and tax base measures at aggregative levels. This study focuses exclusively on the concept of buoyancy and applies the dummy variable (DV) approach to compute estimates for Barbados. The DV technique is chosen since it has the tendency to minimize the errors between the actual and the estimates.

ii. The “Please Effect” Hypothesis

Increased tax effort has been accepted as a desirable way for governments to propel economic growth. The assumption is that private sector marginal propensity to save is low and increased taxation of government will be used entirely to reduce a government deficit (dis-saving) or to increase surplus. It is also possible that as tax revenue goes up, government spending may increase. In such a case, the economic growth rate may actually decrease as taxes increase. This outcome depends on changes in the tax ratio, and how government spends the additional

revenue. This phenomenon of rising government expenditure in correspondence with the increase in the collection of tax revenues is called the "Please Effect".

The starting point of the hypothesis is the relationship between taxes, government expenditure, capital stock, investments and gross national product. Formally this is represented by:

$$g_Y = \frac{s(1-t)+(1-v)}{ICOR} \quad \text{Equation 6}$$

Where s denotes savings, t : tax revenues, $v = g_Y$: ratio of government expenditure to GDP. $ICOR = \frac{\Delta K}{\Delta Y}$, ΔK : change in capital stock equals new net investment and change in GNP (ΔK). If $v = 1$, government spends all the tax revenue regardless of an increase in tax rates and revenue. As a result, private savings, government savings, and investment go down. This lowers the growth rate. In that case:

$$g_Y = \frac{s(1-t)}{ICOR} \quad \text{Equation 7}$$

When the tax rate goes up, g_Y goes down. The "Please Effect" can be estimated by applying the following equation:

$$v = \alpha + \beta \frac{T}{GDP} \quad \text{Equation 8}$$

Where $v = \frac{G}{Y}$ = ratio of government expenditure to GDP, the coefficient α is the expected mean value of v when $\frac{T}{GDP} = 0$. β measures the responsiveness of government's spending to an increase in tax revenue. The "Please Effect" hypothesis was initially developed to refer to the results of vigorous tax efforts having an adverse effect on overall savings in less developed countries (Crook, 2002).

4 Data, methodology and results

i. Data

This research aims to examine the buoyancy of Barbados' tax revenue with respect to its bases in the short run and long run and the speed of adjustment. We also investigate the behaviour of government spending following tax changes to test the proposition that fiscal deficit cannot be reduced by increasing taxes. To achieve these objectives we use annual time series on gross domestic product (GDP) at market prices, retail price index (RPI), government expenditure (G_y), tax revenue (T) and six major tax categories which serve as dependent variables: personal income tax (INVT), corporate income tax (CORPT), value added tax (VAT), excise taxes (XCISE), import duties (IMPDU) and land tax (LNDT). Imports (IMP) are used as the proxy

base for the estimation of excise tax and import duties, since imports duties are levied on the importation of goods and services. GDP at market prices constitutes the proxy base for total tax revenue. The GDP deflator was used as the proxy for all other taxes. GDP at market prices and RPI were used to derive GDP deflator. The deflator is the most comprehensive price index for GDP, it correctly measures inflation. We use time series data for the period 1980-2014 published by the Central Bank of Barbados and the Barbados Statistical Service.

ii. Methodology

The starting point for our estimation of tax buoyancy is the application of stationarity test. The test for stationarity was conducted using Augmented Dicky Fuller unit root test to determine if the variables are individually stationary or non-stationary. Stationary variables permit the estimation of cointegration techniques. The Durbin Watson Statistic (DW) is used to detect the presence of serial correlation in the data set. Next, the Dummy Variable Techniques developed by Singer (1968) was utilized to capture each year in which there has been a tax policy change. Short-term estimates, long-term estimates and the speed of adjustment are then generated from error correction model (ECM) as proposed by Sobel and Holcombe (1996). The coefficient of the error correction term gives the speed of adjustment of each variable towards its long-run equilibrium value. The sign of the coefficient gives the direction of adjustment towards equilibrium. The higher the coefficient of the lagged error term, the faster the speed of adjustment towards equilibrium level. If the sign of the coefficient is negative, it implies convergence towards the equilibrium in the long-run. The ECM is useful since it simultaneously estimates short-run effects, long-term relationship and speed of adjustment. Our end point is the extension of the model to incorporate an analysis of the sensitivity of government spending changes in taxes and its impact on national income – the “Please Effect”.

iii. Model Specification

The selected econometric specification used in this paper allows for direct comparison between the short-run and long-run effects. This is achieved with an error-correction model (ECM). Following the approach of Sobel and Holcombe (1996), Bruce et al. (2006) and Wolswijk (2007) the empirical tax buoyancy model is expressed as:

$$\Delta \text{Log}(T_{i,t}) = \delta_i + \phi_{i,0} \Delta \text{log}(Y_{i,t}) + \lambda_i (\text{log} T_{i,t-1} - \beta_i \text{log} Y_{i,t-1}) + \sum_{i=1} \theta_i D_i + \varepsilon_{it} \quad \text{Equation 9}$$

Two important analyses are of interest. The short-run tax base response to tax changes is smaller or greater than the long-run response. This depends of on whether β_i is less than or greater than $\phi_{i,0}$. The $\phi_{i,0}$ parameter measures the short-term buoyancy and β_i denotes long-term buoyancy. The second issues relates to how fast tax bases move toward a new long-run equilibrium brought about by changes in taxes. The λ_i parameter measures the size of adjustment of the tax base to its long-run equilibrium value, and gives the percentage of disequilibrium that is removed in every period. Therefore, the larger the absolute value of this adjustment parameter, the faster the tax base moves toward its long-run value. Equation (9) is estimated for both aggregate tax revenue and disaggregated tax revenue by category.

We extend the model to incorporate an analysis of the sensitivity of government spending changes in national income – the “Please Effect”. The model is formulated as:

$$\log(v) = \alpha + \beta \log\left(\frac{TR}{GDP}\right) + \varepsilon_t \quad \text{Equation (10)}$$

Where $v = \frac{g_y}{GDP}$ and g_y denotes government expenditure.

iv. Empirical Results

As indicated above, prior to estimating the buoyancy estimates test for stationarity are conducted. The results of the ADF unit root tests are reported in Table 1. All time series variables with the exception of land taxes are non-stationary and integrated of the first order I(1).

Table 1: Unit Root test for Variables

Variables	ADF – Stats	Critical Value (5%)	Integration	DV
Log_GDP	1.417	2.960	I(1)	2.217
Log_GDP_Deflator	0.945	2.951	I(1)	1.77
Log_VAT	0.776	2.951	I(1)	1.68
Log_EXCISE	1.346	2.964	I(1)	1.58
Log_LNDT	2.985	2.951	I(0)	2.01
Log_IMPDU	1.295	2.951	I(1)	1.80
Log_INV	0.585	2.621	I(1)	2.02
Log_CORPT	1.625	2.951	I(1)	1.66
Log_T	2.097	2.951	I(1)	2.08
Log_IMP	0.454	2.951	I(1)	1.916

We estimate equation (9) separately for each tax category by fitting a double log regression model. The estimated coefficients for short-run buoyancy, long-run buoyancy and the speed of adjustment per tax category are shown in Tables 2. In the short-run all categories of taxes have coefficients that are below unity – taxes are not buoyant. Conversely, revenues are buoyant in the long run. This may have resulted because economic forces may have affected changes to restore the long-run equilibrium path of revenue following short-run disturbances. The results suggest that in the long-run income tax, excise duties, VAT and company tax have statistically positive significant effect on the buoyancy of tax revenue. This implies that revenue from these taxes grow faster than GDP. It also suggests that discretionary measures; namely the introduction of VAT and changes in corporation tax rate significantly impact the respective revenues. The estimated buoyancies are: VAT (9.40); import duties (9.34) and corporation tax (1.69). The finding could also be attributed to the fact that it is easier to impose and collect VAT and import duties.

The results indicate that the long-run buoyancy for Barbados’ overall tax system is 2.88. Howard studying the buoyancy of the Barbadian economy from 1974-1984 found a buoyancy of the tax system of .68 which he attested was due from structural changes of the tax system as well as a

burgeoning underground economy which narrowed the tax base. Contrary to our results, (Skeete, Coppin and Boamah 2003) used a similar methodology to this study, and found that total tax buoyancies are above 1 in both the long and short run, but do seem to become more buoyant in the long run. Given our results, it can be argued that a 1 percentage point growth in nominal GDP spurred a more than 1 proportionate total increase in tax revenue. This implies that the Barbados' tax structure has been buoyant over the study period. Income tax and land tax have not been buoyant; with estimates of 0.693 and 0.392 respectively, which shows loss of revenue. The low buoyancy for land tax can be attributed to the difficulty of collecting land tax and is an indication of inefficiency in tax administration, low tax compliance and tax evasion.

Table 2: Buoyancy of Tax Revenues 1980-2014

Tax Category	Short-run Buoyancy Estimates	t-Stats	Long-run Buoyancy Estimates	t-Stats	Speed of Adjustment
Income Tax	0.747	0.432	0.693	3.858	0.163
Import Duties	0.082	0.358	9.344	1.589	0.002
Excise Duties	0.247	1.882	3.274	12.018	0.411
Value Added Tax	0.128	1.337	9.401	5.285	0.064
Land Tax	0.412	2.628	0.392	1.297	0.037
Company Tax	0.032	0.174	1.619	6.811	0.132
Total Tax Revenue	0.267	1.108	2.822	0.747	0.001

As indicated in table 2, the speed of adjustment coefficient for income tax is 0.163 and is significant. It implies a low speed of adjustment - 16 percent of the previous errors in the income tax revenue are corrected for in the current period. The speed of adjustment is highest for excise tax (41%) i.e., adjustment towards its long-term buoyancy is fast

Table 3 shows the estimates from the investigation of the “Please Effect”. The p-value test shows that the parameters are statistically significant. Interestingly, government consumption reduces the taxation effort. The rationale is that policy makers use tax revenues to off-set government consumption expenditure. The results also indicate that government will spend approximately 87 percent of any increase tax revenue. As tax revenue increases, the ratio of government expenditure to the tax revenue will be slightly lower than 87 percent.

Table 3: Dependent variable: Government Spending-to-GDP

Regressor	Parameter	p-value
<i>constant</i>	0.8669	0.000
β	-0.0272	0.000

5 Conclusion

A number of conclusions and important policy implications can be drawn from this study. The study found that Barbados' overall tax revenue has been buoyant in the long-run. Estimates for buoyancies of VAT and import duties have been the highest, whilst corporation taxes are reported to be the lowest. There are important differences between short and long-term buoyancy. In the short-run all categories of taxes are not buoyant, but some categories are reportedly buoyant in the long run. This may have resulted because economic forces may have effected changes to restore the long-run equilibrium path of revenue following short-run disturbances. Therefore policymakers should ensure that every individual tax is designed to respond to national income/output changes.

Interestingly, our results confirm the “please effect” that is, extra collection of tax revenue will be spent by the government. As a result, private savings, government savings, and investment go down. This lowers the growth rate. Successfully narrowing fiscal deficit and reducing the debt-to-GDP ratio is possible. Our research has found that fiscal adjustments based mostly on the spending side are less likely to be reversed and, as a result, can lead to greater reductions in debt-to-GDP ratios than increased tax revenue. One possible explanation is that by reducing expenditure, government is forced to become more efficient and also it does not result in as great a slowdown in the economy as when government takes a greater share of GDP through increased taxation. Spending-based adjustments can effect growth in GDP. The explanation is that lower spending reduces the expectation of higher taxes in the future, with positive effects on consumers and investors. In particular, there might be a boost in the confidence of the latter (Alesina and de Ruy, 2013).

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