The Relationship between Public Spending and Economic Growth in Selected Caribbean Countries: A Re-Examination

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Abstract

This study undertakes a re-examination of the empirical validity of Wagner's Law in selected Caribbean countries. It narrows a gap in the Caribbean literature by (i) explicitly considering population structure in the empirical investigation; (ii) utilising advanced econometric techniques that incorporates non-linearity in testing causality; and (iii) exploring the empirical validity of the ratchet effect. The study finds no empirical support for Wagner's Law, with and without population structure taken into account. However, the ratchet hypothesis is validated. The findings provide useful information for policymakers that can help broaden their understanding of the relationship between government spending and economic development, which could aid policy formulation.

Key Words: Wagner's Law, co-integration, non-linear causality, ratchet effect, Caribbean
JEL Code: C51, E62, H50, O54

1. INTRODUCTION

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This research is the first in what would be a series of studies examining fiscal policy and economic growth in the Caribbean. This initial work focuses on the behaviour of government expenditure both in the short run and long run. The study specifically examines the extent to which the share of government expenditure to Gross Domestic Product (GDP) is affected by economic activity, and ultimately economic development.

The antecedents of governments' spending decisions both in the short run and long run, and more fundamentally, the precise nature of the causal relationship between public expenditure and economic growth is an important public policy issue. Indeed, the preciseness of the relationship between government expenditure and economic activity has taken on greater significance as governments attempt to use fiscal policy to execute countercyclical measures within depressed economies suffering from a lingering recession.

There have been two main bodies of literature that have explored the relationship between government expenditure and economic growth. The first strand relates to Wagner's Law of Expanding State Expenditures, while the second is associated with Keynesian Counter-Cyclical Policy Intervention Theory. Wagner (1883) posited an interesting development thesis, which became known as "Wagner's Law". The Law essentially states that the share of government expenditure to increases more than proportionally with economic activity because the goods and services provided by the public sector generally have income elasticities greater than one. Wagner theorised a positive relationship between government spending and economic activity in the long run, such that while the relationship might not hold at all times, it will hold on average over time. Keynes' (1936) antithesis to Wagner postulates that government spending is an exogenous force that accelerates economic growth in the short run. Bird's (1972) ratchet hypothesis, which is a variant of Wagner's hypothesis, claims that in a crisis public expenditure declines more slowly than per capita income, thereby increasing the ratio of public expenditure to GDP; the converse is true in upturns. In other words, the ratchet hypothesis posits an asymmetry in government expenditure share to GDP over the business cycle. Accordingly, recessions or economic

downturns increase the ratio of government expenditure to GDP more than economic upturns reduce it.

The extant global economic slowdown has reignited the debate among academia and the policy world about the role of public spending in stimulating economic activity. Indeed, governments in the Caribbean have sought to cushion the effects of the economic downturn through expansionary fiscal policy (though limited in some cases given high indebtedness); however, the development impact has been uncertain. Governments' actions have been prompted by the unchallenged theoretical proposition of a positive correlation between public spending and economic activity. However, causality is an empirical issue. Moreover, the direction of causality is important to inform policy, especially in the context of small developing countries like those in the Caribbean with scarce resources. Indeed, Caribbean countries are ideal for examining the relationship between government expenditure and economic output since governments in the Region play a significant role in their respective economies. Not only are they the largest employers, they also play a vital role in the distribution and allocation of the scarce resources.

Does a rate of change in the public spending cause a more than proportional rate of change in economic activity? Or does a rate of change in economic activity cause a more than proportional rate of change in public spending? Does the relationship differ in the short run versus the long run? These are the research questions that this study endeavours to answer in a critical re-examination of the relationship between public expenditure and economic growth in the Caribbean. Specifically, this study investigates the empirical validity of Wagner's Law and the ratchet hypothesis in Barbados, Grenada, St. Lucia and St. Vincent and the Grenadines. The study focuses on the four tourism-dependant Caribbean economies in which public expenditure shares have been particularly strong, and moreover, where data are complete and consistent.

Indeed, it is important that governments' spending decisions are informed by robust analytical and empirical work that can increase the chances of maximising development results. This study therefore contributes to this important public policy issue and narrows a gap in the related Caribbean literature by: (i) explicitly

considering population structure in investigating the relationship between expenditure and growth; (ii) utilising advanced econometric techniques that incorporate non-linearity in testing causality; and (iii) examining the empirical validity of the ratchet hypothesis.

The remainder of the paper is structured accordingly; section 2 reviews the relevant literature, while section 3 discusses key trends in public expenditure and economic growth in the four countries over the period 1980-2011. Section 4 deals with the empirical approach and data, while section 5 presents the empirical results. Section 6 suggests some policy implications and section 7 concludes.

2. LITERATURE REVIEW

The economic literature related to the relationship between government expenditure and economic growth is delineated along the two contending views, which are the hypotheses of Wagner (1883) and Keynes (1936). However, for this study, the relevant literature is that pertaining to the former. Wagner considered public expenditure as a behavioral variable and offered three reasons for a faster rate of increase in public expenditure relative to economic growth. First, as a nation develops, the need for law and order, as well as regulatory activities increases. Second, with development, the need for culture and welfare expenditures, particularly education expands. Third, as development accelerates, rising technological requirements will cause governments to undertake certain economic services that would not otherwise be undertaken by the private sector. In contrast, Keynes viewed public expenditure as an exogenous policy instrument for correcting cyclical fluctuations in aggregate demand. Bird's (1972) ratchet effect hypothesis, which is a variant of Wagner's hypothesis, proposes an asymmetry in expenditure shares with the business cycle.

In relation to Wagner's Law, there have been several interpretations and the empirical literature is replete with econometric tests of its validity; Shelton (2007) provides a comprehensive survey. Results have been mixed both at the individual country level and the cross country level. Thorn (1972), in a study of 52 countries grouped according to their GDP per capita over the period 1952-1962, is one of the earliest

studies in which empirical support for Wagner's Law was found. Empirical findings of subsequent research also confirmed the validity of Wagner's Law in developing countries - Murthy (1981) for India; Nagarajan and Spears (1990) for Mexico and developed countries - Michas (1975) for Canada, Vatter and Walker (1986) for the USA, Gyles (1991) for the United Kingdom and Nomura (1995) for Japan.

Contrastingly, there have been some studies that found no empirical support for Wagner's Law. The results either showed a tendency for government expenditure to decline with economic development [Legrenzi and Milas (2002) for Italy] or no relationship between the two variables is found [Singh and Sahni (1984) for India and Henrekson (1993) for Sweden]. When only developing countries are used in cross-sectional studies, Ghandi (1971), Goffman and Mahar (1971), and Ram (1987) found no empirical support for Wagner's Law. However, other work [Murthy, 1981; and Tanzi and Zee, 1995] found Wagner's Law holds for developing countries when cross sectional data are used. Henrekson (1993) in a critique of earlier studies that found empirical support for Wagner's Law, opined that the results of those studies, especially those that used time series data were likely to be spurious because they were based on non-stationary data that were not likely to be co-integrated.

More recent research, utilising advanced econometrics techniques to investigate the long-run and short-run relationships between government expenditure and economic growth, show long-run elasticities close to one [Arpaia and Turrini, 2008], or greater than one [Akitoby, Clements, Gupta and Inchauste, 2006]. Moreover, the introduction of non-linear causality testing has tended to provide stronger conclusions on the direction of causality between government expenditure and national income. This has been a welcome addition to the slue of advanced econometrics techniques. Karagianni and Pempetzoglou (2009) contended that positive tests of Wagner's Law where non-linear causality exists, suggest a more dynamic and complex relationship between government expenditure and income than what has been reported in the literature. Indeed, such complexity is perhaps more reflective of reality, hence the focus in this study on non-linear causality testing.

While empirical tests of Wagner's Law have been extensive, fewer studies have investigated the important issue of the ratchet hypothesis of Bird (1972), who posited

that in economic downturns government expenditure declines more slowly than GDP per capita, and as such, the ratio of government expenditure to GDP rises. In upturns, government expenditure increases less rapidly than per capita income, and as such, the ratio of government expenditure to income falls. In other words, public expenditure ratchets up during economic downturns and remains at a new higher level after the economy stabilises. Diamond (1977) was one of the earliest empirical investigations of the ratchet effect; however, no empirical support was found for the hypothesis. In more recent studies, Durevall and Henrekson (2010) observed that the ratchet effect is generally not a cause for the growth in public expenditure in the United Kingdom and Sweden. In relation to developing countries, a handful of studies test the ratchet effect; most noteworthy are Hercowitz and Strawczynski (2004) and Gavin and Perotti (1997), who found empirical support for the hypothesis.

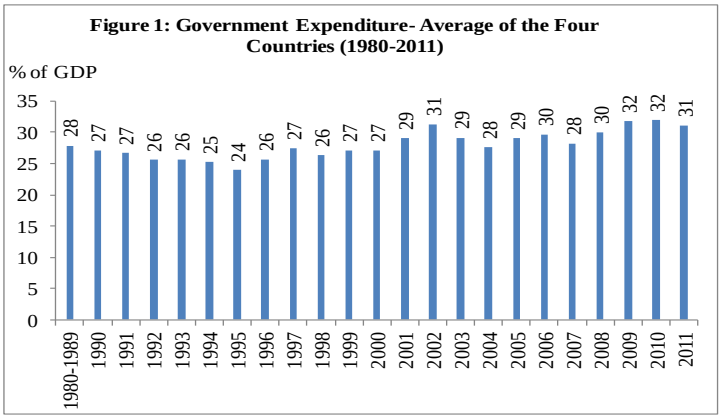
Population/age structure is another important consideration that has received inadequate attention in the literature. Indeed, an increasingly young population tends to raise demands on the public sector for services such as education. While an expanding ageing population tend to increase health spending. Shelton (2007) in a cross-sectional study of developing countries over the period 1970-2000 found that Wagner's Law is influenced by demographics, especially the age group 65 and over.

Studies relating to the Caribbean have been sparse, with mixed results. Grullón (2012) using advanced econometric techniques that included the bounds testing approach to co-integration, found empirical support for Wagner's Law in the Dominican Republic over the period 1960-2005. Grenade and Moore (2008) in their study of 12 selected countries concluded that Wagner's Law holds in only four of these countries. Earlier, Iyare and Lorde (2004) in their study of nine countries upheld particular formulations of Wagner' Law in three of nine countries. The direction of causality ran from income to public expenditure in only one country, while for the other two countries, the direction of causality ran from public expenditure to income. Iyare and Lorde's result were at odds with those of Allyne (1999) who did not find empirical support for Wagner's Law for a similar subset of Caribbean countries. Peters' (1996) study, which included Barbados and Haiti, produced empirical evidence of Wagner's Law.

What is unambiguous about the empirical literature is that results vary depending on methods applied. However, the bevy of empirical studies is a testament to the critical importance of this issue, especially for small developing countries like those in the Caribbean. From the survey of the literature, no recent studies that consider the ratchet effect or the age structure of the population in testing Wagner's Law for Caribbean countries were found. Indeed, consideration of these narrows a fundamental gap in the Caribbean literature.

3. PUBLIC EXPENDITURE AND ECONOMIC GROWTH IN THE CARIBBEAN

Over the sample period (1980-2011), public expenditure has risen as a share of GDP. This pattern is evident across the four countries and within each country. Figure 1 shows that the ratio of government expenditure to GDP, across all countries, rose from an average of 28% in 1980 to an average of 31% in 2011. The relatively large expenditure shares during the 1990s, in part, reflect the expanded role of the public sector as an instrument to speed development as well as to address external shocks. There is a noticeable uptake in the ratio during the 2000s, with the increase being particularly strong in 2008 and 2009, reflecting counter-cyclical spending on the part of all governments (albeit at varying degrees) to cushion the effects of the Great Recession. On the whole, the rising ratio of government expenditure to GDP is associated with three main factors that cut across all four countries: increasing wages and salaries (the public sector is the largest employer in all countries); escalating interest costs (a consequence of ballooning public debt); and expanding capital expenditures (particularly, but not exclusively related to infrastructure upgrade).



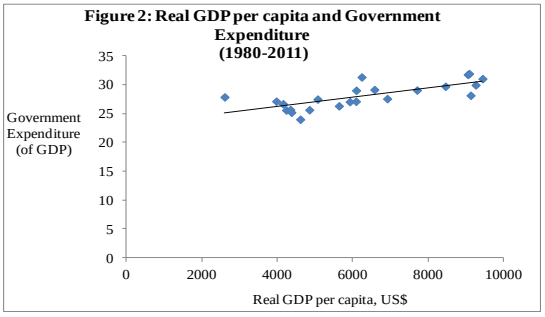
At the individual country level, Table 1 shows that government expenditure has accounted for an ever increasing share of GDP over the past 3 decades. The rise in the decade average ratio of government expenditure to GDP has been persistent in St.

Lucia since the 1990s, with the increase being substantial since the mid to latter 2000s, reflected an expansionary fiscal posture. In Barbados, following its structural adjustment programme in the early 1990s that resulted in significant reductions in expenditures (for example, 8% salary cut for public servants), the decade average ratio regained momentum, reaching a high of 35.4% in 2010. In recent years, in addition to rising wages and salaries and interest payments, the increase in the government expenditure has also been underpinned by off-budgetary spending related to financing of public investments. Moreover, falling GDP has also impacted the ratio. The ratio declined in 2011 as the government embarked on a programme of fiscal consolidation. In Grenada, hurricane rehabilitation spending following Hurricanes Ivan and Emily in 2004 and 2005 respectively, coupled with strong increases in external interest payments in the early part of the decade, accounted for the spike in the ratio during the period 2000-2009. The fall in the ratio since 2010 reflects fiscal consolidation as part of an Extended Credit Facility programme of the International Monetary Fund (IMF). In St. Vincent and the Grenadines, the significant increase in the ratio in 2010, relative to earlier periods was associated with higher current expenditure (on social assistance and rehabilitation cleanup) in the aftermath of Tropical Storm Tomas.Government expenditure has also increased in line with GDP.

Table 1: Government Expenditure (% of GDP) 1980-2011

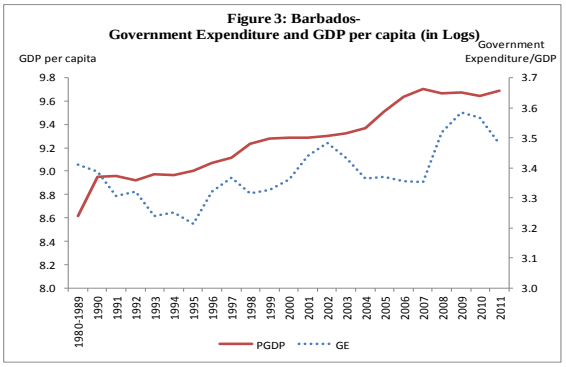
	1980-1989	1990-1999	2000-2009	2010	2011
Barbados	30.3	27.3	30.8	35.4	32.4
Grenada	27.5	25.5	29.0	27.3	27.0
St. Lucia	25.1	24.8	29.3	31.8	34.8
St.Vincent and the Grenadines	27.1	26.5	27.9	33.1	29.8

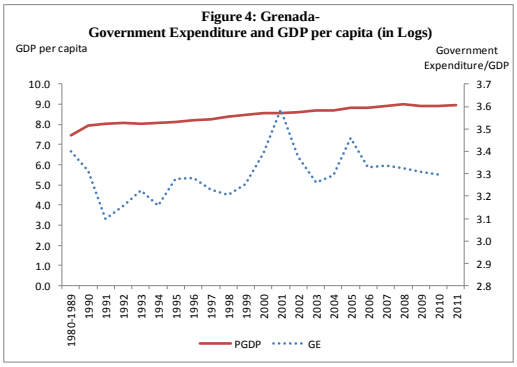
Figure 2 shows a fairly strong positive relationship between government expenditure as a ratio of GDP and GDP per capita for the relatively homogenous group of Caribbean countries.

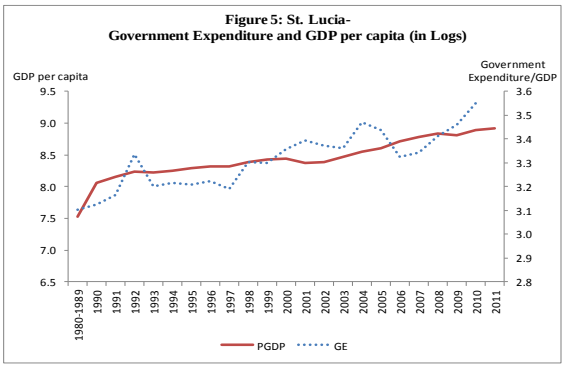


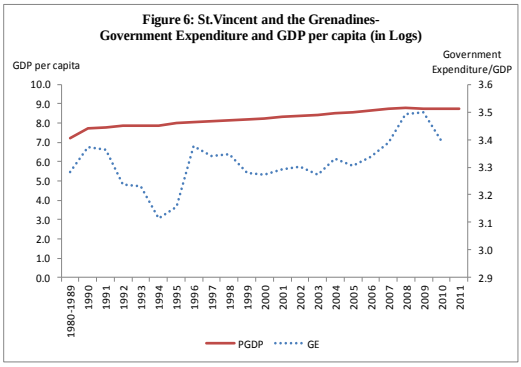
At the country level, the positive relationship also holds as Figures 3-6 show. While there are other factors that explain movements in government expenditure in addition to GDP per capita, and while not only government expenditure affects movements in

GDP per capita, the figures are instructive. An investigation into the structural nature of their relationship in the short run and long run is the focus of the next section.









4. THE EMPIRICAL MODEL, ECONOMETRIC METHOD AND DATA

This section provides an examination of the relationship between government expenditure and output in the four Eastern Caribbean countries. Wagner's Law is tested using the dependency ratio as a control variable and the validity of the ratchet hypothesis is explored. Panel Dynamic Ordinary Least Squares (PDOLS) is used to investigate the long-run validity of Wagner's Law in the four Caribbean countries. Panel analysis, despite allowing for reduced multi-collinearity and providing more degrees of freedom (Carey 1991), is sparingly used among Caribbean researchers, especially when investigating the nexus of government expenditure and economic activity. Additionally, the study utilises econometric techniques that incorporate linear and non-linear causality tests, after conducting related stochastic and cross dependence tests. Non-linear tests are used to avoid some of the inherent problems (particularly weak and limited conclusions) of linear tests. Moreover, non-linear tests are used to capture the dynamic interrelationship between government expenditure and economic activity. An attempt is made to provide more empirical rigour to this important public policy issue so as to offer more meaningful information and policy

insights to broaden policymakers' understanding of the relationship between government expenditure and output.

4.1 The Empirical Model

The study develops a model using government expenditure as a ratio of GDP (ge_t) in the four Caribbean economies, which is determined by economic activity and the dependency ratio as a control variable. The model checks the income elasticity to determine its precise size with and without the use of the dependency control variable. The population structure control variable is derived from determining the size of population within the age range of 0-15 and 65 and over, summed and express as a ratio against the size of population 15–65 age old. As priors, per capita GDP will positively impact government expenditure. The influence of the dependency variable on government expenditure is indeterminate (Shelton, 2007, Durevall and Henrekson, 2010), as the decision of governments to increase expenditure is sometimes driven by political expediency.

Formally, the model for the study is specified as:

$$\Delta(\eta) = \Psi \eta_{t-1} + \sum_{i=1}^{k-1} \beta \Delta \eta_{t-1} + \nu \kappa_t + e_t \qquad (1)$$

where Δ is the first difference operator, η includes the dependent variable of government expenditure as a share of GDP (ge) and the independent variables of per capita GDP (pgdp) and the dependency ratio (dep). Ψ and β are coefficients to be estimated. ν_t is a vector of deterministic variables, and the random term e_t is expected to be white noise. The variables are logged and their stochastic nature is checked after cross dependency and linearity tests are conducted on the panel variables (See Appendices 1A and 1B). The model tests Wagner's Law and the precise size of the income elasticity, along with the nature of causality among the panel variables of government expenditure and per capita GDP.

4.2 Econometric Method

4.2.1 Panel Dynamic Ordinary Least Squares Estimations

The long-run properties of government expenditure in the four countries are determined by a PDOLS model partially developed by Kao and Chiang (2000) and Mark and Sul (2003). The model used in this paper developed by Kao and others was first introduced by introduced by Saikkonnen (1991) and Stock and Watson (1993). It provides estimates of variables that are stationary and non-stationary, and is well behaved in small samples because it avoids endogeneity issues.

With respect to the steps in the estimation procedure, first, the stochastic nature of the variables are checked using the panel unit root procedures of (i) Levin, Lin and Chu (LLC) (2002); (ii) Breitung (2002) (which both have a common unit root process as their null hypothesis); (iii) Im, Pesaran and Shin (IPS) (2002); (iv) the Augmented Dickey Fuller - Fisher Chi-square (ADF) (which have individual unit root processes); and (v) the Hadri z-statistic that has a null hypothesis of no unit root. Next, non-stationary co-integration is analysed by using the system-based panel and group statistic tests of Johansen (1988). Following the Johansen test, cross dependency and linearity tests are conducted before the long and short-run estimates are determine. This is done because panel estimation assumes that variables are cross independent and linear.

The estimation of the long-run relationship for Equation (1) is based on the following regression:

$$ge_t = \alpha_0 + \beta \mathrm{Y}_t + \sum_{i=-k}^{k} \eta \Delta \mathrm{Y}_{t-1}^{1} + e_{\mathrm{t}} \qquad (2)$$

where Y is a vector of all explanatory variables, Y^{1} is a subset of I(1) variables of Y, β is a vector of long-run coefficients and e is a well behaved error term. Our model corrects for problems of endogeneity and autocorrelation, by including the lead and lags of the first order regressors. This paper sets k at 2 since annual data are used.

To investigate the short-run dynamics, the estimates from Equation (2) are used to derive a general error correcting model of the form:

$$\Delta ge_t = \beta_o + \sum_{1=1}^{m} \beta_{1_t} \Delta ge_{t-1} + \sum_{1=0}^{m} \beta_2 \Delta Y_{t-1}^{1} + \sum_{1=0}^{m} \beta_3 X_{t-1} + \sum_{i=1}^{m} \eta (ge_{t-1} - \beta Y_{t-1}) + \mu_{\mathrm{t}} \qquad (3)$$

The rate of change of government expenditure as a ratio of GDP is a function of its past, lagged first difference non-stationary variables (Y^1), lagged stationary variables (X) and the lagged error correction term. The short-run effects are captured by $\beta_1, \beta_2 and \beta_3$ while the rate at which the government expenditure readjusts to steady state (long-run position) after disequilibrium has occurred is given by η.

4.2.2 Linear and Non–Linear Panel Causality Tests

Statistical causation developed by Granger (1969) states that variable X Granger causes Y, as values of Y are better predicted from the past values of X, than from its own values. Variables could therefore show unidirectional causality as X_t causes $Y_t (X_t \rightarrow Y_t)$ or Y_t causes $X_t (Y_t \rightarrow X_t)$ or bidirectional causality where $Y_t \rightarrow X_t$ and $X_t \rightarrow Y_t$. Causality as proposed by Granger is the most common and easily understood method that produces well specified models (Hoover 2001).

(i) Panel Causality: Linear Tests

The Granger Causality test is applied to the four Caribbean countries to ascertain the causality between government expenditure share (ge) and economic activity (pgdp). Panel causality method is chosen over the time series version as it reduces collinearity and improves degrees of freedom [Greenidge, Drakes and Craigwell, 2010; Wright 2011]. Hurlin's (2004) method - where the coefficients are treated as constants, which improves the degrees of freedom and efficiency of the model - is used to carry out the linear panel causality tests. The model is based on:

$$ge_{it} = \varphi_i + \sum_{k=1}^{p} \delta_k ge_{it-k} + \sum_{k=0}^{p} \beta_{ik} x_{it-k} + \varepsilon_{it} \qquad (4)$$

where ge represents government expenditure share, the individual country specific coefficients are given by φ, the autoregressive and regression coefficients on lagged values of government expenditure and the explanatory variables (x) are denoted by δ and β, respectively, while ε is the error term with classical properties [Craigwell 2006; Craigwell and Moore 2008; Greenidge et al., 2010; Wright 2011]. The individual effects φ are presumed fixed along with δ and β and the lag order, k, is

identical (balanced) for all cross-section units of the panel (Hurlin 2004). Hurlin's method requires checking for homogenous and instantaneous non-causality (HINC), which is based on the Wald coefficient test that all the βs are equal to zero for all individuals *i* and all lags *k*. The Wald F-test is:

$$F_{HINC} = \frac{(SSR_r - SSR_u)/Np}{SSR_u/\left[NT - N(1+p) - p\right]}$$

where SSR_u is the sum of squared residuals from equation 4 and SSR_r is the restricted sum of squared residuals under null hypothesis that β_k is zero for all *i* and *k*. Once the regression coefficients are not significantly different from zero the hypothesis is accepted, which implies that the variable *x* is not Granger causing *y* in the sample. This result indicates non-causality and no further need for testing [Hurlin and Venet 2001; Hurlin 2004; Greenidge et al., 2010].

Rejecting the null hypothesis implies that a causal relationship exists across all countries in the data generating process (Greenidge et al., 2010). The indication that regression coefficients are not statistically different across countries is called the homogeneous causality (*HC*) test. The usual Wald statistic is undertaken to check the significance of the coefficients. *HC* is rejected if the Wald statistic given by $F_{HC} = \frac{(SSR_r^{'} - SSR_u)/[(N-1)p]}{SSR_u/\left[NT - N(1+p) - p\right]}$ is significant, where $SSR_r^{'}$ is the residual sum of squares obtained from equation 4 under H_0.

If the HC test is rejected, the regression coefficients must be examined across differing countries via the heterogeneous non-causality (*HENC*) test. The Wald statistic for this calculation is given as $F_{HC} = \frac{(SSR_r^{''} - SSR_u)/p]}{SSR_u/\left[NT - N(1+2p) - p\right]}$ where $SSR_r^{''}$ is the residual sum of squares under the hypothesis that the *k* coefficients are equal to zero only for country *i* [Hurlin and Venet, 2001; Hurlin, 2004; Greenidge et al., 2010].

(ii) Panel Causality: Non-Linear Tests

Given the impact of Globilisation on developing countries such like those in the Caribbean, it is expected that government spending, which is influenced by economic activity both domestically and globally, may display non-linear serial dependence. Using non-parametric methods of spatial probabilities to detect any relations between data series, Baek and Brock (1992a) conducted the first non-linearity causality test. However, the causality test they used did not provide a suitable test statistic if the data series were (i) either linear I(0) or linear I(1) processes. The deficiencies in this approach led to Harvey and Leybourne's (2007) methodology being adapted in this paper. This method provides suitable test statistics which consistently test across non-linear or linear I(0) and I(1) series.

Assuming that the hypothesis being tested is $PGDP \rightarrow GE$, the regression model is written as follows:

$GE = \beta_0 + \beta_1 PGDP_{it-1} + \beta_2 PGDP_{it-2}^2 + \beta_3 PGDP_{it-3}^3 + \beta_4 \Delta PGDP_{it-1} + \beta_5 (\Delta PGDP_{it-1})^2 + \beta_6 (\Delta PGDP_{it-1})^3$ For $GE \rightarrow PGDP$, the model is expressed as:

$$PGDP = \beta_0 + \beta_1 GE_{it-1} + \beta_2 GE_{it-2}^2 + \beta_3 GE_{it-3}^3 + \beta_4 \Delta GE_{it-1} + \beta_5 (\Delta GE_{it-1})^2 + \beta_6 (\Delta GE_{it-1})^3$$

Similar to the linear approach, checks are made if β_{ik} coefficients are statistically different from zero across all the countries and the null is rejected if the results show significant difference. The HINC statistics are employed to check whether the β_{ik} coefficients are statistically different from zero and once the null is rejected the β_{ik} coefficients for each country is used to determine whether these coefficients are non-linear and statistically significant. Appendix 3 provides the results of non-linear causality tests.

4.2.3 The Ratchet Effect as an Alternative Explanation of Wagner's Law

The ratchet effect seeks to determine the asymmetric nature of government expenditure in response to economic cycles. Generally, during a period of economic decline, the rate of change of government expenditure share is larger than the rate of change in a period of economic boom [Goff, 1998; Durevall and Henrekson, 2010]. The hypothesis can be tested using the following model:

$$\Delta ge = \alpha + \beta_p (pgdp - \tau)^p + \beta_n (pgdp - \tau)^n \quad (5)$$

Where $(pgdp - \tau)$ is the business cycle, τ is the trend in GDP per capita, p and n represent positive and negative deviations from trend or expansions and recession respectively, and β_p and β_n are the long-run or steady state coefficients. The ratchet hypothesis states that government expenditure shares rise over time because recessions increase it more than upturns reduce it due to the asymmetry. If fiscal policy is assumed to be countercyclical, the ratchet hypothesis holds if $\beta_p > \beta_n$ since both coefficients are negative. The short-run or contemporaneous responses are also measured to determine whether fiscal responses are pro-cyclical or countercyclical to economic changes. The panel and individual country estimations are done for all countries for the period 1980-2011. Before the dataset is tested and segmented, the trend (τ) is computed by using the Hodrick–Prescott (HP) filter and adjusting lambda to 2 as per capita GDP growth rate was considered a measure of the business cycle.

4.3 Data

Annual data for the period 1980-2011 are used, which were sourced from the IMF's World Economic Outlook database, July 2012 and the World Bank's World Development Indicators, 2011. Consistent with the empirical literature, the dependent variable is the ratio of government expenditure to GDP (ge), where ge is current and capital expenditure of the central government. The independent variables are (i) per capita GDP (pgdp), as the proxy development indicator; and (ii) the population dependency ratio (dep), defined as the population within the age range of 0-15 and 65 and over, summed and express as a ratio against the size of population aged 15-65. The study was challenged by the availability of higher frequency data series that could better capture the relationship between government spending and business cycles. Appendix 2 presents descriptive statistics of the data.

5. ESTIMATION RESULTS: PANEL AND INDIVIDUAL COUNTRIES

With respect to the panel of countries, the long-run results (Table 2) show that with the dependency ratio as a control variable, economic activity is a significant determinant of government expenditure with positive income elasticity. However, the coefficient is less than one (0.129), essentially disproving Wagner's Law. Without the use of the population dependency ratio, the elasticity is higher, but still less than one (0.319). The error correction term, which is significant at the 5% level, shows that for the model with the control variable, government expenditure will take approximately over 3 years to return to equilibrium after a shock.

Table 2: Long-Run Coefficients of Government Expenditure - PDOLS

ge_t = 2.07 + 0.129 PGDP - 0.41 DEP (1.81*) (2.00**)
Diagnostic Tests
R^2 = 0.24 $\overline{R^2}$ = 0.17 F = 3.64 DW = 1.92 NORM = 10.97 HET = 0.26

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics.

No significant results were found in the short-run panel estimates, portending that governments' expenditure is not impacted by national income in the short run or population structure dependency. This perhaps implies that the decision by governments to spend in the short run is driven by political expediency-related activities for example.

At the individual country level, the results for Barbados (Table 3) follow the general panel results as the income elasticity is positive but less than one (0.235) when controlled by the dependency variable. However, the error correction term (-0.97) shows a faster mean conversion speed of just under one period after a shock.

Table 3: Long-Run Coefficients of Government Expenditure - Barbados

ge_t = 0.235 PGDP – 1.98 DEP (3.74***) (2.48***)
Diagnostic Tests
R^2 = 0.68 $\overline{R^2}$ = 0.44 F = 2.86 DW = 2.04 NORM = 1.65 HET = 0.29

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. R^2 is the coefficient of

determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics.

Within the short run, the Government of Barbados spending is impacted by the population dependency ratio; a result that shows the high level of social support for the most vulnerable within the society.

As Table 4 shows, St. Lucia has a significant result for per capita GDP (0.415) in the long run; however, the dependency ratio was insignificant and there were no significant variables in the short run. The level of economic activity coefficient was lower than one, but positive and continues to disprove the essence of Wagner's Law. This result suggests that the short-run decisions of the government's spending are guided by factors outside of national income and the population structure dependency.

Table 4: Long-Run Coefficients of Government Expenditure – St. Lucia

$ge_t =$	0.415 PGDP + 0.067DEP
	(42.02***) (0.31)
Diagnostic Tests	
R^2 = 0.32 $\overline{R^2}$ = 0.09 F = 1.36 DW = 2.01 NORM = 0.65 HET = 0.35	

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics.

In the case of Grenada, the mean reversion rate after a shock indicates that government spending will take approximately 4 periods to return to long-run equilibrium. The coefficient estimate for PGDP (0.28) shows that it has a positive and significant impact on government spending when controlled by the dependency ratio (Table 5).

Table 5: Long-Run Coefficients of Government Expenditure – Grenada

$ge_t =$	0.28 PGDP - 2.68DEP
	(8.33***) (3.74***)
Diagnostic Tests	
R^2 = 0.27 $\overline{R^2}$ = 0.09 F = 0.74 DW = 2.01 NORM = 0.81 HET = 0.40	

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics.

The long-run results for St. Vincent and the Grenadines (Table 6) show that economic activity, though with elasticity less than one, has a negative impact on government spending, as the dependency ratio remains insignificant. Short-run estimates were insignificant and showed that government's spending decisions are made outside national income and dependency levels.

Table 6: Long-Run Coefficients of Government Expenditure – St. Vincent and the Grenadines

$ge_t =$	-0.63 PGDP + 0.61DEP
	(-4.79***) (0.48)
Diagnostic Tests	
R^2 = 0.49 $\overline{R^2}$ = 0.29 F = 2.44 DW = 2.01 NORM = 0.60 HET = 0.76	

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics.

With respect to the panel linear causality tests, the results in Table 7 show bidirectional causality for Grenada and St. Lucia and unidirectional causality ($PGDP \rightarrow GE$) for Barbados and St. Vincent and the Grenadines.

Table 7: Estimation Results - Panel Linear Methods

Country	$PGDP \rightarrow GE$	$GE \rightarrow PGDP$
St. Lucia	0.009***	260***
St. Vincent and the Grenadines	-0.033***	139
Grenada	0.011*	-417.67***
Barbados	0.0067**	1.60

The results for the non-linear causality tests (Table 8) show bi-directional causality for all countries except Grenada.

Table 8: Estimation Results - Panel Non-Linear Methods

Country	$PGDP \rightarrow GE$	$GE \rightarrow PGDP$
St. Lucia	0.01***	0.0000469***
St. Vincent and the Grenadines	-0.014***	-0.0000141***
Grenada	0.0037	0.0000985***

Barbados	0.005***	0.000079**

In relation to the ratchet effect, the panel results for the entire sample period in Table 9 show that short-run fiscal policy or contemporaneous responses are pro cyclical in economic downturns as the b_n coefficient is significant and positive for one response. At the individual country level, the larger positive b_n coefficients relative to the b_p (in absolute terms), suggests symmetry; however, the test is only significant in St. Lucia and St. Vincent and the Grenadines. The steady state coefficients were both significant, and the difference (1.82) when tested for asymmetry was significant at the 10% level, suggesting that the ratchet effect holds on average over the long run, especially during economic downturns. For the steady state coefficients, Barbados, St. Lucia and Grenada were large and the differences when tested showed evidence of asymmetry.

Table 9: Estimation Results - Panel and Individual Ratchet Effects

(1980-2011)

Time period (1980-2011)	Country	Short Run/Response Coefficients		Long Run/Steady State Coefficients		LR Tests of Asymmetry
		b_{1p}	b_{1n}	β_{1p}	β_{1n}	$\chi^2(1)$
	Panel	-0.16	0.56**	1.09***	-0.73*	3.50*
	Barbados	0.18	-2.93	2.22***	-1.87***	7.08***
	St. Lucia	-0.21	1.59*	2.56***	-2.34***	7.03***
	St. Vincent and the Grenadines	-0.51	2.94***	-0.72***	-0.23	0.23
	Grenada	-0.32	3.06	-2.89***	-3.40***	25.42***

6. POLICY IMPLICATIONS

The PDOLS long-run results show that economic activity has a positive effect on government expenditure. However, the results disapprove Wagner's Law as the coefficient when controlled with the dependency ratio, was less than one. The short-run results were insignificant and showed that governments' spending decisions are taken outside of national income and is perhaps tied to political expediency in the short run. The non-linear causality tests generally support bi-directional causality. This result suggests that shocks to both government expenditure and GDP per capita affect both variables non-proportionally because of the existence of non-linear/dynamic effects between the two variables.

The results for the ratchet effect when tested on the differences of the steady state coefficients show that for the panel and the individual countries except St. Vincent and the Grenadines, which was insignificant, that during a period of economic decline, government expenditure share increases more rapidly than it falls during economic upturns. This is consistent with the general theory of the ratchet effect, which states that policymakers are hesitant to reduce the level of government expenditure in a period of decline as support for social services are usually in higher demand than during times of economic boom.

Overall, the findings suggest implications for the design and conduct of fiscal (expenditure) policy, especially in the context of economic downturns. The empirical evidence points to asymmetry in public expenditure shares with the economic cycle. The relatively large size of the response coefficients suggests that changes in economic activity significantly influence government spending, both in the short run and long run. There appears to a symmetric relationship in the short run, suggesting that fiscal policy is pro cyclical, contemporaneously. However, on average over the long term, there appears to be an asymmetry in government expenditure share relative to the business cycle. The findings underscore the importance of having the fiscal space to facilitate countercyclical spending.

Implications for most Caribbean countries would suggest that governments should attempt to increase their available reserves during period of economic boom when support for social services is less, in anticipation of the need for greater government support or a smaller rate of decline in government expenditure during the periods of economic downturns. Caribbean economies are however not noted for the strong accumulation of reserves and most appear to have limited reserves to maintain social services during a period of extended economic sluggishness. It is therefore suggested that these countries attempt to work closer with development partners and multilateral organisations to assist them during periods of economic downturn. The findings also underscore the point that fiscal policy should not equate to economic policy, but it must be part of a broader programme of economic management, which encompasses structural, financial sector, monetary and social sector policies.

7. CONCLUSION

This study has investigated the empirical validity of Wagner's Law in four Caribbean countries: Barbados, Grenada, St. Lucia and St. Vincent and the Grenadines. It narrows a gap in the Caribbean literature by (i) explicitly considering population structure in the investigation of the relationship between public expenditure and growth; (ii) incorporating non-linear causality tests in the slew of advanced econometrics techniques employed; and (iii) exploring the validity of the ratchet effect in the context of Caribbean economies.

While the study confirms the theoretical proposition of a positive and significant relationship between government expenditure and economic development, no empirical support is found for Wagner's Law, with and without population structure taken into account. It appears that Wagner's Law does not represent the behavior of governments' expenditure in the long run. This suggests more complex explanations for the behaviour of public spending in the long run, as evidenced by the robust results of the non-linear causality tests. The study finds general support of the ratchet hypothesis, confirming that government expenditure share falls less rapidly during economic downturns than the rate at which it increases during upturns; perhaps a reflection of the potent sociopolitical nature of spending decisions. The findings suggest implications for the design and conduct of fiscal (expenditure) policies in the countries studied.

Given the short time series, the findings must be interpreted with caution. Indeed, there is scope for further research. Disaggregating public spending into functional components is one area for further study. Explicitly modeling the political economy determinants of public spending and examining the extent to which government spending affects economic activity and development more broadly are also other interesting areas for further work. Nonetheless, the findings of this study provide useful information for policymakers that can help broaden their understanding of the relationship between government spending and economic development, which could aid policy formulation.

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Appendix

Appendix 1: Panel Unit Root Tests

Series: DEP, GE, PGDP				
Sample: 1 128				
Exogenous variables: Individual effects				
Automatic selection of maximum lags				
Automatic lag length selection based on SIC: 0				
and Bartlett kernel				
			Cross-	
Method	Statistic	Prob.**	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.93652	0.1745	3	349
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.27038	0.1020	3	349
ADF - Fisher Chi-square	9.09480	0.1683	3	349
PP - Fisher Chi-square	8.25139	0.2203	3	349
** Probabilities for Fisher tests are computed using an asymptotic Chi				
-square distribution. All other tests assume asymptotic normality.				

Appendix 1B: Panel Unit Root Tests

Series: DEP, GE, PGDP				
Sample: 1 128				
Exogenous variables: Individual effects				
and Bartlett kernel				
Total number of observations: 355				
Cross-sections included: 3				
Method			Statistic	Prob.**
Hadri Z-stat			8.05319	0.0000
Heteroscedastic Consistent Z-stat			6.41971	0.0000
* Note: High autocorrelation leads to severe size distortion in Hadri test,				
leading to over-rejection of the null.				
** Probabilities are computed assuming asympotic normality				
Intermediate results on UNTITLED				
		Variance		
Series	LM	HAC	Bandwidth	Obs
DEP	0.5961	0.389100	9.0	128
GE	0.6630	0.161821	7.0	99
PGDP	0.8984	3.477826	9.0	128

Appendix 2: Descriptive Statistics

	DEP	**GE**	**PGDP**

Mean	-0.447640	3.363962	8.431563
Median	-0.442769	3.329200	8.431572
Maximum	-0.022739	3.831897	9.700625
Minimum	-0.916296	3.096392	6.587297
Std. Dev.	0.235370	0.169089	0.671683
Skewness	-0.115142	0.920491	-0.305047
Kurtosis	1.810181	3.260518	3.037320
Jarque-Bera	6.058385	14.26047	1.541134
Probability	0.048355	0.000801	0.462751
Sum	-44.31635	333.0322	834.7247
Sum Sq. Dev.	5.429095	2.801934	44.21343
Observations	99	99	99

Appendix 3: Homogenous and Instantaneous Non-Linear Causality Tests (No Controls and Controls)

		HINC (No Controls)		**HINC (With Controls)**		**HC**	
	Lags	OLS – Levels	Fixed effects – Levels	OLS – Levels	Fixed effects – Levels	OLS – Levels	Fixed effects – Levels
$GE \rightarrow PGDP$	1	24.78***	3.44***	19.87***	3.19***	9.35***	3.14***
	2	17.22***	3.89***	20.91***	3.13***	8.21***	2.67***
	3	9.67***	2.98***	18.76***	1.94*	6.92***	1.68*
$PGDP \rightarrow GE$	1	21.62***	3.01***	21.28***	3.12***	9.34***	2.40***
	2	25.76***	2.56***	16.89***	3.65***	7.37***	3.12***
	3	11.62***	3.19***	18.92***	1.86*	6.23***	2.16**

Note: ***,** and * indicate significance at the 1,5 and 10 percent level of testing, respectively.