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DETERMINANTS OF PUBLIC EXPENDITURE IN BARBADOS: AN EXPLORATORY STUDY

BY

NLANDU MAMINGI AND NIKITA BISHOP

CENTRAL BANK OF BARBADOS

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Determinants of Public Expenditure in Barbados: An Exploratory Study

Nlandu Mamingi[*] and Nikita Bishop[**]

Abstract

This exploratory study attempts to ascertain and analyse the drivers of public expenditure in Barbados in the period 1980-2013 via aggregated and disaggregated approaches. Using the autoregressive distributed lag (ARDL) methodology à la Pesaran et al. (2001). The study uncovers the following key results. At the aggregate level, in the long run, real GDP, tax revenue, foreign direct investment, debt servicing, and unemployment positively affect public expenditure. On the contrary, budget deficit and foreign aid negatively affect public expenditure in the long run. The long-run results are qualitatively uncovered in the short run. At the disaggregate level, the capital expenditure results are in many instances the opposite of those for current expenditure. Where comparable, it is found that long-run estimates are predominantly larger than short-run estimates. As policy implications, it is important to determine the levels of tax revenue, public debt, FDI, foreign aid, budget deficit, and unemployment that are consistent with a healthy public expenditure, that is, the one which yields a sustainable economic growth, a non-runaway budget deficit and a manageable public debt.

JEL classification: E62, O23, O54, C22

Keywords: Barbados, public expenditure, ARDL.

[*] Corresponding Author: M. Mamingi, Department of Economics, The University of the West Indies, Cave Hill Campus, Bridgetown BB11000, Barbados; Tel.: 1-246-4174278; Fax: 1-246-4389104; Email: nlandu.mamingi@cavehill.uwi.edu

[**] Former Intern, Research and Economic Analysis Department, The Central Bank of Barbados, , Bridgetown, Barbados

1. Introduction

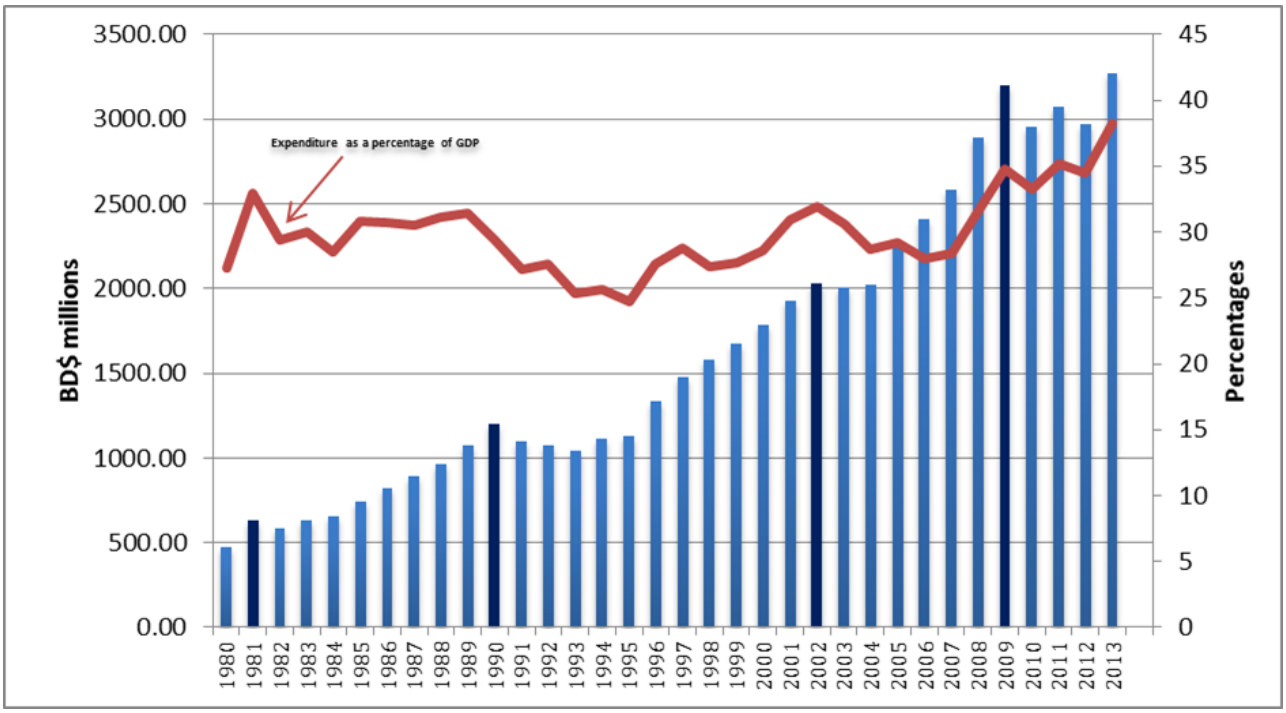
The literature (see, for example, Mundell, 1962 and Ravn, 2012) indicates that a country with a fixed exchange rate regime should resort to fiscal policy more often than any other policy to affect macro-aggregates[1] such as budget deficit, inflation, unemployment, balance of payments and economic growth/development, which generally serve as the health barometer of an economy. Public expenditure is one of the two major tools of fiscal policy. Gaining a deeper understanding of the trend in public expenditure requires at the very least a good knowledge of the key determinants of public expenditure.

This exploratory study deals with Barbados, a small very open economy operating under a fixed exchange rate regime. It attempts to ascertain and analyse the drivers of public expenditure in Barbados in the period 1980-2013 using aggregated and disaggregated approaches. It addresses three basic research questions: (i) What are the main determinants of public expenditure in Barbados at the aggregated and disaggregated levels? (ii) Are the sizes of their short-run and long-run impacts comparable? (iii)What are the policy implications?

One major reason motivates the (re)-examination of the determinants of public expenditure in Barbados in the period 1980-2013. Increasing at an annual rate of 5.6% from 1980 to 2013, public spending (see Figure 1) has been suggested by, among others, IMF(2014) to be curtailed in the context of sizable budget deficit (7.9% of GDP in 2013) and debt (with an annual increase of 7.2%)[2] as well as a slower economic growth (less than 1% annually in the recent years)[3]. This means that it is more than necessary to undertake an exploratory study on the determinants of public expenditure to deepen our understanding of public expenditure phenomenon and potential policy implications.

[1] This is so because fiscal policy is more potent than any other policy in affecting macro-aggregates, particularly output and inflation. The potency seems to be magnified in the context of small very open economies.
[2] In fact, government debt reached 96.4% of GDP in 2013 and 104.9% of GDP in 2015.
[3] The rate of growth was 0.1% in 2014, 0.9% in 2015 and 1.6% in 2016.

Figure 1: Public Expenditure: Level and Percentage of GDP, 1980-2013



Source: See Table 1 in the Appendix

Quite a number of theories have been put in place to explain the size and composition of public expenditure. Wagner's law postulates the existence of a positive trend in public expenditure as economy expands. Many authors have tested the public expenditure–income nexus using Wagner's law (Mamingi, 2015; Verma and Arora, 2010; Babatunde, 2011; Alleyne, 1999; Bairam, 1995; Henrekson,1993; Musgrave, 1969; Goffman, 1968). The results are rather mixed. The Wiseman and Peacock's displacement thesis emphasizes that increase in public expenditure over time is not smooth and public expenditure is rather the consequence of civil wars and social disturbances (Peacock and Wiseman, 1961). The Keynesian model considers public expenditure an explanatory factor of income. The Leviathan model proposed by Brennan and Buchanan (1980) underlines the monopolistic behavior of government which maximizes tax-revenue under rational ignorance, fiscal illusion and collusion among elected officials. The stages of development of Musgrave (1969) and Rostow (1971) acknowledge that public expenditure goes through three stages with larger public expenditure being recorded in the early stage of development because of high demand in infrastructure, health and education. As a country moves from stage one to stage two and ultimately to stage three, public expenditure should dwindle as time passes. Similar to Wagner, Baumol (1993) uses an inductive approach to provide

a plausible explanation for the public expenditure growth. However, the primary concern here is to explain high wage bills of some public sector services. The bottom line is that an increase in labour cost (e.g., wages/salaries) does not necessarily lead to productivity growth as conceptualized by the classical model (Baumol, 1993). The separation of the economy into progressive and non-progressive sectors as well as the distinction between the goods and services markets explain the story about productivity growth. Mascoll (1989), and Craigwell and Mascoll (1990) tested the Baumol's law in the context of Barbados as well as Trinidad and Tobago. A handful of authors have tested mixed theories about public expenditure. Other authors have concentrated on testing the composition of public expenditure (Gupta et al., 2002; Devarajan et al., 1996; Dao, 1995). Aregbeyen and Akpan (2013) are a study which contains a large set of key determinants of public expenditure. Among these determinants, there are young population, elderly population, regime dummy, election dummy, structural adjustment dummy, corruption perception index, debt service, foreign aid, revenue, real income per capita, and trend.

Whatever the theory advocated, it is useful to acknowledge that at the practical level public expenditure is before all a political act (Becker, 1983; Rajkumar and Swaroop, 2007; Dash and Raja, 2012; Monte and Papain, 2001; Becker, 1983). That said, of all theories dealing with public expenditure, in our view only Wagner's law and Keynes effect have been abundantly tested. In addition, most studies have targeted developed countries and a few Asian countries, with other areas not being well served. The Caribbean is such an area.

The present study uses the bounds testing or autoregressive distributed lag (ARDL) approach à la Pesaran et al. (2001) to establish the link from the determinants to public expenditure in Barbados, 1980-2013. The ARDL methodology is in theory beneficial here for at least three reasons. First, it can be applied even if the sample size is small. Second, it takes care of explanatory variable endogeneity. Third, it can be used even if some variables are stationary, I(0), and others integrated of order one, I(1).

The study makes three contributions to the literature. Given that the true model of public expenditure is a priori unknown, this paper uses quite a large set of potential determinants covering political, demographic, social and economic spheres. By so doing, omitted variable bias is hopefully reduced or even eliminated. Second, it uses an appropriate technique of estimation in the context of a model with a "small" sample size, endogenous explanatory variables and

mixed I(0) and I(1) variables. Third, this is a rare study that deals in some length with the determinants of public expenditure in the Caribbean context. Indeed, the few studies on public expenditure that have been conducted on Barbados or the Caribbean are mainly concerned with testing either the restrictive Wagner's law (Mamingi, 2015; Grenada and Wright, 2012; Iyare and Lorde, 2004; Howard, 2002; Alleyne, 1999; Goffman et al., 1971) or the impact of government spending (or function) on economic growth (Carter et al., 2013) or even the causal relationship between government expenditure and tax revenue (Maynard and Guy, 2009).

The study proceeds as follows. Section 2 introduces the Barbadian economy with emphasis on the government expenditure evolution. Section 3 deals with the data and develops the methodology of interest. Section 4 presents and interprets the results of estimation as well as discusses their policy implications. Section 5 contains concluding remarks.

2. Barbados Economy: a Public Expenditure Reading

Barbados, a Caribbean island country, is small in population (284,644 in 2013), land area (430 km square), and economic size (GDP PPP US$4.48 billion in 2013). Barbados is also an open, market-oriented, and fixed-exchange constrained country. Despite its smallness in many departments, the country has behaved well in terms of quality of life at least such captured by Human Development Indicator (HDI). Indeed, the indicator stood at 0.785 in 2013 putting the country in the category of highly human developed countries. The indicator does not, however, tell us the full story about this economy which is largely based on tourism and services. Indeed, the economy has been recently confronted with challenges: low economic growth with less than one percent per year since 2008, high public debt with 95 % of GDP in 2013, and a budget deficit reaching 7.9% of GDP in 2013. At the very least, with a fixed exchange regime, an effective fiscal policy can help deal with the above issues. Thus, among others, it is advisable to examine public expenditure.

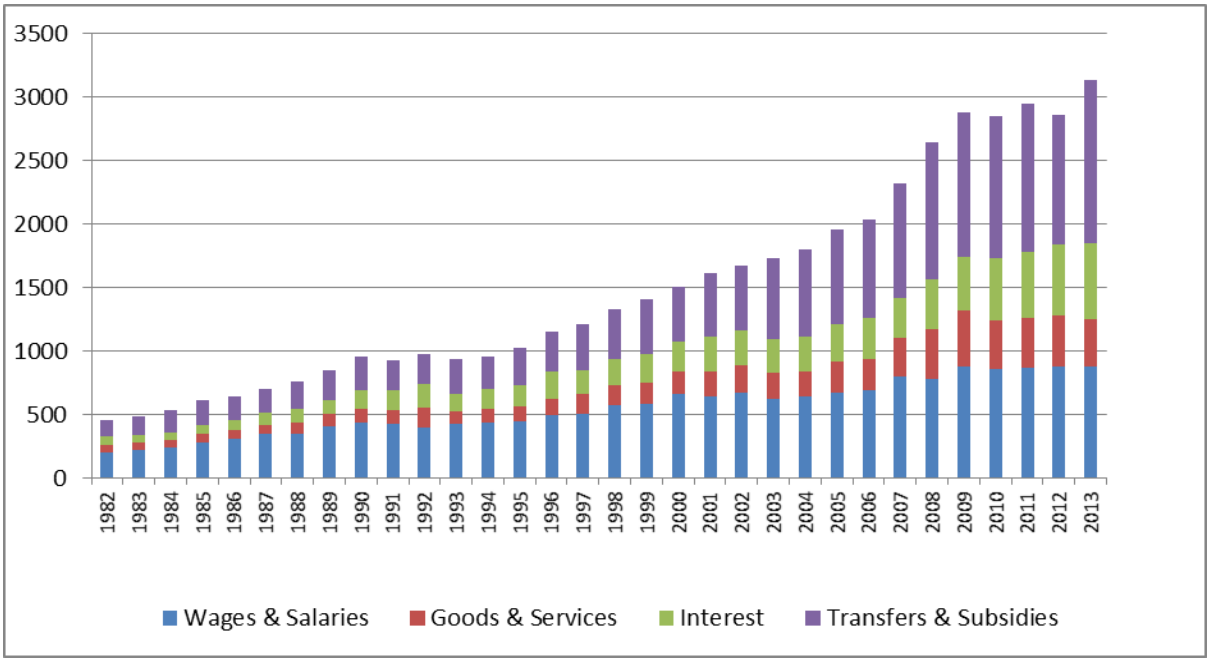
Figure 1 above provides us with the evolution of total aggregate public expenditure in Barbados in the period 1980-2013. Aggregate public expenditure in Barbados has, among others, been influenced by the four global economic recessions. Additionally, the size of the economy magnifies its vulnerability to external shocks. In the recessionary periods illustrated by the dark blue bars in the above figure, government's expenditures grew resulting in an increase in its

deficit (Downes et al., 2014). This implies that recessions have a direct impact on public expenditure. According to the researchers, the fiscal current account deficit that developed from 2008 onward came about from governments increased spending on non-discretionary activities (wages & salaries). Statistically, 39.7% of current expenditure is allocated to wages and salaries.

During economic downturns Barbados seems to employ a pro-cyclical fiscal policy (Guy and Maynard, 2009). For example, for the period of 1990-1993, Barbados reduced its spending by US$154.23 million; however, after 1995 when the economy began to stabilize, there was an increase in spending. This trend proceeded for the next two recessions in 2002 and 2009. However, the economic downturn in 1980s illustrates some evidence of counter-cyclical behavior. This suggests that recessions act as an external determinant of public expenditure growth.

Expenditure as a percentage of GDP illustrates the intensity of public expenditure growth. It indicates that subsequent to the 1980s global recession, total expenditure maintains roughly 30% of GDP. However, from 2008 up to 2013 it has increased to a relatively high 40%. This suggests that if the government continues to increase spending at the current rate it may be forced to employ contractionary policy to avoid the deterioration of its fiscal balance.

Figure 2: Current Expenditure in BDS $Millions, Barbados



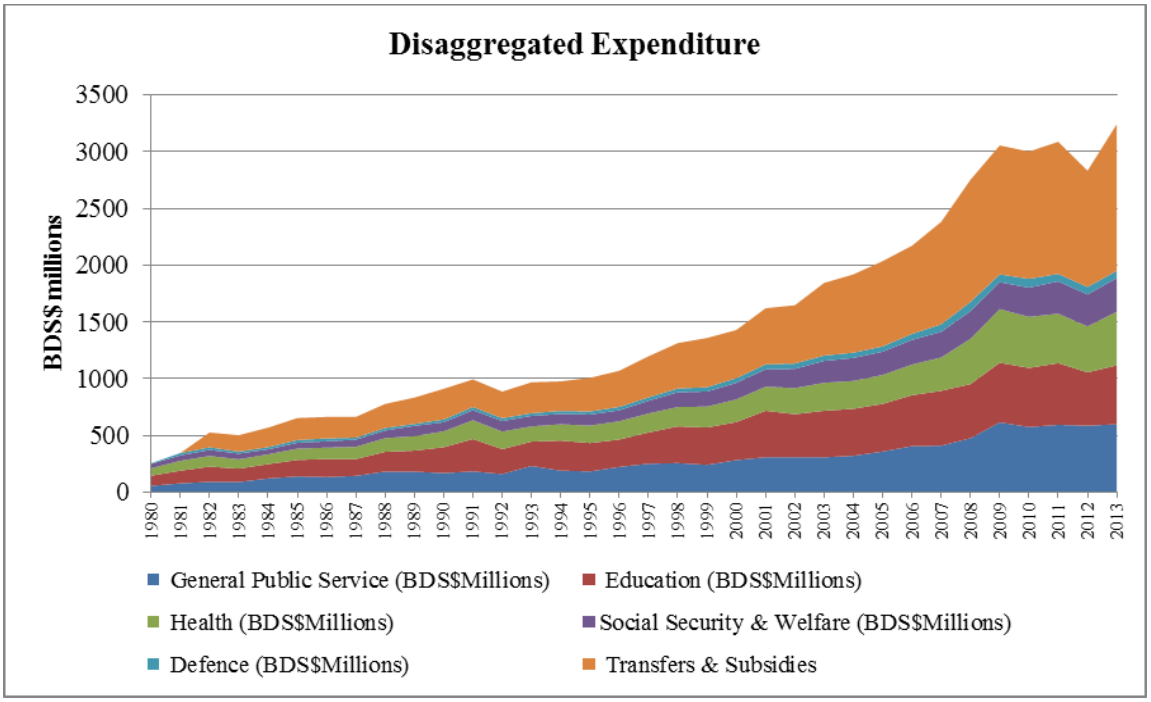
Source: See Table 1 in the Appendix

Figure 2 illustrates the contribution of the components of current expenditure to the overall current expenditure in Barbados. As can be deduced, wages & salaries and transfers & subsidies have been driving current expenditure from the early 1980. However, after 2003 the latter maintains 39% of total current expenditure while the former consumes 32%, leaving a residual of 29% to be allocated between interest payments and goods and services. These findings concur with Downes et al. (2014) in their belief that developing countries tend to distribute most of their resources to current expenditures, given that capital expenditure somewhat remains constant.

Historically, Barbados has maintained relatively small fiscal deficits. However, a large share of public spending is allocated to those statutory institutions that provide merit goods: education, health and public transport. Figure 3 provides a selected disaggregated approach of government spending over the period 1980-2013. On average, 28% of government expenditure is allocated to transfers and subsides. To explain somewhat, there are approximately 17 statutory boards and 15 state-owned enterprises, which the government allocates funding to facilitate daily operations. Since the former institutions are not profit driven, they rarely operate at an optimal level (Howard, 2001). Hence, this provides the rationale for the government's outlays on transfers.

In the case of Barbados, public expenditure is allocated to those areas that enhance social wellbeing. As illustrated in Figure 2, government allocates approximately 27.7% of its current expenditure to provide support to key industries. Apart from transfers and subsidies, they incur an additional 39.7% on wages and salaries, which is consistent with the size of the public sector. Howard (2001) pointed out such high spending in the public sector is as a result of the high level of state involvement in the market economy. He posited that developing countries such as Barbados tend to disburse a greater portion of expenditures on economic services.

Figure 3: Disaggregated Government Expenditure, Barbados



Source:see Table 1 in the Appendix

3. Data and Methodology

We open this section by examining the expected signs of the potential determinants of public expenditure. We consider next the issue of endogeneity of determinants of public expenditure. Thereafter, we examine the stationarity/non stationarity of data. In the last instance, we present the model and the method of estimation.

3.1 Determinants of Public Expenditure

Public Expenditure

At the outset, there is a need to be specific about public expenditure (or public expenditure ratio). The latter can be understood in general sense; that is, the total expenditure engaged by a government for specific goals. This aggregated expenditure be it nominal (*Texp*) or real (*Rtexp*) can be divided into components. There are basically two levels. In the first instance, public expenditure can be decomposed into current expenditure (*Cexp*) and capital expenditure (*Caexp*). At another level, it can be divided into sectors such as general public service, education, health,

defence, social security and welfare, and transfers & subsidies. The second level of decomposition is not pursued here for space reason.

Economic and Financial Variables

Income: real GDP (rgdp) or real GDP per capita (rgdpc)

Several measures can in principle capture the economic performance of a country or a region. Real GDP or real GDP per capita can validly represent income in an expenditure equation. We expect that income significantly and positively affect public expenditure in the long run. Indeed, as seen above Wagner's law postulates that income expansion leads to a more than proportionate increase in public expenditure in the long run.

Tax Revenue (Tr)

The impact of tax revenue on public expenditure can go either way depending on the government's economic philosophy or doctrine (pro-cyclicality or counter-cyclicality). We acknowledge however that generally a tax revenue increase is accompanied by an increase in public spending sooner or later.

Unemployment (Une)

In the context of counter-cyclical policy, it is generally the case that public spending will increase as a result of rising unemployment. This is particularly the case as there is an increase in social services. The contrary will prevail in case of pro-cyclical policy. Thus, the impact of unemployment on public spending is ambiguous as it depends on the prevailing policy adopted by the government. Note here we use unemployment rate.

Recession Dummy (Rdu:1=recession;0 otherwise)

Whether recession leads to an increase in public expenditure or not depends on the government's politico-economic philosophy. In other words, the question is whether pro-cyclical policy or counter-cyclical policy is pursued. In general for a pro-cyclical type of government a recession which leads to a decrease in tax revenue and an increase in unemployment is tackled by decreasing public expenditure and freezing employment. For a counter-cyclical type of

government a recession is combatted by stimulating the economy through an increase in public spending, among others. The impact of recession on public spending is also an empirical matter.

Inflation (CPI)

Inflation enters a spending equation to reflect cyclical factors. In the context of counter-cyclical policy, it is expected that rising inflation lead to a decrease in public expenditure. Of course if a pro-cyclical policy prevails then rising inflation gives rise to an increase in public expenditure. A bigger issue though is that of causality direction. Indeed, it is known that a public expenditure increase which leads to an increase in aggregate demand gives rise to inflation. By the same token, inflationary pressure can lead to an increase in public expenditure. In summary, as for recession, the impact of inflation on public expenditure is an empirical matter.

Fiscal (Budget) Deficit (Bgdf)

For recall, fiscal (budget) deficit arises when expenditures are greater than revenues (tax proceeds). Including fiscal deficit in a public expenditure equation allows us to test for fiscal illusion. In general, an increase in fiscal deficit is accompanied by either a decrease in tax revenue or an increase in public expenditure. Whether fiscal deficit leads to a further increase in public expenditure depends on the government's political philosophy to confront economic ills. It is, however, generally accepted that fiscal deficit negatively affects public expenditure.

Public Debt (Pdebt)

It seems to exist two conflicting impacts of public debt on public expenditure. On the one hand, it is known that apart from taxes, money emission and international (foreign) aid, public debt is another financial source of public expenditure. This means an increase in public debt in theory leads to an increase in public expenditure. On the other hand, there is a possibility that public debt decreases public expenditure mainly through social services. Indeed, the presence of debt may displace or crowd out social services. Hence the impact of public debt on public expenditure is an empirical matter.

Debt Servicing (Debtser)

Debt servicing decreases the amount available for public expenditure; that is, in principle it crowds out public expenditure.

Foreign Borrowing (Fborrow)

Foreign borrowing or external debt is a component of public debt, which is the sum of internal and external debts. As for public debt in general, the impact of foreign borrowing on public expenditure is rather ambiguous.

Foreign Aid (Faid)

Apart from its role of helping in times of catastrophe, foreign aid is a financing tool of public expenditure. Indeed, in general it fills the gap of low saving, insufficient tax revenue and low export earnings. As such, it positively affects public expenditure. Note, however, it is possible that foreign aid be used to finance just consumption. In this case, foreign aid negatively affects public investment. In summary, the impact of foreign aid can go either way although the positive impact seems to dominate.

Foreign Direct Investment (FDI)

The bulk of the literature concentrates on the impact of *FDI* and public expenditure on economic growth. An argument can, however, be made particularly in the context of fixed exchange regime countries, according to which foreign exchange affects public expenditure. This is so as FDI provides the much needed foreign exchange for financing mainly imports[4]. Thus, we postulate a positive relationship between *FDI* and public expenditure.

Demographic Variables

There are three key population variables: total population (*Popt*), population under 15 years (*Pop14*) and population 65 years and above (*Pop65*). We expect all three demographic variables to exercise a bigger pressure on public expenditure. That is, an increase in each individual variable leads to an increase in public expenditure. While for total population, this occurs

[4] We thank DeLisle Worrell for clarifying the role of *FDI* in small open foreign exchange constrained countries as well as the causality running from public expenditure to international reserve.

through the provision of social services, for Pop14 it is through education singularly and for Pop65 through government transfer expenditure and health care expenditure. Perhaps it is useful to add a fourth population variable called dependency ratio (*Dr*) which is the ratio of the number of children (0-14 years old) and older persons (65 years and older) to the working–age population (15-64 years old). This measure of the pressure of the working population is expected to positively affect public expenditure.

Political Variables

Election Dummy (Gedu: 1=election; 0 otherwise).

The impact of election on public expenditure or spending generally depends on political business circle considerations. In many countries public expenditure substantially increases on the eve of elections to "satisfy" the constituency. Thus, overall we expect a positive relationship between election and public spending.

Political Party Dummy (Ppdu: 1=Democratic Labour Party;0=Barbados Labour Party)

The political philosophy of political parties matters a lot concerning the relationship between political party and public expenditure. Indeed, some political parties are more prone to spending than others in pursuit of their objectives. This means that the former will have a bigger impact on public expenditure than the latter.

3.2 Endogeneity Issue

Endogeneity in the regression context is defined statistically as the presence of the correlation between a variable and the error term. Endogeneity of explanatory variables gives rise to biased and inconsistent estimators. That is basically the estimates obtained are useless as their corresponding estimators do not go towards their population parameters. There are three potential causes of endogeneity: omitted variables, measurement error and simultaneity. As far as this exercise is concerned, it is the case that simultaneity is quite present in the relationship between the determinants and public expenditure as double or reverse causation is the rule rather than the exception. For example, Wagner's law and Keynes' law combined imply that income as

well as public expenditure are endogenous. Another clear cut case is the relationship between public debt and public expenditure. Endogeneity can be tested by the Durbin-Wu-Hausman test. The presence of endogeneity is not, however, a death sentence as solutions to the issue do exist. Basically, one can use instrumental variables or an appropriate method of estimation which takes endogeneity into account. In the time series context, a method like the ARDL can do the job. This is the approach used here to put to rest endogeneity issue.

3.3 Data

Data Sources

Table 1 in the appendix provides us with the sources of data. As can be seen, most data is obtained from the Central Bank of Barbados (CBB) and with the exceptions of dummies, population, unemployment and inflation variables, the raw variables are expressed in millions of Barbados dollars[5].

Unit Root Analysis

Time series analysis requires in the first instance testing for stationarity/ non-stationarity of variables. In this connection, we use the augmented Dickey-Fuller (*ADF*) test. Since the ADF test is now common knowledge, we do not expose it here. A non-stationary variable is also known as an integrated series. The order of integration is the number of times one has to difference the series to make it stationary. After determining the level of integration of variables, we decide on the appropriate model and estimation method to use to link determining factors to public expenditure.

3.4 Methodology: Model and Estimation Method

We build the model of determination of explanatory factors of public expenditure in Barbados. In this context, the autoregressive distributed lag approach (ARDL) to cointegration initiated by Pesaran et al. (2001) is used to fulfill this goal. Since the paper by Pesaran et al. (2001) contains all useful details, here we concentrate on what is essential. That said, the text below heavily borrows from Pesaran et al. (2001) and Boamah et al. (2011).

[5] For now on, "dollar" means Barbados dollar.

Among the many models proposed by Pesaran et al. (2001) we concentrate on the following ARDL after some testing:

$$\Delta S_t = c + \pi_{ss} S_{t-1} + \pi_{VV} V_{t-1} + \sum_{i=1}^{p-1} \beta' \Delta z_{t-i} + \delta' \Delta V_t + u_t \quad (1)$$

where S_t is expenditure (total or component), V_t is the matrix of explanatory variables, z_t is $(S_t V_t)$, Δ represents the first difference operator, and u_t is the error term.

To test for the existence of a level relationship between S_t and V_t, in Equation (1), the bounds procedure allows to apply an *F*-test (or *Wald* test) on the joint null hypothesis that the coefficients of the level variables are jointly zero, that is, $\pi_{SS} = 0$ and $\pi_{VV} = 0$. The alternative hypothesis is $\pi_{SS} \neq 0$ or $\pi_{VV} \neq 0$. Here, the *F*-statistic follows a non-standard distribution. That is, the critical values of the regular *F* distribution are no longer valid. Indeed, two asymptotic critical bounds derived by Pesaran et al. (2001) are of interest; they cover three possible classifications of the variables (all are I(0), all are I(1), or variables are mutually cointegrated). Concretely, the lower value bounds concern the case of the variables being purely I(0) and the upper value bounds assume that they are purely I(1). A computed *F*-statistic that is greater than its respective upper value bound points to the existence of a long-run relationship between or among variables, that is, cointegration; on the contrary, if smaller than the lower value bound, then the null of no-cointegration is not rejected; and finally, if the value lies within the bounds, inference is inconclusive. In reality, for cointegration to really hold the *F*-test needs to be supplemented by a *t* test on the adjustment coefficient. The latter *t*-statistic does not follow a *t* distribution. Concretely, if $\pi_{SS} = 0$ and $\pi_{VV} = 0$ are rejected then test $\pi_{SS} = 0$ against $\pi_{ss} < 0$. If the *t*-statistic to test for the latter null hypothesis is negative and greater, in absolute value, than the upper value bound of the *t*, then cointegration is confirmed. Naturally, the existence of cointegration implies that the long-run relationship among variables and corresponding error correction models can be estimated. (See Pesaran et al., 2001 and Boamah et al., 2011).

The long-run coefficient or parameter (LR_{VV}) can be derived from Equation (1) by noting that $\pi_{VV} = LR_{VV} * (-\pi_{ss})$. Indeed, the long-run coefficient associated to a variable of interest is

$LR_{VV} = \pi_{VV} / -\pi_{SS}$ (see Boamah et al., 2011). It means that Equation (1) in error correction form is :

$$\Delta S_t = c + \pi_{SS}(S_{t-1} - LR_{VV} V_{t-1}) + \sum_{i=1}^{p-1} \beta' \Delta z_{t-i} + \delta' \Delta V_t + u_t \quad (2)$$

where the first relationship in parentheses represents the long-run relationship between S_t and V_t. It is important to note that the retained ARDL or ECM must in the first instance pass the autocorrelation test and subsequently the heteroscedasticity, functional misspecification, and normality tests. In addition, it has to satisfy a model selection criterion too, e.g., the Akaike Information Criterion (AIC).

Two further remarks are useful. First, apart from the criteria given above, Equation (2) or its variants have to satisfy the requirements for a valid adjustment mechanism: π_{SS}, the adjustment coefficient, must be negative and greater than minus one. Second, Hendry's approach guides our model selection.

4. Results and Policy Implications

4.1. Results

The results have been obtained using Eviews 9.0. We start by testing for unit root. Table 2 contains the unit root results. As can be seen, with the exception of two variables which are stationary, I(0), and one which is I(2)[6], the rest are integrated of order one, I(1). Consequently, we can validly apply the ARDL to test for cointegration.

The regression results are based on a variant of model (2). The number of lags has been determined using the AIC criterion. In the first instance, we use all the variables of interest and eliminate the models which do not pass the specification tests of interest including the size of the adjustment coefficient which should be negative and greater than minus one. We use a 10% level of significance throughout.

[6] The I(2) variable is no longer used.

Table 2: Unit Root Status of Variables

Variables	Level		1st Difference	
	t-stat	P-value	t-stat	P-value
Bdgf	-0.363	(0.904)	-6.210	(0.000)
Bdgf_ratio	-0.863	(0.787)	-6.820	(0.000)
Caexp	-2.059	(0.262)	-5.686	(0.000)
Cexp	3.478	(1.000)	-3.533	(0.014)
Debtser	0.915	(0.994)	-4.594	(0.001)
Dr	-3.204	(0.030)		
Faid	-0.005	(0.951)	-10.942	(0.000)
Fborrow	1.192	(0.997)	-3.644	(0.010)
Fdi	-6.655	(0.000)		
Gedu	dummy			
Pdebt	1.495	(1.000)	-4.785	(0.003)
Pop14	2.256	(1.000)	-5.674	(0.001)
Pop65	1.206	(0.997)	-1.919	(0.320)
Popt	-2.399	(0.374)	-3.015	(0.145)*
Ppdu	dummy			
Rdu	dummy			
Rgdp	-0.920	(0.768)	-3.720	(0.009)
Rgdpc	-1.340	(0.597)	-3.700	(0.009)
Rtexp	0.350	(0.977)	-5.670	(0.000)
Texp	0.790	(0.992)	-5.520	(0.000)
Texpr	0.040	(0.956)	-6.920	(0.000)
Tr	-0.740	(0.823)	-4.640	(0.001)
Une	-1.910	(0.322)	-3.580	(0.012)

Note: ADF test: levels and 1st differences. In most cases levels contain constant and trend in the regression. (*) I(1) with KPSS test. Variables are defined as in Table 1 in the appendix

Table 3 contains the ARDL results from model (2) for aggregate public expenditure using AIC criterion. Because of small sample sizes and particularly small degrees of freedom we only search over 2 lags. The model passes the basic tests of autocorrelation, heteroscedasticity, misspecification and normality as the *p*-values associated to their respective *F*-values[7] indicate at the 10% level of significance. Thus, we can interpret the results. The cointegrated *F*-value, 5.272, is larger than any Pesaran's upper critical value[8]. Cointegration between aggregate public expenditure and its determinants is thus uncovered. Cointegration is fully confirmed with the

[7] Because of small degrees of freedom, we use *F* distribution instead of chi-square distribution associated with the *LM*, or *LR* or *Wald* tests.

[8] The upper critical *F*-values from PESARAN et al. (2001, 300) are, for k=8, 4.1, 3.39 and 3.06 for the 1%, 5 % and 10% levels of significance, respectively.

adjustment coefficient *t*-value of -21.443 which is in absolute value greater than -4.40 (10 %), -4.57 (5%) and -5.37 (1%). In any case the coefficient of adjustment has the right sign and expresses an almost instantaneous adjustment to equilibrium. Indeed, 92% of disequilibrium is eliminated in one year. Real GDP, Tax revenue, foreign domestic investment, debt servicing and unemployment significantly and positively affect public expenditure in the long run. For example, a one million dollar increase in tax revenue stimulates public expenditure by 980,000.00 dollars. A one million dollar increase in real GDP positively affects public expenditure by 230,000.00 dollars. A 1% increase in unemployment boosts public expenditure by 6.16 million dollars. The positive debt servicing impact is counterintuitive. The impact of FDI is less dramatic: 80,000.00 dollars for one million dollar increase in FDI. On the contrary, foreign aid, and budget deficit significantly and negatively affect public expenditure in the long run. On average, a one million dollar increase in foreign aid decreases public expenditure by approximately 3.00 million dollars. The potential explanation is that foreign aid is financing consumption. A one million dollar increase in budget deficit decreases public expenditure by 1.20 million dollars in the long run. With the exception of foreign aid which ceases to be significant, the short-run impacts of other variables are similar in signs and sizes (although generally smaller). For example, the short-run impact of tax revenue is 900,000.00 dollars which is smaller than 980,000.00 dollars in the long run.

Table 3: ARDL of Total Public Expenditure, Barbados, 1980-2013

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP)	0.504	0.146	3.439	0.003
D(TR)	0.901	0.053	17.086	0.000
D(FAID)	-0.376	0.788	-0.477	0.639
D(PDEBT)	-0.015	0.014	-1.121	0.276
D(FDI)	0.036	0.024	1.509	0.148
D(BGDF)	-1.105	0.061	-18.035	0.000
D(DEBTSER)	0.289	0.060	4.842	0.000
D(UNE)	5.681	1.701	3.340	0.003
CointEq(-1)	-0.922	0.043	-21.443	0.000

Long-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	0.235	0.161	1.459	0.160
TR	0.976	0.048	20.496	0.000
FAID	-3.004	0.909	-3.306	0.004
PDEBT	-0.017	0.015	-1.094	0.288
FDI	0.083	0.033	2.519	0.021
BGDF	-1.198	0.071	-16.918	0.000
DEBTSER	0.313	0.067	4.647	0.000
UNE	6.161	1.883	3.271	0.004
C	-184.548	131.847	-1.400	0.178

R-squared	0.999	Mean Dep. Var.	1702.886
F-statistic	8200.509	Akaike Inf. Crit.	8.549
Prob(F-statistic)	0.000	Schwarz Criter.	9.145
SCF(2,17)=0.956	P=0.404	Hannan-Quinn C.	8.747
HF(12,19)=0.832	P=0.620	MF(5,14)=1.993	P=0.142
JB=1.240	P=0.538	CF(k=8) = 5.272	

Note: Dependent variable is aggregate public expenditure and other variables are defined as in Table 1. ARDL Cointegrating and Long-Run Form. Selected Model: ARDL(1, 1, 0, 1, 0, 1, 0, 0, 0) D(…)=1st difference. Equation (2) is adapted here. *SCF* is the Breusch-Godfrey test for autocorrelation using the *F* form; *HF* is the Breusch-Pagan-Godfrey test for heteroscedasticity using the *F* version; *MF* is the Ramsey Reset test for error specification; *JB* is the Jarque Bera test for normality; *CF* is the cointegration *F*-test such as proposed by Pesaran et al. (2001); *k* is the number of retained level variables in the final model; *P* stands for probability value; The *p*-values provided for the *t-statistics* are meant for a two-sided test. CointEq: long-run relationship between the dependent variable and the explanatory variables.

Table 4: ARDL Results for Capital Expenditure, Barbados, 1980-2013

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP)	0.519	0.255	2.034	0.055
D(TR)	-0.050	0.055	-0.900	0.378
D(FBORROW)	0.044	0.044	1.000	0.327
D(FAID)	-3.979	1.382	-2.880	0.009
D(PDEBT)	-0.038	0.024	-1.586	0.128
D(DEBTSER)	-0.007	0.108	-0.063	0.951
D(UNE)	-4.223	3.580	-1.179	0.251
D(CPI)	-0.575	2.718	-0.212	0.834
CointEq(-1)	-0.897	0.214	-4.193	0.000

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	0.578	0.347	1.668	0.110
TR	-0.055	0.067	-0.829	0.416
FBORROW	0.050	0.042	1.1673	0.256
FAID	-4.438	1.407	-3.153	0.005
PDEBT	-0.043	0.023	-1.880	0.074
DEBTSER	0.201	0.183	1.102	0.283
UNE	-4.710	3.554	-1.325	0.199
CPI	-0.642	3.006	-0.214	0.833
C	-148.150	281.661	-0.526	0.604

R-squared	0.873	Mean Dep. Var	188.209
F-statistic	14.456	Akaike I. Criter.	10.008
Prob(F-statistic)	0.000	Schwarz Criterion	10.512
SCF(2,19)=0.821	P=0.455	Hannan-Quinn Cr.	10.175
HF(10,21)=0.559	P=0.828	MF(5,16))=2.000	P=0.134
JB=0.145	P=0.964	CF(k=8)=3.316	

Note: see Table 3. Dependent variable: capital expenditure. ARDL: Cointegrating and Long-run forms. Selected Model: ARDL(1, 0, 0, 0, 0, 0, 1, 0, 0)

We re-examine the above aggregated model results in the context of the disaggregated components: capital expenditure and current expenditure. Table 4 deals with the results of capital expenditure model. The ARDL model passes all the major diagnostics/specification tests

including normality. The size of the cointegration *F*-value (5.272) indicates that cointegration is satisfied at any level of significance (see footnote 8 for critical values). This is not fully confirmed by the *t*-value of the adjustment coefficient (-4.193) which is less in absolute value than -4.40 at the 10% level of significance. Almost 90% of disequilibrium is eliminated in one year. In the long run, real GDP significantly and positively affects capital expenditure. Indeed, a one million dollar increase in real GDP yields a 580,000.00 dollars increase in capital expenditure. Foreign aid, public debt, somewhat unemployment significantly and negatively affect capital expenditure in the long run. A one million dollar increase in foreign aid crowds out capital expenditure by 4.44 million dollars. A one million dollar increase in public debt leads to a 40,000.00 dollars decrease in capital expenditure. A one percent increase in unemployment decreases capital expenditure by 4.71 million dollars. The short-run impacts of variables are similar in signs and sizes (although a little bit smaller) than the long-run counterparts. For example, the short-run impact of real GDP is 520,000.00 dollars which is smaller than 580,000.00 dollars in the long run.

Table 5 presents the ARDL results for current expenditure. The tests of autocorrelation, heteroscedasticity, misspecification, and normality are satisfied. Cointegration is also uncovered here as the *F*-statistic value (5.77) is greater than the Pesaran *et al.* (2001) critical value, 3.35 at the 10% level of significance. This is also confirmed by the behavior of the *t*-statistic (-4.52), which is greater than -3.86 in absolute value. 60% of disequilibrium is eliminated in one year. In the long run, tax revenue, foreign aid, and public debt significantly and positively impact current expenditure. A one million dollar increase in tax revenue brings about an increase of 980,000.00 dollars in current expenditure. A one million dollar increase in foreign aid yields about an increase in current expenditure of 5.42 million dollars. A one million dollar increase in public debt increase current expenditure by 70,000.00 dollars. Budget deficit negatively and significantly impacts current expenditure. Indeed, a one million dollar increase in budget deficit decreases current expenditure by 630,000.00 dollars. In the short run, a one million dollar increase in tax revenue yields an increase of 590,000.00 dollars in current expenditure. A one million dollar increase in public debt boosts current expenditure by 40,000.00 dollars. A one million dollar increase in budget deficit decreases current expenditure by 620,000.00 dollars.

Table 5: ARDL Results for Current Expenditure, Barbados, 1980-2013

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP)	-0.344	0.298	-1.156	0.260
D(TR)	0.591	0.134	4.424	0.000
D(FAID)	1.462	1.345	1.087	0.288
D(PDEBT)	0.039	0.028	1.425	0.168
D(BGDF)	-0.615	0.095	-6.440	0.000
CointEq(-1)	-0.604	0.134	-4.520	0.000

Long-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	-0.571	0.436	-1.310	0.203
TR	0.979	0.142	6.884	0.000
FAID	5.422	3.356	1.616	0.120
PDEBT	0.065	0.038	1.712	0.100
BGDF	-0.627	0.187	-3.358	0.003
C	326.227	293.192	1.113	0.277

R-squared	.999	Mean Dep. Var.	1497.603
F-statistic	176.788	Akaike Inf. Criter.	10.172
Prob(F-statistic)	0.000	Schwarz Criterion	10.585
SCF(2,21)=0.996	P=0.386	Hannan-Quinn Cr.	10.309
HF(8,23)=1.803	P=0.128	MF(5,18)=2.176	P=0.103
		CF(k=5) = 5.772	

Note: see note to Table 3. Dependent variable: current expenditure. Selected Model: ARDL(1, 0, 0, 1, 0, 1).

4.2 Policy Implications

At the outset two remarks are in order. First, it is worth pointing out that in the context of Barbados economic situation the policy implications of the present results are most meaningful in the context of the role of public expenditure in relation to fiscal deficit, public debt, and economic growth. Second, in terms of policy implementation the politician has the last word.

Since the positive relationship between tax revenue and public expenditure found in the literature (see, for example, Aregbeyen and Akpan, 2013; Ghartey, 2010 and Sobhee, 2004) is uncovered here with causality running from tax revenue to public expenditure (result available upon request; similar result by Sobhee, 2004), tax revenue can be an effective predictor of public

expenditure. Given that the long-run impact is less than one, there is a possibility of decreasing public expenditure by decreasing tax revenue without adding too much to the fiscal deficit. Of course, attention must be paid to tax composition and mix such that citizens' wellbeing and other macro-aggregates are not negatively affected when cuts are done. Put it the other way, a question can be asked if the ultimate objective is to reduce public expenditure, the main culprit in fiscal budget deficit, what is the point of continually raising tax if this ends up feeding public spending?

The state of the economy is ultimately important for dealing with runaway public expenditures. Improving the state of the economy gives room to fiscal space for controlling public expenditure, this despite that the Wagner's law has not been fully verified. The lesson is that the economy has to grow substantially to easy pressure on public expenditures.

Solving unemployment is also solving public expenditure equation. This is so because a reduction in unemployment leads to a reduction of quite of a number of social services transfers. Boosting productivity and competitiveness are key to solving unemployment.

Attention must also be paid to public debt which crowds out capital expenditure and crowds in current expenditure. Likewise, foreign aid which feeds current expenditure and negatively affects capital expenditure needs to be revisited (see also Aregbeyen and Akpan, 2013). Budget deficit is a drag on public expenditure.

Overall, given the state of the economy, it is more important to determine the levels of tax revenue, public debt, FDI, foreign aid, budget deficit, and unemployment that are consistent with a healthy public expenditure, that is, the one which yields a sustainable economic growth, a non-runaway budget deficit and a manageable public debt.

5. Conclusion

This paper attempts to ascertain and analyse the determinants of public expenditure in Barbados in the period 1980-2013 using aggregated and disaggregated approaches. Applying the ARDL methodology à la Pesaran et al. (2001), at the aggregated level the study obtains the following results: real GDP, tax revenue, FDI, debt servicing, and unemployment significantly and positively affect total public expenditure in the long run. On the contrary, budget deficit and foreign aid significantly and negatively affect total public expenditure in the long run. The same qualitative results are obtained in the short run. At the disaggregated level, in the long run, while real GDP significantly and positively affects capital expenditure, foreign aid, public debt, and unemployment significantly and negatively affect capital expenditure. Similar qualitative results are obtained in the short run. Current expenditure is positively affected in the long run by tax revenue, foreign aid, and public debt. On the contrary, budget deficit negatively impacts current expenditure in the long run. In the short run, while tax revenue positively and significantly affects currents expenditure, budget deficit negatively impacts the latter.

The long-run impacts are larger than the corresponding short-run impacts. Overall, given the state of the economy, it is of paramount importance to determine the levels of tax revenue, public debt, FDI, foreign aid, budget deficit, and unemployment that are consistent with a healthy public expenditure, that is, the one which yields a sustainable economic growth, a non-runaway budget deficit and a manageable public debt.

To check for the robustness of the results it is useful to use an alternative model and examine whether the results obtained in the present paper are replicated.

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Appendix

Table 1: Sources of Data for Determinants of Public Expenditure, Barbados, 1980-2013

Data	Sources
Expenditures:	
1. Total Public Expenditure (texp) in BDS$Millions	CBB/Model
1.1. Current Expenditure (consumption expenditure) (cexp) in BDS$Millions	CBB/Model
1.2. Capital Expenditure (caexp) in BDS$Millions	CBB/Model
Determinants:	
2. Real GDP (rgdp) in BDS$Millions	CBB/Online Statistics/Estimates of real GDP (1974prices)
3. GDP per capita in BDS$	Calculated (GDP/Population Total)
4. Population (total) (Popt)	World Bank
5. Population (< 15 years) (Pop14)	World Bank/calculated-total
6. Population (>64 years) (Pop65)	World Bank/calculated-total
7. Foreign Aid (Faid) in BDS$Millions	CBB/BOP Stats (proxy- inter-governmental grants—inflows)
8. Fiscal (Budget) deficit (Bgdf) in BDS$Millions	CBB/Model
9. Public Debt (Pdebt) in BDS$Millions	CBB/Model
10. Debt Service (Dtser) in BDS$Millions	CBB/Model (Interest+amortization)
11. Foreign Borrowing (Fborrowing) in BDS$Millions	CBB/Model (external national debt)
12. Political Party dummy (Ppdu) 1=DLP; 0=BLP	B'dos electoral & Boudaries commission/ http://www.electoral.barbados.gov.bb/generalelectionreport.html
13. Election dummy (Gedu) 1=election;0=no election	B'dos electoral2 & Boundaries commission/ http://www.electoral.barbados.gov.bb/generalelectionreport.html
14. Recession (Rdu) 1=recession 0=otherwise	
15. Unemployment (Une)% of labor force	CBB/Model
16. Dependency ratio (Dr)	World Bank/calculated-total
17. Tax Revenue (Tr)	CBB/Model
18. FDI Inflows (Fdi) in BDS$Millions	CBB/Online Statistics/BOP
19. Inflation (Cpi) in %	CBB/Model

Note: CBB = Central Bank of Barbados; DLP=Democratic Labour Party; BLP=Barbados Labour Party. BOP= Balance of payments. BDS$=Barbados dollars.