"Debt Sustainability in Barbados."

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DEBT AND FISCAL SUSTAINABILITY IN BARBADOS

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ABSTRACT

The question of debt and fiscal sustainability is very important for adequate macroeconomic management. This paper looks at the sustainability of the Government of Barbados' policies with respect to the financing of public expenditure and debt management in the post-independence era. In this regard, cointegration testing of the present value budget constraint – using both fixed and time varying coefficients – was the main tool used in the empirical analysis of the sustainability of the historical fiscal process. The findings suggest that this process has, in fact, been sustainable and point to prudent public sector policies by the fiscal authorities.

JEL Classification: E60; H62; H63

Key Words: *Fiscal Deficit, Debt, Sustainability*

1 INTRODUCTION

The development literature stresses the need for governments of small, open, developing economies like Barbados to run fiscal deficits in order to stimulate economic growth. For instance, the government of a country can build up enough capital stock in one period to place the economy on its steady state growth path by running a fiscal deficit and issuing debt to cover it. This debt can then be repaid in the next period, since the economy has already achieved a high-growth equilibrium. Mankiw (2000) lists three other reasons why budgetary flexibility may be preferable to a balanced-budget rule: stabilisation of the economy through the action of the automatic fiscal stabilisers; reduction in the distortion caused by the incentives in the tax system via tax smoothing; and shifting of the tax burden from current to future generations, who will arguably share in the benefits of the current generation's expenditures.

Nevertheless, in light of the experiences of some developing countries - particularly in Latin America and Sub-Saharan Africa - where widening deficits have been accompanied by spiralling debt and inflation, one might be tempted to surmise that governments of developing countries would be better off balancing their budgets. However, these problems are seen as largely attributable to a lack of fiscal discipline, whereby populist fiscal policies have prevailed and debt and seignorage have been allowed to reach unsustainable levels. The recent example of Argentina illustrates this point, with most economists agreeing that

fiscal mismanagement was largely responsible for the current crisis. Hence, debt crises and hyperinflation do not make a case for balanced budgets but serve instead to underscore the need for governments to pursue *sustainable* fiscal policies.

The effects on debt and inflation aside, fiscal policy also has important implications for the Balance of payments, especially under a fixed exchange rate régime. Indeed, many economists consider that Argentina's fixed exchange rate made it impossible to sustain the country's excessively large deficits. This suggests that in a much smaller and far more open economy with a fixed exchange rate, such as Barbados, fiscal policy becomes even more crucial. Any increase in Government spending will indirectly affect the level of foreign currency reserves through a rise in imports, which account for a sizeable proportion of Government spending.

The Government of Barbados has recently issued international bonds to build up the reserves, which have acted as a buffer against the current unfavourable economic climate and ongoing trade liberalisation. Nevertheless, with the Argentine crisis still fresh in people's memories and with recent increases in the size of the deficit and the level of public sector indebtedness, fiscal policy is increasingly coming under the microscope in Barbados, sending policy makers in search of the most appropriate, sustainable measures with which to re-stimulate economic growth.

In this regard policy makers are constrained, not only by the Government budget, but also by the on-going process of Caribbean regional integration: there is a pressing need for convergence of Barbados' tax rates with those of other CARICOM members in order to encourage Barbadian businesses and human capital to remain at home. In fact, the Barbados Government has already committed to realigning (that is, adjusting downwards) the domestic tax rates on both personal and corporate income by 2003. This is in addition to the relationship between the fixed exchange rate, the balance of payments and fiscal policy, which can be seen from a more conventional perspective, with the fixed exchange rate acting as yet another constraint on fiscal policy. More specifically, economic theory holds that under a fixed exchange rate régime there is limited scope for raising revenue through seignorage if balance of payments problems are to be avoided.

Together, these constraints limit policy makers' capacity to implement tax reforms or exploit seignorage to increase revenue. In the context of a developing economy, expenditure cuts would be considered only as a last resort. Of course, there are a number of expenditure adjustments that could be made: "fat" to be trimmed, tariffs that could stand to be increased and existing welfare schemes which could be better targeted. However, in the current economic environment it will be necessary to move beyond these "efficiency" measures and implement more expansionary spending policies and the resulting widening of the deficit will automatically lead to an increase in debt levels. Therefore, debt is an

appropriate variable to target in devising a fiscal policy that is expansionary, yet sustainable.

It is within this context that this paper seeks to evaluate the sustainability of the Government of Barbados' fiscal policies in the post-independence era, focusing on the debt management aspect. It is important to note that the key concept in this study is that of the *sustainability* of fiscal policy, which refers to the ability of the Government to maintain a given policy stance in the future in spite of any shocks to the system which may arise. This notion is not synonymous with that of *optimality*, with an optimal policy being, that which gives the most desirable outcome possible.

The next section traces the trends in fiscal policy in Barbados since independence. The following section reviews the literature on debt and fiscal sustainability, focusing on two popular empirical approaches to the evaluation of fiscal sustainability: the "accounting" approach and the Present Value Budget Constraint (PVBC) or econometric approach. The fourth section will discuss the situation in Barbados with reference to the theories espoused in the previous section and present the results of the empirical analysis. In the penultimate section the Kalman filter is applied to a state space framework in order to address the so-called Lucas critique of econometric policy evaluation. This section also deals with two issues related to fiscal sustainability: debt sustainability and the development of deficit targets. Coming out of these

discussions will be a number of policy recommendations to ensure the future sustainability of debt and fiscal policies.

2 EVOLUTION OF FISCAL POLICY

In describing the role of the public sector in the financing of economic development in Barbados, Howard (1989) makes an important distinction between colonial and post-independence fiscal policy, a distinction that is borne out by Figure . He argues that under colonial rule, Barbados' public sector finances were managed via ultra-conservative fiscal policy, reflected in the colonial authorities' dependence on sugar exports for revenues and heavy reliance on current surpluses. This policy was shaped by the inadequacy of local financial markets and the authorities' lack of control over monetary policy in the absence of a Central Bank. Howard deemed this balanced budget philosophy to be "functional but anti-developmental"; as it had the desirable effect of minimising balance of payments problems and inflation but at the same time had a negative impact on growth, locking the economy into a low-level equilibrium.

Figure 1 shows that after independence in 1966 there was an initial transition period, which ran until 1973, during which public sector policy continued to be influenced by colonial budgetary principles and the absence of a Central Bank. Nevertheless, since independence the Government has shown greater flexibility with respect to budgetary management, with its more expansionary fiscal policy

having become an important vehicle for the promotion of the country's economic development.

2.1 The Fiscal Balance

As illustrated in Figure 1, the Government of Barbados has consistently recorded a fiscal deficit since independence, as greater emphasis has been placed on income redistribution, that is, increasing levels of public goods provision in the areas of health, education, housing and social security. The greater relative importance attached to capital expenditure in the Government budget can be seen in the fact that, despite recording overall deficits, the Government has continued to run current surpluses, especially since the introduction of VAT in 1997.

The evolution of the fiscal deficit between 1966 and 2001 can be divided into several phases: 1966-1973, 1973-1980, 1981-1990 and 1991-2000, with the year 2001 in a sub-period by itself. As previously mentioned, in the years immediately after independence, the government was slow to shake off the influence of colonial budgetary policy. For this reason, deficit financing did not become an important aspect of fiscal policy until the late seventies, when the government took advantage of high levels of liquidity to obtain funds at low interest rates, thus embarking on an expansionary fiscal policy programme geared towards reducing unemployment. Nevertheless, up until 1980 the deficit was large but relatively well managed (see Haynes and Holder (1987) and Howard (1989)).

The year 1981, however, saw a huge deficit of 9.5% of GDP [Figure 2], which Howard (1989) attributes to the fact that this year was an election year, during which a massive capital works programme was initiated at the same time that the world economy was in recession. Haynes and Holder (1987) cite other factors such as a 1980 income tax reform, which led to a slowdown in revenues, as well as declines in the tourism and sugar sectors. This ushered in a period characterised by consistently high deficit to GDP ratios, due to the continued application of expansionary fiscal policy. This involved heavy spending on developmental projects such as the airport and harbour projects, the secondary school textbook loan scheme, the National Health Scheme and Drug Plan, the Bridgetown Sewerage Project, road-works, soil conservation and refuse disposal projects and the construction of polyclinics, the Arawak Cement Plant, the Spring Garden Highway, the General Post Office, the Barbados Community College and the Samuel Jackman Prescod Polytechnic.

In 1990 another record deficit was registered, to the tune of $236.7 million (nearly 7% of GDP), as the Barbadian economy slipped into recession. The severity of this recession persuaded Government of the need for fiscal restraint. Government reduced the fiscal deficit in 1991 by introducing a number of revenue-raising measures and slashing capital expenditure. Projects were put on hold, with work on a number of school premises, health facilities and roads grinding to a halt. Towards the end of 1991, difficulty in securing non-Central Bank financing forced the Government to further reduce expenditure through lay-

offs and the implementation of an 8% cut in public sector wages. As a result, the deficit averaged just over $60 million (less than 2% of GDP) between 1991 and 2000. The year 2001 brought another recession in the Barbadian economy and a concomitant increase in the fiscal deficit, which rose to 3.5%.

2.2 The Primary Balance

The primary balance (or the non-interest component of the fiscal balance) measures how the current fiscal policy stance affects the net indebtedness of the public sector. That is, since interest payments are the result of past deficits, excluding them from the fiscal balance provides a clearer picture of current behaviour. The primary balance is therefore a useful indicator of the sustainability of the current fiscal stance of the Government.

As Figure 3 shows, from independence up until 1991, the Government of Barbados mainly recorded primary deficits, which were as large as 7.3% [see Figure 4]. Since then, however, primary surpluses have been recorded consistently, averaging nearly 3.0% of GDP, a rough indication that fiscal policy since 1991 has been sustainable on the whole.

3 EVALUATING FISCAL SUSTAINABILITY

There are two commonly used approaches to evaluating fiscal sustainability, which Cuddington (1996) terms **the Accounting Approach** and **the Present Value Budget Constraint (PVBC) Approach**. The starting point for both approaches is the balance sheet of the consolidated public sector or the

government budget constraint. Equation 1 is the one-period budget identity, which shows the sources and uses of funds of the consolidated public sector (central government, public enterprises and the central bank).

Equation 1

$$G_t - R_t + i_t B_{t-1} \equiv B_t - B_{t-1} + M_t - M_{t-1}$$

where G_t, R_t, B_t M_t and i_t are government expenditure, government revenue, government debt the money supply and the interest rate, all in nominal terms, at time t.

Given that the primary balance (S) is equal to government revenue less expenditure $(R-G)$, we substitute $S = R - G$ to get:

Equation 2

$$-S_t + i_t B_{t-1} \equiv B_t - B_{t-1} + M_t - M_{t-1}$$

3.1 The Accounting Approach

The accounting approach involves the use of a number of indicators of fiscal sustainability, which are based on the Government Budget Constraint. These include the Net Worth Indicator, the Tax Gap indicator and the Primary Gap indicator. The first two have not been included in this study. The Net Worth indicator requires the calculation of Government's net worth based on the difference between the actualised value of assets and liabilities, for which it is often difficult to find accurate data; while the Tax Gap indicator was excluded in

light of the constraints on tax reform in Barbados posed by regional integration efforts, as explained in the introduction.

3.1.1 One-period Primary Gap Indicator

The Primary Gap indicator was first proposed by Blanchard (1990) and further developed by Buiter (1993). It focuses on stabilising the ratio of public sector debt to output. For projected paths of the real interest rate and output growth, the N-period primary gap specifies a benchmark primary balance consistent with an unchanged debt ratio, whereby fiscal policy is sustainable if the primary balance is greater than the benchmark. Buiter (1993) shows (see Appendix for Buiter's calculations) that when $N=1$ the primary balance to output ratio necessary to stabilise the debt to GDP ratio $\left(s_1^*\right)$ is:

Equation 3

$$s_1^* = \left(\frac{r_t - g_t}{1+g_t}\right) b_{t-1}$$

The indicator emerging from this analysis is the One-Period Primary Gap, that is, the necessary one-period adjustment in the primary balance, which is given by:

Equation 4

$$GAP_1 = s_1^* - s_t = \left(\frac{r_t - g_t}{1+g_t}\right) b_{t-1} - s_t$$

which is the difference between the required primary balance (s_t^*) and the actual primary balance (s_t).

This indicator is desirable for its simplicity of application, as it requires only the current values of the real interest rate, debt, the primary balance and economic growth. However, it may give a distorted picture of the amount of adjustment required as a result of cyclical variations in public sector revenues and/or expenditures or current real interest rates or growth rates which are not representative of their respective average values in the long-run (Chalk and Hemming, 2000).

3.1.2 Permanent Primary Gap Indicator

In order to get around this, Buiter (1993) calculates the N-period Primary Gap where $N \to \infty$, that is, the permanent primary gap as an additional indicator of fiscal sustainability. This indicator measures the magnitude of the permanent adjustment in the actual and planned primary balance to output ratios that would ensure fiscal solvency, that is, the excess of the required permanent primary balance to GDP ratio over the actual permanent primary balance to GDP ratio. In practice, the current primary balance to GDP ratio is substituted for the actual permanent primary balance to GDP ratio, to give what Buiter terms the "Myopic" Primary Gap (MGAP):

Equation 5

$$MGAP_t^{\infty} = s_t^{*} - s_t = \left(\frac{r_t^{\infty} - g_t^{\infty}}{1 + g_t^{\infty}} \right) b_{t-1} - s_t$$

This equation is similar to the one-period primary gap, except for the substitution of the long-run real interest rate for the current real interest rate and the substitution of the long-run growth rate for the current growth rate.

3.1.3 Pros and Cons of the Accounting Approach

The accounting approach attempts to determine the sustainable fiscal deficit by making assumptions that liabilities can continue to grow at the growth rate of the economy's GDP, so that debt/GDP ratios remain constant. As such, the interpretation of these indicators is relatively simple. Nevertheless, Chalk and Hemming (2000) argue that despite the simplicity and ease of interpretation associated with this approach, these indicators do not distinguish between countries with varying degrees of indebtedness and fiscal imbalance and are therefore more useful in the case of countries characterised by high debt and primary deficits. Furthermore, according to Cuddington (1996), the emphasis on the relationship between GDP growth and increases in debt "*leaves rather vague the role that lenders ultimately play in determining what debt strategies are 'sustainable' and which are not. The PVBC approach is more explicit in this regard.*"

3.2 The PVBC Approach

Once again the starting point for the analysis is the Government Budget Constraint given by Equation 2. Assuming that seignorage is negligible (Belgrave, Campbell, Greenidge and Straughn (2002) show that this assumption is valid for the Barbadian case) and re-arranging this equation gives:

Equation 6

$$B_{t-1} \equiv \frac{B_t}{(1+i_t)} + \frac{S_t}{(1+i_t)}$$

Iterating this equation N periods forward gives the intertemporal budget constraint:

Equation 7

$$B_{t-1} \equiv \sum_{j=0}^{N} \frac{S_{t+j}}{(1+i_t)^{j+1}} + \frac{B_{N+1}}{(1+i_t)^{N+1}}$$

Letting $N \to \infty$ produces the Present Value Budget Constraint:

Equation 8

$$B_{t-1} \equiv \sum_{j=0}^{\infty} \frac{S_{t+j}}{(1+i_t)^{j+1}} + \lim_{N\to\infty} \frac{B_{N+1}}{(1+i_t)^{N+1}}$$

Intertemporal sustainability requires the "no Ponzi game" (NPG) condition to hold, whereby $\lim_{N\to\infty} \frac{B_{N+1}}{(1+i_t)^{N+1}} = 0$. That is, the present discounted value of all future public debt balances must be zero because, as McCallum (1984) showed,

if lenders are behaving optimally and rationally, the government must pay off its debt at some point. Therefore, this condition places the emphasis on the role of lenders in shaping debt dynamics, as opposed to the growth-driven process assumed under the accounting approach. Invoking the NPG condition reduces Equation 8 to:

Equation 9

$$B_{t-1} \equiv \sum_{j=0}^{\infty} \frac{S_{t+j}}{(1+i_t)^{j+1}}$$

The PVBC has a number of implications for fiscal sustainability: firstly, the expected present value of the resources available to the public sector for the servicing of its debt (including seignorage) must be at least equal to the initial stock of debt; secondly, public sector debt cannot be continuously rolled over, that is, repayment of the principal must take place at some point; and thirdly, while the PVBC does not rule out large fiscal deficits or debt ratios, government is required to run some primary surpluses in the future. The Government may bring about these surpluses through a combination of some or all of the following policy options: reducing expenditure; increasing revenue through taxes, grants or privatisation proceeds; monetising the debt, that is, printing money to cover the debt (which is really an inflation tax); defaulting on some or all of the public debt, effectively taxing holders of Government debt; or, finally, shifting between debt sources to take advantage of lower interest rates.

The PVBC approach to evaluating fiscal sustainability involves econometric testing of the validity of the PVBC or of the NPG condition for a set of time series data on spending, revenue, deficits and/or debt, that is, testing whether the historical process that generates fiscal data is likely to result in the PVBC eventually being violated. If the PVBC holds for historical data then the null hypothesis $\lim_{N\to\infty} \frac{B_{N+1}}{(1+i_t)^{N+1}} = 0$ will not be rejected. In other words, the condition being tested is:

Equation 10

$$E\left[\lim_{N\to\infty} \frac{B_{N+1}}{(1+i_t)^{N+1}}\right] \Big| \text{G and R follow historical stochastic processes} = 0$$

Empirical tests of the NPG condition have been popularised by Trehan and Walsh (1991) and Hakkio and Rush (1991) utilising recently developed econometric techniques in stationarity and cointegration analysis. The starting point for these tests is the intertemporal budget constraint in Equation 8, which may be rewritten as:

Equation 11

$$G_t + i_t B_{t-1} \equiv R_t + \sum_{j=0}^{\infty} \frac{1}{(1+i_t)^{j-1}} \left(\Delta R_{t+j} - \Delta E_{t+j}\right) + \lim_{j\to\infty} \frac{B_{t+j}}{(1+i_t)^{j+1}}$$

where the auxiliary variable $E_t = G + (i_t - i)B_{t-1}$ and the interest rate is assumed to be stationary with unconditional mean i. With the NPG condition above, plus an additional definition of $GG_t = G_t + i_t B_{t-1}$, Equation 11 becomes:

Equation 12

$$GG_t - R_t \equiv \sum_{j=0}^{\infty} \frac{1}{(1+i_t)^{j-1}} \left(\Delta R_{t+j} - \Delta E_{t+j}\right)$$

Equation 12 forms the basis for testing the sustainability hypothesis where GG_t and R_t must be cointegrated variables of order one. Suppose R and E are non-stationary in levels so that their first difference is stationary, implying that the term on the right-hand side is stationary; then, for Equation 12 to hold, the left-hand side of the equation must also be stationary. Therefore, both GG_t and R_t must be integrated of order one, $I(1)$, and should be cointegrated. The intuition behind this is that although government revenue and expenditure may grow over time, a stable equilibrium (cointegrating) relationship should exist between them. If GG_t, for example, is non-stationary ($I(1)$) while R_t is stationary ($I(0)$), then there is no long-term or equilibrium relation between them. This implies that government is violating its intertemporal budget constraint because GG_t tends to grow while R_t does not.

The regression for the cointegration test in this case is:

Equation 13

$$R_t = a + \beta GG_t + \mu_t$$

where the null hypothesis of cointegration between the two $I(1)$ variables is tested with $b = 1$ and μ_t being stationary. If there is no cointegration the PVBC does not hold and the fiscal deficit is not sustainable. However, the condition

b=1 is not, strictly speaking, a necessary condition for the government's budget constraint to hold. Hakkio and Rush (1991) showed that when GG_t and R_t are in levels, as opposed to a percentage of GDP or in *per capita* terms, the condition $0 < b < 1$ is a sufficient condition for the budget constraint to be obeyed.

4 RESULTS OF SUSTAINABILITY TESTS

4.1 The Accounting Approach

The one-period primary gap calculated for Barbados [Table 1] suggests that the necessary fiscal adjustment is equivalent to 3.2% of GDP. However, this is a short-run requirement, which reflects the large increase in the fiscal deficit in 2001 and does not speak to long-run sustainability of fiscal policy. The myopic primary gap, on the other hand, has a negative value of –0.8% of GDP, which suggests that fiscal policy is in fact sustainable in the long run, as the actual permanent primary balance is greater than required. As mentioned in the literature review, these indicators are better measures of sustainability in the case of highly indebted countries with serious fiscal imbalances. Nevertheless, although Barbados cannot currently be placed in either of these categories, this approach provides a rough indication of fiscal sustainability, as a precursor to the more powerful and complex econometric analysis of the PVBC approach.

4.2 The PVBC Approach

This section presents the results of the PVBC fiscal sustainability test for Barbados. The data on real revenue and expenditure (the latter includes interest

payments, which is consistent with the form of Equation 12) were obtained from the Central Bank of Barbados data bank and span the period 1974:2 to 2001:4. Figure 5 plots real revenue and real spending. Although a clear upward trend can be identified in both series, there appears to be a definite stable relation between them. Consequently, it is expected that these variables will be non-stationary and cointegrated.

The first step is to determine the order of integration of the two series. The results of the augmented Dickey-Fuller (ADF) test for unit roots (Dickey and Fuller, 1979, 1982) for the variables in levels and first differences are presented in Table 2. The test is based on the following regressions:

$$\Delta R_t = \alpha_1 + \beta_{1t} + \delta_1 R_{t-1} + \sum_{j=1}^{J} \alpha_j \Delta R_{t-j} + \varepsilon_t$$

and

$$\Delta GG_t = \alpha_2 + \beta_{2t} + \delta_2 GG_{t-1} + \sum_{j=1}^{J} \alpha_j \Delta GG_{t-j} + \varpi_t$$

where J in the regressions is chosen so that it is sufficiently large to ensure that the error term is free of significant serial dependence. The null hypothesis of non-stationarity is rejected if $\delta_1(\delta_2)$ is significantly negative. The series are tested for stationarity over the period 1974:2 to 2001:4 and also for two sub-periods: 1974:2-1979:4 and 1980:1-2001:4, where the analysis in Section 2.1 suggested that there may have been a shift in fiscal policy behaviour. The results indicated that both series are non-stationary in levels, $I(1)$, and stationary

in their first differences, $I(0)$, at the 1% level, for the entire sample and also for the sub-periods chosen.

Having established that the series are $I(1)$, it is now possible to search for cointegration between them using the multivariate framework proposed by Johansen (1988) and Johansen and Jurelius (1990). In conducting the test, consider a vector autoregressive model (VAR) of the form:

$$\boxed{B(L)X_t = \xi_t}$$

where $X = [R_t, GG_t]'$. By applying the Beveridge-Nelson decomposition $B(L) = B(1) + (1-L)B^*(L)$ to the lag polynomial operation on X_{t-1}, the equation can be rewritten as:

$$\boxed{\Delta X_t = -\tilde{B}(1)X_{t-1} + \sum_{j=1}^{\infty} B\Delta X_{t-j} + \xi_t}$$

where $B(1)$ is a matrix of long-run multipliers and B the short-run dynamic coefficients. The rank, r, of $B(1)$ determines the number of cointegrating vectors that exist. If $B(1)$ is less than full rank, X_t is cointegrated and $B(1)$ can be expressed as $B(1) = \gamma\alpha$, where α is the matrix of cointegrating vectors and the coefficients in γ represent the speed of adjustment of the system to disequilibrium. The $B(1)$ matrix is estimated as an unrestricted VAR and tested as to whether the restriction implied by the reduced rank of $B(1)$ can be rejected.

The null hypothesis is $H_1(r)$ against $H_1(k)$ and the test statistics used in this decision are: the trace statistic, given by -

$$Q_t = -T \sum_{i=T-1}^{k} \log(1-\lambda_i) \text{ , for } r = 0,1,...,k-1 \text{ and } \lambda_i = \text{the } i^{th} \text{ largest eigenvalue}$$

and the maximum eigenvalue statistic, which is given by -

$$\boxed{Q_t = -T \log(1-\lambda_{T-1}) = Q_T - Q_{T+1}}$$

Table 3 shows that for the sample used in this study there is one cointegrating vector, that is, the rank, r, of $B(1)=1$.

Since the variables of interest are cointegrated, a vector error correction model is estimated, the results of which are presented in Table 4 along with some standard diagnostic test statistics.

The results indicate that the variables under examination are cointegrated and that the estimated coefficient for expenditure (b from Equation 13) is highly significant and relatively close to one. Based on these two criteria - the existence of a cointegrating relationship and b sufficiently close to one - it can be concluded that fiscal policy has been sustainable over the period.

5 RELATED ISSUES

There are a number of other issues related to fiscal sustainability that are of paramount importance for policymakers and which are briefly explored in this section. In the first sub-section, our regression equation for the cointegration test

under the PVBC approach is reformulated as a time varying coefficient (TVC) model, thus enhancing the explanatory power of the results and rendering them more useful for policy development. Secondly, as mentioned in the introduction, debt is the most significant fiscal policy variable in the Barbadian context, given the external and institutional restrictions on revenue-raising and expenditure-cutting policies. The next sub-section is therefore dedicated to the evaluation of debt sustainability in Barbados. After that, the following sub-section will take a brief look at the topical question of deficit-targeting, setting out a simple guide to assist policymakers in their decisions.

5.1 The Time Varying Coefficient (TVC) Model

The foregoing analysis of the intertemporal budget constraint under the PVBC approach assumed that the parameters were fixed over time. This has been cited as a drawback by some authors, including Abdulnasser (2002), who argued that parameters cannot be used for policy recommendation if the so-called Lucas critique is not taken into consideration. The Lucas (1976) critique of econometric policy evaluation is that macroeconomic parameter estimates are not invariant under changes in policy régime and therefore such estimates are useless for forecasting the impact of the policy changes.

Apart from Lucas, Engle and Watson (1987) give two further reasons why one should consider allowing the parameters of any given model to change over time. Firstly, there may be structural changes in the data generation process caused

by changes in the unobservable components of economic variables such as expectations. Secondly, allowing the parameters to vary with time may reduce the possibility of model misspecification.

In order to address these issues in this paper, Equation 13 is re-written as a TVC model to allow for the adjustment process of the parameters. This is done by writing it as a state-space model of the form:

Equation 14

$$\boxed{\begin{aligned} RG_t &= \alpha + \beta_t GG_t + \mu_t \\ \beta_t &= \beta_{t-1} + \gamma_t \end{aligned}}$$

The first equation is called the observation, measurement or signal equation and the second is referred to as the transition or state equation. The latter describes the dynamics of the coefficient β. The error terms μ and γ are assumed to be independent white noise processes. The model is estimated by applying the Kalman filter over the sample period. The Kalman filter is to time series models in state-space form as least squares computations are to a regression model. For a more extensive exposition of the Kalman filter and time series see Harvey (1993). The estimation by Kalman filter of equation 14 yields the following results:

$$\boxed{R_t = \underset{(0.1382)}{-23.27} + \underset{(0.000)}{0.97}\, GG_t}$$

Here the numbers in parentheses are the associated p-values.

The results are similar to the fixed coefficient model, with the estimated coefficient for expenditure very close to one and highly significant. The residuals were tested for unit roots by conducting an ADF test and the results (a test value of –5.7773 versus a critical value of –3.4919 indicated that they were stationary at the 1% level of significance. This confirms that the two variables form a cointegrating relation.

One of the advantages of the TVC model is that it gives information about the β coefficient within the sample period. Figure 6 shows a time plot of the point value of β, as well as a band of two standard errors of the residuals. The graph shows that the estimated β remains relatively close to one; this provides further evidence that government has fulfilled its budget constraint during the sample period. There were some periods of volatility in the late 1970s and early 1980s and again around 1991 and 1992, but these were not persistent. Furthermore, since 1992 β has moved closer and closer to one. This implies that changes in the government deficit are followed by adjustments to future spending, which when discounted is equal to the original change in the present value of the government deficit.

5.2 Debt Sustainability

Although the above finding of fiscal sustainability also implies that the debt position is sustainable (see Equation 8), some authors (Trehan and Walsh (1991), Hénin (1997)) propose testing this explicitly by looking at the stationarity

of the first difference of the stock of public debt. The Augmented Dickey-Fuller test, when applied to the first difference of the real stock of public debt in Barbados over the period, resulted in a test statistic of –6.2341, which, when evaluated against a critical value of –4.2505, confirms that the series is stationary at a significance level of 1%. In other words, the solvency condition of Equation 8 is satisfied. This is an expected result given that the test is really the mirror of the cointegration test of the Government accounts. In fact, Trehan and Walsh (1991) observed that the stationarity of the variation of the stock of public debt is a sufficient condition for the sustainability of the fiscal position.

Another way of looking at this is through the use of debt ratios. The most commonly used ratio is that of debt service payments to exports of goods and non-factor services. Hence, a country's ability to service its debt also depends on the outlook for exports, its import requirements, the level of foreign reserves, terms of trade, international interest rates and capital market developments as well as the degree of flexibility the economy has to deal with exogenous shocks.

5.3 The Optimal Size of the Fiscal Deficit

An in-depth investigation into the optimal size of the deficit is beyond the scope of this study and was not attempted here. Instead, the focus was solely on the sustainability of the fiscal position, irrespective of what it was or should have been. Nevertheless, it seems appropriate at this point to reflect briefly on this issue.

Although the literature is somewhat mute on the size of the fiscal deficit to GDP ratio, some simple accounting shows that the debt–GDP ratio evolves according to the formula:

Equation 15

$$d_t - d_{t-1} = -\left[\frac{\psi_t}{1+\psi_t}\right] d_t + def_t$$

Where d_t is the debt–GDP ratio at the end of period t; ψ_t is the growth rate of nominal GDP in period t (real growth plus inflation); and def_t is the deficit–GDP ratio in period t. Thus, nominal GDP growth reduces the debt-GDP ratio, but a larger deficit (relative to GDP) increases the debt-GDP ratio. If the debt–GDP ratio is constant we get:

Equation 16

$$d_t = [(1+\psi_t)/\psi_t]\, def_t$$

This equation can be used as a guide for determining the limit on the fiscal deficit. The main implication of Equation 16 is that in the long run a deficit guideline def^* and a debt guideline d^* can be mutually consistent only for one particular growth rate of nominal GDP.

Using long-run real GDP growth of 3% per annum plus a long-run inflation rate of 2.5% would imply 5.5% annual growth of nominal GDP. Taking the 2000 and 2001 debt-GDP ratios of 69.5% and 79.1% as sustainable (this has already been

confirmed by the foregoing analysis), Equation 15 gives a deficit-GDP ratio between 3% and 3.6% as compatible and hence sustainable. Therefore, this range would be suggested as optimum.

6 CONCLUSION

In synthesis, the findings of sustainability tests, under both the "accounting" and the "PVBC" approaches, indicate that fiscal policy since independence has in fact been sustainable. Even when the latter approach was evaluated within a time varying coefficient model, results showed that the TVC remained close to one for the whole of the review period, providing further empirical support for the finding that Government has consistently adhered to its budget constraint.

The onus is therefore on policymakers to extend this favourable track record into the future, resisting the urge to rest on their laurels and working to ensure that future policy decisions continue in the tradition of prudent fiscal management that has been established. This will be all the more difficult to achieve in the face of the new challenges posed by the twin phenomena of globalisation and liberalisation: It will be necessary to balance the need for policies which can increase competitiveness and stimulate growth against the need to maintain fiscal discipline in order to preserve Barbados' good standing in the international financial community. In this regard, policymakers are urged to observe the guidelines set out above for the management of the fiscal deficit.

Another important point, which was mentioned in the introduction but nevertheless bears repeating, is that the findings of this paper merely point to the sustainability of fiscal policy and do not speak to the notion of optimality. We must strive therefore to not only maintain but also improve on our performance thus far, with optimality rather than sustainability as our ultimate goal.

Finally, notwithstanding the somewhat narrow focus of this study, fiscal sustainability should not be contemplated in a vacuum, but rather it must be seen within the wider context of overall macroeconomic sustainability. To this end, policymakers must coordinate fiscal policy with other policy areas, so as to maintain an environment of low inflation and unemployment, exchange rate stability and external account equilibrium, as well as fiscal sustainability.

APPENDIX

Primary Gap Analysis (Buiter et al, 1993)

We can divide equation 2 through by nominal GDP (P_tY_t), where P_t is the GDP deflator and Y_t is real GDP at time t:

$$\boxed{\frac{B_t}{P_tY_t} \equiv (1+i_t)\frac{B_{t-1}}{P_tY_t} + \frac{\Delta M}{P_tY_t} - \frac{S_t}{P_tY_t}}$$

Now let $\pi_t = \frac{P_t}{P_{t-1}} - 1$ and $g_t = \frac{Y_t}{Y_{t-1}} - 1$, so that:

$$\boxed{P_tY_t = P_{t-1}Y_{t-1}(1+g_t)(1+\pi_t)}$$

Substituting equation 4 into equation 3 we get:

$$\boxed{\frac{B_t}{P_tY_t} \equiv \frac{B_{t-1}(1+i_t)}{P_{t-1}Y_{t-1}(1+g_t)(1+\pi_t)} + \frac{\Delta M}{P_tY_t} - \frac{S_t}{P_tY_t}}$$

Now, assuming that $\frac{\Delta M}{P_tY_t}$ (seignorage) is negligible and letting $s_t = \frac{S_t}{P_tY_t}$, $b_t = \frac{B_t}{P_tY_t}$, and given that r_t is the real interest rate and that $1+r_t \cong \frac{1+i_t}{1+\pi_t}$, we get the Government Budget Constraint in terms of real output:

$$\boxed{s_t = \frac{(1+r_t)}{(1+g_t)}b_{t-1} - b_t}$$

Rearranging we get:

$$\boxed{s_t = \left[\frac{1+g_t}{1+r_t}\right]^{-1}\left[b_{t-1} - \left(\frac{1+g_t}{1+r_t}\right)b_t\right]}$$

Iterating forward N periods we get the required primary surplus to GDP ratio (s_t^*):

$$s_t^* = \left[\sum_{k=0}^{N-1}\prod_{j=0}^{k}\left(\frac{1+g_{t+j}}{1+r_{t+j}}\right)\right]^{-1}\left[b_{t-1} - \prod_{j=0}^{N-1}\left(\frac{1+g}{1+r}\right)b_{t-1+N}\right]$$

where b_{t-1} is the initial debt to GDP ratio and b_{t-1+N} is the target debt ratio $N \geq 1$ periods later.

With a constant real N-period interest rate r^N and a constant real rate of economic growth g^N, this simplifies to:

$$s_t^* = \frac{r^N - g^N}{\left(1+g^N\right)\left[1-\left(\frac{1+g^N}{1+r^N}\right)^N\right]}\left[b_{t-1} - \left(\frac{1+g^N}{1+r^N}\right)^N b_{t-1+N}\right]$$

If the target debt ratio is the same as the initial ratio (that is, if there is a constant debt ratio) this simplifies further to:

$$s_0^* = \frac{r^N - g^N}{\left(1+g^N\right)}\left[b_{t-1}\right]$$

When $N = 1$ the constant primary surplus becomes:

$$s_0^* = \frac{r_t - g_t}{\left(1+g_t\right)}\left[b_{t-1}\right]$$

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Figure 1

Evolution of the Fiscal Deficit (1953-2001)

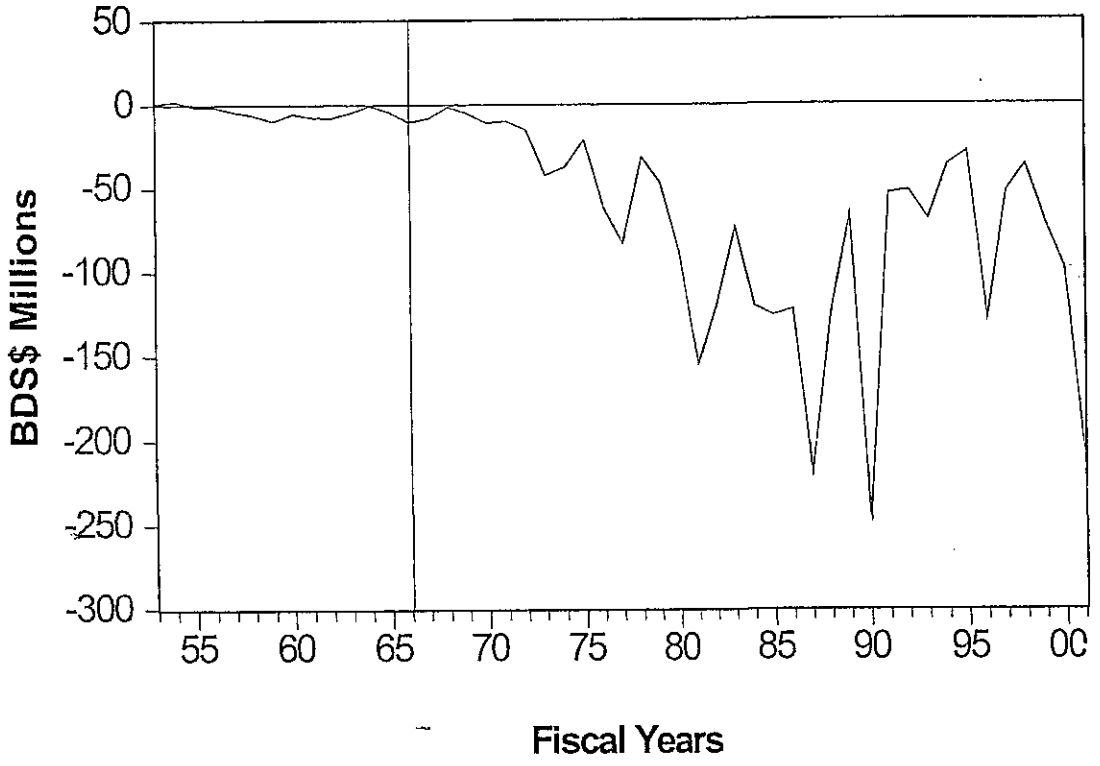

Figure 2

Ratio of Fiscal Deficit to Nominal GDP at Market Prices

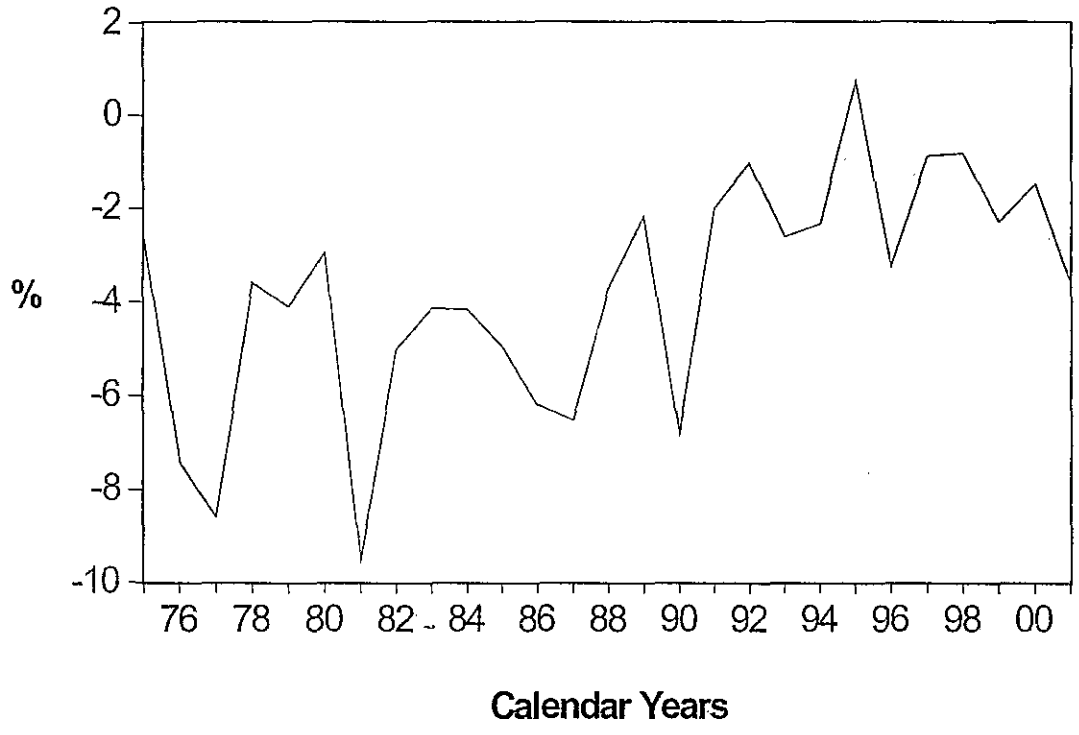

Figure 3

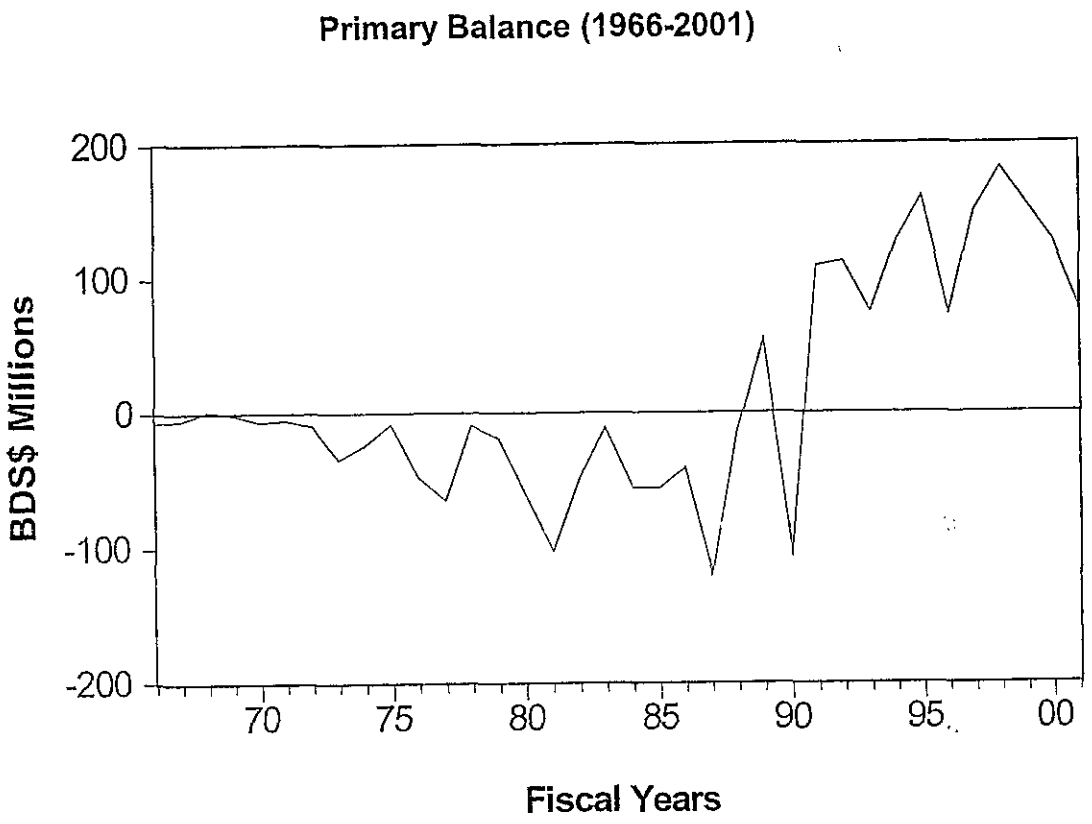
Primary Balance (1966-2001)
200
100
0
-100
-200
BDS$ Millions
70
75
80
85
90
95
00
Fiscal Years

Figure 4

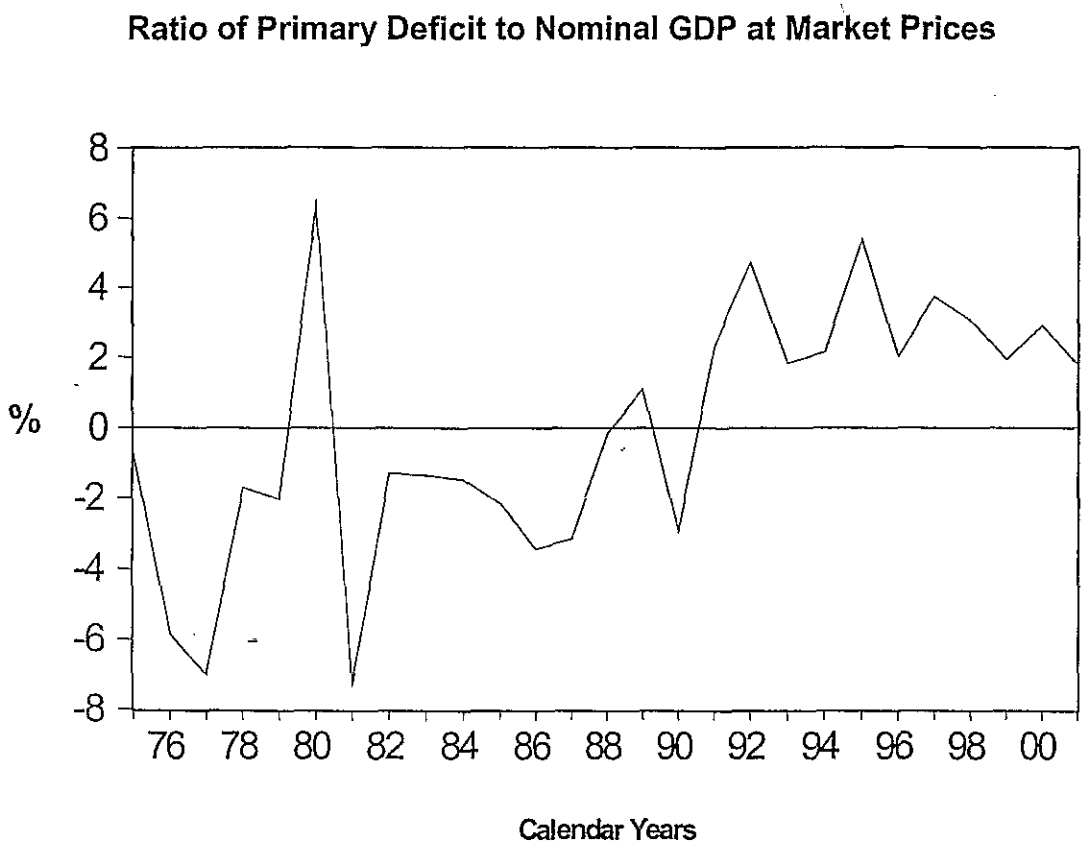
Ratio of Primary Deficit to Nominal GDP at Market Prices
%
8
6
4
2
0
-2
-4
-6
-8
76
78
80
82
84
86
88
90
92
94
96
98
00
Calendar Years

Figure 5

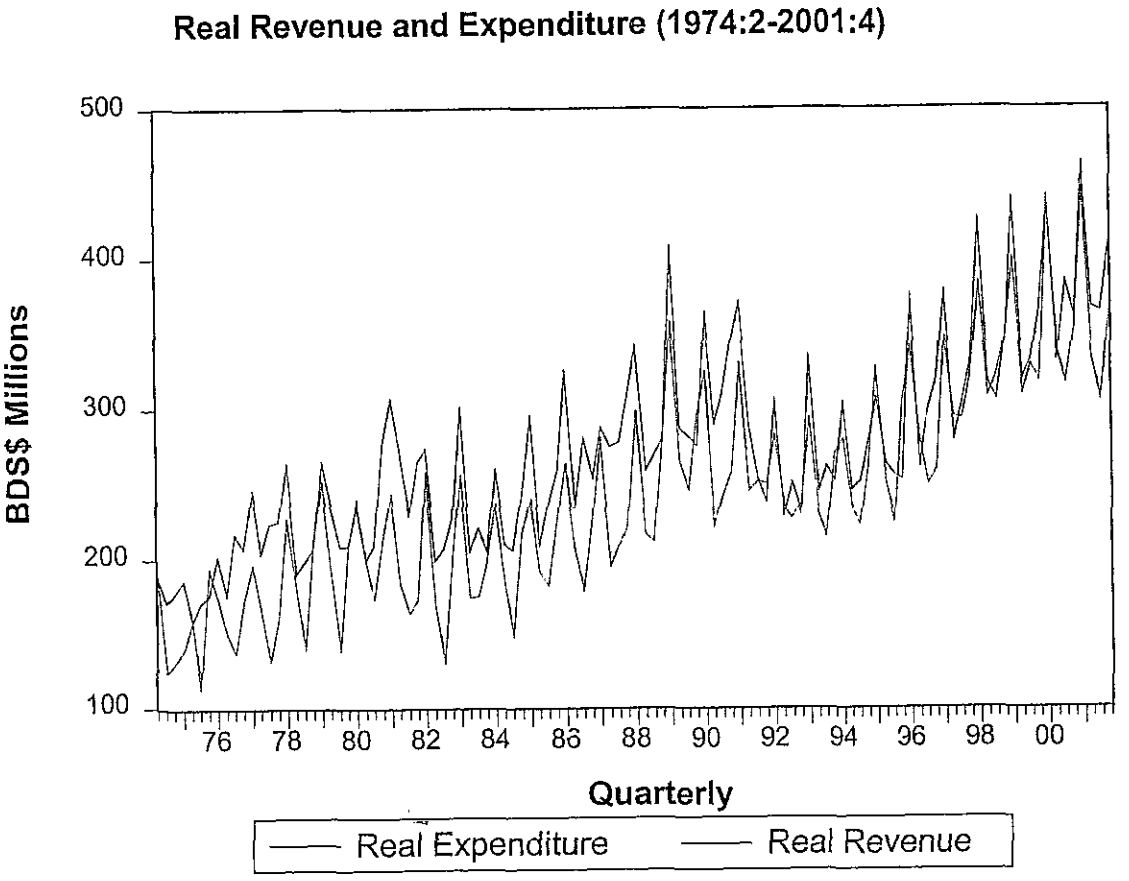
Real Revenue and Expenditure (1974:2-2001:4)
BDS$ Millions
500
400
300
200
100
76
78
80
82
84
86
88
90
92
94
96
98
00
Quarterly
Real Expenditure
Real Revenue

Figure 6

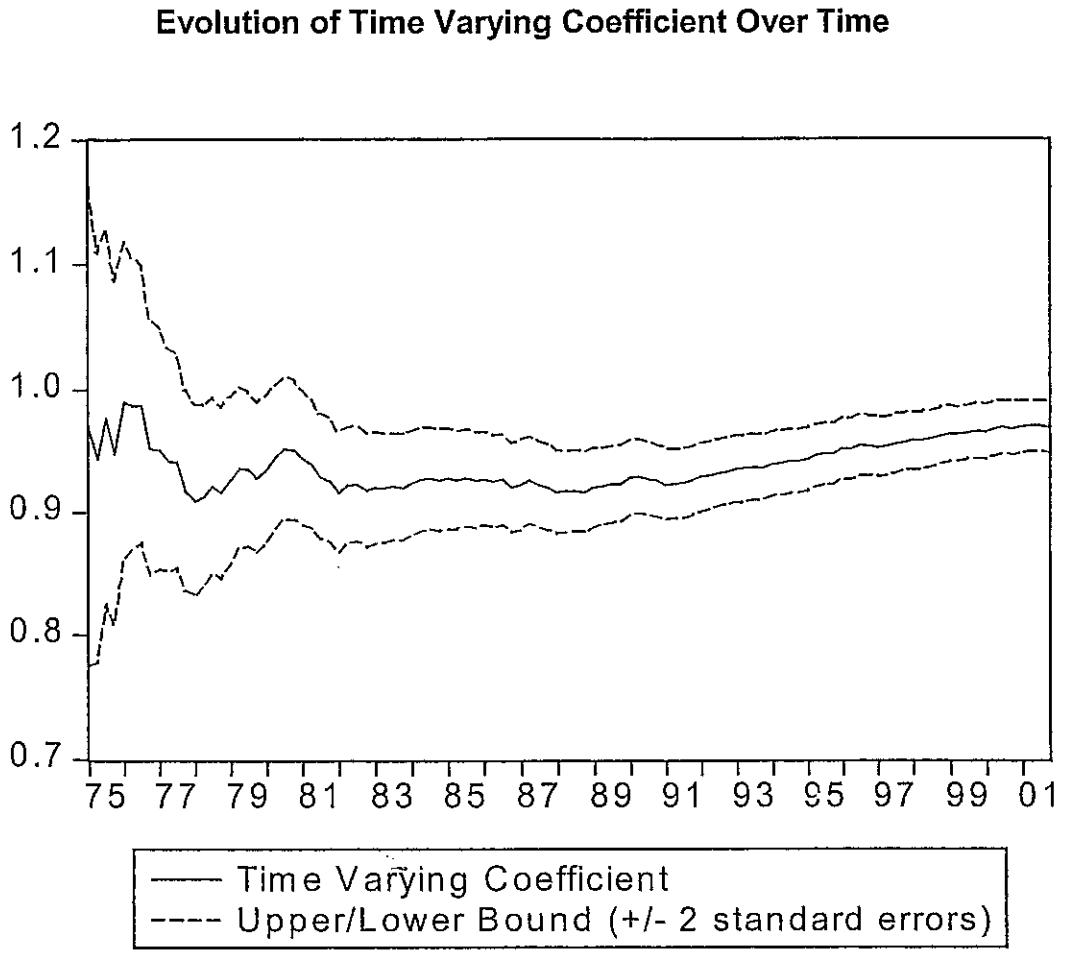
Evolution of Time Varying Coefficient Over Time
1.2
1.1
1.0
0.9
0.8
0.7
75 77 79 81 83 85 87 89 91 93 95 97 99 01
Time Varying Coefficient
Upper/Lower Bound (+/- 2 standard errors)

Table 1

Results of Primary Gap Analysis (One-period and Myopic Permanent)

BDS $million / %		
One-Period Primary Gap	**GAP_1**	**3.2%**
Real Interest Rate	r_t	4.4%
Required Primary Balance to GDP (1-period)	s^*_1	5.0%
Actual Primary Balance to GDP	s_t	1.8%
Myopic Permanent Primary Gap (long-run)	**MGAP**	**-0.8%**
Long-run Interest Rate on Debentures	i_L	7.0%
Long-run Inflation Rate	π_L	2.5%
Long-run Real interest Rate	r_L	4.5%
Long-run Growth Rate	g_L	3.0%
Required Primary Balance to GDP (long-run)	s^*_L	1.0%

Table 2

Results of Augmented Dickey-Fuller Test for Stationarity

SERIES		1974:II - 2001:IV		1974:II - 1979:IV		1980:I - 2001:IV	
		NO TREND	TREND	NO TREND	TREND	NO TREND	TREND
RR		0.1064	-1.5130	0.9926	-0.3397	0.1836	-1.9674
D(RR)		-8.1081	-8.0709	-6.2921	-6.3275	-6.7775	-4.5753
RG		-0.1042	-1.4529	-0.6559	-2.7760	-0.1677	-1.7531
D(RG)		-6.7762	-6.7554	-5.1506	-5.0860	-6.4731	-6.6872
McKinnon	1%	-3.4928	-4.046	-3.5437	-4.1219	-3.5111	-4.0727
Critical	5%	-2.8887	-3.4519	-2.9109	-3.4875	-2.8967	3.4645
Values	10%	-2.5811	-3.1512	-2.5928	-3.1718	-2.5853	-3.1585

D denotes the first difference of the original series

Table 3

Results of Johansen Test for Number of Cointegrating Vectors

NULL HYPOTHESIS (r) ABOUT THE NUMBER OF COINTEGRATING EQUATIONS (RR, RG)	1974:II – 2001:IV	
	r = 0	r ≤1
Trace statistic	25.006	1.3720(**)
Critical Values 5%	-18.17	-3.74
1%	-23.46	-6.4
Max-eigen Statistic	23.63	1.3720(**)
Critical Values 5%	-16.87	-3.74
1%	-21.47	-6.4

*(**) indicates significance at the 5%(1%) level

Table 4

Results of Cointegrating VAR Regression

Results of the Cointegrating VAR Regression Sample(adjusted): 1974:4 2001:4 Observations: 108 Standard errors in ( ) & t-statistics in [ ]	
Cointegrating Eq:	**CointEq1**
RR	1.0000
RG	-0.9053 (0.0939) [-8.3487]
C	-356.426
R-squared	0.83442
Adj. R-squared	0.81258
Log Likelihood	-578.1214
Akaike Information Criteria	14.1234
Schwarz Criteria	14.3565