Fiscal Sustainability in an Open Economy with an Exchange Rate Peg

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Central Bank of Barbados

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Introduction

This paper answers the question as to whether Barbados' fiscal policy since the 1970s has been sustainable, with the aid of a methodology which focuses on foreign exchange reserve adequacy as the most proximate indicator of sustainability. Fiscal sustainability is usually assessed in terms of the long-term ability to service the government debt out of incremental savings from economic growth. What has become apparent is that the upper limits to fiscal deficits that may be considered sustainable, using this approach, are far in excess of the 60 %rule of thumb which has gained currency internationally as a prudent upper limit. What is more, as was the experience of Barbados in 1991, fiscal deficits can become unsustainable at far lower debt levels, if the resultant debt service requirements deplete the country's foreign exchange reserves to such an extent that people become worried about the stability of the exchange rate. In small economies that are as open as is the case for Barbados, the foreign exchange constraint is the one that determines the sustainability of the fiscal stance, because that limit kicks in far sooner than does any overall limit of the ability to service the overall debt.

This paper uses a simple model of the fiscal impact on the balance of payments as a framework for assessing the sustainability of fiscal policy in Barbados. It allows us to explore the impact on the balance of payments and the accumulation of foreign exchange reserves of money creation to finance fiscal deficits. We are able to stress the reserves of foreign exchange by experimenting with various levels of money creation, sustained over varying periods of time. The rule of thumb for reserve adequacy in Barbados remains the equivalent of three months of imports. We compare the reserves under stress of money creation to see under what circumstances money creation would have driven foreign reserves below that level.

Barbados has had surpluses on the current account of government operations every year since 1970, except for three years. It therefore comes as a surprise that the country's government debt-

to-GDP ratio is now in the region of 100 percent. In the first section of our paper we review the growth of debt, discuss its structure (domestic vs foreign debt, debt by maturity, interest costs, etc) and explore the economic circumstances and fiscal policies that lay behind the rising debt ratio. We explore in depth those periods when debt rose most swiftly. Sections II, III and IV are devoted to the analysis of government expenditure, revenue and financing, respectively.

In the Section V we review previous studies of debt sustainability in Barbados, as well as approaches to debt sustainability of small open economies that use standard methodologies for assessing fiscal sustainability. This body of research forms the background for our own study, and we will compare the assessment of sustainability that we introduce in this paper with the results using these standard methodologies.

The sixth section of the paper introduces a model of the economy that establishes the link between the financing of fiscal deficits and the accumulation of foreign exchange reserves. The model is very much in the tradition of monetary approaches to the balance of payments, but it also incorporates wealth effects and an explicit link between the fiscal balance and the extent of money creation. In Section VII the analysis of fiscal sustainability is undertaken with the use of this model to explore the implications for foreign reserve adequacy of alternative levels of money-financed fiscal deficits.

Section I: Overview of Debt and Fiscal Policy in Barbados

A number of authors have presented comprehensive reviews of the development of Barbados' debt and fiscal positions. Work by Howard (1988) and Anyadike-Danes (1991), for example, confirm that, like most developing economies, Barbados' fiscal position and sovereign debt followed dynamic, multi-stage processes characterized by alternating periods of expansionary policies and fiscal restraint. Specifically, Howard noted that there has been a sustained increase in the deficit and the resultant debt since the mid-1970s as conservative, colonial governance policies were replaced by post-independence, development-oriented strategies.

In addition to the dynamic growth of the fiscal deficits and debt over the last 30 years, two periods of debt distress have been identified. During both the early 1980s and 1990s, Barbados

faced severe foreign exchange constraints and was forced to seek assistance from the International Monetary Fund (IMF). Two stand-by arrangements were agreed to cover the periods 1982-1984 and 1992-1993 and provided foreign exchange support, contingent on a number of austerity measures related to reducing the fiscal deficit and constraining the growth of debt. The purpose of this section, therefore, is to analyse the trends in the fiscal balance and the debt to cast some light on the possible causes of these periods of debt distress.

Figure 1 illustrates the dynamics of the fiscal balance since 1980 as a ratio to GDP. Three critical dimensions emerge from the analysis of the 30-year period. The first is that, as noted by Greenidge and Archibald (2004), both capital and current spending grew substantially over the period, reflecting the emphasis on accelerating human resource development through improved healthcare, education, housing and social security.

Figure 1: Fiscal Components, Balance and Ratios
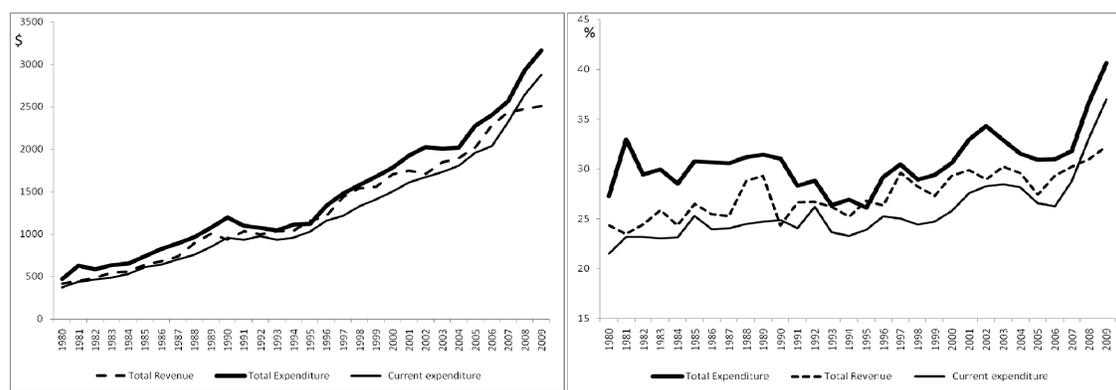
Panel 1   **Panel 2**

The second dimension relates to the evolution of the current account. While current expenditure – the major driver of total expenditure over the period – exploded by an annual average of 10.1% between 1981 and 1990, stabilizing fiscal consolidation during the early 1990s resulted in average annual expenditure growth slowing to 4.7% between 1991 and 2000. However, persistent growth in all expenditure categories, primarily increases in wages and salaries, transfers and subsidies to statutory bodies and interest payments, pushed expenditure up by 91% between 2000 and 2009.As Panel 1 in Figure 2 illustrates, the expansionary spending policies during these periods were matched by sustained increases in current revenues. During the 1980-

1990 period, revenues increased steadily, reaching $985.6 million in FY 1989/90, up from the $442.2 million a decade earlier.

Similar increases were recorded over the next two decades, predicated primarily on the introduction of the Value Added Tax (VAT) in 1997 and enhanced corporate receipts driven by growth in the offshore sector. As Figure 2 illustrates, the resultant current account balances have been primarily positive, averaging $76.2million or 1.5% of GDP over the period.

Figure 2: Current Account and Total Fiscal Balance
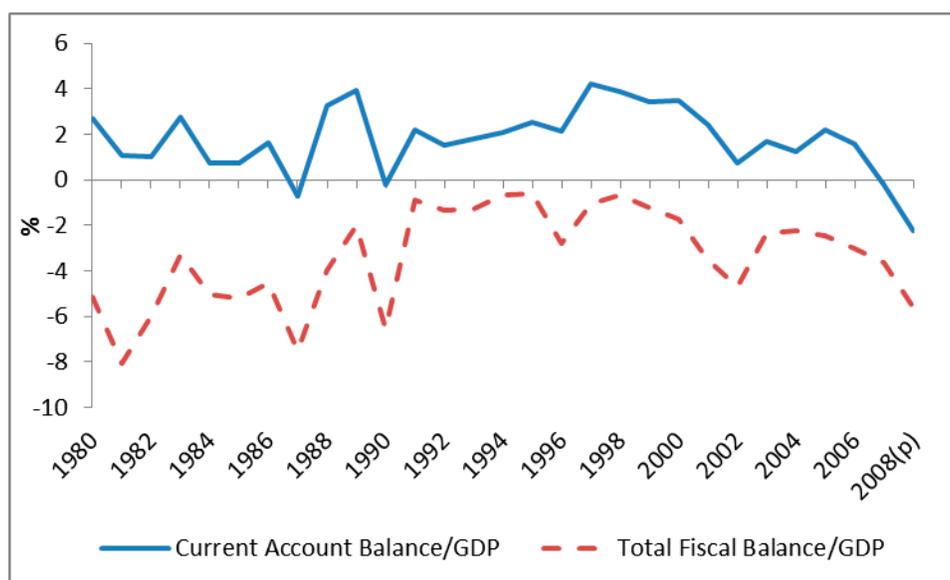
The final dimension is that while the current account balance of government was predominantly positive, persistent overall fiscal deficits over the same period, and in particular widening fiscal gaps since 2000 averaging $295.2 million or 3.9% of GDP, highlight the contribution of capital formation to the fiscal imbalance. Capital spending increased gradually in the 1980s, moving from $102.6 million in 1980 to $240.0 million in 1990. However, as a large portion of the fiscal consolidation of the 1990s fell on capital expenditure, there was a rapid decline to $9107.3million by 1995. Since then, however, capital expenditure has grown substantially, peaking at $355.2 million in 2002, and averaging $240.3 million between 2003 and 2009. Conversely, as GDP growth outpaced that of capital spending, as a ratio to GDP, capital expenditure was highest in the 1980s, averaging 6.3% for the period, compared to 3.9 and 3.7 in the following decades, respectively.

As a result of the persistence of the fiscal imbalance, the country has recorded a sustained rise in the level of debt over the period. From $493.2 million in 1980, the debt increased exponentially to $ 7,367.3 million at the end of 2009 – an average rate of growth of 10% per annum.

Figure 3: Debt and GDP
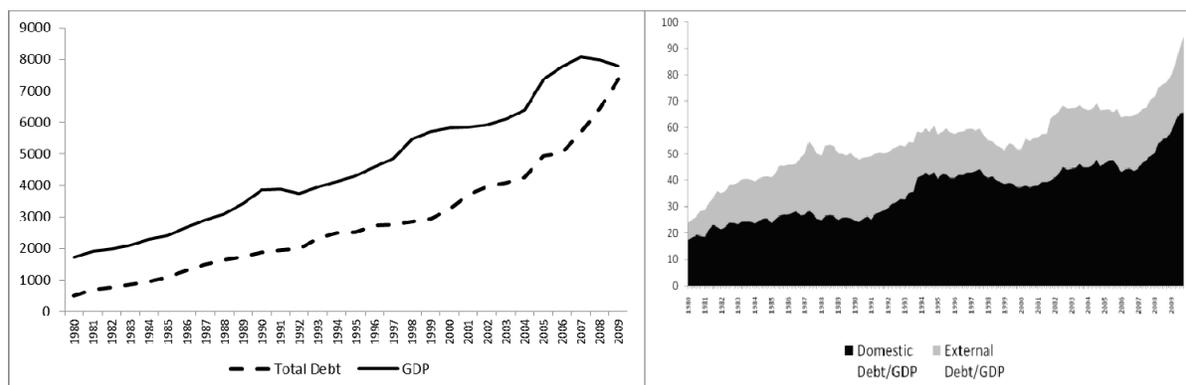
__Panel 1__	__Panel 2__

Conversely, output growth, as measured by nominal market-price GDP, averaged 5.4% over the 30-year period (Panel 1, Figure 3), resulting in a year-end debt-to-GDP ratio that moved from 28.5% in 1980 to 48.7% in 1990, 55.9% in 2000 and 94.6% in 2009. (Panel 2, Figure 3). It is worthy to note that a number of loans[1] which had been guaranteed by government prior to 2005 were taken over during this period and these contributed approximately $400 million (or 5.2% of GDP) increases in the central government debt recorded between 2005 and 2009.

Panel 2 in Figure 3 also disaggregates outstanding debt on a quarterly basis since 1980 into domestic and external components in relation to GDP. While the ratio of external debt to the total was almost identical in 2009 as in 1980, there was substantial variance over the period, reflecting shifting dynamics in both the domestic and external markets.

The ratio climbed steadily throughout the 1980s, peaking at 50% in the first quarter of 1989 as government relied heavily on external funding to meet its budgetary short-fall. However, during the early 1990s, government began to face severe foreign financing constraints, which as Hoeven (1995) notes, is possibly linked to foreign financiers' uncertainty about the rapid increase in

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[1] These included the Coast Guard, ABC Highway expansion and the new prison facility.

Barbados' foreign debt during the preceding decade as well as the ability to service existing external debt in the midst of dwindling foreign reserves.

Domestic financing made a resurgence during this period and, as domestic liquidity increased in the following years, government continued to rely primarily on domestic sources to finance its deficits. As a result, by the end of 2009, the ratios of domestic and external debt to GDP were 65.7% and 28.8%, respectively.

Section II Government Expenditure Analysis

Capital Expenditure

As noted, while current revenues were, in general, adequate to offset the costs of current expenditure, recurring fiscal deficits were the result of growing levels of capital expenditure. Overall, this capital expenditure was dominated by spending on tourism-related infrastructure, education, healthcare, housing and road and highway infrastructure. As with the various current expenditure categories, government's capital expenditure evolved over the three decades in three distinct phases.

Figure 4: Capital Expenditure Ratios
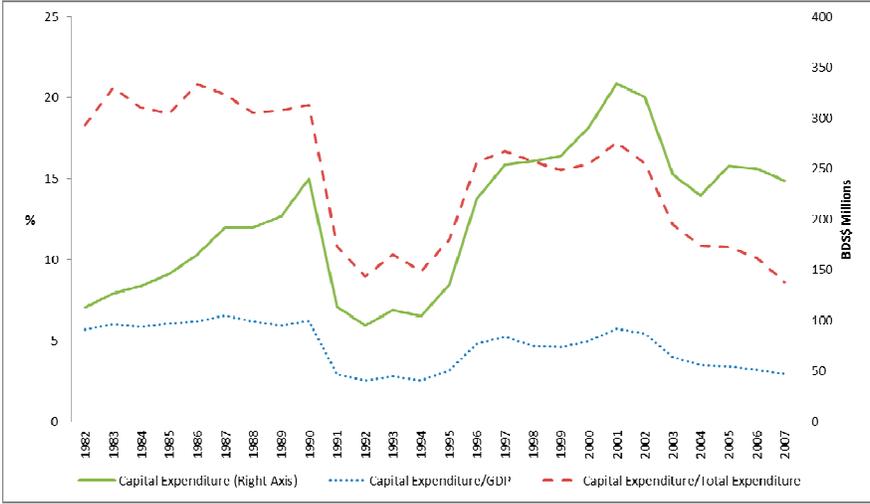
The first of these, which lasted from 1980 until 1990, saw capital expenditure as a ratio to GDP remaining relatively stable, moving from 8.0% in 1982 to 6.2% in 1990, and averaging 6.5%

over the period. Over the period[2], capital expenditure totalled approximately BDS$ 1.8 Billion, starting with $138.8 Million in 1980 and rising to $240.1 million by 1990. During this period, the largest individual categories of capital expenditure related to housing[3] ($99.4 million); airport development ($69.0 million); hospital and polyclinics infrastructure ($58.3 million); highway development and road rehabilitation ($51.2 million); primary and secondary schools ($46.2 million); the transport board ($40.4 million); and rural development [4] ($32.9 million). Accordingly, the government departments responsible for transport and public works, civil aviation, education and culture, agriculture and housing and land and the environment accounted for, on average, more than 50% of total capital spending.

The second phase began in 1991 when, during the fiscal consolidation programme, capital expenditure fell by 52.7%, driven mainly by declines in spending in all of the major categories previously identified. During this year, capital spending as a percentage of GDP fell to under 3%. This indicates that, as would be expected, reductions in capital spending outpaced cuts to current expenditure during the period of fiscal consolidation, reflecting the relatively greater scope for reducing discretionary capital spending vis-à-vis non-discretionary current expenditure such as wages and interest payments. From 1991 through to 1994, continuing austerity measures kept capital spending depressed to well below the levels observed during the 1980's. While disaggregated data on capital spending during 1992 and 1993 was unavailable, the available summaries indicate that spending on the broad economic categories of public works, healthcare, housing, agriculture and education, which accounted for between 46 and 55% of total capital outlays during those periods, all declined.

By 1995, capital expenditure began to grow again, both in real terms and as percentages of GDP and total expenditure. During this second period of growth, which lasted until 2001, capital spending grew rapidly from $135 million in 1995 to a peak of $334.1 million in 2001. While this resulted in persistent increases in the ratio of capital spending to GDP, significant gains in GDP over the period served to stabilise the ratio, preventing it from reaching the highs of the early 1980's. Throughout this stage, a number of additional categories emerged as major contributors

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[2] Due to data unavailability, sector-specific data for 1989, 1992, 1993 and 1998 have been excluded from the analysis.
[3] Includes National Housing Corporation, Land Acquisition and Tenantry Relocation and Redevelopment Project
[4] Includes development of the Scotland District

to capital expenditure growth. In particular, spending on sanitation[5], which accounted for just 3.4% of total capital outlays in 1994, increased sevenfold to 22.9% by 1996 and stood at 18.3% by 2001.

Another major capital expenditure which emerged related to education, namely the Education Sector Enhancement Programme (Edutech), an IADB/CDB-sponsored programme which began in 1998. By 2000, annual spending on Edutech amounted to $46.1 million, accounting for 15.9% of total capital expenditure. At the same time, spending on a number of other projects increased, including the airport development and expansion, which averaged $24 million per year between 1999 and 2001, and highway expansion which doubled from $16.7 million in 1994 to $38.9 million in 2001.

The final stage, delineated by the start of the recessionary period in 2001, saw a gradual decline in capital expenditure, occasioned by fall-offs in nearly all of the major categories. In particular, expenditure on the highway expansion, airport expansion and sanitation-related spending all contracted by over 45% relative to the previous period.

Figure 5: Capital Expenditure by Project
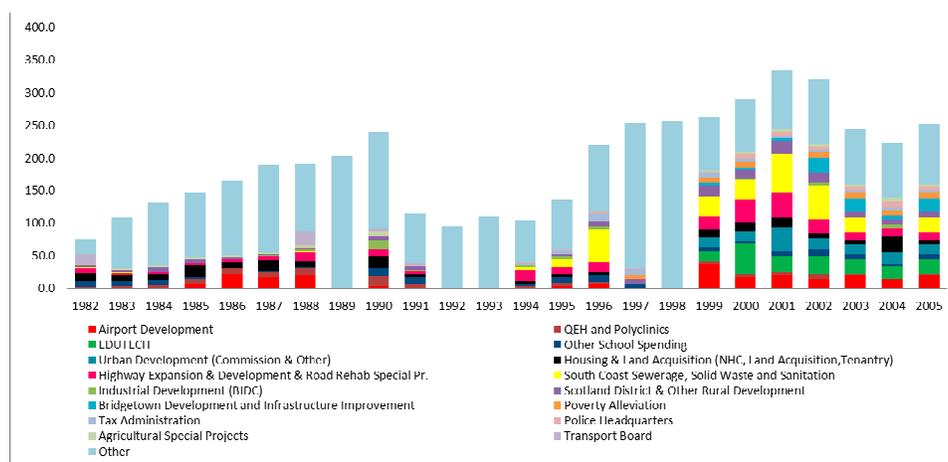
 An important consideration in this analysis relates to off-budget spending and its attendant impact on reported capital expenditure and the stock of disbursed and outstanding debt. Specifically, the use of Public-Private Partnerships (PPPs) – contractual arrangements between the public and private sector in which the financial costs and operation of a service or capital

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[5] Includes the South and West Coast Sewerage projects and solid waste project

venture are borne jointly by the two parties – resulted in sizeable, off-budget spending between 2005 and 2009. In general, these arrangements entailed limited or no capital outlays by government during the development phases of the project, allowing government to defer on-budget spending and minimise increases in its debt during the period. However, as figure X illustrates, if these values are included as part of gross debt, the impact on central government liabilities is quite significant. In particular, the PPPs related to prison and court construction, maritime security and highway expansion would have been equivalent to as much as 8.6 and 9.2% of total debt in 2006 and 2007, respectively.

Figure 6: Impact of PPPs on Central Government Debt
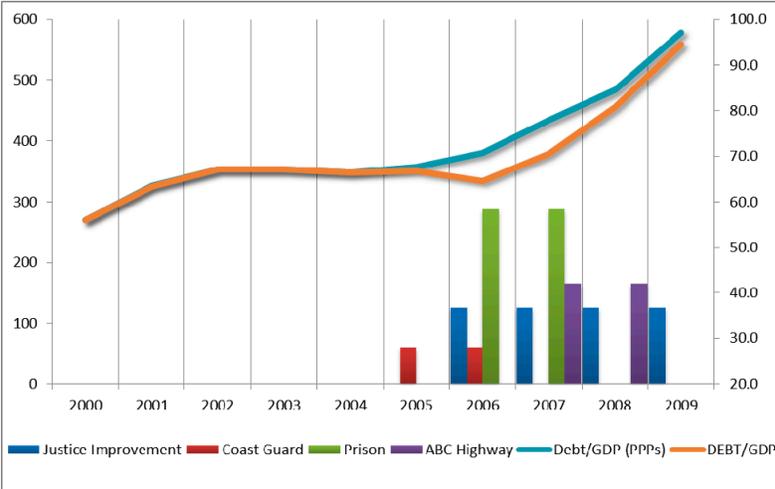
Another notable dynamic of capital expenditure, albeit with a less significant impact, related to a reclassification of capital spending which involved the reassignment of certain categories of capital expenditure to a current expenditure sub-category, reflecting the creation of a statutory body to oversee the functioning of the primary national hospital. As such, while total expenditure still captured this form of spending, total on-budget capital expenditure was understated to the extent that it excluded capital formation carried out by the statutory body. Adjusting for these values, capital expenditure would be understated by approximately $7.4M since 2003.

Transfers and Subsidies

The growth of transfers and subsidies has closely mirrored that of GDP over nearly the entire period of analysis such that between 1980 and 2002, the ratio was relatively stable, resulting in a correlation co-efficient of 0.94 between the two for the period. In general, these transfers and subsidies were primarily directed toward the transport board, the university campus, the defence force and the tourism authority. Over these 23 years, transfers and subsidies accounted for between 21.3 and 25.5% of total expenditure and were equivalent to, on average, 7.2% of GDP. In 2003, however, the ratio to GDP moved into double-digits (11.0), driven in large part by the reallocation of hospital-related capital spending, wages and goods and services expenditure to transfers and subsidies, in line with the creation of a statutory board at that institution. This is further reflected by the increased proportion of transfers and subsidies to total expenditure, with the former accounting for, on average 34.0% of total spending between 2003 and 2007, compared to 23.9% averaged over the preceding 23 years. As expected, the ratio stabilised somewhat following the reclassification, before rising again in 2007, driven to a large extent by spending associated with the country's hosting of a major sporting event in the same year.

Figure 7: Transfers and Subsidies, Wages and Goods and Services Expenditure
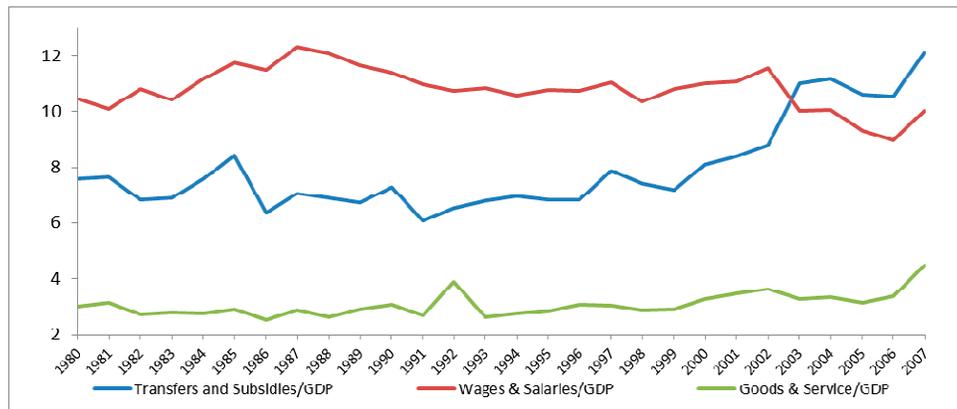
Wages

Over the review period, wage-related public expenditure more than quadrupled from $215.5 million in FY1983/84 to $865 million in 2009. As a percentage of GDP, wage expenditure was much less volatile over the period, accounting for 10.8% of GDP in 1982 and just 11.1% by 2009, averaging 10.8% over that period. Despite its relative stability, the increase in wage expenditure as a ratio to GDP over the three decades can be divided into three distinct periods.

The first was a period of growth and, following a slight decline between 1982 and 1983, wage payments as a ratio to GDP rose gradually from 10.4% to 11.8% by 1985. During this period, a disproportionate percentage of the growth in wage expenditure (61.4%) was occasioned by expansion in the public sector wage index. By the end of this growth phase in 1987, wage payments peaked, representing 12.3% of domestic output.

Figure 8: Wage Expenditure Decomposition
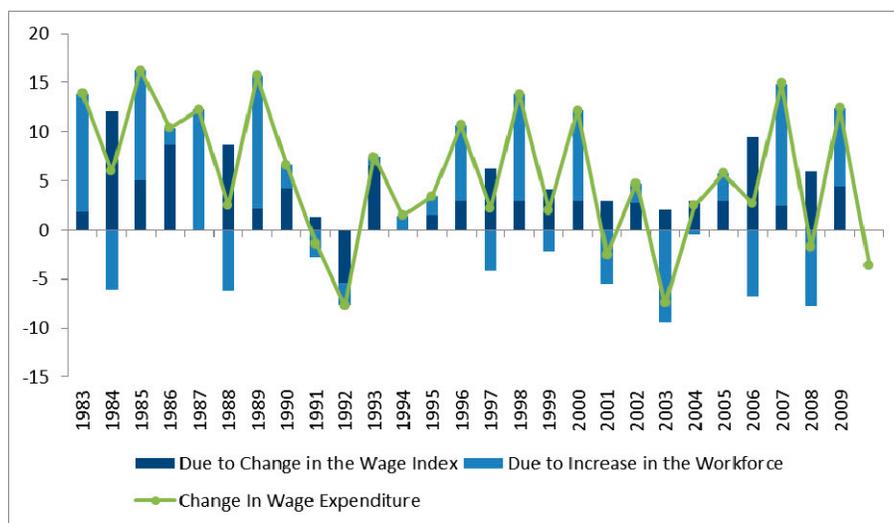
The subsequent phase began with persistent declines in the ratio from 1988 to 1992, as the growth in total wage expenditure slowed relative to GDP. During this period, the contribution of average wages to the increasing wage spending was halved, accounting for just 30.3% of the increases in wage payments. Not surprisingly, the only period in which the wage index actually declined was in 1992 – the period during which a series of austerity measures were implemented to address severe fiscal and external trade imbalances.

Though wages payments continued to grow over the next decade, recovery in domestic output resulted in only slight increases in the ratio to GDP. Sustained growth was recorded in two sub-periods, 1995-1997 and 1999-2002, and again average wage growth played the dominant role in pushing wage expenditures higher.

The final period started with a significant contraction in the ratio, driven primarily by further improvements in GDP, which outpaced the hikes in wage payments. More notably, however, the end of this period was marked by rapid appreciation in the ratio, caused by a combination of weakening GDP and large increases in the wage index, which outpaced the contractions in public sector employment. The result was that total wage-related payments were equivalent to 9.0% of GDP in 2006, but 11.1% in 2010. A caveat is necessary when examining these results. From the period 2003-2008, the analysis of the wages and salaries expenditure category is made challenging due to the aforementioned reclassification of spending categories during that period. As such, the reassignment of a portion of wages to the transfers and subsidies category would necessarily reduce the value of the former.

Section III. Government Revenue Analysis

Tax Buoyancy

As economies grow the potential tax derived from them also expands. On concept used to measure the potential yield of taxes to be derived form an economy is its tax buoyancy. Tax buoyancy (TB) is defined as the percentage change in revenue divided by the percentage change in GDP.

$$TB = \frac{\%\Delta Revenue}{\%\Delta Base}$$

,where the tax base is proxied by some variable, usually GDP.

Note that tax buoyancy does not take into account the changes in tax rates. In addition, a general characteristic noted by the tax buoyancy literature is that measures of tax buoyancy vary substantially from year to year and it is thus more useful to look at tax buoyancy over a period of at least 10 to 15 years.

Two methods were utilised in calculating the buoyancy. In the first, the buoyancy for each year was calculated and the average taken. This method while simple, has the disadvantage that it can vary substantially between years and outliers, whether unusually high or low, would have a substantial impact on calculated tax buoyancy. The second approach entailed a regression of the log of tax revenues on the log of GDP. The coefficient of the log of the base is a measure of tax buoyancy. This approach is also somewhat sensitive to outliers and the time interval under consideration in the regression. In addition, both the buoyancies for the direct and indirect taxes were considered.

Table 1: Estimated Buoyancies

	Tax Revenue Buoyancy	Direct Tax Buoyancy	Indirect Tax Buoyancy
Average of Annual Buoyancy measures (1977-2009)	2.46	2.56	2.81
Regression of ln(revenue) on ln(GDP)	2.34	2.12	2.51

Both techniques are problematic. The annual average of buoyancies exhibits substantial variation between years rendering it fairly limited as a forecasting device. The regression results do not take attribute all changes in the tax take to the buoyancy rather than changes in the tax rates. Nevertheless, we do not substantially deviate from the accepted methodologies for estimating buoyance and the purpose is to establish a relative ranking compared to other jurisdictions. Nonetheless the results provided by the regression appear to be more plausible than those by the average expenditure per year method. Some comparative buoyancies are shown below.

Table 2: Comparison of Tax Buoyancies

	Direct Tax	Indirect Tax	Total tax
Brazil	0.05	0.23	0.16
Chile	1.56	0.56	0.98
China	3.06	1.65	1.89
Ghana	1.76	2.9	2.37
Kenya	1.13	1.44	1.23
Malaysia	0.73	0.99	0.83
Mexico	2.37	2.42	2.4

The results suggest that Barbados' tax buoyancy does not appear to be problematic and thus the attendant buildup of debt stemmed more so from the expenditure choices than weaknesses in revenue intake.

Goods and Services

Goods and services expenditure has grown by an average of 8.2% between 1981 and 2010 while total expenditure has grown by around 6.6% per annum. Consequently, total expenditures have grown from just under 9% in the 1980s to 13% of total government expenditure by the end of 2010. Both total expenditure and its goods and services subcomponent have in fact grown faster than average inflation which has averaged 3.8% from 1981 to 2010. Interestingly, the goods and services component of expenditure has risen sharply since 2007 relative to the more moderate expansion from1993 to 2006. The Central Bank's 2007 Annual Report noted that "Similarly, outlays on goods and services rose by 24.4% in 2007, reflecting the reclassification of some items previously recorded under capital expenditure."

Section IV. Analysis of Government Financing

Despite some notable changes in structure,financing of the fiscal deficit has shown an increased bias toward domestic financing. During the period 1980-1988 while most of government's financing was provided domestically, the contribution of external sources increased, as more than 50% of annual financing was often sourced from non-residents. During this period, there was some reliance on the central bank for financing, albeit at lower levels than in subsequent years. As Anyadike-Danes (*ibid.*) noted, both commercial banks and the National Insurance Fund were the main sources of domestic financing during this period, particularly as the security to deposit ratios were continually raised during the 1980's. By 1990, domestic financing had become the major source of financing at a time when the government found difficulty accessing foreign capital markets.

In particular, government began to rely heavily on the central bank to support its fiscal position with lending from the monetary authority accounting for more than 60% of annual total financing between 1989-1991. This financing was provided through both medium and long-term instruments, as central bank holdings of debentures increased simultaneously with their advances to the government. Between 1990 and 1998, domestic financing continued to dominate and during this period, an increasing level of funding was provided by the National Insurance Fund – which increased its holdings of government debentures by over $500 M.

Figure 9: Government Financing
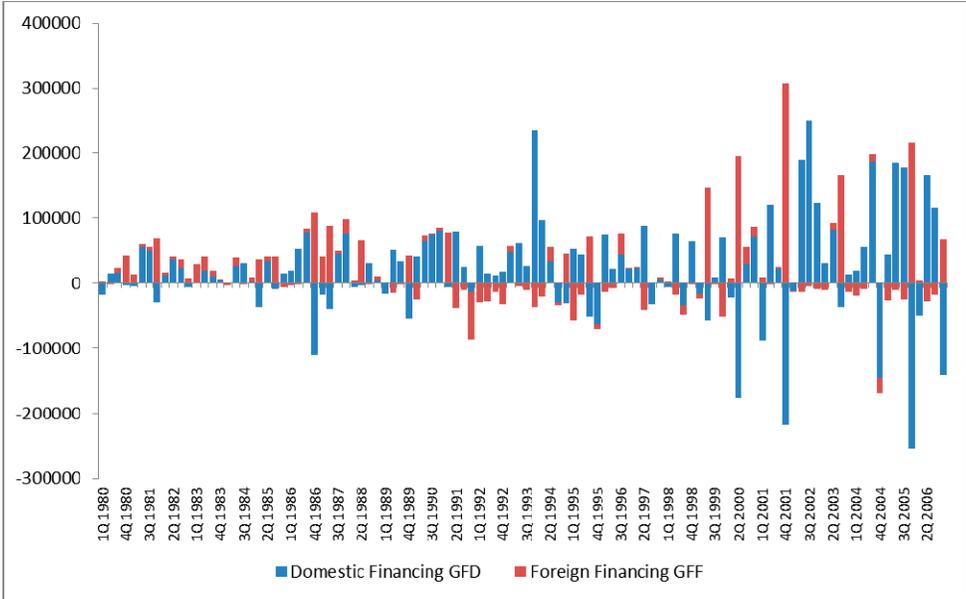
Simultaneously, central bank financing began to decline as its holdings of securities as well as advances to central government all registered significant contractions. In 2004, central bank financing began to pick-up again, increasing substantially again in 2005 before contracting through 2007.

Section V. Literature Review

As noted earlier, there is a small but growing body of empirical research on Barbados' debt and fiscal position. In general, the analysis has focused on sustainability with respect to government's capacity to service its debt in the short and long-run. Using an Ordinary Least Squared approach Craigwell et al. (1987) examined the determinants of Barbados' external debt over the period 1959-1986. The authors found that major deviations in real output, real government expenditure and the balance on the external accounts were key in explaining the change in external debt levels. While this work provided an important insight into the reasons for external debt accumulation, it was not intended to address the sustainability of the debt.

Greenidge and Archibald (2004) conducted an empirical analysis of post-independence fiscal positions and debt structure in Barbados, relying on budget constraint fundamentals in which debt is regarded as sustainable if it is matched by expected future budget surpluses.

Employing a primary fiscal gap methodology, the authors found that, despite rising expenditures, past fiscal behaviour had been prudent and the fiscal position was stable. Further, following Trehan and Walsh (1991), the authors relied on co-integrating econometric analysis to examine the long-run sustainability of the debt position. Greenidge and Archibald (2004) tested for stationarity and co-integration between government expenditure and revenue under the assumption that if the expenditure and revenue are non-stationary, I(1) variables in levels, I(0) in their first differences and are co-integrated, a stable, long-run relationship exists between them such that fiscal deficits are corrected in the long run and the debt is seen as sustainable. If this condition does not hold, then there is no long-term or equilibrium relation between revenue and expenditure and, as such, government is violating its inter-temporal budget constraint and the debt is unsustainable.

Using data from 1974-2001, divided into two policy-defined sub-periods, the authors found that expenditure and revenue were, indeed, co-integrating, *I(1)* variables and concluded that Barbados' debt was sustainable in the long-run.

These findings are informative rather than prescriptive to the extent that the existence of a long-run relationship says little about the state's ability to meet its short-term obligations.

Subsequent research based on the same budget constraint fundamentals was carried out by Drakes (2008), who constructed an Auto-Regressive Integrated Moving Average (ARIMA) model (equivalent to a fiscal policy reaction function) to forecast future primary balances. Drakes' analysis focused on the long-run dynamics of debt inasmuch as it tested the fiscal response to an independent measure of solvency, specifically the debt-to-GDP ratio, to examine the sustainability of debt. Scenario analysis was then used to determine the best, most-likely and worst-case scenarios of government debt and, using a calculated benchmark of 80.2% of GDP, Drakes did not find that the existing level of debt was unsustainable. She did note, however, that government debt was indeed approaching unsustainable levels.

Research by ECCLAC (2008), using the broad definition of sustainability as a stable debt-to-GDP ratio, also concluded that Barbados' debt appeared sustainable. However, the authors of the ECLAC study pointed out that this was so despite persistent increases in the nominal value of the debt since all that was necessary for this ratio to be deemed sustainable was that it was stable, which requires only that the stock of debt and nominal GDP grow at the same rate. The authors of the regional study further contended that a stable debt-to-GDP was not as useful a measure in countries such as Barbados that have relatively high debt ratios because it belies the underlying dynamics of the debt. Using a debt-to-GDP benchmark ratio of 40%, the authors conclude that Barbados would have to make a "significant" adjustment to its fiscal position to reduce its level of outstanding debt.

A caveat when examining the aforementioned research is that the sustainability analysis and discussion has focused almost extensively on debt/GDP and debt service ratios, but in the absence of a theoretical upper bound to the ratios (which does not exist), an arbitrary choice must be made as to what is sustainable. The old rules of thumb (debt/GDP ratio of 60%, debt service/income of 15%) are no longer valid, based on recent experience.

All of these approaches have examined the deficit in relation to spending and revenue, generally treating the type of financing and its impact on reserves as peripheral to the overall analysis. However, econometric work on relatively small open economies (See for example Wilford and Wilford, 1978 and Leon, 1988) has suggested that domestic financing, particularly seinorage to finance the deficit, can have a significant impact on reserves. These approaches have relied on the monetarist approach to the balance of payments (MABP) which posits that, under a fixed

exchange rate regime, full employment and no full sterilisation of reserves, imbalances on the external account are primarily monetary phenomena, resulting primarily from mismatches between the supply of, and demand for, money. Starting with an equilibrium money function of the form:

$$M_s = m \cdot (R + D) \qquad (1)$$

$$M_d = \frac{P^{a_1} Y}{i^{a_2}} \qquad (2)$$

$$M_s = M_d \qquad (3)$$

Where M_s and M_d are the supply of and demand for money, respectively, a is the money multiplier, R is international reserves, D is domestic credit, P is the price level, Y is real income and i is the market rate of interest. Taking logs and differentiating with respect to time, yields:

$$d \log m + \frac{R}{R+D} d \log R + \frac{D}{R+D} d \log D = d \log P + a_y d \log Y + a_i d \log i \qquad (4)$$

Rearranging the above and replacing the differential by the first difference operator (Δ) provides a testable reserve flow equation of the form:

$$\frac{R}{R+D} \Delta \log R = a_1 \Delta \log P + a_2 \Delta \log Y + a_3 \Delta \log i + a_4 \Delta \log m + a_5 \frac{D}{R+D} \Delta \log D \qquad (5)$$

-Where the coefficient of greatest interest is a_5 referred to as the offset coefficient which represents the elasticity of domestic credit with respect to foreign reserves. Under the assumption of the MABP, this should be equal to -1. The validity of this theory for Barbados has been examined by Coppin (1994) and Howard and Mamingi (2002), each of whom found some support for the MABP.

Most notably, the latter two authors found that by taking account of co-integrating relationships among the variables, the MABP held for Barbados as the offset coefficient – the relationship between domestic credit and reserves – was -1.006, implying a unitary, inverse relationship between changes in credit and international reserves.

Section VII. Stress Testing for Fiscal Sustainability

Building on the MABP approach, we examine the impact of Central Bank credit to government. We begin with a definition of domestic absorption of the form:

$$A = Y + \gamma W \tag{1}$$

$$W = \partial FXR + \partial CBCG + \partial CBCB \tag{2}$$

Where A is aggregate spending power, Y is income earned from the production of goods and services and W represents changes in financial wealth FXR represents foreign exchange reserves of the monetary authority, and $CBCG$ and $CBCB$ represent central bank's credit to government and to the banking system, respectively. The coefficient γ is indicative of the impact of the changes in financial variables on absorption. Further, we assume that:

$$I = f(A) \tag{3}$$

, where I refers to retained imports. Since, *ceterus paribus*, the value of imports is equivalent to the change in reserves, we obtain:

$$FXR_{t-1} - FXR_t = f(A) \tag{4}$$

Given the limited central bank lending to commercial banks, we can focus on the influence of CBCG on the reserve position. We can therefore abstract from an empirical model of the form:

$$FXR_{t-1} - FXR_t = \alpha(GDP)(\frac{CBCG}{A}) \cdot \beta \tag{5}$$

$$with\ \beta = \frac{\frac{\Delta I}{I}}{\frac{\Delta GDP}{GDP}} \tag{6}$$

Where α is the extent of money creation, measured as a percentage of GDP and β is the elasticity of imports with respect to absorption. Equation (5) suggests that the change in foreign reserves is equivalent to the level of money creation, the impact of money creation on absorption and the marginal propensity to import.

Regarding the ratio of money creation to absorption, we propose to examine fiscal sustainability under alternative assumptions, including results drawn from Howard and Mamingi (2002).

From the coefficient of import changes with respect to changes in Central Bank credit to government we derive an estimate of the elasticity of import demand with respect to changes in fiscal policy. We use this relationship to stress foreign exchange reserves by increasing the government deficit that is financed by Central bank credit. Economic agents in Barbados consider foreign exchange reserves to be inadequate when they fall below the equivalent of 12 weeks of imports. We therefore consider fiscal deficits unsustainable if they drive the foreign reserves below that level for an extended period of time.

Using this approach, we may examine the Barbados experience over the past 2 decades, and make a judgement as to what levels of additional fiscal pressure would have rendered fiscal policy unsustainable. Alternative scenarios are shown in Figures 10 and11.

Figure 10: Foreign exchange reserves with and without money creation
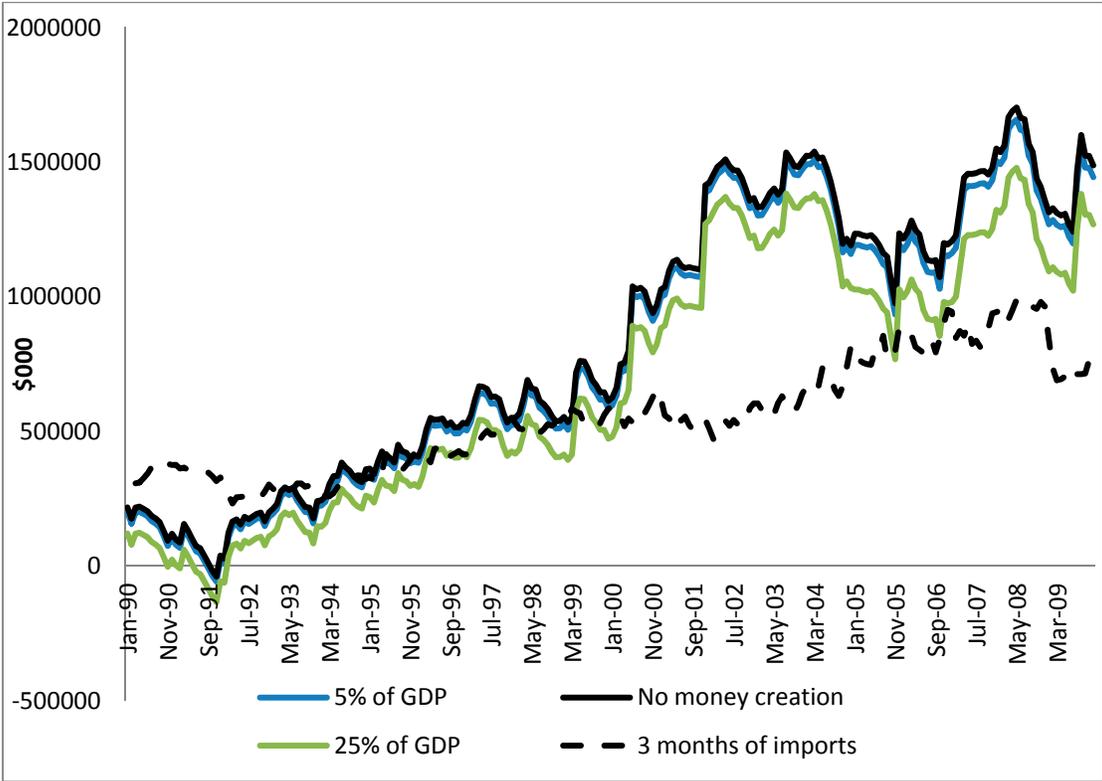
Figure 11: Foreign reserves, actual and 2 scenarios of money creation
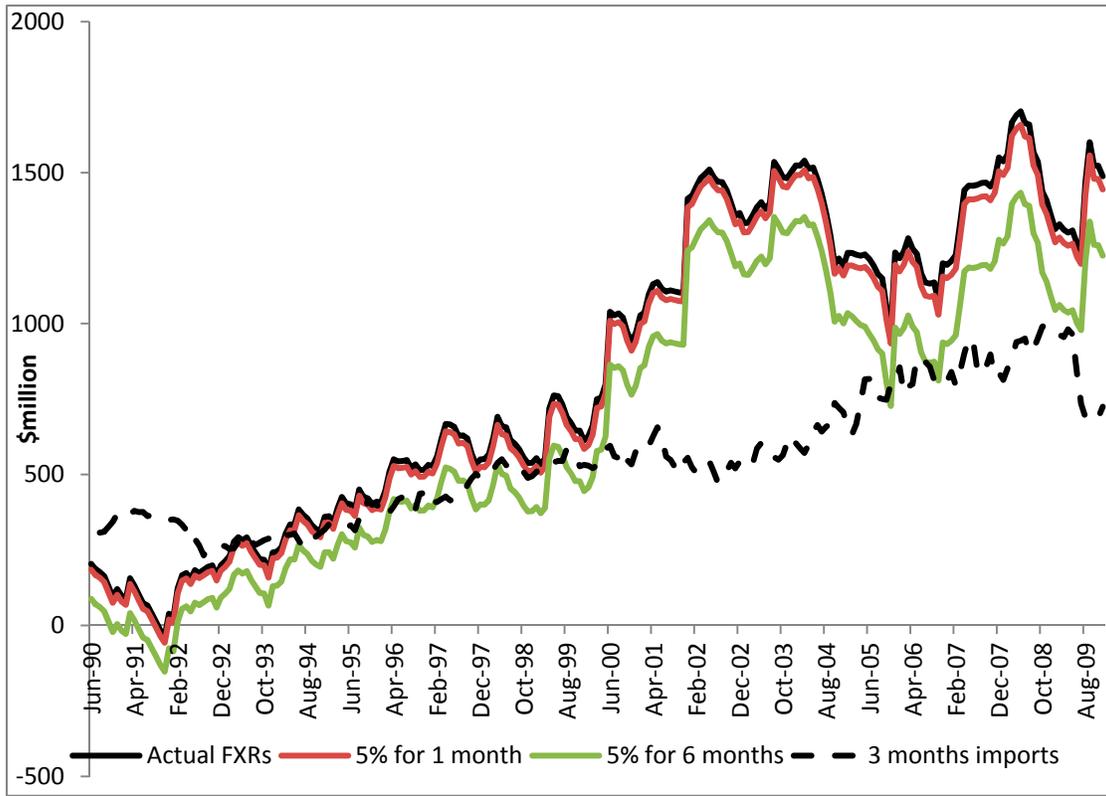
Both figures show the actual levels of foreign reserves, and the equivalent of three months of imports. Actual reserves have been above that level ever since Barbados emerged from the balance of payments crisis of the early 1990s. The figures also show the impact on the reserves of various levels of money creation, measured as a percentage to GDP. In the first chart of the pair, money creation is in evidence for a single month only. If the monetary impulse is as little as 5 % of GDP, foreign reserves remain adequate. However, if the monetary impulse had been as large as 25 % during the decade of the 1990s, the underlying level of fiscal deficit would have been unsustainable. In the second figure of this pair, the monetary impulse remains at 5%, but in this case it is sustained for 6 months at that level. The conclusion is similar, i.e. that a fiscal deficit requiring finance of that order of magnitude from the Central Bank would not have been sustainable in the 1990s, but in the first decade of the new century reserves have been at such a high level that even fiscal pressures of that size could have been sustained.

Figure 12: How foreign reserves decline with increasing money creation (% of GDP), Dec. 2009
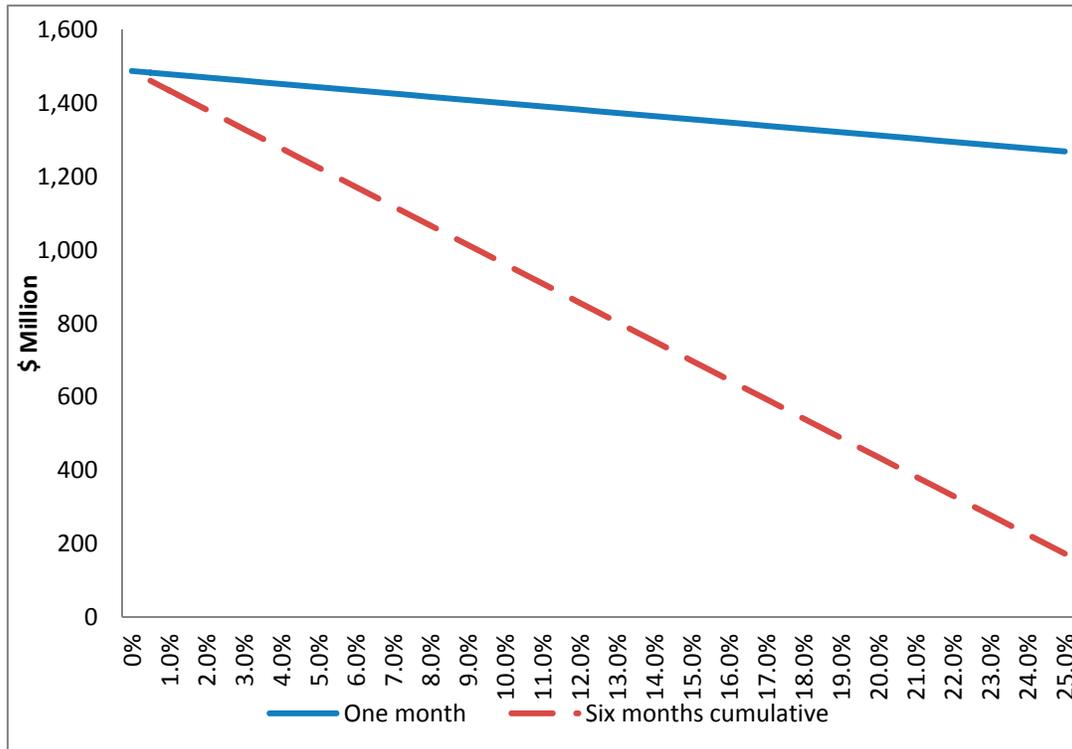

Figure 12 shows how foreign exchange reserves at December 2009 would have declined with stresses that increase as a percentage of GDP. The illustration indicates that money creation that is sustained for one month only, leaves reserves well above the 3 month limit, which is approximately $800 million, even for money creation equivalent to 25% of GDP. The fiscal deficit would have become unsustainable only when it required money creation as high as 13% of GDP, sustained for six successive months. Money creation of this magnitude would have reduced foreign reserves to the equivalent of 3 months.

Conclusion

Viewed by the criterion of the adequacy of foreign reserves, fiscal deficits in Barbados were unsustainable in the late 1980s and the early 1990s. Excessive money creation to finance those deficits drove foreign reserves well below the minimum of three months of imports needed to stabilize market expectations about the exchange rate. However, since 1993 fiscal deficits have been sustainable, and they have remained so in spite of the considerable rise in debt-to-GDP ratios in the first decade of the new century. Even though the fiscal deficit for 2009 was very high, reflecting the adverse impact of the international economic crisis, a much larger deficit could have been accommodated, without depleting foreign exchange reserves and imperiling the exchange rate anchor.

References

Ahmed Q. and Mohammed S, (1990) Determinants of Tax Buoyancy: Empirical Evidence from Developing Countries , *European Journal of Social Science*, 1990, Vol. 13 No. 3, p 408-413.

Anyadike-Danes, M. K. (1991). Barbados' Government debt, 1966-1990: An Analytical History. *Barbados: University of the West Indies, Cave Hill*. Research Papers [(72986) 336.21].

Craigwell, R. C., Rock, L. & Sealy, R. (1988). On the Determination of the External Public Debt: The Case of Barbados. *Journal of Social and Economic Studies*, Vol. VII, No. 4.

Coppin, A. (1994). The Determinants of International Reserves in Barbados: A Test of the Monetarist Approach *Social and Economic Studies* Vol XLIII, No. 2, p. 75-89.

Drakes, L. (2008). Estimating a Sustainable Public Debt Level for Barbados. *Central Bank of Barbados, Research Department.* 29th Annual Review Seminar.

Greenidge, K. & Archibald, X. (2002). Debt and Fiscal Sustainability in Barbados. *Central Bank of Barbados, Working Papers*.

Howard, M. (1989). Public Sector Finance. *Carib Research and Publications Inc., Bridgetown*. Chapter 11, *Dependence and Development in Barbados, 1945-1985*, p. 115-128

Howard, M. and Mamingi, N. (2002) The monetary approach to the balance of payments: an application to Barbados, *The Singapore Economic Review*, Vol. XLVII, No. 2, p. 213-228

Leon, H. (1988). The Monetary Approach to Movements in Caribbean Balance of Payments. *Social and Economic Studies,* Vol. XXXVII, No. 4, p. 1-37.

Van der Hoeven, R., Pyatt, G. and P. Richards (1995) Structural Adjustment and fiscal policy: A case study for Barbados, *Employment Papers,* 3, Geneva: International Labour Office.

Wilford, D.S. & Wilford, T. W. (1977) Monetary approach to balance of payments: On world prices and the reserve flow equation, *Review of World Economics*, Vol. CXIII, No. 1, p. 31-39

Appendix I

	Total Claims on Central Govt	Advances	Treasury Bills	Debentures
1980	87.4	29.8	46.0	11.6
1981	128.7	48.4	66.5	13.8
1982	105.9	42.3	53.3	10.4
1983	106.1	39.1	67.0	0.0
1984	96.1	59.5	36.6	0.0
1985	99.4	39.1	47.9	12.4
1986	89.2	49.8	31.1	8.4
1987	84.4	65.8	0.9	17.8
1988	96.1	59.5	21.2	15.4
1989	158.6	86.8	59.7	12.1
1990	204.9	119.2	73.6	12.1
1991	266.0	210.2	46.0	9.8
1992	239.4	143.2	88.3	7.9
1993	225.3	152.9	64.8	7.5
1994	217.4	119.7	90.2	7.5
1995	111.5	58.3	53.2	0.0
1996	71.8	71.8	0.0	0.0
1997	64.1	28.7	34.8	0.6
1998	50.0	0.0	49.4	0.6
1999	83.1	63.2	19.2	0.6
2000	15.6	0.0	15.0	0.6
2001	0.6	0.0	0.0	0.6
2002	0.6	0.0	0.0	0.6
2003	0.6	0.0	0.0	0.6
2004	52.7	52.1	0.0	0.6
2005	199.2	124.5	74.1	0.6
2006	134.0	133.4	0.0	0.6
2007	123.0	102.5	19.9	0.6