

## **Fiscal Sustainability Tool for Small Open Economies**

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The fiscal risk of small open economies (SOEs) is motivated by the behaviours and policy preferences of policymakers. A useful methodology for SOEs is therefore one which considers the impact of taxes, fiscal spending and the financing of fiscal deficits on the balance of external payments. The World Bank and the IMF have adopted a debt sustainability framework (DSF) to evaluate the risk of debt distress in Low Income Countries (LICs). The IMF DSA uses as its starting point the proposition that what limits fiscal space is the level of debt. This is the conventional notion, and it is based on the thesis that beyond a certain threshold, the level of debt becomes a drag on growth. That, by itself, does not constrain fiscal expansion, as is evident from recent experience. Our study critiques this analysis and offers a testable model which can estimate the parameters that measure the impact of a money-financed fiscal deficit on aggregate expenditure, and the impact of that expenditure on imports and foreign reserves. This is done by utilizing Agenor (2004) model to estimate the loss of foreign reserves from the central bank's financing of Government.

Keywords: fiscal sustainability, debt, balance of payment crisis, foreign reserves

JEL Classifications: E4; E5; E6; F34; C5;

This version: October 2016

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## 1. Introduction

This study proposes an approach to measuring fiscal sustainability which reflects the behaviour and policy preferences of a typical small open economy (SOE). As far as we know, this approach is novel and unique as the fiscal risks of SOEs are not only motivated by their chosen method for financing the fiscal gap, but also the peculiarities which characterises the economies. Small open economies are characterised by their high propensity to import. Inflationary pressures manifest themselves in increased demand for imports and foreign exchange. Fiscal expansion drives up aggregate expenditure and generates inflationary pressure. This manifests itself in a deterioration of the external balance. Fiscal expansion becomes unsustainable when the pressure on the foreign exchange market intensifies to the point where it triggers a balance of payments crisis. Such a crisis will trigger adjustments, involving a loss of real income and will be characterised by high inflation, the widespread use of informal markets and a general loss of investor confidence. We propose a fiscal sustainability assessment tool that uses this threshold to define the sustainability limit.

The International Monetary Fund (IMF) Debt Sustainability Analysis (DSA) framework uses as its starting point the proposition that, what limits fiscal space is the level of debt. This is the conventional notion, and it is based on the thesis that beyond a certain threshold, the level of debt becomes a drag on growth. Debt by itself, does not constrain fiscal expansion, as is evident from recent experience. Governments may and do choose to grow debt beyond the threshold, in spite of the fact that this will slow growth (if indeed it is true that there is an optimal value of debt to GDP, which remains controversial). Since the financial crisis of 2008, most countries, emerging and industrial, have had debt to GDP ratios well in excess of the commonly recommended optimal thresholds. Ironically, policies designed to reduce the outstanding levels of debt involve fiscal cutbacks which depress growth, as a consequence the debt to GDP ratios tend to remain stubbornly high, in the face of best efforts to reduce them. The policy stance which too often emerges from the conventional DSA therefore leads to a policy contradiction: there is a need to cut fiscal deficits to pay down debt, but the ensuing depression of GDP makes it difficult to get the ratio down.

Our recently published book *Fiscal Sustainability and Debt* proposes an alternative measure of fiscal space, and for assessing of sustainability. The approach focuses on the impact of fiscal policy on aggregate spending. Noteworthy, it is the impact of fiscal policy and public finance on aggregate spending, rather than the level of Government indebtedness, that in practice constrains fiscal space and sets the limits to fiscal sustainability. This can be explained by considering the impact of government spending. For instance, consider a situation in which Government spending exceeds revenue by \$100 million. If Government is able to fully fund this deficit with the issue of domestic bonds, there is no impact on aggregate expenditure, because the purchasers of the bonds buy them with savings diverted from the domestic consumption stream. Therefore, aggregate private spending is reduced by the same amount as the additional funding to Government.

The issue of Government bonds abroad provides an inflow of foreign funds to finance any additional imports that result from the increase in Government spending hence there is no additional pressure on the foreign exchange market. The additional government spending has no effect on fiscal space in either of these two circumstances, because neither provokes any

increased pressure on the balance of payments. However, if Government is unable to attract buyers for its bonds at market rates, which usually happens when overall fiscal policy is considered inappropriate by markets, Government is obliged to fund the additional spending by money created by the central bank, or by the accumulation of arrears. In either case there is an inflationary impact on the economy, and it is this inflationary impact which reduces fiscal space and leads to unsustainable position. In the case of the small open economy, the inflationary pressure may manifest itself as an increased demand for imports, a reduction in foreign exchange reserves and a depreciation of the exchange rate. In the event that the pressure on the foreign exchange market intensifies to a point where it triggers capital flight and unanticipated currency depreciation, it is evident that the fiscal expansion is unsustainable.

This, then, is the logic of the approach to debt sustainability embodied in the book *Fiscal Sustainability and Debt*, and is the main thrust used in the development of the “Fiscal Sustainability Tool” which this paper describes. The tool is intended for use in small very open economies (SVOE), where the import propensities are high and the potential for substituting home production for imports is very low. In such economies the impact of fiscal expansion on the foreign exchange market is large and direct.

We define the sustainable frontier in terms of the exchange market pressure generated by the fiscal stance as manifested in the size of the fiscal deficit. The limit of sustainability is reached when the exchange market pressure resulting from the fiscal deficit reaches a level that triggers capital flight and fear of a chaotic devaluation. The service payments on government's external debt are a second source of potential balance of payments difficulty. External borrowing to finance fiscal expansion is in general preferable to domestic borrowing because it brings additional foreign exchange to cover the additional import spending that ensues, but there is a limit when the servicing additional external debt drives the pressure on the foreign exchange market beyond the trigger point. Our methodology combines the impact of the foreign debt service and the fiscally induced demand for imports, to assess the total effects on the balance of payments.

The tool allows us to measure fiscal sustainability by considering:

- ) The expected level of foreign exchange reserves, which is the most accessible and closely watched financial indicator;
- ) The expected foreign financing of the Government deficit and the cost of servicing that additional foreign debt, so that a forecast can be made of the net effect on foreign inflows;
- ) The expected domestic private financing available at market rates, and the unfinanced amount that will have to be funded by the central bank or the accumulation of arrears; and
- ) An estimate of the additional demand for imports that will arise from the additional Government expenditure.

Armed with this information, we may derive the impact of the additional expenditure of \$100 million on the level of foreign exchange reserves. The new level may then be compared with what is perceived to be the threshold level, which varies from country to country, and depends on local market perceptions and preferences. The deficit is unsustainable if the additional

expenditure drives foreign exchange reserves below that threshold; it is sustainable otherwise. The approach that measures sustainability in this way is intuitively appealing: the deficit becomes unsustainable when it raises the probability of a balance of payments crisis to a level beyond the market threshold. It comes with a single readily available indicator: the projected level of foreign exchange reserves. Moreover, un-sustainability by this measure means the policy cannot be persisted with, because a crisis will ensue.

When comparing the fiscal sustainability analysis (FSA) (i.e the approach proposed in our paper) with the debt sustainability analysis (DSA) one can clearly note that the FSA is more powerful. This conclusion is based primarily on three arguments. Firstly, the FSA uses a market-based threshold, in contrast to the DSA. When fiscal expansion creates exchange market pressure of an intensity that drives foreign reserves and/or the rate of depreciation beyond levels with which markets are comfortable, there will inevitably be a balance of payments crisis. Balance of payments crises in SVOE's are very difficult to correct, and they often damage economic development prospects. Secondly, the DSA thresholds are abstract, and there is no consensus on where those thresholds ought to be set. Thirdly, the FSA avoids the contradiction inherent in policies based on achieving a DSA ratio, i.e generating a fiscal surplus to lower the amount of debt depresses GDP. The rationale for this conclusion lies in the relationship between the numerator and the denominator. Note well, if the denominator shrinks then the numerator is driven down, hence it becomes harder to lower the ratio.

A country using the FSA methodology may find that it is not necessary to achieve an overall fiscal surplus to relieve pressure on foreign reserves, and that surpluses on the fiscal current account will suffice. That is not to say the FSA will suggest a way to avoid fiscal austerity. On the contrary, whenever foreign market pressure is excessive, fiscal contraction is necessary, and it must be sufficient to relieve the foreign exchange market pressure. That does invariably mean a fall in GDP, but such a decline is inevitable, because there are insufficient foreign currency inflows to satisfy the demand for imports at the current rate. That is the reason for the excessive foreign market pressure, and imports can only grow when there are additional inflows.

In principle the FSA and the DSA are complementary, if the FSA is interpreted as the measure of sustainability, and the DSA can be interpreted as indicating the optimal level of debt. SVOE's needs to achieve sustainable fiscal strategies that steer them clear of balance of payments crises. Having successfully done so, they may then wish to reduce the burden of debt service, in order to create more fiscal space.

## **2.0 Literature Review**

At a very basic level, fiscal sustainability refers to the ability of the Government to balance its income and revenues: government expenditure and investments are fully financed through tax receipts. An effective policy decision requires no excessive increases in debt. Hence, for fiscal policy to be sustainable it must not have any detrimental effect on the economy.

The definition of the concept fiscal sustainability varies by researchers and region.<sup>4</sup> Blanchard et al (1990) describes sustainability as the government's ability to avoid excessive debt accumulation based on current policies. Blanchard et al. (1990) further describes sustainable fiscal policy as one where tax and expenditure policies are maintained and does not lead to further public debt accumulation. Similarly, Croce and Ramon (2003) define fiscal policy sustainability as the situation where the Government is able to meet and service its debts through solvency. In the event that the economy is steering away from such policy it will inevitably lead to a crisis. Adams, Ferranini and Pak (2010) distinguish between dynamic and static sustainability. Dynamic sustainability refers to a situation where the budget does not erode debt by causing long-term explosion and static sustainability implies that the budget is financed easily between periods.

Government's ability to avoid debt distress and to channel fiscal policy on a sustainable path is not only constrained by activities/events in the real sector but also by those in the external sector. Natixis Economic Research (2010) supports this view as they argue that Government may encounter temporary funding problems due to irregularity in the functioning of financial markets even if there are no underlying liquidity problems. Achieving fiscal sustainability therefore requires government to effectively and sufficiently address/manage the results of its fiscal policy interaction in both the internal (domestic) and external (foreign) markets. A good fiscal sustainability indicator is therefore one that is clear, simple and provides early signals to policymakers of potential problems in relation to debt accumulation.

Fiscal expansion, whether financed publicly or externally, impacts both the foreign exchange reserves and eventually the balance of payments. Fiscal stimulus impacts aggregate demand, imports through the creation of money to fund the deficit as well as the foreign balance. However, according to the IMF (2012) in its debt sustainability framework guidance note, fiscal adjustments must be economically, socially and politically feasible. Among others, IMF (2012) indicates that for fiscal policy to be sustainable: government budget should be readily financed without large future adjustments in revenue and expenditure or without having to resort to a default/debt monetization. The IMF/DSA framework has frequently been criticized for its rigidity and accuracy of predicting a crisis.

## **2.1 Limitations of the Standard DSA Analytical Approach**

The IMF's Debt Sustainability Analysis has three (3) main building blocks. The first is the analysis of sustainability of total public debt and of total external debt. Second is the analysis of the structure of current debt, vulnerabilities in the structure of the policy framework, and third is the impact of the alternative debt-stabilizing policy paths in cases where difficulty can emerge. Within the model the probability of a country experiencing debt distress is estimated using probit models (See Figure 1).

Among its various limitations, the IMF DSA Analytical Approach allows little room for country-specific characteristics. The model takes a general approach, ignoring the peculiar characteristics of small open economies such as Jamaica, Belize and Barbados. Namely, SOEs

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<sup>4</sup> Blanchard et al (1990). "The Sustainable Fiscal Policy; New Answers to Old Questions"  
Worrel (2015). "Fiscal Sustainability in Small Open Economies"

are highly dependent on imports and very susceptible to shocks. The lower income countries (LIC) template allows for debt threshold to be calculated using; the average growth rates of Gross Domestic Product (GDP) and three categories which represent a country's policy. The DSA assigns an institutional assessment score rather than provide a continuous variable that could be obtained from within an original regression model. This method ignores critical information that is usually available in the continuous variables. The loss of information limits usefulness of country-specific values which can be used as covariates and reduces the prediction and accuracy of the model to forecast a crisis.<sup>5</sup>

Another limitation relates to the five (5) debt measures that are used to resolve conflicting signals. These measures are flawed in two ways; the worst-case aggregator (WCA) can only predict a crisis if one of the five debt measures exceeds the threshold of the remaining four measures. In this case, the WCA is bias, as it often indicates that a crisis is pending and is justified by the purported weights. It is impossible to find simple aggregators that signal a crisis.

Utilizing the IMF-DSA requires one to select the debt sustainability probability thresholds that minimises the IMF-WB loss function. The lost function is a methodology which comprises Type I and Type II errors (See Figure 2). Type I and Type II errors are treated equally, such that the same weight ( $\alpha=0.5$ ) is attributed to instances of missed debt crises and episodes of false alarms. The use of the loss function biases the results of the IMF framework. Arguably, the equal weights applied to both the crisis observation as a share of total crisis and false alarm as a share of total tranquil periods are implicit weights. In the DSF each crisis observation is greater than each false alarm. Considering the bias the weight on missed crisis is higher than on false alarms.

Commonwealth Secretariat (2016) have indicated that the IMF should consider readjusting its own 'loss function' by adding greater weight to minimising false alarms vis-à-vis minimising missed debt crises. Berg et al. (2014), and Commonwealth Secretariat (2016) posits that if the "institutions own loss function" is applied to analyze the LICs' debt sustainability – the results indicate that there appears to be an overly strong emphasis on minimising Type II errors vis-à-vis minimising Type I errors, reflecting on much greater than 0.5. Commonwealth Secretariat (2016) argues that methodology and the lack of a formalised feedback mechanism (i.e the recognition of a productive expenditure and growth nexus) in the application of the DSF may have also led to such results.

Commonwealth Secretariat (2016) questions the appropriateness of debt thresholds and the nexus between public investment and growth. The Commonwealth notes that in order to propel productive investments, some form of debt financing is necessary to augment countries' domestic savings – especially in LICs, where savings rates are low. Additionally, there is the general acceptance that fiscal surplus and increased external debt financing may at some point be essential to combat future exogenous shocks, as well as to help smooth consumption and taxes. This 'catch-22' complicates the usefulness of the current WB-IMF debt sustainability in investigating and predicting the sustainability path and prospects of countries, particularly the LIC's.

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<sup>5</sup> The information loss occurs even if the Debt Threshold Analysis cut-off discrepancy noted in the calculation of the probability cutoff.

## 2.2 Theoretical Literature

Most studies on the assessment of sustainability use the Intertemporal Budget Constraint (IBC) approach which is most commonly known as the present value budget constraint. It focuses mainly on equality between the present value of inflow of primary balances and the present stock of debt. Bagnai (2010) argues that the IBC approach is not sufficient because it can allow countries to volatile their trajectories of the debt-to-GDP ratio and it is a constraint that is imposed on debtors in defined inter-temporal equilibrium models. As a consequence Bagnai (2010) concludes that unsustainable debt paths will never be observed. Rouibini (2001) take a different approach and argues that the IBC criterion is too flexible, as it allows government to run very large deficits for a long period of time as long as it maintains a primary surplus in the long run, which would affect the creditability of the government. He suggests that government debt can be considered sustainable if it the Debt-to-GDP ratio is non-increasing.

Several approaches to determine sustainability have been developed to estimate a ceiling for the public debt of a country. Bi (2001) definition of fiscal space provides a maximum level of debt that the government can facilitate fiscal policy. The study provides a clear indication of the limit of fiscal space by comparing the present fiscal limit and projected future levels of debt. Bi attempted to estimate a limit though the construction of an infinite-horizon model of a closed economy where fiscal limits occur endogenously from Laffer curves. On the other hand, Ostry et al.(2010) introduce the concept of fiscal space, based on the degree of governments' flexibility on its spending options. The flexibility is determined by examining historical records of the country's fiscal policy. Wright and Grenade (2013) labeled an optimal debt-to-GDP ratio as one that maximizes economic growth but does not reduce private investment or increase credit costs. Hence, welfare is then maximized. However, in order for it to be optimal, the debt must be sustainable or otherwise a persistent increase in debt will result in stunt DGP growth and decline in standard of living. Conversely, a country's debt may be sustainable, but has no contribution to a country's growth and social welfare which implies that either a lower or higher debt-to-GDP ratio is optimal.

Bohn (2005) established the Model-Based Sustainability (MBS) criterion. He assumed infinitely lived optimizing agents, a government that balances its debt in the long run (does not run negative debt), and complete financial markets. Bohn (2005) included a stochastic discount factor for contingent claims. The MBS criterion varies from the IBC criterion since the discount rates of future surpluses depend on the distribution of primary surpluses across the states of nature.

## 2.1 Empirical Literature

### *Time series Models*

Mahmood and Raouf (2012) applied the Present Value Budget Constraint Approach to examine Debt sustainability in Pakistan. Unit root test for discounted debt series and co-integration test between government and revenue series were conducted. The results revealed that fiscal policy was unsustainable in Pakistan during that period. Bohn (2005) applied unit root tests for real

variables unscaled by GDP for the period 1972 to 2003 in the US,. Bohn (2005) found no credible evidence of the unit root tests in the debt-GDP and deficit-GDP ratios.

### *Multiple Equation Models*

Tanner and Samake (2008) examined the sustainability of fiscal policy under uncertainty in Brazil, Mexico, and Turkey. They applied the Vector Autoregression approach and Monte Carlo Simulations. Garcia and Rigobon(2004) assessed debt sustainability of Brazil from a risk management perspective. They analyzed debt accumulation equation which includes stochastic correlated variables such as stochastic real interest rate and growth rates. In order to estimate the correlation pattern of macro variables they proposed a VAR model and used Monte Carlo Simulations, which allowed them to determine that the debt-to-GDP ratio exceeds the threshold of 75 per cent.

Sakuragawa and Hosono(2009) investigate fiscal sustainability of Japan with a Dynamic System of General Equilibrium model that included costs. They explicitly extended Bohn's (1990) model with financial intermediation costs to a stochastic environment. This inclusion of intermediation allow for the analysis of the relationship between interest rates and GDP growth rates, since intermediation costs reduce the interest rate and hence the return of a government bond. The results revealed that when the real GDP growth rate is 2.5 per cent, the average interest rate becomes 2.57 per cent in the presence of significant intermediation costs and the debt-to-GDP ratio steadily increases to become sustainable.

## **3. Methodology**

The methodology we are offering for the assessment of fiscal sustainability, which is especially useful for small open economies (SOEs), is based on the impact of taxes, fiscal spending and the financing of fiscal deficits, on the balance of external payments. The risk of fiscal unsustainability is the distance from a default, where a default is manifested in the form of a balance of payments crisis. The requisite elements of our fiscal sustainability analysis (FSA) are:

- FSA Element 1:** A forecast of the balance of external payments;
- FSA Element 2:** A forecast of the level of foreign reserves and the change in the exchange rate implied by the current external balance, the current reserves level and the BoP forecast;
- FSA Element 3:** A reading from the foreign exchange market as to the minimum level of foreign exchange reserves which the market views as adequate for liquidity needs;
- FSA Element 4:** A forecast of Government foreign debt service; and
- FSA Element 5:** An estimate of the impact of Government tax and expenditure on aggregate national expenditure, and the import demand that results from this.



All the elements are straightforward, except for the last. That element entails estimating a model which can provide a fiscal multiplier to measure; the impact of fiscal expansion on aggregate spending, and a propensity to import model; to measure the impact of additional spending on the demand for imports. The combination of the fiscal multiplier and the import propensity enables us to establish a measure of the impact of fiscal changes on the balance of payments. A simple model borrowed from a familiar text Agenor (2004) is presented in the next section. The model has been modified to address the peculiarities of SOEs.

We begin the fiscal sustainability assessment with an analysis of the historical data on the balance of external payments, as reflected in the movement of foreign exchange reserves. From knowledge of the periods when countries experienced balance of payments crises, we gain an appreciation of market sentiment about the minimum level of reserves that agents deem to be acceptable. In the case of Barbados, the last balance of payments crisis was in 1991-92, when foreign reserves dwindled and were equivalent to just a couple of weeks' imports. Apart from that period, reserves have stayed above the equivalent of 12 weeks of imports, which is the most commonly used number. There have been arguments in favour of a higher number, but they are not well founded.<sup>6</sup> In the case of Barbados if we apply this 12 week cover threshold and compare that level with reserve levels before and after the 1991-92 crises, we find that they are all comfortably above that level.

We may also use the historical experience to determine how far the fiscal policy was from generating a balance of payments crisis, at any time during the historical period. For this purpose we devise stress tests assuming larger fiscal deficits, financed entirely by the creation of new money. Money creation causes deterioration in the balance of payments because, unlike other sources of financing, it does not depress the demand for imports, nor does it provide any additional foreign exchange to fund the additional imports. In contrast, if the deficit is financed by domestic borrowing, those savings are diverted from the consumption stream, thereby reducing imports; if the deficit is financed externally, it brings additional foreign exchange. By stressing the balance of payments with increasing fiscal deficits financed by money creation, we would be able to determine where the implied loss of foreign reserves would have reduced the outstanding amount of reserves below the threshold that is applicable in that country's foreign exchange market. The parameters needed for this stress test are the fiscal multiplier which measures the impact of the additional financial wealth on aggregate expenditure, and the import propensity.

Extending this methodology to measure the sustainability of current fiscal policy is a straightforward matter. One may measure the distance to default (a balance of payments crisis) by increasing the money-financed fiscal deficit in the current year, or, more usefully, examine the forecast over a multi-year period, to determine the feasibility of a fiscal strategy over time, since the effects on foreign exchange reserves will be cumulative. In this paper we will not attempt multi-year forecast because we are not privy to the fiscal strategies of countries going forward, even though that is the preferred procedure in application.

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<sup>6</sup> See Worrell, 2015, <http://www.centralbank.org.bb/news/article/8672/more-foreign-reserves-are-not-necessarily-better>.

In this paper we introduce our methodology for fiscal sustainability assessment (FSA). The application of the FSA approach requires an undertaking of the following steps:

**Step 1:** A review of the historical experience with respect to foreign reserve levels, taking note of any known periods of balance of payments crisis. This allows the research to gain insight about the minimum levels of foreign reserves that market agents view as credible: we expect to find that the onset of a BoP crisis will be signalled by a fall in reserves below that level. In the absence of any BoP crisis, we hypothesize that the minimum threshold level is the equivalent of 12 weeks of imports.

**Step 2:** Stress the historical foreign reserves data by increasing the money-financed fiscal deficit, using parameters from the empirical model in Section 4 for the fiscal multiplier and the propensity to import. Stress testing the money-financed deficit to increase by 2 percent of GDP and 5 percent of GDP would be necessary. The foreign reserve levels under these stresses should be compared with the actual reserves, and the acceptable threshold reserve level. These results should reveal how far the fiscal outcome was from a level which might have triggered a BoP crisis. This is a practical market-based measure of sustainability, and a useful indicator of fiscal space.

**Step 3:** is a static analysis of the current fiscal deficit in each country, and the amount of fiscal space remaining to government. This step entails an experiment which requires one to increase the money-financed fiscal deficit by increments of one percent of GDP, and plot the associated decline in foreign exchange reserves. If the amount of fiscal space is greater, then the higher percentage of money-financed deficit can be created without reducing reserves below the threshold of market credibility.

The three (3) Steps outlined above is the extent of the analysis reported in this paper. In an actual policy setting there would be at least an additional step; that is **Step 4**. This step brings together all the elements in the assessment methodology and requires:

- ) A forecast of the balance of external payments to the end of the policy period (for example, the end of the fiscal year);
- ) A forecast of the level of foreign reserves and the change in the exchange rate implied by the current external balance, the current reserves level and the BoP forecast, based on the projected fiscal deficit;
- ) A reading from the foreign exchange market as to the minimum level of foreign exchange reserves which the market views as adequate for liquidity needs (i.e Step 1 above);
- ) A forecast of Government foreign debt service, based on outstanding debt and financing to the end of the forecast period; and
- ) An estimate of the impact of Government tax and expenditure on aggregate national expenditure, and the import demand that results from this, using parameters estimated from the testable model.

The forecast level of foreign reserves, derived from the above is equal to:

- ) The current reserves level, plus (minus),
- ) The forecast overall BoP surplus (deficit), minus,
- ) Service costs on additional borrowing to cover the fiscal deficit for the current period, minus, and
- ) Additional imports resulting from any government borrowing that increases the net domestic assets of the monetary authority.

This forecast level of foreign reserves is compared with the minimum threshold level. If the value(s) are below the minimum, a sufficient fiscal contract to restore fiscal space is warranted. If they are comfortably above the threshold, stress tests of increasing intensity may be applied to estimate the distance the fiscal stance is away from threatening the threshold. This is a good measure of the extent of fiscal space remaining.

#### 4. The model

The model is based on a simple logic: in the small very open economy (VSOE), the fiscal deficit reaches its sustainable limit at the point where it triggers capital flight and exchange market pressure that causes a balance of payments crisis. Our model provides a methodology for establishing the relationship between the fiscal deficit and the balance of payments, so that for any VSOE we may estimate the distance to a crisis. Our framework is flexible and can be adapted to incorporate elements of any standard model, including monetary models of the BoP and appropriately parameterised dynamic system of general equilibrium (DSGE) models.

Our point of departure is a conventional monetary model, described in Agenor (2004, page 294) as:

$$\text{Log MO} = \text{log } P + \text{log } y - .r \quad (\text{Equation 1})$$

Equation (1) is the money demand equation, with prices  $P$ , real income  $y$  and an interest rate  $r$  as arguments.

$$\text{Log MB} = .\text{log } NDA + (1 - )\text{log } FXR \quad (\text{Equation 2})$$

Equation (2) represents the base money equation, with the net domestic assets of the central bank  $NDA$  and the bank's foreign exchange reserves  $FXR$  as arguments. Purchasing power parity holds, and domestic prices change in line with foreign prices  $P_f$ , plus changes in the exchange rate hence:

$$\text{Log } P = \text{log } P_f + \text{log } ER \quad (\text{Equation 3})$$

There is uncovered interest rate parity, and domestic interest rates vary with foreign rates  $r_f$  and changes in the exchange rate  $ER$  leads to:

$$r = r_f + ER \quad (\text{Equation 4})$$

In order to highlight the implications of the model, Agenor (2004) makes a number of assumptions, for convenience of exposition: that real income is exogenous, that international inflation and the foreign interest rate are both zero, the money multiplier is two and the logs of the NDA and FXR in Equation 2 are equally weighted. These assumptions will all be relaxed as appropriate in applying the model. With the assumptions Equations 1 - 4 may be reduced to:

$$\text{Log FXR} = \log y + \log ER - \log NDA \quad (\text{Equation 5})$$

If there is no change in income and the exchange rate is pegged, foreign reserves fall by the amount by which the NDA increases. The principal source of NDA increases in SVOEs is the financing of government deficits. This is the essential relationship that enables us to estimate the risk of a balance of payments crisis that is inherent in any size of fiscal deficit: if the public sector borrowing requirement is sufficiently large so that the increase in central bank funding causes a massive drain on foreign reserves, it is clear that this deficit is unsustainable.

Agenor (2004) points out that the BoP crisis arrives well before foreign reserves are exhausted, because when reserves reach a market-determined lower bound, a speculative attack occurs, motivated by market apprehension of a forced exchange rate depreciation (Agenor, Figure 8.1, Page 299). In order to reflect this, the threshold NDA (and associated foreign reserve loss) which defines the limit of sustainability of the fiscal deficit in our model is set at the market-determined lower bound for foreign reserves.

Relaxing the assumptions: a simple intuitive model is developed. We begin by replacing the money multiplier assumption by an empirical estimate of the multiplier, based on the reduced form of the monetary equilibrium equation:

$$\text{Log } m = \alpha_0 + \alpha_1 \log P + \alpha_2 \log y - \alpha_3 \log MB \quad (\text{Equation 6})$$

where  $m$  is a measure of broad money. The multiplier is estimated as the coefficient of  $MB$ . If there is not a sufficiently long data series for the estimation, we use a ratio based on the available data. Next we make inferences about the impact of this increase in financial wealth on import spending and the demand for foreign exchange. For this we need an import equation, which we may estimate from an augmented import equation:

$$\text{Log } \text{imp} = \alpha_0 + \alpha_1 \cdot (y + MO) + \alpha_2 \cdot \log ER \quad (\text{Equation 7})$$

where the change in financial wealth  $MO$  augments the effect of income on imports  $\text{imp}$ . We maintain the assumption of purchasing power parity, which is realistic in the case of SVOEs. Alternatively, we may need to intuit the  $\alpha_1$  coefficient from recent observations, if there is insufficient data for equation testing. The additional loss of foreign reserves from the central bank's financing of Government will be estimated as the product of the money multiplier  $\alpha_3$  and the propensity to import  $\alpha_1$  is therefore :

$$(\text{imp}) = - NDA \cdot \alpha_3 \cdot \alpha_1 \quad (\text{Equation 8})$$

This amount may be greater or less than  $NDA$ , depending on the size of the money multiplier and the propensity to import. The discrepancy will result in a change in the monetary base.

Equations (6) to (8) comprise a testable model with which we can estimate the parameters that measure the impact of a money-financed fiscal deficit on aggregate expenditure ( $y_3$ ), and the impact of that expenditure on imports and foreign reserves ( $ir_1$ ).

## 5. Model Application and Data

In light of the objectives of our “Fiscal Sustainability Tool” that is, to estimate parameters that measure the impact of a money-financed fiscal deficit on aggregate expenditure, and the impact of that expenditure on imports and foreign reserves we recommend the use of three (3) equations. Equation 6 (the monetary equilibrium), Equation 7 (imports) and Equation 8 (the additional foreign exchange pressure) are our proposed models for conducting the empirical fiscal sustainability analysis (FSA). These equations allow for the investigation of the implicit multiplier effect of government deficit – financed through domestic debt, on the monetary aggregates. The uses of these equations can be rationalized. Firstly, high government spending increases the money in circulation. The condition for stock equilibrium in the money market is that changes in the nominal money supply equal changes in nominal demand for money. Hence, expansion in the supply of money implies an excess demand for imports (that is, an excess demand for foreign currency) and an acceleration of output (real income). This puts excessive pressure on money supply. Secondly, monetary expansion results in increased imports and unfavorable balance of payment position. Higher imports lead to reduction in the foreign reserves and this can eventually result in a decline in the value of the currency, loss international reserves and pressure on the exchange rate etc.

If there is excessive additional reserve pressure (i.e. if  $y_3 > ir_1$ ) it implies that money supply increases faster than economic growth (See Table 3). With foreign reserve being depleted Governments would find it difficult to meet foreign debt service payments. On the other hand, rapid domestic expansion in the economy pressures government consumption expenditure, consumer prices and the degree and form of borrowing. Deficits will therefore grow larger and linger for a longer time. This implies that governments will be unable to cover its expenditure in the short and medium term and are thus insolvent. In essence, fiscal policy can be deemed unsustainable. While it may be hard to precisely assess insolvency versus illiquidity, this approach can provide a sensible assessment of whether solvency is at stake.

Our empirical estimation makes use of six (6) important variables; price ( $p$ ), real income ( $y$ ), monetary base ( $m$ ), imports ( $ir$ ), exchange rate ( $e$ ) and net domestic assets ( $n$ ). Monthly data for these variables were compiled for the 1983-2015. The data series was collected from the Barbados Central Bank Online statistics: Data at a Click, the Eastern Caribbean Central Bank Statistical Database and the Central Bank of Malta. Our analysis covers six (6) small open economies: Barbados, Malta, St Kitts and Nevis, Grenada, Saint Lucia and St Vincent and the Grenadines. This allows us to conduct an analysis from a geographical perspective and allows for an analysis based on two types of exchange rate regime (fixed and floating).

The parameters of the model have been estimated by Ordinary Least Squares technique. The OLS computational procedure is fairly simple compared to other econometric techniques and it has the best, linear, unbiased Estimator (BLUE). Estimation results are presented in Table 1 indicating R<sup>2</sup> is very high from 0.93 to 0.98 expressing the good explanation of dependent

variable on independent variables. The results show that consumer prices (i.e inflation) has a negative impact on money supply in three (Barbados, Malta and St Vincent and the Grenadines) of the six countries investigated. The findings also indicate that from among the sample countries, the relationship between money supply and prices is greatest in Barbados. Specifically, the coefficient ( $\rho$ ) is -0.44 per cent which implies that a one percent decrease in national income will lead to a decrease money supply by 0.44 percent. Note well, all of Barbados' parameters are significant at the 5 percent level of significance.

From our findings, there is a positive relationship between monetary base and money supply in Barbados and St Kitts and Nevis. For Barbados, the monetary base coefficient is 0.202 which implies that a one percent increase in monetary base will increase money supply by 0.202 percent. In St Kitts and Nevis, the impact is smaller. The monetary base coefficient is 0.002 which implies that a one percent increase in monetary base will increase money supply by 0.002 percent. Estimates for Grenada, Malta, and St Vincent and the Grenadines indicate that the coefficient of monetary base is not statistical significance. It means that monetary base has no impact on money supply in the countries. This result contradicts the theory of money.

Among other variables investigated, nominal gross domestic product (GDP) plays an important role in determining the money supply. The coefficient ( $\gamma$ ) which represents nominal GDP has a positive and significant relationship with money supply in all six countries investigate. The nominal GDP coefficient for St Lucia is the largest. It indicates that an increase by 1 unit growth in nominal GDP would result in an increase by in money supply by 1.77 percentage points. The smallest impact is noted in Grenada, with a coefficient ( $\gamma$ ) of 0.02. Any attempt to pay down debt will lower income; therefore, for the debt-to-income ratio to fall government would be required to obtain income from an outside source. This can come from either an increase in exports, or a decrease in government spending. An increase in income would allow the public sector to pay down its debts and reduce its debt-to-income ratio. The monetary authorities thus; can constrain government by limiting central bank lending to the government. This is not only conducive to lower inflation but also to sustain long run exchange rates and promote economic growth.

The results of equation (7) are presented in Table 2. It shows that there have been no excessive additional reserve pressure ( $MB < (\gamma + MO)$  or equivalently  $\beta_3 < \beta_1$ ) in Barbados, Grenada, Malta, St Kitts/Nevis and St Vincent and the Grenadines. This implies that governments have been able to cover expenditure in the short and medium term and are thus solvent. The issues facing these countries are liquidity. There is a growing consensus that fiscal policy is more effective – i.e. crowding out is less likely when interest rates are low because the central bank is less likely to act to offset changes in government spending. In the case of Saint Lucia, the data indicates there has been additional reserve pressure ( $4.805 > 0.456$ ), implying fiscal policy is on an unsustainable. A forecast for the year 2016, reveal that to close the gap imports needs to decline by 28 per cent decline in imports see Table 3. Tables 4, presents analysis of a 5 per cent increase in NDA to analyze the required change in imports that would be necessary to achieve sustainability. Base on the significance of the variables and the value of the coefficient Barbados and St Lucia have been selected to conduct “the stress test”. The results indicate that Barbados would be required to decrease their import bill by at least 5 per cent. Saint Lucia on the other hand requires a 10 percent decline in imports in order to reduce pressure on the foreign reserves and by extension achieve fiscal sustainability.

## 6. Conclusion

This study notes that there have been increasing concerns about the issue of fiscal sustainability due to weakened public finances of CARICOM countries and the Dutch Caribbean as they experienced balance of payment crises, foreign exchange losses. These countries are open and import dependent hence fiscal policy puts pressure on these external accounts such as the widening deficit, economic growth slowed and severe exchange rate depreciation pursued as all SOE's accounted for 3.24 percent of total GDP of CARICOM and the Dutch Caribbean and the debt to GDP ratio rose to 98% compared to industrial countries which accounted for 106%. Countries resorted to rescue measures such as Structural reforms, Fiscal adjustments, Debt restructuring, Debt rescheduling, Debt swaps, Debt default, Debt relief in an effort since revenues were insufficient and too volatile to meet governments spending priorities.

Small open economies (SOEs) such as CARICOM countries are in need of a fiscal sustainability methodology that is clear, simple and provides early signals to policymakers of potential problems in relation to debt accumulation. In this regard, we are of the view that our "Fiscal Sustainability Tool" is a powerful tool for signalling debt distress. In fact, we conclude that our approach should be a more preferred methodology over the IMF's DSA since it uncovers and addresses some of the IMF DSA limitations. These include our movement away from a debt-threshold approach. The IMF's model hinges on debt thresholds. We allow for country specific characteristics unlike the IMF DSA which generally ignores the peculiar characteristics of small open economies. Additionally, our model does not require any use of a "loss function: hence country-specific values useful. Utilizing the IMF-DSA requires one to select the debt sustainability probability thresholds that minimises the IMF-WB loss function.

The application of the FSA approach requires an undertaking of: a review of the historical experience with respect to foreign reserve levels, taking note of any known periods of balance of payments crisis. Stress testing on the historical foreign reserves data by increasing the money-financed fiscal deficit. In addition to a static analysis which entails an experiment which requires one to increase the money-financed fiscal deficit by increments of one percent of GDP, in comparison with the associated decline in foreign exchange reserves. The result from the application of our model indicates that nominal GDP has a positive and significant relationship with money supply in all six countries investigated. The nominal GDP coefficient for St Lucia is the largest. It indicates that an increase by 1 unit growth in nominal GDP would result in an increase by in money supply by 1.77 percentage points. The smallest impact is noted in Grenada, with a coefficient ( $\gamma$ ) of 0.02. Any attempt to pay down debt will lower income; therefore, for the debt-to-income ratio to fall government would be required to obtain income from an outside source. Our "Fiscal Sustainability Toolkit" approach assumes countries suffer from balance of payment pressures and thus requires medium term strategies.

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## Appendix

Figure 1: IMF Debt Threshold Equations

Probit debt threshold regression

$$Prob_j (y_{it} = 1) = \theta(\beta_{Debt_j} Debt_j + \beta_{MIC} Debt_j \times MIC + \beta_{CPIA} CPIA + \beta_{Growth} Growth)$$

Debt threshold analysis equation

$$\overline{D_j^{DTA}} = \frac{\theta^{-1}(\overline{P_j^*} - \hat{\beta}_{CPIA} \times \overline{CPIA^G} - \hat{\beta}_{Growth} \times \overline{Growth})}{\hat{\beta}_{Debt_j}}$$

*Variables*

*Debt<sub>j</sub>* – The debt variable, with *j* indexing five alternatives (present value of external debt-to-GDP; present value of external debt-to-exports; present value of external debt-to-revenues; debt service-to-exports; debt service-to-revenue).

*MIC*– Interaction dummy variable for middle-income countries. Controls for a possible heterogeneous effect of external debt across different levels of development.

*CPIA*– Country Policy and Institutional Assessment, which measures policies and institutional quality.

*Growth*– Proxies for governance and economic shocks.

Figure 2: The IMF DSA Loss Function

$$L = \alpha \times \frac{MC}{A + MC} + (1 - \alpha) \times \frac{FA}{B + FA}$$

MC      number of missed debt crises

A        number of crises that are correctly called

FA       number of false alarms

B        number of tranquil (i.e. non-crisis) periods correctly called

Table 1 Parameter Estimates of the Model 1

Dependent Variable	Variable	Coefficient	t-value	Probability
Money Supply	Constant	-5.048	-6.167	0.000
	P	-0.442	-4.764	0.000
	Y	1.953	18.208	0.000
	MB	2.86	4.037	0.005
Barbados	Constant	4.934	42.522	0.000
	P	0.017	3.265	0.302
	Y	0.002	5.176	0.000
	MB	0.002	1.043	0.016
Grenada	Constant	-4.70	-12.654	0.000
	P	-0.036	-3.178	0.000
	Y	1.621	69.768	0.000
	MB	0.027	0.4189	0.679
Malta	Constant	73.11	-3.559	0.001
	P	36.051	1.259	0.218
	Y	1.772	6.905	0.000
	MB	4.805	3.637	0.001
Saint Lucia	Constant	0.854	0.488	0.629
	P	0.024	0.514	0.611
	Y	0.770	2.632	0.014
	MB	0.002	2.00	0.080
St Kitts/Nevis	Constant	-3.861	-10.943	0.000
	P	-0.019	-2.986	0.006
	Y	1.504	25.786	0.000
	MB	0.000	0.5007	0.6203
St Vincent and the Grenadines	Constant	-3.861	-10.943	0.000
	P	-0.019	-2.986	0.006
	Y	1.504	25.786	0.000
	MB	0.000	0.5007	0.6203

**Table 2 Parameter Estimates of the Model 2**

Dependent variable	Variable	Coefficient	t-value	Probability
Imports	Constant	-81.897	-0.738	0.467
	(y + MO)	0.366	20.578	0.000
Barbados	Constant	40.822	1.424	0.1646
	(y + MO)	0.461	21.210	0.000
Grenada	Constant	50.266	0.575	0.570
	(y + MO)	0.695	25.038	0.000
Malta	Constant	26.6226	4.413	0.000
	(y + MO)	0.456	14.413	0.000
Saint Lucia	Constant	17.193	8.762	0.000
	(y + MO)	0.311	18.623	0.000
St Kitts/Nevis	Constant	5.433	10.443	0.000
	(y + MO)	0.000	17.708	0.000
St Vincent and the Grenadines	Constant	5.433	10.443	0.000
	(y + MO)	0.000	17.708	0.000

**Table 3 Parameter Estimates of the Model 3**

	Equation	Change in Imports Forecast
Barbados	- NDA. 3. 1	2.86 > 0.366
Grenada	- NDA. 3. 1	0.002 < 0.461
Malta	- NDA. 3. 1	0.027 < 0.695
Saint Lucia	- NDA. 3. 1	4.805 > 0.456
St Kitts/Nevis	- NDA. 3. 1	0.002 < 0.311
St Vincent and the Grenadines	- NDA. 3. 1	0.000 = 0.000

Notes. If there is excessive additional reserve pressure (i.e. if  $\beta_3 > \beta_1$ ) it implies that money supply increases faster than economic growth. Note well,  $\beta_3$  corresponds to the values on the left hand side in column 3 above. On the contrary  $\beta_1$  corresponds to values on the right hand side in column 3 above.

Table 4: Stress test: assuming the change in NDA is 5 percent of GDP (i.e.  $NDA=0.05$ )

	Equation	Imports Forecast	Change in imports required
Barbados	- NDA. 3. 1	- NDA (2.86* 0.366)	5 per cent decrease
Saint Lucia	- NDA. 3. 1	- NDA (4.805*0.456)	10 per cent decrease

Note. Displays the change in imports necessitated by a 5% increase in NDA.

Figure 3:

