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A Fan Chart Approach

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Vulnerability, Debt and growth in the Caribbean

By: Leandro Andrian, Valerie Mercer-Blackman, Andrea F. Presbitero and Alessandro Rebucci

Abstract: High government debts, weak economic growth, vulnerability to external shocks and the design of sound fiscal consolidation strategies are among the most critical issues that some of the Caribbean countries has currently to deal with. Stabilization programs may harm economic growth but, under certain conditions, they could be expansionary. The main result of this analysis is that the uncertainty about the future evolution of debt increases when the volatility of exogenous shocks that affect fiscal revenues are properly accounted for in the debt sustainability analysis.

JEL Classification: E62, O54, H60, H63
Key words: Debt sustainability, Growth, Volatility, Caribbean countries.

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Table of Contents

1. Introduction

High (and rising) public debts, weak economic growth and the design of fiscal consolidation strategies are among the most critical issues that some of the Caribbean countries have to deal with. The macroeconomic framework is further complicated by the long-lasting global downturn, given the high vulnerability of Caribbean economies to external shocks (International Monetary Fund, 2013). Some Caribbean countries are now in a situation of stagnant growth and rising and unsustainable public debts. A consensus is emerging about the necessity to reduce public debt levels to revamp growth, as a high debt-low growth trap may be the result of a debt overhang problem (Krugman, 1988). Large public debts are also associated with higher borrowing costs, especially in times of crisis and global uncertainty, crowding out public investment and expenditures (Jaramillo and Weber, 2012). In addition, large debts could induce a bias towards short-term investment, reducing productivity and human capital accumulation, and they are often associated with capital flights. As a result, in emerging and developing economies, more indebted countries tend to growth slower (Pattillo, Poirson and Ricci, 2011; Presbitero, 2012). Therefore, fiscal consolidation — hopefully together with growth-enhancing reforms — is often indicated as a key policy tool for heavily indebted countries to achieve their growth potential (Sahay, 2005; Greenidge, Drakes and Craigwell, 2010; Greenidge et al., 2012; Yartey et al.,2012).

In addition to high indebtedness, Caribbean countries have certain characteristics that make them more vulnerable and more sensitive to shocks. Fiscal consolidation in the Caribbean is complicated by volatile tax revenues and expenditure rigidities (Yartey et al., 2012). In addition, the high dependency of the Caribbean on external conditions can compromise efforts to undertake a fiscal consolidation program thus making the high debt-low growth trap scenario more likely.

Low policy buffers also make it difficult for small countries in the Caribbean to sustain a fiscal consolidation plan. Johnson (2011) enumerates some conditions for fiscal contractions to have an expansionary effect, and these do not always hold for Caribbean countries. First, if long-term interest rates are significantly reduced because there was a high perceived sovereign default risk. Second, if spending cuts are offset by higher household or firm spending because of the confidence boost. Third, if monetary policy becomes more expansionary this can partially offset the negative short-run effects of spending cuts on the economy. Fourth, tighter fiscal policy with easier monetary policy can - with a devaluation of the currency - increase exports that could mitigate the fiscal contraction. For the case of the Caribbean, spreads may fall but interest rates on debt are not generally high. Second, higher private sector spending would generally go to imports, substantially dampening the multiplier effect. Finally, with a political commitment to a fixed exchange rate, constrained monetary policy options combined with weak monetary transmission mechanisms, and high uncertainty due to the undue influence of external conditions, these conditions probably do not hold for the Caribbean. Moreover, Mercer-Blackman and Melgarejo (2013) have shown that the high dependence of GDP shocks to external conditions in general reduces the scope for policies to be effective in the Caribbean.

There are other additional uncertainties that have been examined more recently in the literature: the timing of the adjustment may be delayed during recessions. Moreover, temporary reversals due to natural disasters (quakes, storms, hurricanes, etc.) are generally not taken into account when fiscal adjustment plans are devised. The Commonwealth Secretariat has advocated quite recently that small countries such as those in the Caribbean could be eligible for some type of concessionary debt reduction. Their justification is that these countries are small and vulnerable because of their exposure to external shocks, and this vulnerability is structural rather than derived from policy choices.

This paper proposes a simple modification to debt sustainability analyses that is more appropriate for a vulnerable Caribbean country. The approach augments the feedback effects of a shock on the fiscal stance to reflect the difficulty these countries have of sticking to a fiscal consolidation plan given the uncertainty about the related variables and the lack of fiscal buffers. Using the proposed methodology, we assess the sustainability of the debt, given the high vulnerability, of five Caribbean countries – the Bahamas, Barbados, Jamaica, Suriname and Trinidad and Tobago – to external shocks (i.e. global demand, natural disasters).

In particular, given the dependence of the five countries on tourism and commodity exports, we consider how the volatility of commodity prices and tourist arrivals affect debt sustainability. While tourism and the recent increase in commodity prices have significantly contributor to growth in the Caribbean, they also increased fiscal volatility. Government revenues are extremely dependent on exogenous and volatile variables, making debt sustainability more uncertain than it is generally considered in the standard debt sustainability analysis (DSA).

We use an augmented Fan Chart approach, developed by Andrian and Reyes-Tagle (2012), to evaluate how the probability distribution of the debt-to-GDP ratio is responsive to the volatility of commodity prices (in mineral-dependent economies) or tourist arrivals (in tourism-dependent economies). The main result is that the uncertainty about the future evolution of debt increases when the volatility of exogenous sources of revenues are endogenized into the debt sustainability model.

The remainder of the paper proceeds as follows. The next Section reviews the recent literature on fiscal policy, and discusses the implications for each of the countries. It also briefly outlines the evolution of public debt and fiscal policy in the five Caribbean countries to preliminary assess the possible effects of fiscal consolidation in those countries. Section 3 introduces the different approaches to debt sustainability (sub-section 3.1), focusing on the modified Fan Chart approach, augmented to take into account external shocks (sub-section 3.2). Section 4 discusses the main results for each of the five countries. Finally, Section 5 tries to summarize some general results, discusses their policy implications and proposes some possible strategies to escape from the high-debt, low-growth trap.

2. Expansionary Fiscal Consolidation and Fiscal Multipliers: a summary of the literature

The debate on multipliers: does it increase uncertainty?

The debate over austerity in the US and Europe has revamped the debate on possible expansionary effects of restrictive fiscal policies. Fiscal stimuli, undertaken in many countries in order to deal with the severity of the crisis have been justified by the implicit assumption that public spending would boost output, so that the fiscal multiplier is at least equal to one. By contrast, fiscal adjustments required by austerity policies in peripheral European countries and in other indebted countries are justified by evidence suggesting a low or even negative multiplier.

This debate is relevant also for Caribbean states to the extent that some of them are undertaking severe fiscal adjustments trying to minimize their negative effects on output growth. The original debate goes back to the contribution by Giavazzi and Pagano (1990), who observed that, in the 1980s, Denmark and Ireland seemed to experience two episodes of expansionary fiscal contractions. Alesina and Ardagna (1998) and Alesina and Ardagna (2010) provide additional evidence. However, this would be important when considering the central forecast of what a possible debt-to-GDP trajectory would look like, but would not be helpful in considering the certainty of that planned outcome. In Europe the scope for more control by policy-makers and less dependence on outside factors could allow some degree of predictability. For small economies, the degree of the possible shocks makes forecasting a possible outcome much more uncertain.

Finally, a useful policy lessons for the Caribbean can derive from a recent analysis of the impact of fiscal adjustment on the United States, Europe and Japan, which shows that "smooth and gradual consolidations" are to be preferred to frontloaded or aggressive consolidations, especially for economies in recession facing high risk premia on public debt, because sheltering growth is key to the success of fiscal consolidation in these cases" (Batini, Callegari and Melina, 2012).

The effect of fiscal policy on output growth depends on the magnitude of the fiscal multiplier, and a possible expansionary effect of fiscal consolidation strictly depends on a small or negligible multiplier. In the Keynesian tradition, multipliers are larger than one, suggesting that an increase in government spending has a more than proportionate effect on economic activity. This view has been criticized by the neoclassical tradition on the grounds that an increase in government spending would have no discernible effect on economic output, as it will be accompanied by sharp reductions in consumption and investment. The uncertainty about its impact is compounded in countries subject to large external shocks, where much of government spending may go to imports. Indeed, other than the business cycle, country characteristics matter and fiscal expansions are likely to be more effective when: 1) the stimulus is neither saved nor spent on imports, 2) monetary policy is accommodative, and 3) the fiscal stance is sustainable (Spilimbergo, Symansky and Schindler, 2009). Because the fiscal multiplier is likely small for the

Caribbean countries, implying less influence of policy-makers on the fiscal outcome, external variables outside of their control will tend to have more influence on the debt trajectory.

Fiscal policy and consolidation in the Caribbean countries

The macroeconomic and fiscal framework of the Caribbean countries is characterized by three main stylized facts (Sahay, 2005): 1) high public debt-to-GDP ratios, among the largest worldwide, 2) limited fiscal space, since a large share of fiscal expenditures are committed to payroll, interest payments and pensions, and 3) a strong dependence on external factors, mainly climatic conditions, the US business cycle and commodities prices, as shown by the cross-country correlation of GDP, revenues and primary expenditures.

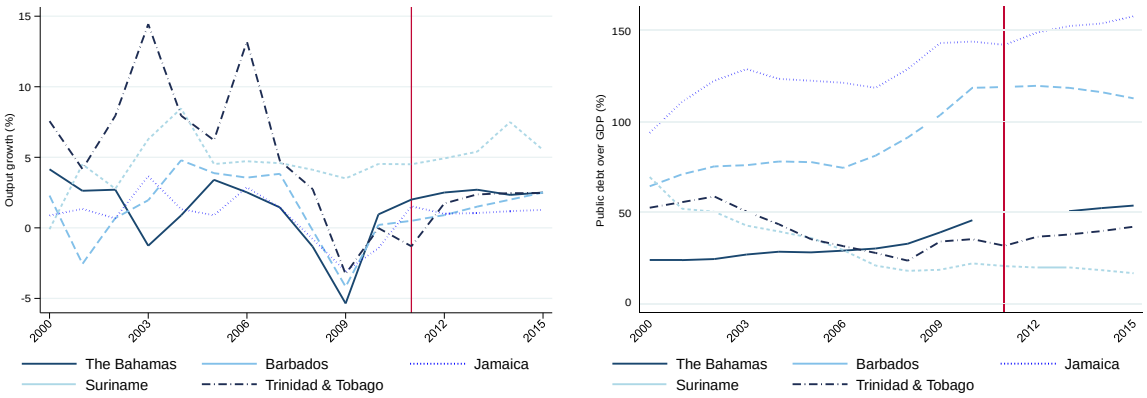
Notwithstanding some common features, the five countries of this study show some degree of heterogeneity between commodity exporters and tourism-dependent economies, in terms of growth and indebtedness. Mineral-dependent economies (Suriname and Trinidad and Tobago) took advantage of rising commodity prices, suffering less from the global crisis, and show better growth prospects than tourism-dependent countries (Figure 1, left panel). The latter have a large and increasing debt-to-GDP ratio — Jamaica and Barbados in particular — while Suriname and Trinidad and Tobago benefited from large mineral revenues to run primary surplus and to reduce the ratio of public debt over GDP in the years before the onset of the global crisis (Figure 1, right panel). Their fiscal stance, however, remains extremely dependent on mineral revenues and on the future commodity prices.[8]

Given these differences, the debt sustainability analysis will be country-specific and it will try to point out the main sources of vulnerability of each country and the more feasible and efficient consolidation strategy.

Fiscal consolidation is more likely to be successful if certain conditions are met, according to recent literature. The first condition is that the economy is close to the brink, meaning that the marginal tax rate and the debt-to-GDP are high and that public debt is at risk of sustainability. The second condition has to do with consumers myopia or, more realistically, to their capacity to borrow in order to smooth consumption inter-temporally. The empirical literature on fiscal multipliers complements these conditions showing that multipliers are lower (or negative) — and hence consolidation more likely to be successful — 1) in developing countries than in advanced economies; 2) in countries with flexible exchange rate regimes; 3) in more open economies, and 4) in expansionary periods rather than in recessions. The latter three points are consistent with the fact that fiscal adjustments are more likely to be expansionary — thanks to an export boom — in countries with room for interest rates reduction, wage moderation and exchange rate depreciation (Perotti, 2012).

[8] More details at country-level are reported in Table 1 and in Section 4.

Figure 1: Growth and public debt in selected Caribbean countries



(a) Real output growth

(b) Government gross debt

Notes: Elaboration on WEO database, April 2012. Figures on the right of the vertical red line are IMF projections.

All these conditions are measurable at the country level, so that it would be possible to preliminary assess, at least to some extent, whether the five Caribbean countries are good candidates for an expansionary fiscal consolidation. Table 1 provides a set of comparable indicators about the fiscal and external positions, output growth, and financial sector development.

The fiscal indicators show that debt sustainability is a critical issue for the five Caribbean countries. Jamaica and Barbados are heavily indebted, in the Bahamas the debt-to-GDP ratio doubled in the last decade and it is projected to breach the 50 percent threshold (Figure 1, left panel). In Suriname and Trinidad and Tobago debt levels are much smaller, but this is the result of favorable shocks in commodity prices. Notwithstanding large mineral revenues, those two countries run a negative primary balance in 2010, as also Barbados and the Bahamas. In Jamaica, the positive primary balance is largely offset by debt service, resulting in a large budget deficit. The sovereign credit ratings confirm the risks on debt sustainability, with government bonds classified at a medium risk or as speculative (in Suriname and Jamaica). Data on fiscal revenues and on marginal tax rates show that Barbados, Suriname and Trinidad and Tobago have limited room to further increase revenues to stabilize the debt-to-GDP ratio. The situation in the Bahamas is peculiar, with a zero corporate income tax rate, no VAT, but a 35% customs duties on imports.

Table 1: Caribbean countries: selected indicators

	BHA	BRB	JAM	SUR	TTB
Fiscal indicators					
Public sector revenue over GDP (REO, 2010)	16.8	35.0	26.4	26.7	34.0
Public sector primary expenditures over GDP (REO, 2010)	18.9	36.5	21.8	29.3	35.3
Public sector primary balance over GDP (REO, 2010)	-2.1	-1.6	4.5	-2.6	-1.3
Public sector gross debt over GDP (REO, 2010)	45.4	116.8	141.3	22.0	35.9
Marginal corporate tax rate	0%[1]	25%	n.a.	36%	25%
Sovereign credit rating (REO, latest available)[2]	BBB+	BBB-	B-	B+	A-
Output indicators					
GDP per capita, PPP (REO, 2011)	30,959	23,417	9,029	9,457	20,053
Real GDP growth (REO, 2010)	1	0.2	-1.4	4.5	0
Average real GDP growth, 2001-2011 (REO)	0.8	1.1	0.8	4.8	5.2
External indicators					
Exchange rate regime (IMF)	Fixed	Fixed	Float.[3]	Fixed	Fixed
Average trade openness, 2001-2011 (REO)	87	95.1	90.9	123.3	100.4
Current account over GDP, 2001-2011 (REO)	-10.9	-6.3	-10.5	-3.7	17.6
Financial sector indicators					
Inflation (REO, 2010)	1.6	6.6	11.8	10.3	13.4
Credit to the private sector over GDP (WB, 2009)	92.8	63.0[4]	31.4	35.1	35.7
Liquid liabilities over GDP (WB, 2009)	79.1	96.8[4]	45.1	73.3	41.2
Credit constrained firms (ES, 2010)	44.8%	22.7%	44.4%	43.0%	49.8%
Central Bank discount rate (ECLAC, 2010)	5.3	7	7.7	n.a.	3.9

Notes: REO is the Regional Economic Outlook (International Monetary Fund, 2012*b*), ECLAC is the Macroeconomic Report by Economic Commission for Latin America and the Caribbean (2012), WB refers to the Financial Structure Database (Beck, Demirgüç-Kunt and Levine, 2000; Beck and Demirgüç-Kunt, 2009), and ES refers to the Enterprise Survey and define as credit constrained firms which are partially of fully credit constrained (for the precise definition, see Kuntchev et al., 2012).

(1) but 35% tax rate on duties.
(2) median of ratings published by Moody's, Standard & Poor's, and Fitch.
(3) managed floating.
(4) refers to 2006.

Macro indicators make it clear that the five countries are extremely heterogeneous in terms of per capita GDP and output growth. The two commodity exporters experienced a sustained growth over the last decade and are facing the global crisis much better that tourism-dependent economies, which are still in the midst of the recession, after a decade of stagnant growth.

As regards the external sector, all countries are very open economies, especially the commodity- dependent ones and they all have some sort of fixed peg exchange arrangement, apart from Jamaica, which runs a managed floating exchange rate. The current account record over the last decade still makes a clear separation between Jamaica, Barbados and the Bahamas — net importers — and Suriname, with a smaller current account deficit, and Trinidad and Tobago, which run a large surplus.

Inflation in 2010 has been quite sustained in all economies but the Bahamas. The central

bank discount rates were well above the zero lower bound (ZLB), even if the Bank of Jamaica lowered the discount rate to 2 percent in 2010. Finally, credit markets are well developed in the Bahamas and Barbados, while in Jamaica, Suriname and Trinidad and Tobago the ratio of credit to the private sector over GDP is much lower and below the average value of Latin America and Caribbean countries. Moreover, the share of firms which are financially constrained is well above the regional (LAC) average (31.3%) in all five countries except Barbados. These two indicators, one at macro level and the other at the firm-level, consistently suggest that financial markets are not fully developed, so that consumption smoothing may be an actual constraint for domestic agents, at least in Jamaica, Suriname and Trinidad and Tobago.

In sum, the fiscal position and the poor growth performance of the Caribbean countries makes consolidation a key strategy to trigger a growth acceleration[9]. However, it should be taken into account that the ongoing recession — or the timid recovery — can make austerity policies self- defeating in the short run (Jaramillo and Cottarelli, 2013). With respect to the euro zone and the US, where this argument is compelling, the data presented in Table 1 suggest the fiscal consolidation in the Caribbean may be successful. As the southern European countries, the five Caribbean countries are, to a different extent, close to the brink, but, different from the former, the latter have room for an accommodating monetary policy and can benefit from being very open economies. Even if they lack the exchange rate policy option (apart from Jamaica), they can try to offset the direct negative effect of consolidation on consumption gaining competitiveness with some form of wage moderation. Financial market development should make it possible to smooth consumption inter-temporally, at least in the richer Bahamas and Barbados, while poorer countries can take advantage of the fact that fiscal multipliers should be lower.

3. The methodological approach

3.1 Assessing debt sustainability

> *Because debt sustainability is a forward-looking concept, it cannot be assessed with certainty. In that sense, debt sustainability analysis [. . .] is impossible. At best, [. . .] one can make educated guesses but it is important to recognize at the outset that these are just guesses, no matter how sophisticated they may be.*
>
> Charles Wyplosz (2011)

As the quotation by Charles Wyplosz reported above makes clear, assessing debt sustainability is a sort of "mission impossible". Other than the critical problem of making educated guesses on the future, a key issue is that the very definition of a sustainable debt is not unique. For instance, debt sustainability may be defined either in terms of stationarity of the debt-to-GDP ratio or in terms of solvency, and it may be analyzed adopting a deterministic or a probabilistic approach. While a detailed discussion of the approaches to define debt sustainability is beyond the scope of this paper, some basics concepts will briefly introduced to provide the analytical framework which is behind the debt sustainability analysis undertaken in Section 5[10].

[9] Even if it is true that Suriname and Trinidad and Tobago show better figures on the budget balance and output growth, these look more gloomy if the mineral sector is excluded from the analysis, as we will show in Section 4.

As standard in the literature, we define the government dynamic budget constraint in discrete time as:

$$\Delta d = \frac{(r - \gamma)}{1 + \gamma} d + (g - \tau) \quad (1)$$

and in continuous time as:

$$\dot{d} = (r - \gamma)d + (g - \tau) \quad (2)$$

where d is the ratio of public debt over GDP, r is the real interest rate, γ is the rate of growth of real GDP, g is the ratio of government (non-interest) expenditures over GDP and τ is the ratio of fiscal revenues over GDP. From this very simple macroeconomic identity, it is easy to see that fiscal policy (g, τ) has always a direct effect on the debt-to-GDP ratio d. In addition, fiscal policy could affect the interest rate and/or the GDP growth rate, depending on the assumptions made in the underlying model.

The standard approach to debt sustainability requires the debt-to-GDP ratio not to follow an exploding path (Blanchard, 1990). A stable debt ratio would require the left-hand side of equations 1 and 2 to be equal to zero. This implies that as long as the real interest rate is higher than the GDP growth rate, the country must run a primary surplus:

$$(g - \tau) = \frac{(r - \gamma)}{1 + \gamma} d \approx (r - \gamma)d \quad (3)$$

This approach provides a very simple and intuitive long-run equilibrium condition and it is not data demanding. However, the required fiscal adjustment (the debt-stabilizing primary surplus minus the actual primary balance) does not depend on the policy mix, in the sense that, being everything exogenous, a reduction in government expenditures or an increase in taxes do not affect the equilibrium condition. Moreover, the model does not provide any indication of the effect of the fiscal adjustment on aggregate consumption. Finally, being a long-run approach, variables are assumed to stay close to their historical trends: exogenous shocks and uncertainty can only be modeled looking at how the required fiscal adjustment varies along with different hypothesis about the long-run values of r or g[11].

These main limitations of the standard approach can be addressed within alternative frame-works. Here we would focus on the importance of volatility for the DSA. The standard Fan Chart approach would be modified to deal with the strong dependency of Caribbean economies on external shocks, coming either from tourism or from commodity prices.

[10] For a concise arithmetic of debt sustainability, see Ley (2010), while Borensztein et al. (2010) provide a balanced discussion of different approaches.

[11] A simple extension of this approach is the one adopted, for instance, by the World Bank and the IMF in their Debt Sustainability Framework (International Development Association and International Monetary Fund, 2010). Moving from equation 1, opportunely modified to take into account the structure of public debt, the evolution of *d* can be easily calculated on the ground of the projections of the main macroeconomic variables included in the government budget constraint. Simple stress tests can be run assuming determined shocks on the underlying projections. Debt sustainability is generally assessed looking at whether the evolution of the debt-to-GDP breaches a given threshold.

3.2 The effects of external shocks on debt sustainability

The five countries in this study suffer, to varying degrees, from a severe dependence on external factors, being tourism or commodities prices (see Section 5 below). To take into account the high volatility of tourist arrivals and commodity price shocks on debt sustainability, we would apply an extension of the Fan Chart (FC) approach (Andrian and Reyes-Tagle, 2012), explicitly designed to assess the effect of the volatility (shocks) of additional variables on the probabilistic debt path.

While we refer to Arizala et al. (2008) and Borensztein et al. (2010) for an extensive discussion of the FC approach and its application to the IaDB DSA toolkit, here we briefly describe the augmented Fan Chart model, as discussed by Andrian and Reyes-Tagle (2012).

Uncertainty in the standard DSA is modeled as entirely deterministic: the "stress tests" involve a set of possible shocks and treat them ignoring the correlation across shocks and the joint dynamic response to shocks of the macroeconomic variables which explain the debt dynamics. The Fan Chart approach to debt sustainability provides a stochastic apparatus to assess debt sustainability under a combination of several likely macroeconomic shocks (Celasun, Debrun and Ostry, 2007). The FC aims at estimating a probabilistic distribution of the debt-to-GDP ratio based on: 1) the joint distribution of shocks, as provided by a VAR econometric model of the country economy, and 2) a set of external forecasts on risk inputs. Specifically, the debt dynamics is made by two parts:

- **a deterministic component**: the law of motion of debt (d) would depend on the primary surplus f , the interest rates on domestic rd and foreign (rf) debt, exchange rate (e) depreciation, and GDP growth rate (γ):[12]

$$d_t = \left[\alpha\frac{(1+r_t^d)}{(1+\gamma_t)} + (1-\alpha)\frac{(1+r_t^f)(1+\Delta e)}{(1+\gamma_t)}\right] d_{t-1} - ps_t \qquad (4)$$

- **a stochastic component**: the coefficients and the variance-covariance matrix from a VAR(p):

$$Y_t = \mu_0 + \sum_{k=1}^{p} \mu_k Y_{t-k} + \xi_t \quad \text{where} \quad Y_t = (r_t, \gamma_t, ps_t, \pi_t, e_t) \quad \xi \sim N(0, \Omega) \qquad (5)$$

make it possible to generate projections and a set of simulated paths of the variables which enter equation 4.

In addition, external forecast can complement the backward looking VAR approach to include expert projections. External forecasts would be used to calculate the central path of the debt- to-GDP ratio, while the variance-covariance matrix of the VAR residuals is used to calculate the joint distribution of the errors and the simulated debt paths.

[12] Because of data limitations in some countries, we also adopt a simplified version of the law of motion, where *r* is the real interest rate (calculated implicitly from the ration between interest expenditures at time *t* over the stock of public debt at time $t-1$):

$$dt = \frac{(1+rt)}{(1+\gamma t)} dt-1 - pst$$

The augmented FC approach takes into account the country's dependence on a specific and volatile source of revenue and includes that volatility in the VAR model and in the debt dynamic equation. In this way, the vulnerability to exogenous shocks is not simply modeled by using external ad hoc forecasts, but it is endogenous to the model.

In Caribbean countries, government's revenues rely heavily on tourism (see the discussion on the Bahamas, Barbados and Jamaica, sub-sections 4.1, 4.2 and 4.3) or on oil revenues (see the discussion on Suriname and Trinidad and Tobago, sub-sections 4.4 and 4.5), and therefore inherit their volatility and shocks. Starting from the debt equation 4, the primary surplus (PS) is defined as the difference between revenues (REV) and expenditures net of debt service (EXP):

$$PS_t = REV_t - EXP_t \tag{6}$$

The projections of the primary surplus required to calculate the evolution of d_t are based on the estimation, on historical data, of the following equations:

$$ln(EXP_t) = \gamma_0 + \gamma_1 ln(EXP_{t-1}) + \gamma_2 ln(GDP_t) \tag{7}$$

$$ln(REV_t) = \beta_0 + \beta_1 ln(REV_{t-1}) + \beta_2 ln(GDP_t) \tag{8}$$

Equation 8 is then augmented to include the country-specific source of vulnerability. For tourism-dependent economies, the revenue equation is augmented including the number of visitors (*VISITORS*)[13]:

$$ln(REV_t) = \beta_0 + \beta_1 ln(REV_{t-1}) + \beta_2 ln(GDP_t) + \beta_3 ln(VISITORS_t) \tag{9}$$

In case of mineral-dependent economies, equation 8 is splitted into two equations, one for non-mineral revenues and a second for mineral revenues. The latter would include also the price of the relevant commodity (generally, the oil price index, *OIL PRICE*):

$$ln(NONMIN\ REV_t) = \delta_0 + \delta_1 ln(NONMIN\ REV_{t-1}) + \delta_2 ln(GDP_t) \tag{10}$$

$$ln(MIN\ REV_t) = \delta_3 + \delta_4 ln(MIN\ REV_{t-1}) + \delta_5 ln(OIL\ PRICE_t) \tag{11}$$

In any case, GDP and the source of volatility (*VISITORS* or *OIL PRICE*) are related by a VAR(1) system, including also inflation and nominal depreciation:

$$Y_t = \theta_0 + \theta_1 Y_{t-1} + E_t \tag{12}$$

where Y is a 4×1 vector including $ln(GDP)$, inflation, nominal depreciation and $ln(VISITORS)$ ($ln(OIL\ PRICE)$)

To assess the relevance of including country-specific vulnerabilities in the FC approach, we will look at debt dynamics under two alternative scenarios:

[13] In the following analysis we have chosen to focus on the number of arrivals as the key variable to measure the importance of tourism. Receipts may seem more appropriate to assess the impact of the tourism economy on debt sustainability, but they may not be a true exogenous shocks, since the private sector may adjust prices to offset a variation in the number of visitors. The latter indicator, instead, may be considered a truly exogenous shock. However, results using international tourism receipts are qualitatively similar.

1. **baseline model**: $\beta_3 = 0$ (tourism), or $\delta_5 = 0$ (minerals)
2. **augmented model**: $\beta_3 \neq 0$ (tourism), or $\delta_5 \neq 0$ (minerals)

With the VAR (1) estimates it is possible to simulate the evolution of the public debt-to-GDP ratio (equation 4) for a horizon period of five years (the starting point is generally 2010). With this approach it is possible to forecast and simulate 10,000 times the sequences of GDP and the external shock (mineral prices of number of arrivals) for five periods ahead and, for each simulation, retrieve the values of revenues and expenditures required to pin down the value of primary surplus to include in equation 4. Taking the interest rate r at its average value of the sample period, it is possible to calculate the probabilistic evolution of the debt-to-GDP ratio under the baseline and augmented models, which are then plotted in the Fan Chart diagram.

Finally, it is worth stressing that the main implication of this exercise is the assessment in the change in volatility of debt projections across the two classes of models, rather than the precision of their point estimates, which rely on a VAR(1) system estimated with annual data on few years.

4. Country analysis

4.1 The Bahamas

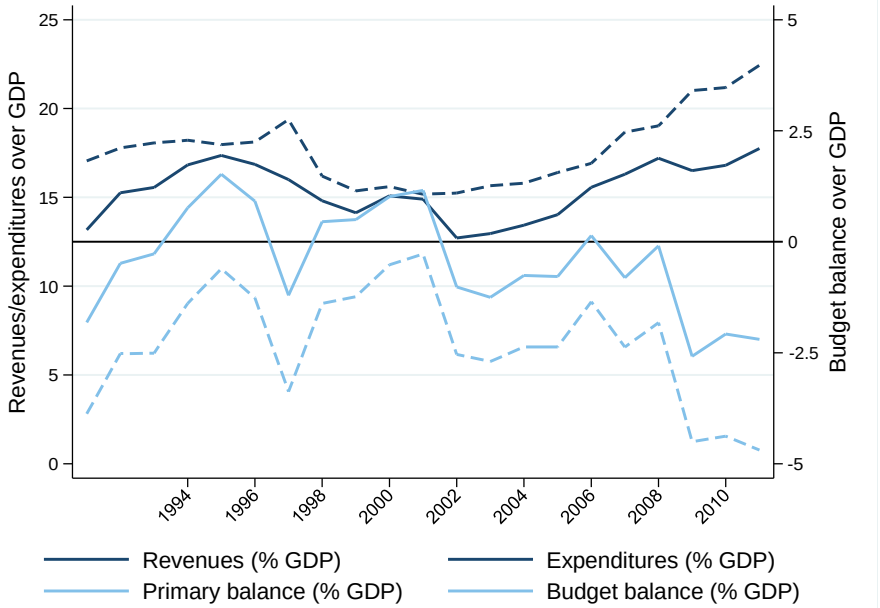
The macroeconomic and fiscal framework

The collapse in tourism following the US recession and the failure of CLICO Bahamas, an insurance company with total liabilities of about 1 percent of GDP, determined a severe contraction of the economy of the Bahamas. After a fall in GDP by 5.4% in 2009, the Bahamas are slowly re- covering from the global crisis, thanks to a rebound of the tourism sector and to large investment in the construction sector. Economic growth is projected to by 2.5 percent in 2012, but the fiscal position remain vulnerable. The Government tried to mitigate the effects of the crisis adopting countercyclical policies, but it simultaneously experienced a contraction in tax revenue. In this environment, the fiscal deficit expanded and debt indicators worsened (Branch and Johnson, 2010). The fiscal balance is projected to further deteriorate reaching a deficit of 5 percent of GDP in 2012. Expenditures as a share of GDP are on an upward trend and increased from 15.8 in 2004 to 22.4 in 2011, while revenues stabilized at their pre-crisis level of about 17% of GDP (Figure 2)[14]. As a result, central government debt, which is mainly domestic debt, increased from 30% of GDP in 2007 to 45% in 2010, and it is expected to reach 55% of GDP in 2015 (International Monetary Fund, 2011a).

Over the last two decades, and especially since 2000, public debt has been negatively correlated with output growth and capital formation in the Bahamas. The rapid growth slowdown started in 2006 (the yearly real GDP growth rate plummeted from 3.4% in 2005 to -5.4% in 2009) has been associated with a surge in public debt that, in five years, increased from 29 to 45 percent of GDP. In the last five years, a similar negative relationship emerges between the

[14]Where not otherwise specified, all data of Section 4 are taken from the April 2012 IMF World Economic Outlook database or from the latest IMF Article IV Consultation.

Figure 2: The Bahamas: government budget



Notes: calculations based on WEO database, April 2012.

debt-to-GDP ratio and capital formation, since total investment decreased from 30% of GDP in 2006 to 21.8% in 2010 (Figure 3).

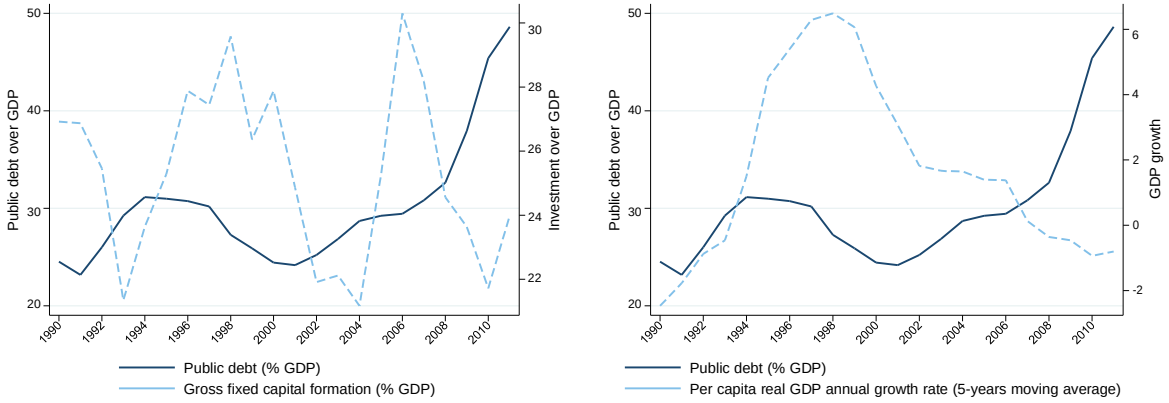
The evidence of the presence of debt overhang, the weak fiscal position and the growing debt ratio make fiscal consolidation the main policy priority. According to the International Monetary Fund (2011a), "a strong fiscal consolidation strategy is essential to place the public debt-to-GDP ratio on a sustainable path and to build buffers [. . .] *to mitigate the impact of natural disasters and external shocks."*

The role of tourism shocks

The Bahamas are extremely dependent on the tourism economy: according to the World Development Indicators, international tourism receipts accounted for 28 percent of GDP, on average, during the last 15 years and they represented more than 60 percent of export value in 2009. However, receipts from international tourism and the number of arrivals have been highly volatile (Figure 4, left panel). The number of visitors, in particular, sharply declined during the recent crisis, reaching the values of the late 1980s. The right-hand side diagram of Figure 4 shows that the volatility of arrivals, as measured by its cyclical component, is strongly correlated with the cycle of government revenues and real output. This evidence would justify the adoption of the augmented Fan Chart model to have a more comprehensive assessment of debt sustainability, which endogeneize the effect of the tourism sector on the fiscal balance.

The results of the VAR(1) system described by equations (7)-(9) are reported in Table 2. While in the augmented version of the Fan Chart the number of visitors is positively correlated with government revenues, its coefficient is not statistically significants. Thus, the results of

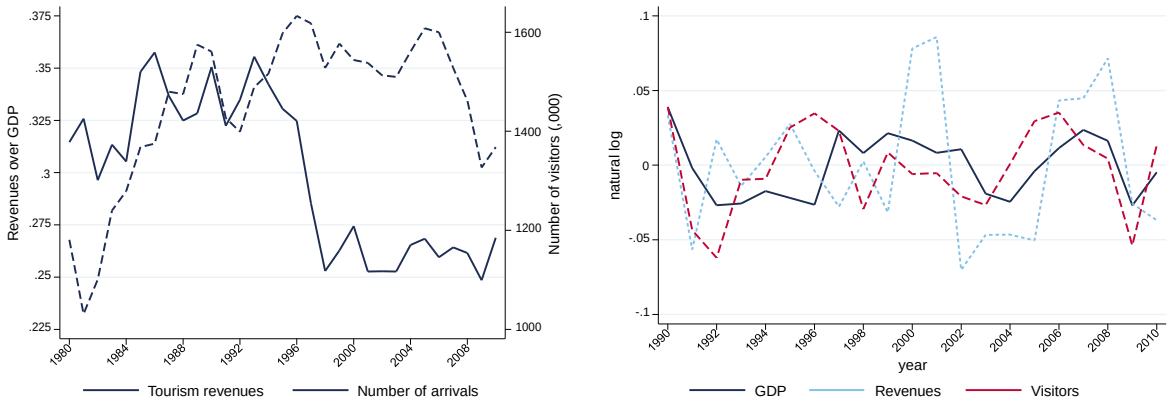
Figure 3: Debt, investment and growth in the Bahamas



(a) Debt and investment (b) Debt and growth

Notes: Calculations based on WEO database, April 2012. Data on GDP growth are five-year moving averages.

Figure 4: The Bahamas: the role of tourism



(a) Tourism economy (b) Volatility of visitors, GDP and government revenues

Notes: Calculations based on WEO (April 2012) and WDI data sets, and Central Bank of Barbados data. In the right panel, each variable measure the cyclical component of the natural logarithm of real GDP, real government revenues and number of visitor arrivals, and it is detrended using the Hodrick and Prescott (1997) filter (bandwidth: 6.25).

the Fan Chart, reported in Figure 5, should be interpreted with caution[15]. The actual figures may not be precisely estimated, but the overall picture remains valid and confirms that the inclusion of the volatility of tourism affects the DSA. The central path of the debt-to-GDP ratio projected with the augmented model lies well above the one projected with the baseline model. More important, the standard deviation of the probability distribution significantly increases from 0.08 to 0.15, suggesting that feedbacks effect of the tourism sector on the fiscal position of the domestic economy can have relevant consequences on the assessment of debt sustainability.

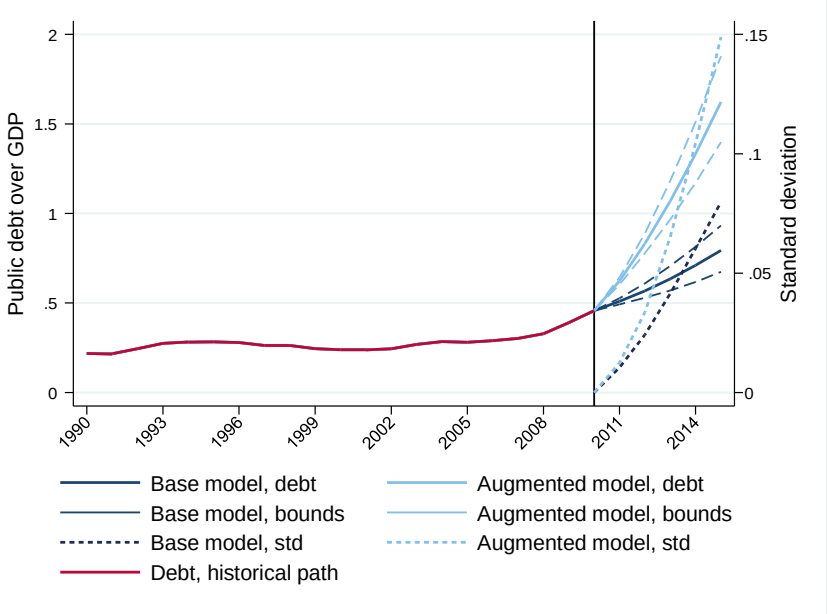
[15]The Fan Chart reports the central path of the debt-to-GDP ratio and the 5^{th} and 95^{th} percentile of the simulated distributions under the base and the augmented models. The dotted lines represent the standard deviation of the projections.

Table 2: The Bahamas: results from the VAR of the augmented Fan Chart approach

	Dependent variable:		
	EXP_t	REV_t	
	eq (7)	eq (8)	eq (9)
Constant	-0.325*	-0.364**	-1.623
	(0.185)	(0.319)	(2.211)
REV_{t-1}		0822***	0.793***
		(0.120)	(0.183)
GDP_t	0.188*	0.206	0.205
	(0.097)	(0.166)	(0.219)
$VISITORS_t$			0.171
			(0.324)
EXP_{t-1}	0.893***		
	(0.063)		

Notes: The table reports regression coefficients of the OLS estimation of equations (7)-(9) and, in parenthesis, the associated standard errors. * significant at 10%, **5%, ***1%.

Figure 5: The Bahamas: baseline and model augmented with total visitors



Notes: Calculations based on WEO database, April 2012, and Central Bank of Barbados data. The Fan Chart reports the central path of the debt-to-GDP ratio and the 5^{th} and 95^{th} percentile of the simulated distributions under the baseline and the augmented models. The dotted lines represent the standard deviation of the projections.

4.2 Barbados

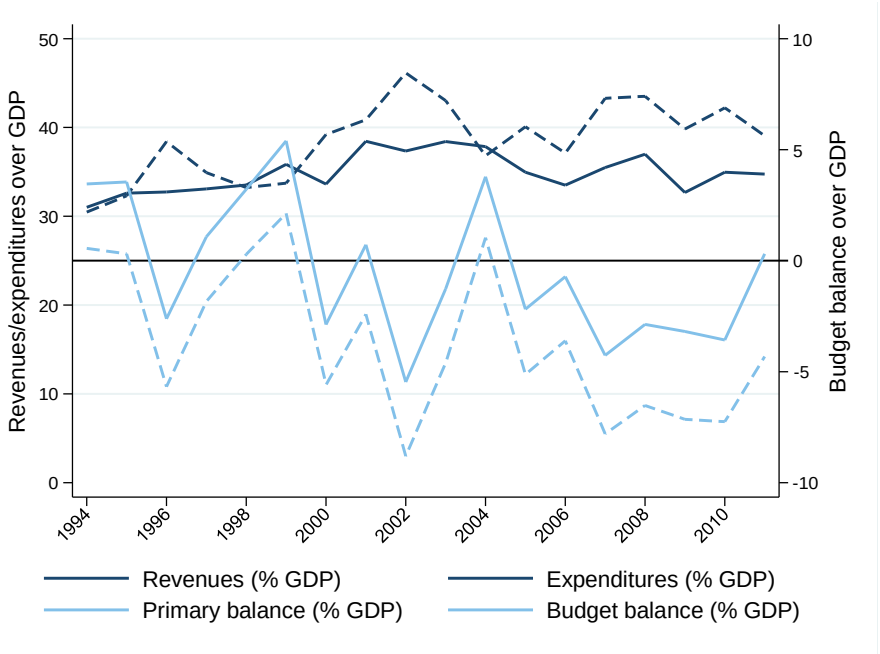
The macroeconomic and fiscal framework

The economy of Barbados has been hardly hit by the global financial crisis. Tourism arrivals plummeted by almost 9 per cent in 2009, even if they increased by 2.6 per cent and by 6.7 per cent in 2010 and 2011. The positive trend in the number of arrivals has been offset by a shorter length of stay and by tourists limited spending; as a result, tourism

expenditures declined substantially (15% in real terms in July 2011, on yearly basis). Real GDP growth has followed a similar pattern: after a sharp fall in 2009 (-4.2%), a weak recovery followed in 2010 and 2011. Projections for the period 2012-2012 ranges between 1.2 and 2 per cent (International Monetary Fund, 2012a).

As showed by Figure 6, the loosening of fiscal policy in response to the crisis has widened the government deficit, piling up on a rising debt-to-GDP ratio. The government reacted to the crisis increasing counter-cyclical public spending. Rising government expenditures (passed from 37.1% of GDP in 2006 to 42.2% of GDP in 2010) and falling revenues (passed from 37% to 32.7% of GDP between 2008 and 2009) severely deteriorated the fiscal stance. The fiscal deficit almost doubled with respect to the 2006 value, reaching 7.2 percent in 2010, while public debt amounted to 117 percent of GDP in 2010, almost 40 percentage points more than in 2007.

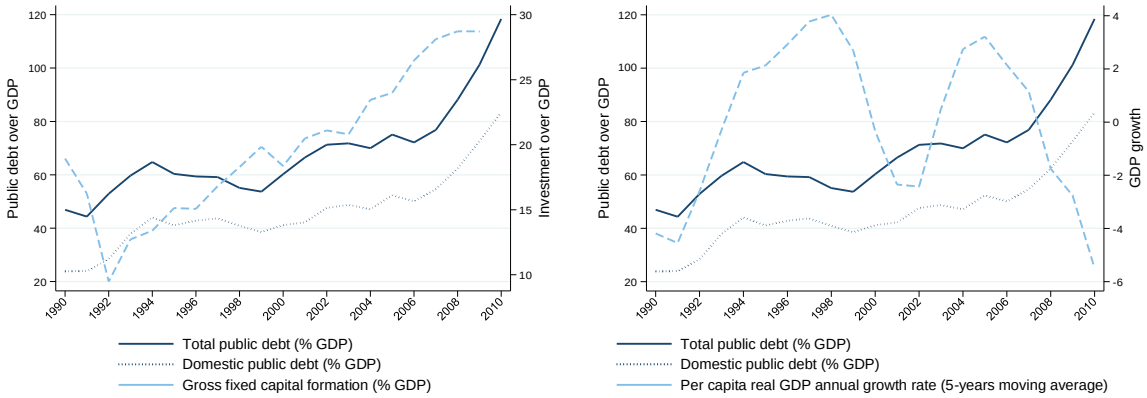
Figure 6: Barbados: government budget



Notes: calculations based on WEO database, April 2012. Data on GDP growth are five-year moving averages.

The evolution of public debt, investment and growth over the last 20 years show that, while total public debt went hand-in-hand with capital formation (the correlation between public debt and investment is equal to 0.43 and it is statistically significant, see Figure 7, left panel), while there is almost no correlation between public debt and output growth (the coefficient of correlation is equal to -0.06, see Figure 7, right panel). However, considering exclusively external public debt, the correlation with investment is stronger while the one with GDP growth is negative and statistically significant (the coefficient of correlation is equal to 0.64). This descriptive evidence points to the presence of a high debt — high investment — low growth scenario, which is consistent with a negative effect of (external) debt on the economy working not through capital accumulation, but via a low productivity growth (Blavy, 2006; Pattillo, Poirson and Ricci, 2011).

Figure 7: High debt, high investment, and low growth in the Barbados



(a) Debt and investment

(b) Debt and growth

Notes: calculations based on Central Bank of Barbados and World Development Indicators data

Over the course of the past 20 years, in fact, total factor productivity has declined, on average, by about 1-2 percent a year (International Monetary Fund, 2010).

A recent analysis of the sectorial and macroeconomic vulnerabilities of Barbados points out that, while the financial system and the corporate and household sectors present limited vulnerabilities, the weak performance of last years has further deteriorated the balance sheet of the non-financial public sector. Public debt is mostly domestic (external debt amounted to 32% of GDP and domestic debt to 85% to GDP in 2010), held by stable investors, mainly the financial system and the National Insurance Scheme, and denominated in domestic currency[16]. These elements attenuate the solvency risk. However, the accumulation of a net negative foreign currency position is exposing the non-financial public sector to exchange rate shocks. A 30 percent devaluation of the Barbadian dollar would determine a contraction of three percentage points of GDP, given the large losses incurred by the public sector (Yartey, 2012).

The role of tourism shocks

Tourism is the main source of foreign exchange and value added in Barbados (Worrell et al., 2011): according to the World Development Indicators, between 1995 and 2010 international tourism receipts accounted for 31 percent of GDP, on average, and for more than half of export revenues (60% in 2009). The high dependence on the tourism sector is a major source of vulnerability for the domestic economy. Furthermore, tourism arrivals and receipts depend on external market conditions (and especially on the business cycle of UK and and US), as the recent crisis years make it evident, increasing the volatility of the economy.[17]

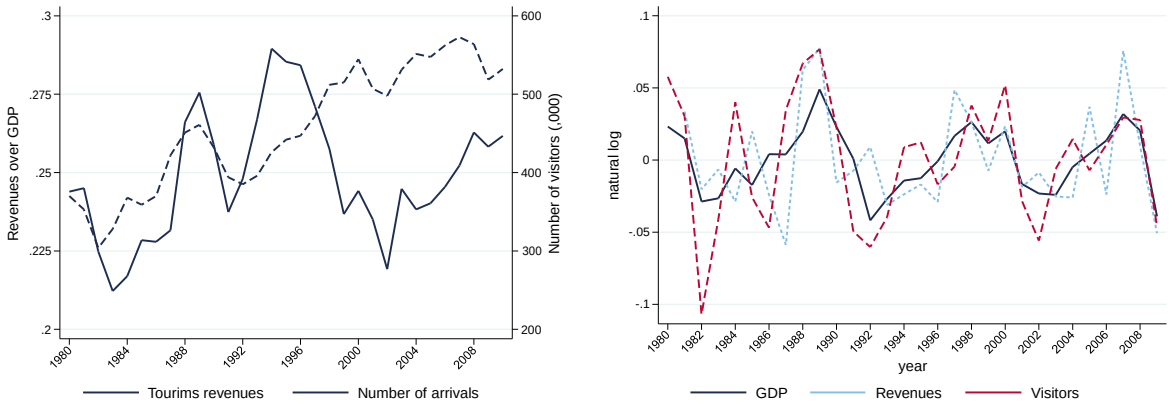
[16] Public debt help by foreign residents is mostly long-term.

[17] The dependence of the Barbados economy on the growth performance in UK and US has been particularly evident during the 1991-92 and 2001 episodes, when growth barely dipped below zero in the two advanced economies, but triggered economic recessions in Barbados (International Monetary Fund, 2010).

Fiscal policy and debt sustainability analysis can be significantly affected by the volatility of the tourism economy, since this is the most relevant variable affecting government revenues.

Figure 8 shows the evolution of the number of arrivals and tourism revenues (left panel) and the correlation between the cyclical components of tourism arrivals, government revenues and real GDP (right panel). Since 1980, the number of visitors followed a positive trend and the external negative shocks had only a transitory effect on tourism arrivals, which generally bounced back to original levels after the shock (Browne, Edwards and Moore, 2009). By contrast, the historical pattern of receipts from international tourism is more volatile and without a clear upward trend. Shorter staying periods and less spending can have a severe impact on the domestic economy and the fiscal balance. To measure to what extent external shocks may affect debt sustainability, we compare the evolution of the cyclical components of the number of arrivals, government revenues and real output. The right panel of Figure 8 highlights that the volatility of the number of visitors is associated with the cyclical component of revenues and real output, with the former being more volatile than the latter.[18] Thus, it seems important to introduce the vulnerability of the tourism sector into a formal model of debt sustainability.

Figure 8: Barbados: the role of tourism



(a) Tourism economy (b) Volatility of visitors, GDP and government revenues

Notes: Calculations based on WEO (April 2012) and WDI data sets, and Central Bank of Barbados data. In the right panel, each variable measure the cyclical component of the natural logarithm of real GDP, real government revenues and number of visitor arrivals, and it is detrended using the Hodrick and Prescott (1997) filter (bandwidth: 6.25).

The augmented Fan Chart approach described in Section 3.2 allows for the possibility of including the number of arrivals as an additional variable in the revenue equation 9. The results of the VAR(1) system described by equations (7)-(9) are reported in Table 3. In the baseline model, revenues are positively correlated with GDP, while in the augmented model the inclusion of the number of arrivals makes the coefficient on GDP smaller and no more statistically significant, By contrast, the elasticity of revenues with respect to international arrivals is statistically significant and equal to 0.46. Therefore, in the augmented FC approach the volatility of the tourism sector is assumed to endogenously impact the fiscal balance.

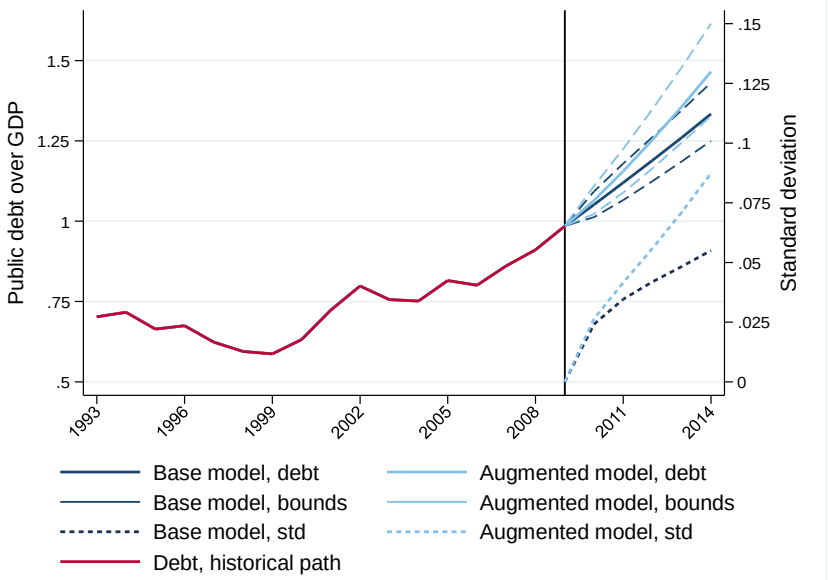
[18]The standard deviation of the cyclical component of revenues is 0.036, while the standard deviation of the cyclical component of real GDP is 0.023.

Table 3: Barbados: results from the VAR of the augmented Fan Chart approach

	Dependent variable:		
	EXP_t	REV_t	
	eq (7)	eq (8)	eq (9)
Constant	-0.829***	-0.384**	-6.522***
	(0.178)	(0.141)	(2.018)
REV_{t-1}		0.644***	0.537***
		(0.123)	(0.113)
GDP_t	1.234***	0.621**	0.191
	(0.238)	(0.234)	(0.247)
$VISITORS_t$			0.458***
			(0.150)
EXP_{t-1}	0.271*		
	(0.150)		

Notes: The table reports regression coefficients of the OLS estimation of equations (7)-(9) and, in parenthesis, the associated standard errors. * significant at 10%, **5%, ***1%.

Figure 9: Barbados: baseline and model augmented with total visitors



Notes: Calculations based on the WEO database, April 2012, and on Central Bank of Barbados data. The Fan Chart reports the central path of the debt-to-GDP ratio and the 5^{th} and 95^{th} percentile of the simulated distributions under the baseline and the augmented models. The dotted lines represent the standard deviation of the projections.

The visualization of the baseline and augmented Fan Chart models are presented in Figure 9. From the diagram it is evident that the cone of uncertainty increases in the augmented model with respect to the standard Fan Chart: the standard deviation of the simulations is higher in the augmented model than in the baseline case. Besides, the debt to GDP ratio has an upward slope trajectory in the augmented model that lies above the one of the baseline case, suggesting that neglecting the feedback effects of tourism shocks on the government budget leads to an underestimation of the debt-to-GDP ratio and of its variability.

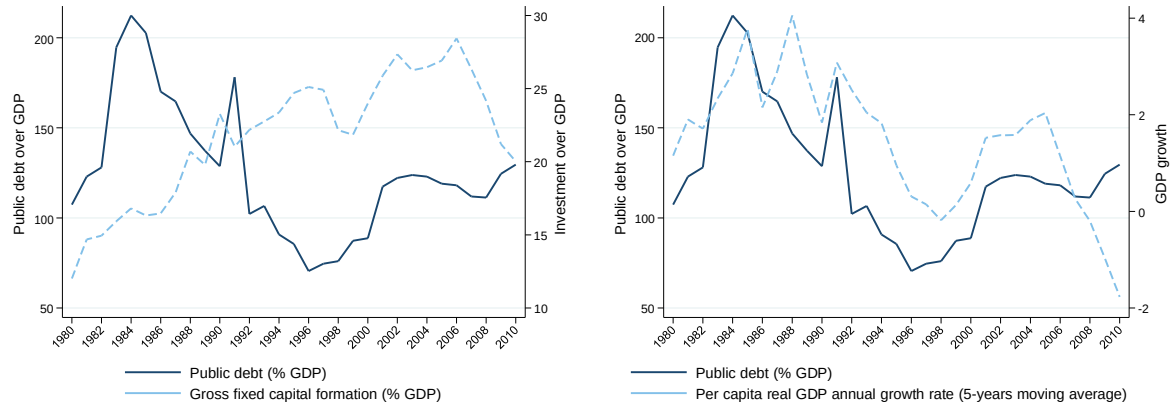
Under the standard Fan Chart approach, public debt is projected to reach 133 percent of GDP by 2014, with a 90 percent probability of being between 125% and 143% of GDP. With the augmented model, the central projection is at 146% of GDP, while the confidence interval bounds widen at 133% and 161%.

4.3 Jamaica

The macroeconomic and fiscal framework

Jamaica represents an interesting case study to assess the impact of public debt on economic growth in emerging markets. Starting in the 1980s, investment grew substantially reaching over 28 percent of GDP in 2006, while economic growth deteriorated and reached an average yearly growth rate of 0.4 percent between 1996 and 2010 (Figure 10). As with Barbados, this "low growth-high investment" paradox is often ascribed to a stagnant productivity. The rise in government debt, accelerated after the 1995 financial crisis, is one of the factors behind the low productivity growth. Public debt sharply increased from 70 percent of GDP in 1996 to about 120 percent in the mid-2000s. In that period, debt overhang lowered total factor productivity because of an inefficient allocation of resources and delayed structural and macroeconomic reforms. The distortionary effect of high tax rates needed to serve public debt would be an incentive to the development of the less-productive informal sector. Finally, high debt-servicing costs have reduced the fiscal space available for productivity-enhancing public spending, including public investment (Artana and Naranjo, 2003; Blavy, 2006; Presbitero, 2010; World Bank, 2011).

Figure 10: The "low growth — high investment" paradox in Jamaica



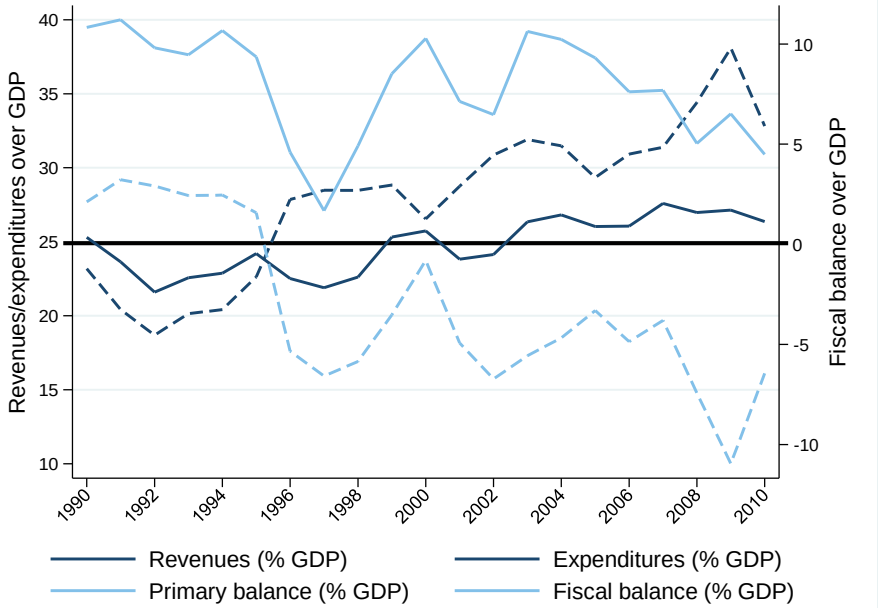
(a) Debt and investment

(b) Debt and growth

Notes: Calculations based on WEO database, April 2012, and on data from the Debt Management Unit (Ministry of Finance). Data on GDP growth are five-year moving averages.

The high public debt has strong implication for the fiscal balance, given the large share of interest expenditures over GDP in the yearly budget. Since 1990, debt service has accounted, on average, for 11 percent of GDP and almost 40 percent of government expenditures. As a result, the primary surplus has always been positive (see Figure 11) in order to try to stabilize the debt ratio. During the global recession, the domestic economy contracted by 1.7% in 2008, 2.6% in 2009 and 0.6% in 2010 and it is now weakly

Figure 11: Jamaica: government budget



Notes: Calculations based on WEO database, April 2012, and on data from the Central Bank of Jamaica.

recovering.[19] The fiscal position, however, is still worsening and the primary surplus has been lower than expected. The government deficit was equal to 6.4 percent of GDP in FY2011/12, mainly because of a lower than expected revenues[20] and public debt rose to 140 percent of GDP. According to the IMF, lacking strong fiscal and structural reforms, public debt will reach 150% of GDP in the medium term, because of sluggish growth and a weak fiscal stance. Therefore, the growing public debt, rising expenditures, related to potential weaknesses in expenditure management, and debt overhang make a fiscal stabilization program is a key priority for the government.[21]

The role of tourism shocks

About one fourth of Jamaica's GDP in 2011 has been related, directly or indirectly to travel and tourism, which are the largest source of external current inflows (World Travel & Tourism Council, 2012). The number of visitor arrivals has steadily increased since 1990, almost doubling in 2010, when the number of stopover arrivals was close to 2 million, 1.2 million coming from the US. The share of international tourism receipts over GDP, instead, has been quite stable around 16% (Figure 12, left panel).

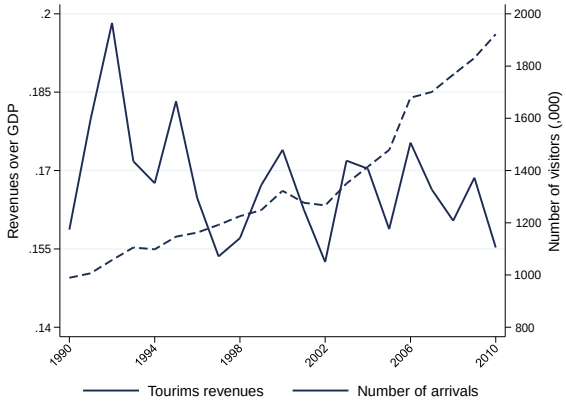
[19] Jamaica signed a Stand-By Agreement with the Fund in February 2010 for SDR 850 million. The program ended in May 2012 and Jamaica drew SDR 542 million.

[20] According to the latest IMF Public Information Notice (No. 12/56, June 7, 2012), this is mainly due to "*lower tax revenues associated with cuts in fuel taxes, weak tax administration, and widespread use of tax incentives and waivers*".

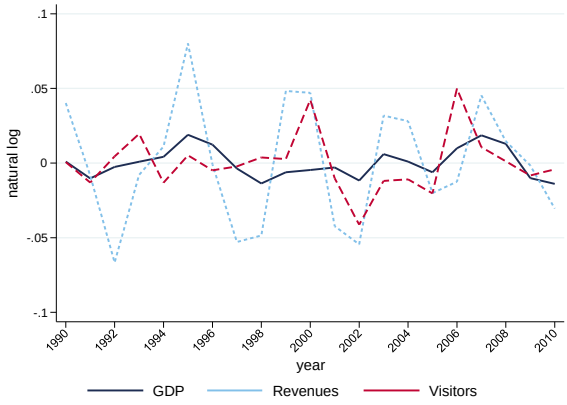
[21] A tax system reform, the design of sound budgetary institutions and debt management are long-lasting issues in Jamaica (see, for instance, the discussion by Artana and Naranjo, 2003, relative to the early 2000s) and the 2007 special issue of the Public Finance Review (Bahl and Wallace, 2007).

During the FY 2010/2011, when real output contracted by 0.5%, tourism has been the only sector showing a positive growth rate. Thus, differently from the recent trends in tourism in the Bahamas and Barbados, the Jamaica tourism economy has hardly been hit by the global slowdown and by the US recession, in particular. More generally, the tourism sector is certainly an important source of revenues and value added in Jamaica, but it is less volatile than elsewhere in the Caribbean. The right-hand side diagram of Figure 12 shows that the cyclical component of the series of number of arrivals has been quite stable since 1990. Only in the last decade there has been some relevant deviation from the trend, after the September 11, 2001 terrorist attack and during the recent crisis. By contrast, government revenues have been much more volatile, with a standard deviation of the cyclical component twice the one of the number of arrivals.

Figure 12: Jamaica: the role of tourism



4.3.1.1 Tourism economy



4.3.1.2 Volatility of visitors, GDP and government revenues

Notes: Calculations based on data from the WEO (April 2012), the WDI, Jamaica Tourist Board (for tourist arrivals), Central Bank of Jamaica and the Debt Management Unit (Ministry of Finance). In the right panel, each variable measure the cyclical component of the natural logarithm of real GDP, real government revenues and number of visitor arrivals, and it is detrended using the Hodrick and Prescott (1997) filter (bandwidth: 6.25).

Notwithstanding the arrivals grew quite steadily in recent years. To measure the importance of tourism on the domestic economy would require an assessment of debt sustainability even taking into account the possible effects of external shocks of tourism on the fiscal balance. The results of the estimation of the VAR(1) system which is the base for the augmented Fan Chart model (equations (7)-(9)) are reported in Table 4. The main findings are in line with the descriptive evidence showed on the right panel of Figure 12. The high variability of revenues is confirmed by the high standard errors of the coefficient on lagged revenues; the stable trend in stopover arrivals, instead, is reflected in the lack of significance of the *VISITORS* variable.

The Fan Charts built on the ground of these results are reported in Figure 13. With a 95 percent level of confidence, the debt-to-GDP ratio in 2015 will be bounded between 186% and 210%, according to the baseline model, or between 181% and 203%, according to the augmented model. Consinstently with what discussed so far, the tourism sector, while being a large one in Jamaica, does not seem to be an additional source of fiscal volatility.

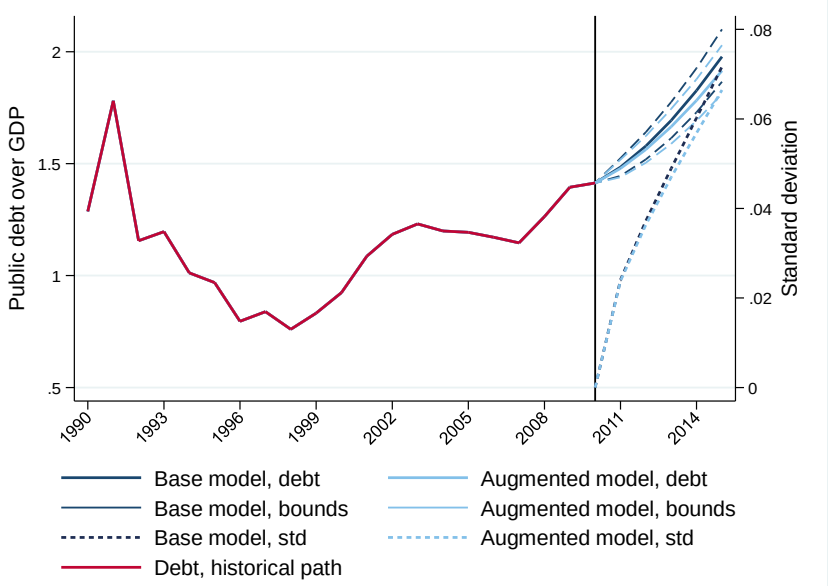
Table 4: Jamaica: results from the VAR of the augmented Fan Chart approach

	Dependent variable:		
	EXP_t	REV_t	
	eq (7)	eq (8)	eq (9)
Constant	-8.718***	-6.717***	-6.079***
	(2.825)	(1.681)	(1.983)
REV_{t-1}		0.273*	0.204
		(0.159)	0.196
GDP_t	1.606***	1.598***	1.452***
	(0.491)	(0.360)	(0.431)
$VISITORS_t$			0.093
			(0.145)
EXP_{t-1}	0.625***		
	(0.124)		

Notes: The table reports regression coefficients of the OLS estimation of equations (7)-(9) and, in parenthesis, the associated standard errors. * significant at 10%, **5%, ***1%.

The debt-to-GDP ratio is projected to follow similar upward trends both in the baseline and in the augmented Fan Chart models and the variability of projections is quite similar (it is actually slightly smaller in the augmented model).

Figure 13: Jamaica: baseline and model augmented with total visitors



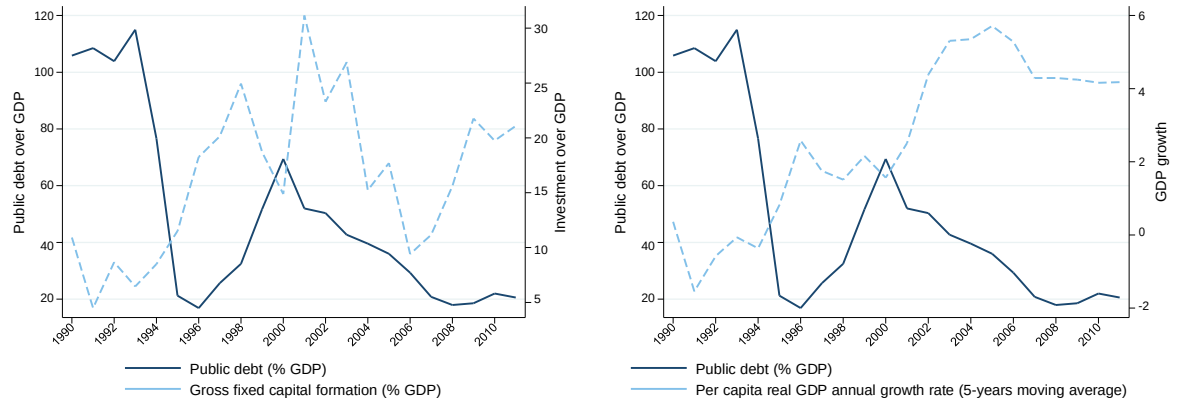
Notes: Calculations based on data from the WEO (April 2012), the WDI, Jamaica Tourist Board (for tourist arrivals), Central Bank of Jamaica and the Debt Management Unit (Ministry of Finance). The Fan Chart reports the central path of the debt-to-GDP ratio and the 5^{th} and 95^{th} percentile of the simulated distributions under the baseline and the augmented models. The dotted lines represent the standard deviation of the projections.

4.4 Suriname

The macroeconomic and fiscal framework

The dependence on mining exports, exogenous shocks and inadequate macroeconomic policy responses were the roots of volatile output growth, fiscal revenue volatility, and high inflation episodes during the 1990s (Fritz-Krockow et al., 2009). Since 2000, GDP growth increased — the average yearly growth rate has been close to 5 percent — and public debt declined from 70 to 20 percent of GDP (Figure 14, right panel). On the whole, the visual inspection of the evolution of public debt, output growth and investment suggests that debt overhang has been associated with low capital accumulation and GDP growth (Figure 14). Between 1990 and 2011, the correlation between the debt-to-GDP ratio and real growth (investment over GDP) has been negative and equal to -0.62 (-0.53).

Figure 14: Debt, investment and growth in Suriname



(a) Debt and investment

(b) Debt and growth

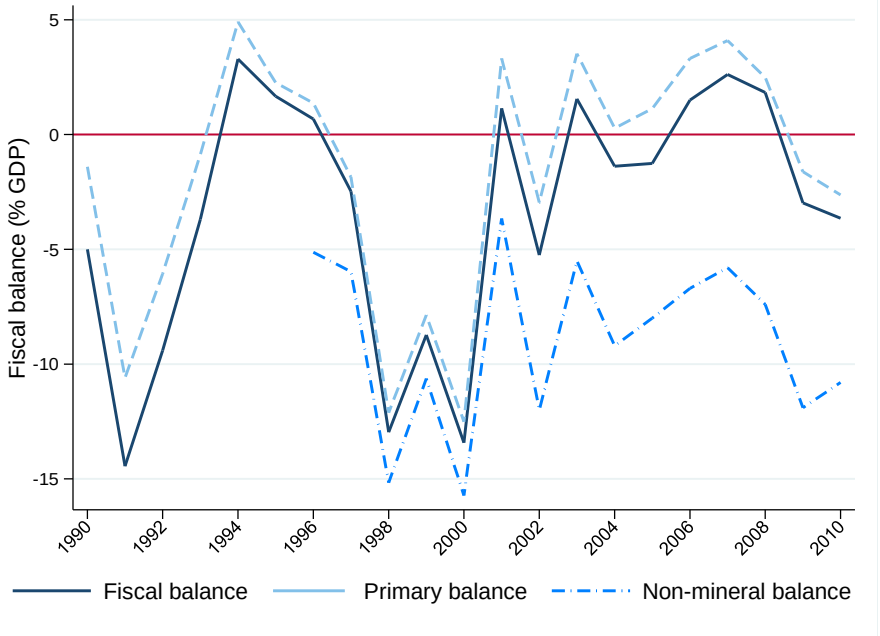
Notes: Calculations based on WEO database, April 2012. Data on GDP growth are five-year moving averages.

Notwithstanding positive growth rates throughout the global financial crisis, the fiscal position worsened in 2009 (Figure 15). The overall fiscal deficit is estimated to have shifted from a surplus of 2.2 percent of GDP during 2007–08 to a deficit of 3.3 percent of GDP during 2009–10 and public debt increased moderately from 18 percent of GDP in 2008 to 21.6 % in 2010, but still remaining at a relatively low level (International Monetary Fund, 2011b) [22]. In addition to the worsening fiscal stance, fiscal policy and debt sustainability are undermined by the strong dependence of government revenues on the mineral sector. As shown in Figure 15, since 2004 mineral revenues accounted for about 7-9 percent of GDP and they are expected to rise in the medium term. While, if properly managed, they can contribute to raise potential output and productive capacity [23], the high dependence on the mineral sector represents an additional source of fiscal vulnerability.

[22] A word of caution in interpreting these data is required. In April 2012 revised and improved national accounts data, rebased to 2007, were released, indicating that nominal GDP in 2010 was about 20 percent higher than previously assessed. Historical data, instead, are generally missing before the 1990s, because of the unstable political situation, and some basic information on government revenues still lacks for the 1990s. Data on mineral revenues, which are relevant for our analysis, start in 1996.

[23] The government has recently announced the establishment of a sovereign wealth fund designed to retain

Figure 15: Minerals revenues and government budget in Suriname



Notes: Calculations based on WEO database, April 2012, IMF Staff Reports (various issues) and Fritz-Krockow et al. (2009).

World market price changes for bauxite, gold and oil have caused significant volatility in tax revenues in the past (Fritz-Krockow et al., 2009, chapter 3), and they may pose significant additional risks to the debt sustainability analysis.

The role of mineral revenues

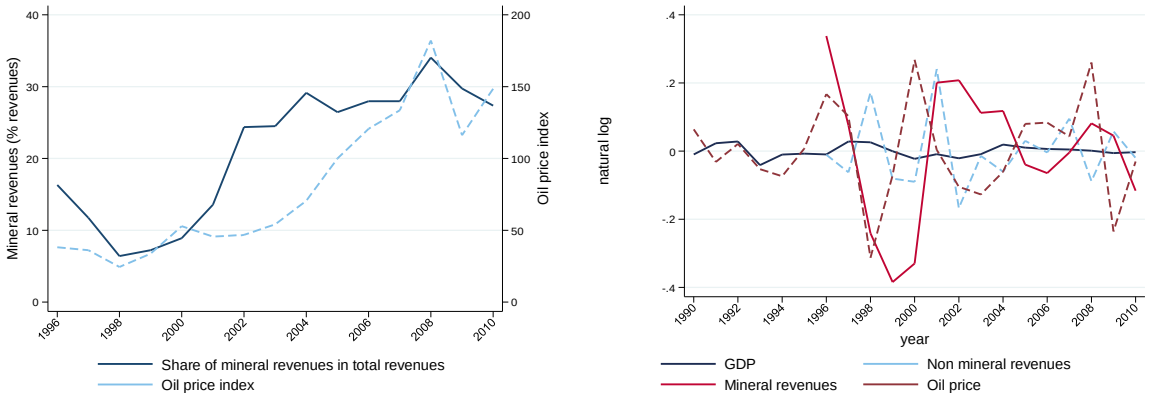
As discussed in the previous section, the economy of Suriname has been historically vulnerable to changes in world commodity prices; the mineral sector has growth over the last decade and it now contributes for almost 9 percent of domestic product. Government revenues from the mineral sector steadily increased since 2000 and they represented almost one third of total revenues in 2011. The rise in mineral revenues has largely benefited from the increase in oil prices in the 2000s (Figure 16, left panel). The dependence on world prices, however, is a source of vulnerability, as shown by the volatility of the cyclical component of oil prices and mineral revenues (Figure 16, right panel). In particular, the volatility of oil prices is reflected in the higher volatility of mineral revenues than of non-mineral revenues[24]. Output growth, instead, has been more stable, suggesting that external shocks might be a severe problem especially for fiscal policy.

To assess how debt sustainability may be affected by the variability of commodity prices,

revenues from the mining sector for future generations and to mitigate fiscal volatility.

[24]The standard deviation of the cyclical component of mineral revenues is equal to 0.20, while the one of non-mineral revenues is 0.11. The oil price index (average of U.K. Brent, Dubai, and West Texas Intermediate) has been taken as a measure of exogenous shock. Similar results hold using the aluminum price or a weighted average of oil and metal prices indexes.

Figure 16: The volatility of minerals revenues and debt sustainability in Suriname



(a) government revenues and expenditures

(b) business cycle

Notes: Calculations based on WEO database, April 2012, IMF Staff Reports (various issues), Fritz-Krockow et al. (2009) and the IMF Primary Commodity Prices data set. In the right panel, each variable measure the cyclical component of the natural logarithm of real GDP, real oil and non-oil government revenues and the oil price index (average of U.K. Brent, Dubai, and West Texas Intermediate), and it is de-trended using the Hodrick and Prescott (1997) filter (bandwidth: 6.25).

we augment the Fan Chart approach along the lines described in Section 3.2; specifically, the baseline revenue equation 8 is substituted by the two equations 10 and 11 describing, respectively, the behavior of non-mineral and mineral revenues. Results are reported in Table 5, which shows that the elasticity of mineral revenues to the oil price is quite large (0.48) and statistically significant.

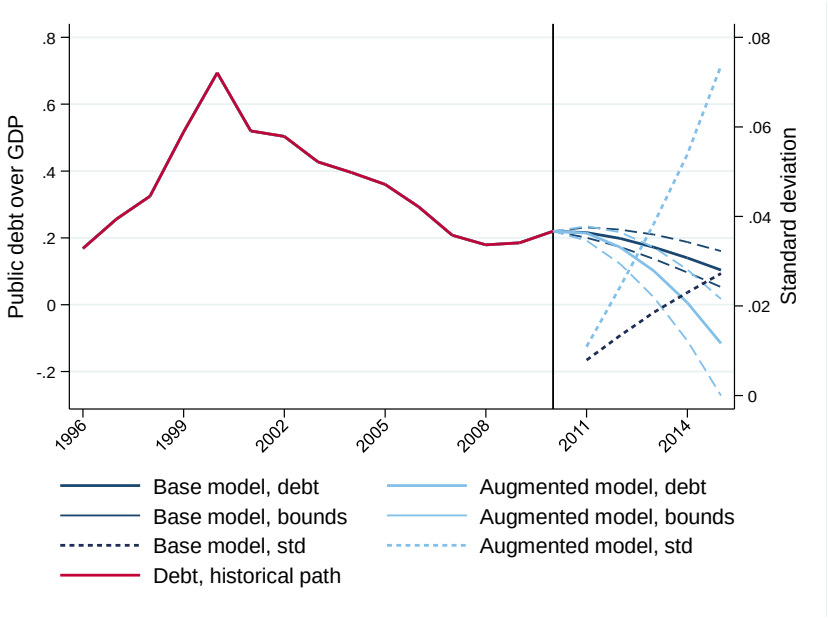
Table 5: Suriname: results from the VAR of the augmented Fan Chart approach

	Dependent variable:			
	EXP_t	REV_t	$NONMIN\ REV_t$	$MIN\ REV_t$
	eq (7)	eq (8)	eq (10)	eq (11)
Constant	-2.873	-1.083**	-5.778**	-5.514**
	(1.777)	(0.408)	(2.165)	(2.346)
REV_{t-1}		0.535***		
		(0.158)		
GDP_t	0.297	0.592***	0.317	
	(0.242)	(0.195)	(0.232)	
$NONMIN\ REV_{t-1}$			-0.099	
			(0.292)	
$MIN\ REV_{t-1}$				0.572**
				(0.190)
$OIL\ PRICE_t$				0.479**
				(0.208)
EXP_{t-1}	0.314			
	(0.262)			

Notes: The table reports regression coefficients of the OLS estimation of equations (7), (10) and (11) and, in parenthesis, the associated standard errors. * significant at 10%, **5%, ***1%.

With the VAR (1) estimates of Table 5 it is possible to simulate the evolution of the public debt-to-GDP ratio (equation 4) for a horizon period of five years (starting point 2010). The FC approach forecasts and simulates 10,000 times the sequences of GDP and oil price for five periods ahead and, for each simulation, retrieves the values of revenues and expenditures required to pin down the value of primary surplus to include in the simplified version of equation 4. Figure 17 displays the evolution of the baseline model and the one of the augmented model, where the oil price is included. From the diagram it is evident that in the augmented model the variability of the debt projections is much higher than under the baseline model: the standard deviation of the projections at five years increases are, respectively, 0.07 and 0.03. Moreover, this simulation shows that the path of the debt ratio is declining, especially when oil prices are included in the model. In this case, the downward trend is particularly steep and the debt-to-GDP ratio goes to zero in 2014. Anyway, we would like to stress again that the main implication of this exercise is the increase in volatility of debt projections, rather than the precision of their point estimates, which rely on a VAR(1) system estimated with annual data on a few years.

Figure 17: Suriname: baseline and model augmented with oil prices



Notes: Calculations based on WEO database, April 2012, IMF Staff Reports (various issues), Fritz-Krockow et al. (2009) and the IMF Primary Commodity Prices data set. The Fan Chart reports the central path of the debt-to-GDP ratio and the 5^{th} and 95^{th} percentile of the simulated distributions under the baseline and the augmented models. The dotted lines represent the standard deviation of the projections.

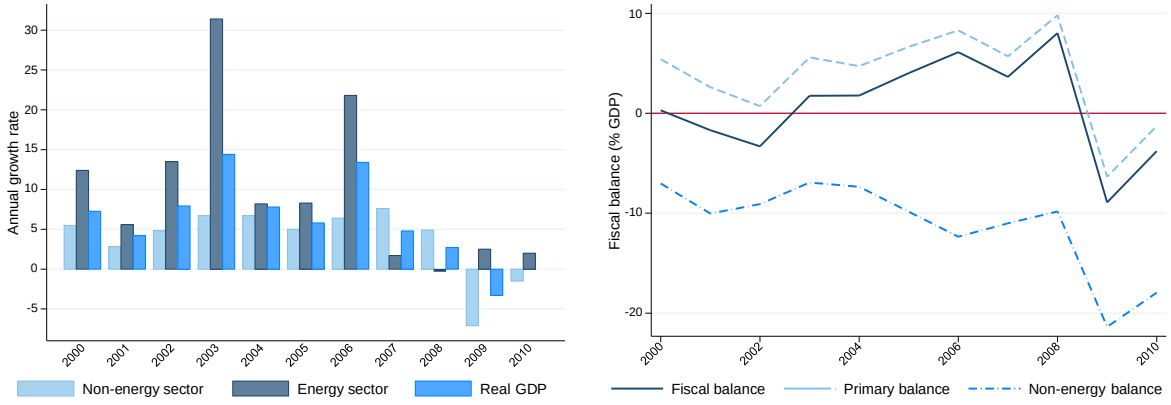
4.5 Trinidad and Tobago

The macroeconomic and fiscal framework

Trinidad and Tobago is highly dependent on the energy sector, which accounts for almost half of domestic output and whose performance has been traditionally volatile and has significantly influenced output growth (see Figure 18, left panel and next section).

While the economic outlook is quite positive, the fiscal position is projected to deteriorate. Trinidad and Tobago is expected to growth at 1.7% in 2012, after the severe contraction in 2009 (-3.3%) and the additional slowdown (-1.3%) in 2011. Public sector debt has reached 37% of GDP in FY 2011/2012, after a sharp increase of 12 percentage points in the last four years, mainly due to the collapse of the financial sector and to the deteriorating fiscal budget (Figure 19). The latest IMF projections point out that public debt may further increase following a worsening of the fiscal stance, due to a decline in energy output, rising expenditures and almost constant revenues (International Monetary Fund, 2012*c*). In 2009-2010 government expenditures reached almost 40 percent of GDP, while they averaged 28.4% of GDP over the previous decade. As a result, the budget balance abruptly passed from a surplus to a strong deficit in 2009 and 2010 (Figure 18, right panel), and it is projected to remain in deficit in the medium term.

Figure 18: Trinidad and Tobago: the energy sector and the government budget



(a) Real GDP growth

(b) Government budget

Notes: Calculations based on WEO database, April 2012, and on Central Bank of Trinidad and Tobago data.

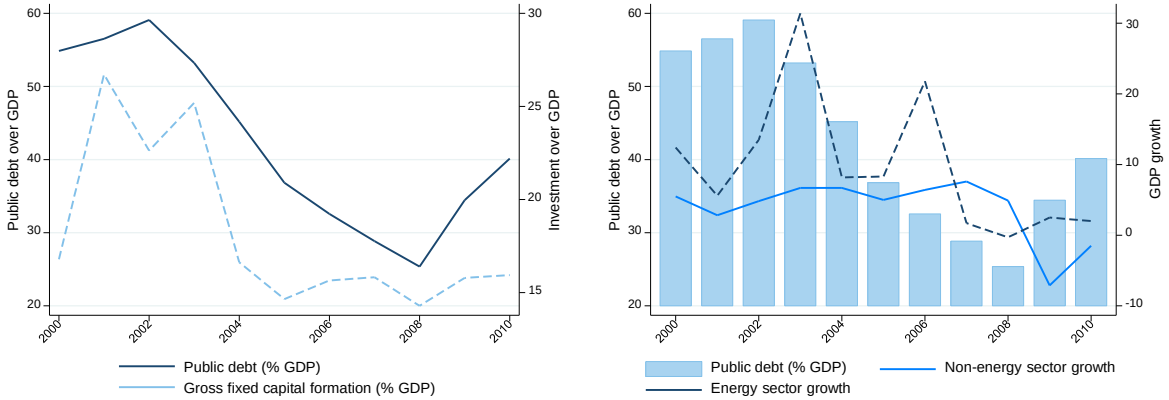
The descriptive analysis of the past evolution of public debt, investment and growth, showed in Figure 19, does not suggest that debt overhang has been a problem in Trinidad and Tobago. In particular, the investment rate and the debt-to-GDP ratio are strongly correlated (the coefficient of correlation is equal to 0.79), suggesting that the high debt was not a disincentive to capital accumulation.

The role of the energy sector

In recent years, the energy sector has seen falling production, limited exploration activity, and declining reserves (see Figure 20, left panel). In 2008, at the peak of oil prices, the energy sector in Trinidad and Tobago accounted for the 49% of domestic GDP and for 57% of government revenues (Central Bank of Trinidad and Tobago, 2010). Hence, the energy sector remains at the center of the country's economy.

[25]The correlation between output growth in the energy sector and the non-energy sector is only 0.17, while the correlation between total output growth and the real growth of the energy sector is equal to 0.81.

Figure 19: Debt, investment and growth in Trinidad and Tobago

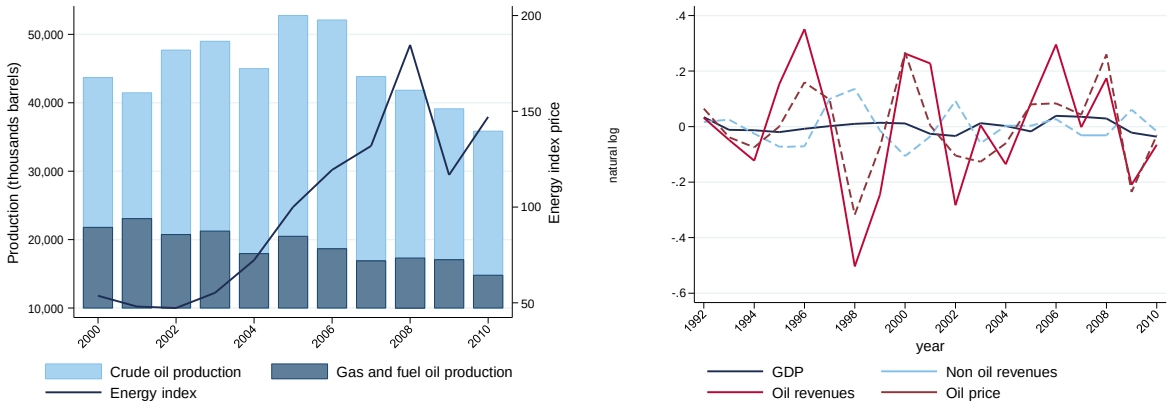


(a) Debt and investment (b) Debt and growth

Notes: Calculations based on WEO database, April 2012, and on Central Bank of Trinidad and Tobago data.

While the energy sector is expected to recover in the medium term, depleting energy reserves and uncertainties in the global energy markets represent significant risks (for a discussion of the development of the energy sector, see International Monetary Fund, 2012*d*).

Figure 20: Trinidad and Tobago: the role of the energy sector



(a) Energy production and prices (b) Volatility of oil price, GDP and revenues

Notes: Calculations based on WEO database, April 2012, IMF Primary Commodity Prices data set, and Central Bank of Trinidad and Tobago data. In the right panel, each variable measure the cyclical component of the natural logarithm of real GDP, real oil and non-oil government revenues and the oil price index (average of U.K. Brent, Dubai, and West Texas Intermediate), and it is detrended using the Hodrick and Prescott (1997) filter (bandwidth: 6.25).

The sharp increase in energy prices since 2002 (Figure 20, left panel) has boosted the domestic economy, at least until the onset of the global crisis (Figure 18, left panel). However, energy sector growth and energy revenues are highly volatile and depend on external conditions[25]

. The right-hand side of Figure 20 provides a simple representation of the linkages between the volatility of oil price and the one of government revenues. As well known, the cyclical component of the oil price series between 1992 and 2010 has been particularly volatile (the standard deviation is equal to 0.22).

As a consequence, energy revenues (standard deviation: 0.15) are much more volatile than non-energy revenues (standard deviation: 0.06) and, given the dominant share of the former in total government revenues, the lack of diversification of the country's economy is a significant source of vulnerability for fiscal policy and output growth.

To take into account the different evolution of energy and non-energy revenues and the effect of their volatility on the government budget and debt sustainability, we use the augmented Fan Chart approach. As for the exercise on Suriname (sub-section 4.4), the revenue equation used in the baseline model (see equation 8) is substituted by equations 10 and 11, which incorporate the effect of oil prices on the fiscal balance.

The results of the VAR(1) system described by these equations are reported in Table 6, from which it is evident that non-energy revenues are path-dependent and depend on output growth; while energy revenues are volatile (the lagged term is small and not statistically significant) and strongly dependent on the contemporaneous market price of oil (the elasticity is greater than one and it is statistically significant).

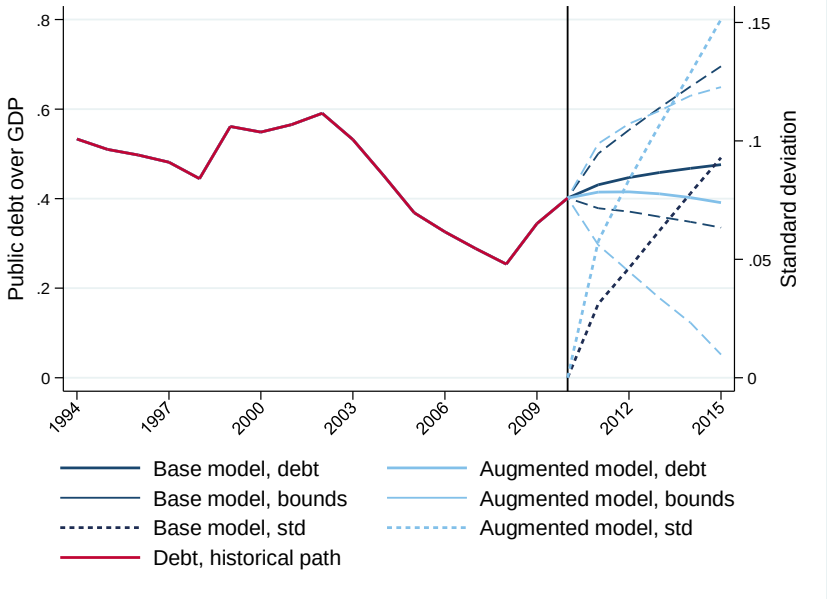
Table 6: Trinidad and Tobago: results from the VAR of the augmented Fan Chart approach

	Dependent variable:			
	EXP_t	REV_t	$NONMIN\ REV_t$	$MIN\ REV_t$
	eq (7)	eq (8)	eq (10)	eq (11)
Constant	-1.117**	-1.083**	-0.350	-3.200***
	(0.417)	(0.408)	(0.326)	(0.555)
REV_{t-1}		0.535***		
		(0.158)		
GDP_t	0.517**	0.592***	0.325*	
	(0.177)	(0.195)	(0.186)	
$NONMIN\ REV_{t-1}$			0.597**	
			(0.234)	
$MIN\ REV_{t-1}$				0.075
				(0.147)
$OIL\ PRICE_t$				1.148***
				(0.183)
EXP_{t-1}	0.635***			
	(0.132)			

Notes: The table reports regression coefficients of the OLS estimation of equations (7), (10) and (11) and, in parenthesis, the associated standard errors. * significant at 10%, **5%, ***1%.

The Fan Chart based on this VAR structure of the economy, together with the baseline FC, are represented in Figure 21. Two results emerge from the comparison between the baseline and the augmented model. First of all, the explicit inclusion of energy price volatility in the revenue equations greatly increases the variability of the debt projections. The standard deviation of the 5-year debt projections is 0.15 in the augmented model, but only 0.9 in the baseline. Second, the central projection of the augmented model is lower than the one obtained with the standard Fan Chart, given the upward trend in the oil price. However, the great uncertainty on the distribution of the simulated paths of the debt-to-GDP ratio in five years should be interpreted as a *caveat* about the actual reliability of point estimates.

Figure 21: Trinidad and Tobago: baseline and model augmented with oil prices



Notes: Calculations based on WEO database, April 2012, IMF Primary Commodity Prices data set, and Central Bank of Trinidad and Tobago data. The Fan Chart reports the central path of the debt-to-GDP ratio and the 5^{th} and 95^{th} percentile of the simulated distributions under the baseline and the augmented models. The dotted lines represent the standard deviation of the projections.

The main implication of this exercise, by contrast, is the identification of an important source of exogenous volatility, which should be considered to assess debt sustainability.

5. Concluding remarks and policy implications

The fiscal stance in some Caribbean countries is extremely critical and debt sustainability requires, in certain cases, a severe fiscal adjustment. Especially in times of crisis, the opposition to fiscal consolidation is strong, as more expansionary fiscal policies are often invoked to boost aggregate demand and ignite growth acceleration. Nevertheless, the literature has pointed out that, under certain conditions, episodes of fiscal consolidation may be expansionary. If fiscal consolidation is credible and large enough to restore debt sustainability, consumption may increase in response to a future lower taxation, assuming that agents can borrow from financial markets. Small or negligible multipliers imply that fiscal policy has a very limited effect on output, making the consolidation more likely to succeed.

Within this framework, we deepen the analysis to point out the vulnerability of Caribbean states to external shocks. The dependence of the tourism industry to the business cycle of US and other advanced economies, and to commodity price shocks increase the volatility of government revenue and add an additional source of risk for debt sustainability. We show that adapting the standard Fan Chart approach to include some country-specific vulnerabilities is generally associated with a significant increase in the variability of medium-run debt projections. Therefore, a prudent DSA should endogenize the effect of shocks on the government budget to assess how debt sustainability critically depends on external shocks.

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