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Riding the Storm:  
Fiscal Sustainability in the Caribbean

by Serhan Cevik and Vibha Nanda

I N T E R N A T I O N A L M O N E T A R Y F U N D

## IMF Working Paper

Western Hemisphere Department

### Riding the Storm: Fiscal Sustainability in the Caribbean

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#### Abstract

Fiscal sustainability remains a paramount challenge for small economies with high debt and greater vulnerability to climate change. This paper applies the model-based sustainability test for fiscal policy in a panel of 16 Caribbean countries during the period 1980–2018. The results indicate that the coefficient on lagged government debt is positive and statistically significant, implying that fiscal policy in the Caribbean takes corrective actions to counteract an increase in the debt-to-GDP ratio. Nonlinear estimations, however, show that the quadratic debt parameter is negative, which indicates that fiscal policy response is not adequate to ensure sustainability at higher levels of debt. We also find that the fiscal stance tends to be countercyclical on average during the sample period. These empirical results confirm that maintaining prudent fiscal policies and implementing growth-enhancing structural reforms are necessary to build fiscal buffers and ensure debt sustainability with high probability even when negative shocks occur over the long term.

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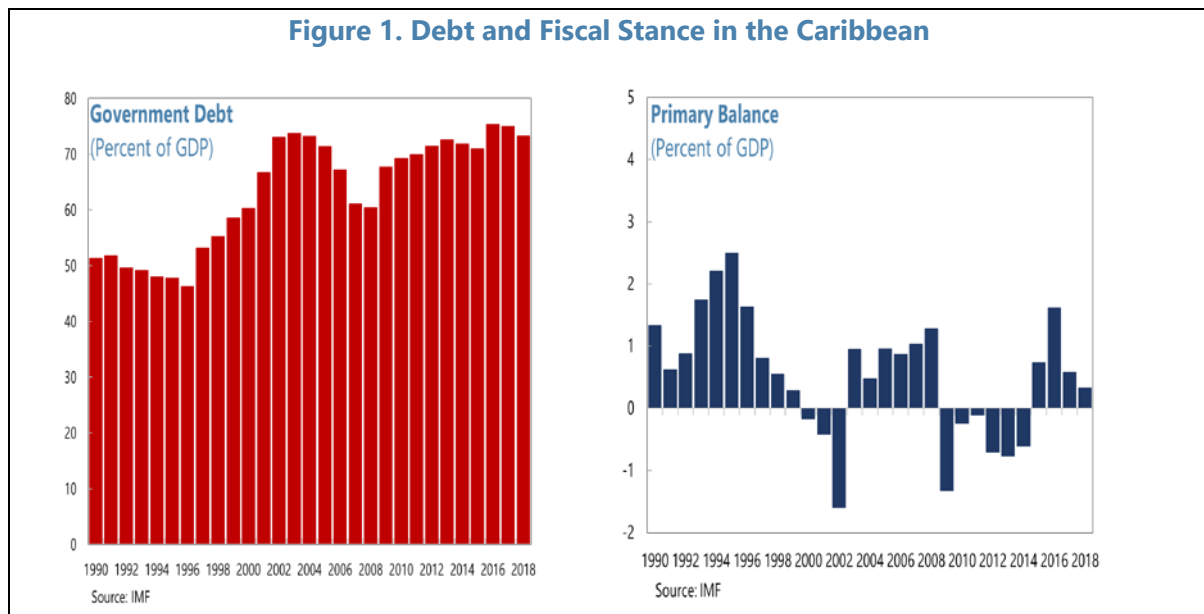
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## I. INTRODUCTION

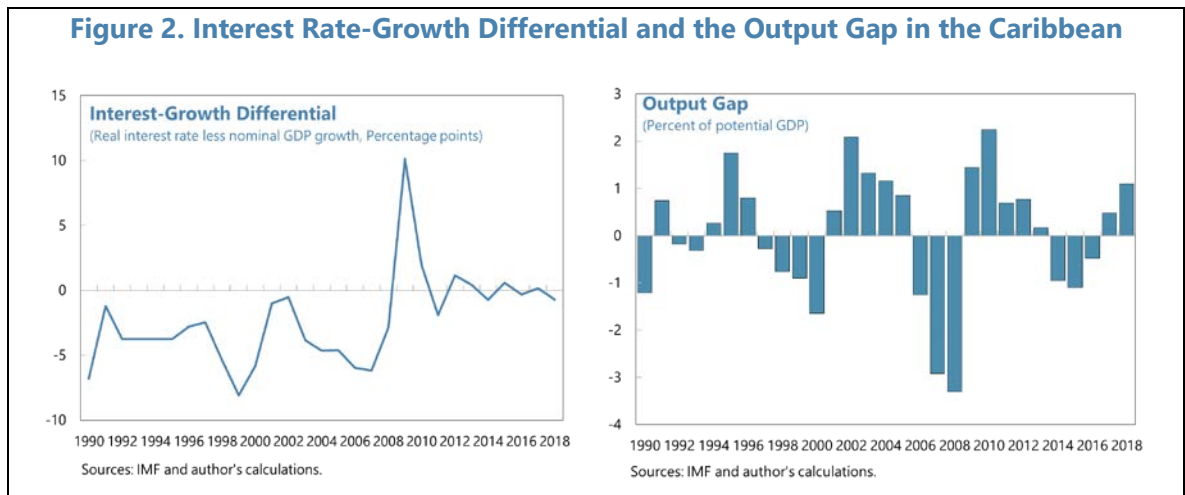
**Fiscal sustainability is a paramount challenge for small countries with high debt and greater vulnerability to climate change.** The state of public finances in the Caribbean has improved in recent years, with more prudent policies and reforms aimed at enhancing revenue mobilization and rationalizing expenditures. The fiscal stance, as measured by the primary budget balance, moved to a surplus of 0.8 percent of GDP, on average, during the period 2015–2018 from a deficit of 0.6 percent between 2009 and 2014. Many Caribbean countries, however, still face significant fiscal vulnerabilities with the average level of government debt standing at 73.3 percent of GDP in 2018 (Figure 1). This is substantially higher than 60.4 percent a decade earlier before the onset of the global financial crisis, as well as the average debt-to-GDP ratio of 50.8 percent among developing countries. These small open economies are also significantly more vulnerable to natural disasters and risks associated with climate change.<sup>2</sup> It is therefore necessary to build fiscal buffers and ensure debt sustainability with high probability even when negative shocks occur repeatedly over the long term.



**This paper analyzes the sustainability of fiscal policy in the context of 16 Caribbean countries over the period 1980–2018.** There are empirical studies investigating the cyclical and sustainability of fiscal policy in Latin America and the Caribbean, but these findings tend to reflect fiscal behavior in large Latin American countries rather than small island states in the Caribbean. A key issue in assessing fiscal sustainability is the differential between the interest rate paid to service government debt and the rate of economic growth. For highly indebted countries, a favorable interest rate-growth differential, if sustained for an extended period, could mean the difference between an explosive and a declining path for the debt-to-GDP ratio.

<sup>2</sup> The average annual cost of weather-related damage in the Caribbean is 2.4 percent of GDP, about six times more than that of larger countries.

Among Caribbean countries, this differential was unusually low for most of the period prior to the global financial crisis (Figure 2). Accordingly, in this paper, we focus exclusively on a more homogenous panel of 16 Caribbean countries over a long span of time, estimating the cyclically adjusted primary balance (CAPB) as a measure of discretionary fiscal policy and applying the model-based fiscal reaction function approach to fiscal sustainability developed by Bohn (1998). This approach determines that a country is fiscally solvent in the long run if the primary budget balance as a share of GDP is an increasing linear function of the debt-to-GDP ratio. The results indicate that the coefficient on lagged government debt is positive and statistically significant, which means that fiscal policy in the Caribbean accounts for sustainability considerations to counteract an increase in the debt-to-GDP ratio. However, we find some evidence of nonlinearities in the fiscal policy response to debt accumulation. With the quadratic debt parameter turning negative, countries do not appear to adjust adequately in order to account for sustainability considerations at higher levels of debt. Furthermore, we estimate separate fiscal reaction functions for government revenue and expenditure and find that fiscal adjustment to counteract debt accumulation is revenue-based on average. With regards to cyclical behavior, we show that the fiscal policy stance tends to be countercyclical, but government spending has a significant procyclical bias. All in all, these results confirm that maintaining prudent fiscal policies and implementing growth-enhancing structural reforms are necessary to build fiscal buffers and ensure sustainability with high probability even when negative shocks occur over the long term.



**The structure of this paper is as follows.** Section II provides a summary of the related literature. Section III describes data used in the analysis. Section IV presents the empirical methodology and results. Finally, Section V concludes the article with policy implications.

## II. RELATED LITERATURE

**There is a rich literature identifying cross-country links between fiscal behavior and economic and institutional characteristics.** The tax-smoothing model with perfect foresight proposed by Barro (1979) and Lucas and Stokey (1983) suggests that fiscal policy is determined by the government's need to smooth distortions associated with taxation. Accordingly, revenue

and spending shocks should be absorbed by budget deficits during economic recessions and by surpluses in times of economic expansion. From an empirical point of view, however, the tax-smoothing theory cannot explain the persistence of budget deficits, and why countries facing similar economic shocks experience in reality different fiscal policy paths. Many empirical studies find that the fiscal policy stance tends to be procyclical, contrary to theoretical considerations calling for neutral or countercyclical behavior (Gavin and Perotti, 1997; Bohn, 1998; Talvi and Végh, 2000; Favero, 2002; Galí and Perotti, 2003; Lane, 2003; Kaminsky, Reinhart, and Végh, 2004; Alesina and Tabellini, 2005; Wyplosz, 2006; Debrun and Kumar, 2007; Ilzetzki, Mendoza and Végh, 2010). Procyclicality appears to stem from the level of economic development (Easterly and Rebelo, 1993), structural features such as trade openness, financial development and natural resource dependence (Alesina and Perotti, 1995; Schaechter and others 2012) and demographic and political characteristics (Roubini and Sachs 1989; Woo, 2003; Abiad and Baig, 2005; Celasun, Debrun, and Ostry, 2007; Debrun and others 2008; Ghosh and others 2013).

**The model-based fiscal reaction function approach proposed by Bohn (1998) is a simple empirical test of fiscal sustainability.** This relates the primary balance to the level of debt, with or without conditioning on further controls. It can be written as follows:

$$pb_t = \alpha + \beta d_{t-1} + \delta \tilde{y}_t + \varepsilon_t$$

in which  $pb_t$  is the primary balance as a share of GDP,  $d_{t-1}$  is the government debt-to-GDP ratio,  $\tilde{y}_t$  is the output gap,  $\varepsilon_t$  is the error term. The coefficient  $\beta$  denotes the responsiveness of fiscal policy as measured by the primary balance to the debt ratio. A positive response of the primary balance to an increase in the debt-to-GDP ratio (that is,  $\beta > 0$ ) is sufficient to satisfy the government's intertemporal budget constraint under reasonable assumptions.<sup>3</sup> Applying this approach to the United States, Bohn (1998) finds an increasing fiscal policy response to debt accumulation across different sample periods. Abiad and Ostry (2005) show that the primary surplus responds positively to an increase in the debt-to-GDP ratio in a set of 31 emerging market economies over the period 1990–2002, but the fiscal policy reaction weakens among countries with high levels of government debt. Likewise, Celasun, Debrun, and Ostry (2007) identify a positive relationship between primary balance and the lagged debt-to-GDP ratio in a panel of 34 emerging market economies over the period 1990–2004. A similar result is found by Mendoza and Ostry (2008) for 22 industrialized countries during the period 1970–2005 and 34 developing countries during the period 1990–2005. Looking at a balanced panel of 49 advanced and emerging market economies over the period 1990–2012, Cevik and Teksoz (2014) show that fiscal policy after the global financial crisis has turned even more procyclical and become less responsive to the government's intertemporal budget constraint and, therefore, long-run fiscal solvency concerns, especially in developing countries.

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<sup>3</sup> As shown by Daniel and Shiamptanis (2013) and Ghosh and others (2013), however, a positive  $\beta$  cannot be viewed as enough to achieve fiscal sustainability, if there is a limit for positive values of primary balances, for instance, at very high debt levels or if the reaction of financial markets is accounted for (e.g., the increase in the primary balance is not large enough to account for the exploding interest rate-growth differential)

**Empirical studies tend to reflect fiscal behavior in large Latin American countries rather than small island states in the Caribbean.** A few studies focusing on Latin America and the Caribbean obtain evidence of weak fiscal policy response to an increase in the debt-to-GDP ratio (Kufa, Pellechio, and Rizavi, 2003; Alberola and Montero, 2006; SELA, 2013; Campo-Robledo and Melo-Velandia, 2015; Khadan, 2019; Kemoe and Lonkeng, 2020). Similarly, analyzing the cyclical stance of fiscal policy in Latin America and the Caribbean, Daude, Melguizo, and Neut (2011), Klemm (2014) and Alberola and others (2016) find that fiscal policy is procyclical on average. These findings, however, may reflect fiscal behavior in large Latin American countries rather than small Caribbean countries or do not draw on cyclically adjusted indicators. Therefore, in this paper, we estimate fiscal reaction functions for a panel of relatively homogenous 16 Caribbean countries, using the CAPB as a measure of the fiscal policy stance, over a long span of time.

### III. DATA OVERVIEW

**We construct an unbalanced panel dataset of annual observations covering 16 Caribbean countries over the period 1980–2018.**<sup>4</sup> Macroeconomic and institutional variables used in the analysis are assembled from the IMF’s International Financial Statistics (IFS) and World Economic Outlook (WEO) databases, the World Bank’s World Development Indicators (WDI) database. Our dependent variable is the CAPB, and the main variables of interest are the debt-to-GDP ratio and the output gap. Following the literature, we include a number of control variables that are expected to capture the fundamental determinants for fiscal policy behavior. Following the literature, we introduce a number of control variables, including real GDP per capita as proxy for a country’s level of development, inflation as an indicator of macroeconomic stability, the real effective exchange rate, trade openness as measured by the share of international trade in GDP, the terms-of-trade index, and financial development as measured by credit to the private sector as a share of GDP. For robustness checks, we also include a binary variable for the occurrence of natural disasters and the presence of national and supranational fiscal rules.

**We estimate potential real and nominal GDP for each country by applying the Hodrick-Prescott (HP) filter to decompose real GDP into trend and cyclical components.** The HP filter removes low-frequency variations and smoothes the GDP series to its stochastic trend, depending on the weight assigned to the linear time trend (Hodrick and Prescott, 1997). If there is no noise, the series is fully informative and the weight— $\lambda$ —should be equal to zero. While a  $\lambda$  of 100 is typically the choice for annual data in the literature, Baxter and King (1999) argue that a value of 10 is more reasonable, and Ravn and Uhlig (2002) recommend 6.25 for estimations using annual data. After experimenting with a range of smoothing parameters, we find marginal computational differences in the analysis and adopt a  $\lambda$  of 6.25. It should be noted that the HP filter is also susceptible to the end-point problem—the trend follows actual GDP more closely at the beginning and end of the estimation period than in the middle. We deal with the end-point

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<sup>4</sup> Our sample of Caribbean countries includes Anguilla, Antigua and Barbuda, Aruba, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

problem by extending the series through 2024, using projections, before applying the HP filter to the GDP series.

**The impact of cyclical changes on revenues and expenditures is filtered out to capture the discretionary fiscal stance as our dependent variable.** There is no one-size-fits-all approach in the literature for cyclical decomposition of fiscal balances, as the appropriate adjustment needs to take several country-specific factors into account, including data availability, the fiscal regime, and the economic structure of the country. In this paper, we follow the methodology outlined by Hagemann (1999) and Fedelino, Ivanova, and Horton (2009) and define the cyclically-adjusted budget balance (CAB) as a share of potential GDP as:

$$CAB = \left[ \sum_{i=1}^k T_i^{CA} - E^{CA} + X \right] / Y^*$$

where  $Y^*$  is the level of potential output,  $T_i^{CA}$  represents the cyclically-adjusted tax revenues from the  $i$ -th category (i.e., corporate and personal income taxes, sales tax, excises and customs duties),  $E^{CA}$  is the cyclically-adjusted government expenditures, and  $X$  is non-tax revenues. To implement the adjustment, we use the elasticities of revenue and expenditure with respect to the output gap, which are denoted  $\varepsilon_T$  and  $\varepsilon_E$ . Accordingly,  $T_i^{CA}$  and  $E^{CA}$  are defined as  $T_i^{CA} = T_i(Y^*/Y)^{\varepsilon_T}$  and  $E^{CA} = E(Y^*/Y)^{\varepsilon_E}$ , respectively. The measurement of the underlying fiscal stance, however, can be refined further by excluding interest payments. Since interest payments are not directly under the control of policymakers and may not be necessarily correlated with cyclical output fluctuations, it is removed to calculate the CAPB as a share of potential GDP in the following form:

$$CAPB = \left[ \sum_{i=1}^4 T_i^{CA} - (E - I_p)^{CA} + (X - I_r - G) \right] / Y^*$$

where  $I_p$  and  $I_r$  denote interest payments and interest receipts, respectively, and  $G$  represents foreign grants. In this analysis, I perform cyclical adjustment on total tax revenue and expenditure by using the aggregate elasticities with respect to the output gap of revenue (assumed to be 1) and expenditure (assumed to be 0). To analyze the composition of fiscal adjustment at a granular level, we also use the cyclically adjusted revenue and primary spending scaled by potential GDP as the dependent variable in our fiscal reaction functions.

**Summary statistics for the variables used in the analysis are presented in in Table 1.** There is a significant degree of dispersion across the Caribbean in terms of the fiscal policy stance and macroeconomic and institutional conditions. It is also essential to analyze the time-series properties of the data to avoid spurious results by conducting panel unit root tests. We check the stationarity of all variables by applying the Im-Pesaran-Shin (2003) procedure, which is widely used in the empirical literature to conduct a panel unit root test. The results, available upon request, indicate that the variables used in the analysis are stationary after logarithmic transformation or upon first differencing.



Table 1. Summary Statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
CAPB/ Potential GDP	454	0.6	4.1	-10.5	21.1
Revenue/ Potential GDP	468	24.0	6.4	5.8	61.1
Primary expenditure/ Potential GDP	454	23.5	6.6	6.7	82.3
Debt	427	64.4	34.1	9.1	158.8
Output gap	624	0.0	2.8	-14.3	12.8
Real GDP per capita	606	9,691	7,765	662	32,080
Consumer price inflation	575	7.4	21.8	-51.4	369.3
Real effective exchange rate	596	114.0	114.7	28.9	1293.6
Terms of trade	549	145.4	43.2	55.5	314.6
Trade openness	561	102.3	34.4	14.5	275.0
Financial development	573	44.1	20.0	6.6	149.3

Source: IMF; World Bank; authors' calculations.

#### IV. EMPIRICAL METHODOLOGY AND RESULTS

**The fiscal reaction function provides information on how fiscal policy responds to the economic cycle and debt dynamics.** We test fiscal sustainability by applying the model-based fiscal reaction function approach proposed by Bohn (1998) and expanded by Fatás and Mihov (2003), Galí and Perotti (2003), and Alesina and Tabellini (2008). This test indicates that a country is fiscally solvent in the long run if the primary balance as a share of GDP is an increasing linear function of the debt-to-GDP ratio. In other words, a government should react to an increase in the debt-to-GDP ratio by improving the primary balance in order to restrain the debt ratio from rising further. Our baseline fiscal reaction function takes the following dynamic form:

$$CAPB_{i,t} = \beta_0 + \beta_1 CAPB_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 OG_{i,t} + \beta_4 X_{i,t} + \eta_i + \mu_t + \varepsilon_{i,t}$$

where  $CAPB_{i,t}$  is the cyclically adjusted primary balance scaled by potential GDP in country  $i$  at time  $t$ ,  $D_{i,t-1}$  is the stock of government debt as a share of GDP,  $OG_{i,t-1}$  is the output gap,  $X_{i,t}$  represents a vector of control variables, including real GDP per capita, consumer price inflation, trade openness, and financial development.<sup>5</sup> The  $\eta_c$  and  $\mu_t$  coefficients denote the time-invariant country-specific effects and the time effects controlling for common shocks that may affect inflation across all countries in a given year, respectively.  $\varepsilon_{c,t}$  is an idiosyncratic error term that satisfies the standard assumptions of zero mean and constant variance. To account for possible heteroskedasticity, robust standard errors are clustered at the country level.

**We estimate and present the standard fixed effects model, but we prefer the dynamic specification as our baseline model.** From a methodological point of view, since the lagged dependent variable is correlated with the error term in a dynamic model of panel data, a possible solution is the system GMM estimator developed by Arellano and Bover (1995) and Blundell and

<sup>5</sup> As robustness checks, we include the real effective exchange rate, the terms-of-trade index, a binary variable for the occurrence of natural disasters, and the presence of national and supranational fiscal rules.

Bond (1998). The system GMM approach involves constructing two sets of equations, one with first differences of the endogenous and pre-determined variables instrumented by suitable lags of their own levels, and one with the levels of the endogenous and pre-determined variables instrumented with suitable lags of their own first differences. We apply the one-step version of the system GMM estimator to ensure the robustness of the results, as the standard errors from the two-step variant of the system GMM method are known to be downward biased in small samples.

**To avoid the problem of instrument proliferation in the GMM estimations, we use the minimal number of instruments by collapsing the instrument.** The use of all available lagged levels of the variables in the GMM estimation leads to a proliferation in the number of instruments, which reduces the efficiency of the estimator in finite samples, and potentially leads to over-fitting. A further issue is that the use of a large number of instruments significantly weakens the Hansen  $J$ -test of over-identifying restrictions, and so the detection of over-identification is hardest when it is most needed. Conversely, however, restricting the instrument set too much results in a loss of information that leads to imprecisely estimated coefficients. Estimation of such models therefore involves a delicate balance between maximizing the information extracted from the data on the one hand, and guarding against over-identification on the other. To this end, we follow the strategy suggested by Roodman (2009) to deal with the problem of weak and excessively numerous instruments. We also validate the system GMM identification assumptions by applying a second-order serial correlation test for the residuals and the Hansen  $J$ -test for overidentifying restrictions. In all the regressions, the  $p$  values of the Arellano-Bond (AR) autocorrelation test and the Hansen  $J$ -test results confirm the absence of second-order serial correlation in the error term of the first-difference equation and the validity of internal instruments.

**The empirical results, presented in Table 2, show a consistent picture across different model specifications and estimation methods.** Since potential endogeneity of some variables and the presence of correlation between the unobserved country-specific effects and the lagged dependent variable may render the fixed-effects estimation approach inappropriate and biased, our primary focus is on the estimation results obtained via the system GMM approach. Indeed, discretionary fiscal policy appears to be strongly persistent, as denoted by the positive and statistically highly significant coefficient on the lagged CAPB across all specifications of the model.

- ***Sustainability of fiscal policy.*** We find that the coefficient on government debt is positive and statistically significant, which is an indication of fiscal behavior that takes into account the government's intertemporal budget constraint and, therefore, long-term fiscal solvency concerns. Its magnitude, however, is not economically large. In our sample of Caribbean countries, the fiscal policy reaction to an increase of one percentage point

in the lagged debt-to-GDP ratio is limited to about 0.02 percentage point, after controlling for other relevant factors, during the period 1980–2018.<sup>6</sup>

- **Cyclicality of fiscal policy.** We find that the coefficient on the output gap is positive and statistically significant. This result confirms that the fiscal stance is countercyclical for the sampled countries over the period 1980–2018, which is contrary to previous studies that tend to show procyclical fiscal behavior among developing countries, especially in Latin America. This finding may reflect our focus on Caribbean countries (instead of Latin America as a whole) and use of the CAPB as a measure of the fiscal policy stance over a long period. Nevertheless, this should be interpreted with caution as it may reflect deteriorating fiscal performance during economic slowdowns and recessions in these small and highly open economies (Celasun, Debrun, and Ostry, 2007).

**The composition of fiscal adjustment, presented in Table 3, is consistent with long-term debt sustainability, but expenditure policies exhibit a procyclical bias.** Using the cyclically adjusted revenue and expenditure series, we estimate separate fiscal reaction functions for government revenue and spending as a share of potential nominal GDP. The results indicate that while revenues respond positively to an increase in the debt-to-GDP ratio, expenditures have an insignificant (negative) response. In other words, controlling for other factors, fiscal adjustment to counteract debt accumulation tend to be revenue-based in our sample of Caribbean countries during the period 1980–2018. In terms of cyclical behavior, we find that government spending has a statistically significant pro-cyclical bias, while revenues appear to be an insignificant contributor on average.

**With regards to control variables, we find that macroeconomic and financial features influence fiscal reaction functions.** The statistically significant coefficient on real GDP per capita indicates that the CAPB improves, on average, by about 0.5 percentage point with each percentage point increase in the level of income, which is consistent with previous empirical studies that estimate income elasticity in an interval of 0.3–0.6. Consumer price inflation, on the other hand, has a negative coefficient, which is not statistically significant at conventional levels in dynamic regressions. We find that both trade openness and financial development have significant negative effects on discretionary fiscal policy, which may reflect greater financial capacity to enable deficit financing.

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<sup>6</sup> The empirical evidence from a plethora of studies on fiscal reaction functions shows that the debt coefficient usually varies between 0.01 and 0.10 (Checherita-Westphal and Zdarek, 2017).

Table 2. Fiscal Reaction Functions—Baseline Estimations

	Fixed Effects		System GMM	
CAPB <sub>t-1</sub>			0.661*** [0.036]	0.629*** [0.039]
Debt <sub>t-1</sub>	0.028** [0.012]	0.049*** [0.012]	0.015*** [0.004]	0.023*** [0.005]
Output gap	0.185* [0.101]	0.263*** [0.089]	0.212*** [0.063]	0.262*** [0.069]
Real GDP per capita		-2.139 [3.411]		0.455** [0.201]
Inflation		-0.013 [0.003]		0 [0.006]
Trade openness		0.033** [0.015]		-0.013** [0.005]
Financial development		-0.092** [0.039]		-0.019** [0.009]
Number of observations	411	367	411	367
Number of countries	16	16	16	16
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.13	0.21		
AR1 <i>p</i> -value			0.00	0.000
AR2 <i>p</i> -value			0.14	0.179
Hansen <i>J</i> -test <i>p</i> -value			0.05	0.088

Note: The dependent variable is the cyclically adjusted primary balance (CAPB) as defined in Section III. Robust standard errors, clustered at the country level, are reported in brackets. A constant is included in each regression, but not shown in the table. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

**Table 3. Fiscal Reaction Functions—Composition of Fiscal Adjustment**

	<b>System GMM</b>	
	Revenue	Primary spending
Lagged dependent variable	0.739*** [0.0379]	0.626*** [0.0410]
Debt <sub>t-1</sub>	0.0174* [0.009]	-0.001 [0.0101]
Output gap	-0.139 [0.129]	-0.453*** [0.147]
Controls	Yes	Yes
Number of observations	367	367
Number of countries	16	16
Country FE	Yes	Yes
Year FE	Yes	Yes
Adjusted R <sup>2</sup>		
AR1 <i>p</i> -value	-	-
AR2 <i>p</i> -value	0.768	0.838
Hansen <i>J</i> -test <i>p</i> -value	0.561	0.189

Note: The dependent variables are the cyclically adjusted revenue and primary expenditure as a share of potential GDP. Robust standard errors, clustered at the country level, are reported in brackets. A constant is included in each regression, but not shown in the table. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

## V. ROBUSTNESS CHECKS

**We carry out an extensive sensitivity analysis to attain a more nuanced picture of fiscal reaction functions.** We test for potential nonlinearities in fiscal policy outcomes among our sample of Caribbean countries during the period 1980–2018 by fitting a quadratic regression of the dynamic model estimated via the system GMM. These results, presented in Table 4, show that the CAPB response to an increase in the debt-to-GDP ratio is nonlinear, turning negative at higher levels of government debt. This could be a sign of fiscal fatigue—that is, the necessary fiscal effort to achieve sustainability becomes untenable at high levels of indebtedness (Ghosh and others, 2013).

**We also conduct a series of further robustness checks, presented in Table 5, to confirm our baseline results.** First, we include the lagged output gap instead of its contemporaneous value, as policymakers may react to past conditions and also help address measurement errors in real time.<sup>7</sup> Although this is not a statistically significant *ex ante* indicator at conventional levels, it still

<sup>7</sup> An emerging strand of the empirical literature on fiscal reaction functions, using real time data instead of ex post observations, finds countercyclical fiscal behavior, especially in advanced economies (Forni and Momigliano,

**Table 4. Fiscal Reaction Functions—Nonlinear Estimations**

<b>System GMM</b>		
CAPB <sub>t-1</sub>	0.658*** [0.0360]	0.625*** [0.038]
Debt <sub>t-1</sub>	0.033*** [0.012]	0.048*** [0.0143]
Debt <sup>2</sup> <sub>t-1</sub>	0 [8.000]	-0.000* [9.000]
Output gap	0.213*** [0.063]	0.263*** [0.069]
Controls	No	Yes
Number of observations	411	367
Number of countries	16	16
Country FE	Yes	Yes
Year FE	Yes	Yes
AR1 <i>p</i> -value	0.000	0.000
AR2 <i>p</i> -value	0.135	0.161
Hansen <i>J</i> -test <i>p</i> -value	0.037	0.062

Note: The dependent variable is the cyclically adjusted primary balance (CAPB) as defined in Section III. Robust standard errors, clustered at the country level, are reported in brackets. A constant is included in each regression, but not shown in the table. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

points towards countercyclical behavior. Second, we truncate the sample at the 5<sup>th</sup> and 95<sup>th</sup> percentiles to exclude outliers, and reach very similar results. Third, we exclude commodity-exporting countries (Guyana, Suriname, and Trinidad and Tobago) from the sample and find marginally larger coefficients on the debt and output gap variables and thereby conclude that our baseline findings are not driven by commodity price cycles. Fourth, we exclude the period after the global financial crisis and conclude that the positive fiscal reaction to an increase in the debt-to-GDP ratio remains unchanged, but becomes stronger in the post-crisis period. Fifth, we bring in the real effective exchange rate and the terms-of-trade index as additional controls

2004; Golinelli and Momigliano, 2006; Cimadomo, 2007; Beetsma and Giuliodori, 2008; Bernoth, Hallet, and Lewis, 2008). However, even though real time data may yield empirically better performing descriptions of fiscal behavior, such figures are available only for a limited number of mostly advanced economies.

variables (instead of consumer price inflation and trade openness) and find that these variables do not have a significantly different effect on the fiscal policy stance. Sixth, we include a binary variable for natural disasters and find that it does not have a statistically significant effect at conventional levels. The occurrence of a natural disaster, however, appears to lessen the fiscal response to debt as well as the extent of countercyclicality. Finally, we introduce a binary variable for the presence of national and supranational fiscal rules and find that although fiscal rules do not appear to have a statistically significant effect on fiscal policy, the coefficient on national fiscal rules is positive whereas supranational fiscal rules have a negative coefficient. In our sample, however, only two countries have implemented fiscal rules at the national level—Grenada since 2015 and Jamaica since 2010. Six member countries of the Eastern Caribbean Currency Union (ECCU)—Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines—have followed the supranational targets for public and budget deficit set by the ECCU since 1998, but these supranational rules do not impose an effective constraint on fiscal policy at the national level.

**Table 5. Fiscal Reaction Functions— Robustness Checks (System GMM)**

	System GMM							
	Lagged output gap	Truncated sample	Pre-crisis period	Additional Controls	Lagged Natural Disasters	Non-Commodity exporters	Fiscal rules	
							National	Supranational
CAPB <sub>t-1</sub>	0.631*** [0.039]	0.629*** [0.038]	0.599*** [0.050]	0.565*** [0.053]	0.713*** [0.042]	0.628*** [0.038]	0.626*** [0.038]	0.624*** [0.038]
Debt <sub>t-1</sub>	0.024*** [0.005]	0.023*** [0.005]	0.0120* [0.006]	0.012* [0.006]	0.019*** [0.005]	0.024*** [0.005]	0.022*** [0.005]	0.025*** [0.005]
Output gap		0.262*** [0.069]	0.288*** [0.082]	0.316*** [0.092]	0.201** [0.088]	0.264*** [0.069]	0.263*** [0.070]	0.260*** [0.069]
Output gap <sub>t-1</sub>	0.007 [0.068]							
Natural disasters <sub>t-1</sub>					0.382 [0.526]			
Fiscal rule							0.673 [1.071]	-0.401 [0.390]
REER				-0.007 [0.013]				
TOT				-0.009* [0.005]				
Controls	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Number of observations	367	367	231	222	258	367	367	367
Number of countries	16	16	16	15	11	16	16	16
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR1 <i>p</i> -value	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000
AR2 <i>p</i> -value	0.246	0.179	-	0.279	0.274	0.157	0.181	0.175
Hansen <i>J</i> -test <i>p</i> -value	0.047	0.088	0.019	0.016	0.033	0.082	0.082	0.077

Note: The dependent variable is the cyclically adjusted primary balance (CAPB) as defined in Section III. Robust standard errors, clustered at the country level, are reported in brackets. A constant is included in each regression, but not shown in the table. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

## VI. CONCLUSION

**This paper applies the model-based sustainability test for fiscal policy in a panel of 16 Caribbean countries over the period 1980–2018.** Fiscal sustainability remains a paramount challenge for small countries with high debt and greater vulnerability to climate change. Despite recent improvements, any Caribbean countries struggle with high levels of government debt—an average of 73.3 percent of GDP in 2018 compared to 50.8 percent among other developing

countries. There are some empirical studies investigating the cyclical and sustainability of fiscal policy in Latin America and the Caribbean, but these findings tend to reflect fiscal behavior in large Latin American countries rather than small Caribbean states. Therefore, in this paper, we estimate fiscal reaction functions for a panel of relatively homogenous 16 Caribbean countries, using the CAPB as a measure of the fiscal policy stance, over a long a span of time

**Policymakers should maintain a countercyclical fiscal policy stance that takes into account long-run solvency concerns.** Applying the model-based fiscal reaction function approach to fiscal sustainability, we find that the coefficient on lagged government debt is positive and statistically significant, implying that fiscal policy in the Caribbean takes corrective actions to counteract an increase in the debt-to-GDP ratio. However, we find robust evidence of nonlinearities in the fiscal policy response to debt accumulation. With the quadratic debt parameter turning negative, countries do not appear to adjust adequately in order to ensure sustainability at higher levels of indebtedness. Furthermore, estimating separate fiscal reaction functions for government revenue and expenditure, we show that fiscal adjustment against debt accumulation is revenue-based on average. With regards to cyclical behavior, we show that the fiscal policy stance tends to be countercyclical, but government spending has a significant procyclical bias. These results confirm that maintaining prudent fiscal policies and implementing growth-enhancing structural reforms are necessary to build fiscal buffers and ensure debt sustainability with high probability even when negative shocks occur over the long term.



## REFERENCES

- Abiad, A., and T. Baig (2005) "Underlying Factors Driving Fiscal Effort in Emerging Market Economies," IMF Working Paper No. 05/106 (Washington, DC: International Monetary Fund).
- Abiad, A., and J. Ostry (2005) "Primary Surpluses and Sustainable Debt Levels in Emerging Market Countries," IMF Working Paper No. 05/6 (Washington, DC: International Monetary Fund).
- Alberola, E., and M. Montero (2006) "Debt Sustainability and Procyclical Fiscal Policies in Latin America," *Economia*, Vol. 7, pp.157–193.
- Alberola, E., I. Kataryniuk, A. Melguizo, and R. Orozco (2016) "Fiscal Policy and the Cycle in Latin America: The Role of Financing Conditions and Fiscal Rules," BIS Working Papers No. 543 (Basel: Bank for International Settlements).
- Alesina, A., F. Campante, and G. Tabellini (2008) "Why Is Fiscal Policy Often Procyclical?" *Journal of the European Economic Association*, Vol. 6, pp. 1006–1036.
- Alesina, A., and R. Perotti (1995) "The Political Economy of Budget Deficits," *IMF Staff Papers*, Vol. 42, pp. 1–31.
- Arellano, M., and O. Bover (1995) "Another Look at the Instrumental-Variable Estimation of Error-Components Models," *Journal of Econometrics*, Vol. 68, pp. 29–52.
- Barro, R. (1979) "On the Determination of Public Debt," *Journal of Political Economy*, Vol. 87, pp. 940–971.
- Baxter, M., and R. King (1999) "Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series," *Review of Economics and Statistics*, Vol. 81, pp. 575–593.
- Beetsma, R., and M. Giuliadori (2008) "On the Relationship Between Fiscal Plans in the European Union: An Empirical Analysis Based on Real-Time Data," *Journal of Comparative Economics*, Vol. 36, pp. 221–242.
- Bernoth, K., A. Hallet, and J. Lewis (2008) "Did Fiscal Policymakers Know What They Were Doing? Reassessing Fiscal Policy with Real-Time Data," DNB Working Papers No. 169, (Amsterdam: Central Bank of the Netherlands).
- Blundell, R., and S. Bond (1998) "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics*, Vol. 87, pp. 115–143.
- Blundell, R., S. Bond, and F. Windmeijer (2000) "Estimation in Dynamic Panel Data Models: Improving on the Performance of the Standard GMM Estimators," IFS Working Paper No. 00/12 (London: Institute of Fiscal Studies).
- Bohn, H. (1998) "The Behavior of U.S. Public Debt and Deficits," *Quarterly Journal of Economics*, Vol. 113, pp. 949–63.
- Campo-Robledo, J., and L. Melo-Velandia (2015) "Sustainability of Latin American Fiscal Deficits: A Panel Data Approach," *Empirical Economics*, Vol. 49, pp. 889–907.

- Celasun, O., X. Debrun, and J. Ostry (2007) "Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A 'Fan Chart' Approach," *IMF Staff Papers*, Vol. 53, pp 401–425.
- Cevik, S., and K. Teksoz (2014) "Deep Roots of Fiscal Behavior," *Journal of Banking and Financial Economics*, Vol. 2, pp. 5–33.
- Checherita-Westphal, C., and V. Zdarek (2017) "Fiscal reaction Function and Fiscal Fatigue: Evidence for the Euro Area," ECB Working Paper No. 2036 (Frankfurt: European Central Bank).
- Cimadomo, J. (2012) "Fiscal Policy in Real Time," *Scandinavian Journal of Economics*, Vol. 114, pp. 440–465.
- Daniel, B., and C. Shiamptanis (2013) "Pushing the limit? Fiscal policy in the European Monetary Union," *Journal of Economic Dynamics and Control*, Vol. 37, pp. 2307–2321.
- Daude, C., A. Melguizo, and A. Neut (2011) "Fiscal Policy in Latin America: Countercyclical and Sustainable?" *Economics: The Open Access*, Vol. 5, pp. 1–29.
- Debrun, X., and M. Kumar (2007) "The Discipline-Enhancing Role of Fiscal Institutions," IMF Working Paper No. 07/171 (Washington, DC: International Monetary Fund).
- Debrun, X., L. Moulin, A. Turrini, J. Ayuso-i-Casals, and M. Kumar (2008) "Tied to the Mast? National Fiscal Rules in the European Union," *Economic Policy*, Vol. 23, pp. 297–362.
- Easterly, W., and S. Rebelo (1993) "Fiscal Policy and Economic Growth: An Empirical Investigation," *Journal of Monetary Economics*, Vol. 32, pp. 417–458.
- Fatás, A., and I. Mihov (2003) "On Constraining Fiscal Policy Discretion in EMU," *Oxford Review of Economic Policy*, Vol. 19, pp. 112–131.
- Favero, C. (2002) "How Do European Monetary and Fiscal Authorities Behave?" CEPR Discussion Paper No. 3426 (London: Centre for Economic Policy Research).
- Fedelino, A., A. Ivanova and M. Horton (2009) "Computing Cyclically Adjusted Balances and Automatic Stabilizers," IMF Technical Notes and Manuals No. 09/05 (Washington, DC: International Monetary Fund).
- Forni, L., and S. Momigliano (2004) "Cyclical Sensitivity of Fiscal Policy Based on Real Time Data," *Applied Economic Quarterly*, Vol. 50, pp. 299–326.
- Galí, J., and R. Perotti (2003) "Fiscal Policy and Monetary Integration in Europe," *Economic Policy*, Vol. 37, pp. 535–572.
- Gavin, M., and R. Perotti (1997) "Fiscal Policy in Latin America," NBER Macroeconomics Annual, Vol. 12, pp. 11–71 (Cambridge, MA: National Bureau of Economic Research).
- Ghosh, A., J. Kim, E. Mendoza, J. Ostry, and M. Qureshi (2013) "Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies," *Economic Journal*, Vol. 123, pp. F4–F30.
- Golinelli, R., and S. Momigliano (2006) "Real-Time Determinants of the Fiscal Policies in the Euro Area," *Journal of Policy Modeling*, Vol. 28, pp. 943–964.
- Hageman, R. (1999) "The Structural Fiscal Balance: The IMF Method," IMF Working Paper No. 99/95 (Washington, DC: International Monetary Fund).

- Hodrick, R., and E. Prescott (1997) "Postwar U.S. Business Cycles: An Empirical Investigation," *Journal of Money, Credit, and Banking*, Vol. 29, pp. 1–16.
- Ilzetzki, E., E. Mendoza, and C. Végh (2010) "How Big (Small?) Are Fiscal Multipliers?" NBER Working Paper No. 16479 (Cambridge, MA: National Bureau of Economic Research).
- Im, K., M. Pesaran, and Y. Shin (2003) "Testing for Unit Roots in Heterogeneous Panels," *Journal of Econometrics*, Vol. 115, pp. 53–74.
- Kaminsky, G., C. Reinhart, and C. Végh (2004) "When It Rains, It Pours: Pro-cyclical Capital Flows and Macroeconomic Policies," NBER Working Paper No. 10780 (Cambridge, MA: National Bureau of Economic Research).
- Kemoe, L., and C. Lonkeng (2020) "Sailing Against the Wind: Benchmarking the Fiscal Response of Caribbean Countries to Debt," IMF Working Paper, *forthcoming* (Washington, DC: International Monetary Fund).
- Khadan, J. (2019) "Fiscal Sustainability in the Caribbean: An Econometric Analysis," IDB Working Paper No. IDB-WP-1014 (Washington, DC: Inter-American Development Bank).
- Klemm, A. (2003) "Fiscal Policy in Latin America over the Cycle," IMF Working Paper No. 14/59 (Washington, DC: International Monetary Fund).
- Kufa, P., A. Pellechio, and S. Rizavi (2003) "Fiscal Sustainability and Policy Issues in the Eastern Caribbean Currency Union," IMF Working Paper No. 03/162 (Washington, DC: International Monetary Fund).
- Lane, P. (2003) "The Cyclical Behavior of Fiscal Policy: Evidence from the OECD," *Journal of Public Economics*, Vol. 87, pp. 2661–2675.
- Lucas, R., and N. Stokey (1983) "Optimal Fiscal and Monetary Policy in an Economy without Capital," *Journal of Monetary Economics*, Vol. 55, pp. 55–93.
- Ravn, M., and H. Uhlig (2002) "On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations," *Review of Economics and Statistics*, Vol. 85, pp. 235–243.
- Roodman, D. (2009) "How to do xtabond2: An Introduction to Difference and System GMM in Stata," *Stata Journal*, Vol. 9, pp. 86–136.
- Roubini, N., and J. Sachs (1989) "Political and Economic Determinants of Budget Deficits in the Industrial Democracies," *European Economic Review*, Vol. 33, pp. 86–136.
- SELA (2013) "Debt Burden and Fiscal Sustainability in the Caribbean Region," SP/RECD-pim-ALC/DT N° 2-13 (Caracas: Sistema Económico Latinoamericano y del Caribe).
- Schaechter, A., T. Kinda, N. Budina, and A. Weber (2012) "Fiscal Rules in Response to the Crisis—Towards the 'Next Generation' Rules: A New Dataset," IMF Working Paper No. 12/187 (Washington, DC: International Monetary Fund).
- Talvi, E., and C. Végh (2000) "Tax Base Variability and Pro-cyclical Fiscal Policy," NBER Working Paper No. 7499 (Cambridge, MA: National Bureau of Economic Research).
- Woo, J. (2003) "Economic, Political, and Institutional Determinants of Public Deficits," *Journal of Public Economics*, Vol. 87, pp. 387–429.