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Searching for a Safe Harbor

Fiscal Policy Responses in Small Island Developing States

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Searching for a safe harbor: fiscal policy responses in small island developing states[1]

Khamal Clayton and David Rosenblatt

Abstract

Over the last two decades, there has been a growing empirical literature to test whether governments' fiscal policies systematically respond to changes in the level of debt-to-GDP. Most research has focused on advanced and emerging economies and has overlooked developing countries, especially small island developing states (SIDS). While Caribbean fiscal reaction functions have been estimated in the literature, this paper fills a gap by broadly including all SIDS in the analysis. We find that weak fiscal sustainability has been maintained, but mostly due to the more recent period of the analysis, and with the exclusion of the outlier of São Tomé and Principe. The magnitudes of the coefficient of the increasing primary balance in response to increasing debt-to-GDP is in line with estimates from the literature including, for example, past work on Caribbean SIDS. Two novel findings are that extreme weather events are indeed associated with deteriorations in the primary fiscal balance, and that primary balances may respond pro-cyclically to economic booms and acyclically or counter-cyclically to economic busts.

Keywords: Debt sustainability, Fiscal reaction function, Primary balance, Debt-to-GDP ratio, SIDS, small states

Introduction

Over the last two decades, there has been a growing empirical literature to test whether governments' fiscal policies systematically respond to changes in the level of debt-to-GDP. The basic notion is that primary balances must improve to adjust to increases in the level of indebtedness. Otherwise, the intertemporal budget constraint will be violated, and debt-to-GDP increases incessantly.

Bohn (1998) pioneered the simplest empirical test for this relatively weak form of fiscal sustainability by investigating if there is a positive coefficient of a linear regression of the primary surplus against debt-to-GDP, with appropriate control variables. Since Bohn's (1998) seminal work on fiscal reaction functions using long time series data for the United States, several strands of thought have blossomed, primarily using panel data on samples of advanced economies (Ghosh et al. 2013; Checherita-Westphal and Žďárek 2017; Everaert and Jansen 2017). However, across the research on fiscal

[1] The authors are grateful to Diether Beuermann for very helpful comments and to Sota Iishi for first-rate research assistance. The opinions expressed here are only attributable to the authors and not to the Inter-American Development Bank. All errors are ours. Email: Khamal Clayton: khamalc@iadb.org; David Rosenblatt: drosenblatt@iadb.org.

sustainability, most research has focused on advanced and emerging economies, and has overlooked developing countries, especially small island developing states (SIDS). [2] Recently, Khadan (2019) and Cevik and Nanda (2020) expanded the focus towards SIDS, but the sample was restricted geographically to the Caribbean region. There has been no attempt, that we know of, to broadly include all SIDS. SIDS constitute a particular group of interest, given that they face similar challenges of small scale, isolation or disperse geography, and high vulnerability to weather phenomena. In addition, fiscal sustainability has proven to be particularly difficult for small island developing states (SIDS). For example, average general government debt-to-GDP of SIDS from 2000-2019 was 64%, as compared to 55 % for low- and middle-income countries.[3] This technical note will be the first study to explore fiscal response functions in SIDS on a global scale.

As the literature has evolved, non-linear relationships have been explored – in which case, governments may respond appropriately to rising indebtedness at low levels of indebtedness but confront "fiscal fatigue" and reverse this stance at higher levels of indebtedness (Ghosh et al., 2013). However, Fournier and Fall (2015) argued that this phenomenon was only observed when Japan was included in their sample. Following Fournier and Fall (2015) robustness checks, Checherita-Westphal and Žďárek (2017) also show that their fiscal reaction functions are robust to the selection of countries, i.e. no single country's debt level drove the response of the primary balance. That said, most studies in this strand of the literature do not undertake rigorous robustness checks or limit their checks to only model specifications.

Unlike many past studies, we aim to show that our results are robust to the countries selected, and we identify outliers that may have outsized effects on our results. Furthermore, we also include a "temporal" check by gradually shrinking the end year used by our sample to show that our results are somewhat robust to the end year used. This temporal check is important as we use a dataset that includes the effects of the pandemic (2020-2022).

The paper begins with a brief literature review, followed by a description of the data, and the methodology and results. A wide variety of robustness checks are then presented. We conclude with a brief discussion of the strengths and weaknesses of this approach to fiscal sustainability and potential options for future research.

[2] Defined by the full member list found here: https://www.un.org/ohrlls/content/list-sids
[3] Arthor's calculations using IMF's WEO database.

Literature Review

(a) Fiscal Reaction Functions

Bohn (1998) has been the *zeitgeist* for the literature on fiscal sustainability of public debt for the last two decades. Bohn (1998) proposed a linear function, where the primary balance as a percent of GDP, pb_t, responds to the prior period's debt-to-GDP ratio, d_{t-1}, and a collection of macroeconomic and institutional control variables, $X_{i,t}$,.. In the simplest iteration of this model in the literature, $X_{i,t}$, is limited to the contemporaneous output gap, which would capture the effect of the business cycle on the fiscal balance. Finally, ε_t represents the error term. Bohn (1998) suggests that a condition for debt sustainability (unsustainability) is if β_1 is both statistically significant and is positive (negative). However, Ghosh et al. (2013) would later describe Bohn's condition as a "weak sustainability condition".

$$pb_t = \beta_1 d_{t-1} + \sum_i^n \rho_i X_{i,t} + \varepsilon_t \qquad (I)$$

Mauro et al. (2009) extended Bohn's (1998) analysis on U.S. fiscal dynamics to 55 advanced and emerging markets. Mauro et al. (2009) found that fiscal responses do vary over time for several advanced and emerging economies. In addition to a panel data analysis, Mauro et al. (2009) also produced several country-specific regressions using time periods exceeding 25 and, in some cases, more than 200 years. However, unlike Bohn (1998), most research has favored panel data analysis as the availability of reliable data on several fiscal variables, particularly in non-advanced economies, is weak, particularly before 1990.

Ghosh et al. (2013) deviated from (I) by proposing a cubic form for the d_{t-1} term (II) and adding the government expenditure gap as an additional macroeconomic variable. The government expenditure gap, derived from passing government expenditures through a filter, such as the Hodrick-Prescott filter (Hodrick and Prescott 1997), captured temporary deviations from government spending.

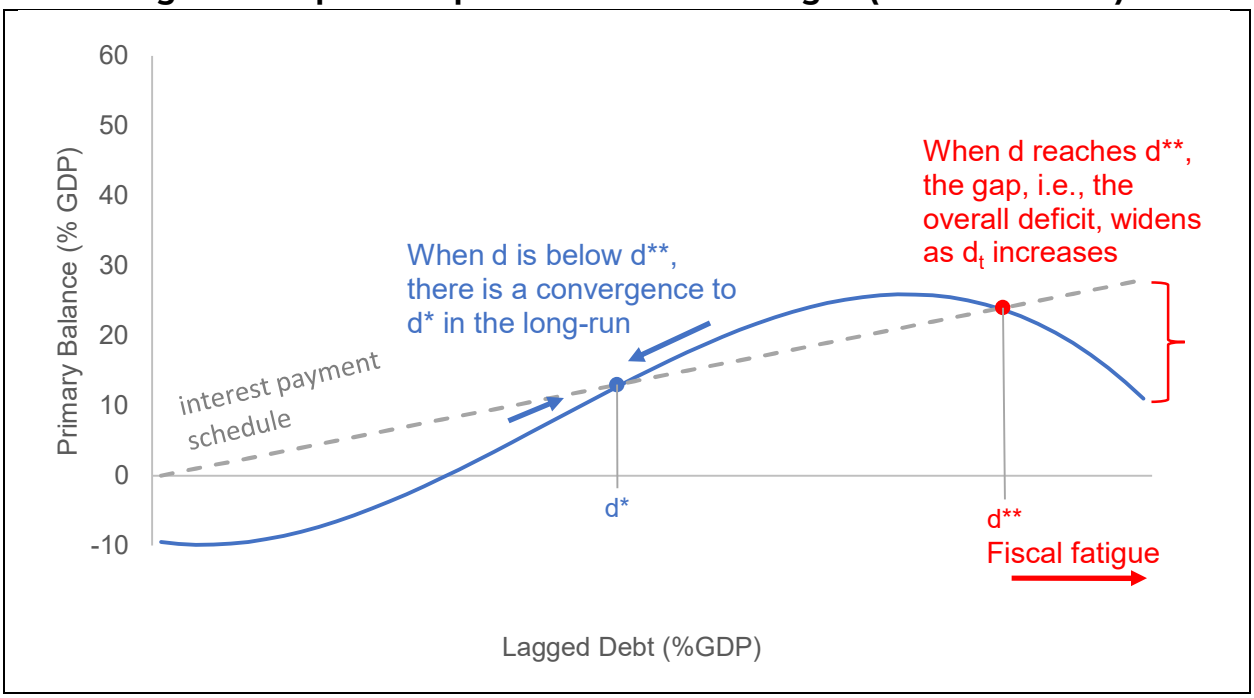
$$pb_t = \beta_1 d_{t-1} + \beta_2 d_{t-1}^2 + \beta_3 d_{t-1}^3 + \sum_i^n \rho_i X_{i,t} + \varepsilon_t \qquad (II)$$

The inclusion of the general government expenditure gap is rare in the literature. Although Mendoza and Ostry (2007), Bohn (2008), and Ghosh et. al. (2013) have included it as an explanatory variable, most research in this space has overlooked it. It is possible that its inclusion may capture effects from several other variables including election cycles, and natural disasters. That is, the unusual or unexpected expenses during the election year or the post-disaster expenses (e.g. social support and reconstruction) affect the primary balance through the expenditure channel.

(b) Fiscal Fatigue

The introduction of non-linear specifications suggests that fiscal responses would change depending on debt levels (see Figure 1 below). Under the cubic specification (i.e. $\beta_3 < 0$), at debt levels below d_t^*, debt accumulation occurs as primary balances are lower than interest payments. However, as debt levels approach d_t^*, primary balances increase. After d_t^*, but before d_t^{**}, primary balances are higher than required interest payments and thus debt levels tend to converge to d_t^*. However, shocks can increase debt-to-GDP beyond d_t^{**}. After d_t^{**}, the required interest payments will be higher than the primary balance thus resulting in a financing gap. To fill this gap, the government will need to borrow, thus increasing the debt-to-GDP ratio and decreasing the primary balance generated at t+1. This would cascade into a negative feedback loop as $t \to \infty$. In other words, debt to GDP follows an explosive trajectory.

Figure 1. Graphical Explanation of Fiscal Fatigue (Percent of GDP)



Source: Adapted from Ghosh et al. (2013).
Note: d_t refers to the lagged debt-to-GDP at time t. d* refers to the long-run equilibrium for debt and is the first intersection of the interest payment schedule with the fiscal reaction function. d** refers to the debt limit, after which fiscal fatigue occurs.

Fiscal fatigue has been observed, through a cubic specification, among a sample of 23 advanced economies (Ghosh et al. 2013), and, through a quadratic specification, in the Caribbean (Cevik and Nanda 2020) and tourism-dependent Latin American and Caribbean countries (Hernández and González 2023). Furthermore, Ghosh et. al. (2013) argue that the presence of non-linearities suggest that Bohn (1998)'s sustainability condition is "weak", i.e. a necessary but not sufficient condition for debt sustainability.

(c) Recent trends in research

It has been observed that primary balances tend to be persistent—i.e., the primary balance in time period t-1 has a statistically significant impact on the primary balance in time period t. Policymakers respond to both contemporaneous information and historical trends when determining their fiscal policy measures. For example, policy makers take into account both the last period's debt levels as well as the historical primary balance when setting in place their current target for the primary balance. There is evidence of strong persistence of primary balances in the Caribbean (Khadan 2019; Cevik and Nanda 2020), and the Euro Area (Checherita-Westphal and Žďárek 2017; Everaert and Jansen 2017).

Including the lagged dependent variable (LDV) can mitigate, if not eliminate, the presence of serial correlation in the residuals of the estimator (Keele and Kelly 2006). This type of serial correlation may result from a misspecification of the model as the historical values of variables, such as the primary balance, may respond to more recent information, as explained earlier. Therefore, for both theoretical and practical reasons, there has been a gradual shift towards the inclusion of the LDV in (I) and (II) . However, the inclusion of a LDV can introduce a type of omitted variable bias described as "dynamic endogeneity" (Arellano and Bond 1991; Nickell 1981). More specifically, for small T, large N datasets, the inclusion of the lagged dependent variable can result in biased estimates for the coefficient of pb_{t-1}, which is commonly described as the "Nickell bias" (Nickell 1981).

Recent research has emphasized the presence of the endogeneity of several variables, especially the output gap, and the current account. These variables are of particular importance as the former is used to identify counter- or pro-cyclical fiscal responses[4] while the latter is used to identify evidence the "twin deficits hypothesis". Recent studies have produced conflicting results for broad fiscal policy in SIDS. Khadan (2019) finds a pro-cyclical fiscal policy while Cevik and Nanda (2020) find a counter-cyclical fiscal policy (but a procyclical government spending bias) in the Caribbean using a comparable collection of countries across overlapping time periods. On the other hand, several studies have identified evidence for the twin deficits hypothesis in the Euro Area (Checherita-Westphal and Žďárek 2017; Everaert and Jansen 2017) and the Caribbean (Khadan 2019) thus reinforcing the endogeneity concern within this space.

The effect of fiscal rules on primary balances has been broadly mixed. Ghosh et. al. (2013), Checherita-Westphal and Žďárek (2017), and Cevik and Nanda (2020) found that fiscal rules did not have a statistically significant impact on fiscal responses (neither primary balance nor its cyclically-adjusted variant). On the other hand, Everaert and Jansen (2017) did find a positive and statistically significant impact on the primary

[4] There is a vast literature on the cyclicality of fiscal policy. One recent contribution is Galeano et al (2021).

balance using a sample of OECD countries. One key issue is effective compliance with quantitative fiscal rules, as document in Ardanaz et al (2023).

Although climate change and its fiscal implications has grown in importance in recent years, research on the impact of climatological events within the fiscal reaction literature has been limited. Lis and Nickel (2010) estimate that extreme weather events can cause a decrease in primary balances equivalent to 0.23 percent and 1.1 percent of GDP. However. more recently, Cevik and Nanda (2020), using a dataset of Caribbean countries found no statistically significant impact of past natural disasters (t-1) on contemporaneous cyclically-adjusted primary balances.

Finally, Hernández and González (2023) and Khadan (2019) found evidence that debt in the Caribbean may be sustainable, if albeit weakly. However, "weakly sustainable" debt is particularly worrisome for a region susceptible to external shocks, including hurricanes and price shocks. We aim to expand their analysis to a larger pool of SIDS, using several model specifications and robustness checks that were not done before.

Table 1. Summary of Results from Several Papers

Paper	Dependent Variable	Coefficient	Sample	Model(s)
Mendoza and Ostry (2008)	Primary Balance	0.2 – 0.04 (Industrial), 0.04-0.11 (Emerging), 0.04-0.07 (All)	Industrial (22), EM (34), All(56)	FE estimator with robust S.E. and AR(1) coefficients for residuals
Lis and Nickel (2010)	Overall Balance ("budget balance")	0.016 - 0.17 (All), 0.015 (Developing), 0.059 - 0.067 (OECD), 0.092 - 0.095 (EU)	All (138)	FE, IV-FE
Ghosh et al. (2013)	Primary Balance	-0.208 to -0.225	23 AE countries	GLS + AR(1)
Checherita-Westphal and Žďárek (2017)	Primary Balance	0.029 - 0.038	18 Euro area	Panel IV-FE
Everaert and Jansen (2017)	Primary Balance	0.026 - 0.041	21 OECD countries	GLS + AR(1)
Khadan (2019)	Primary Balance	0.019 - 0.024	10 Caribbean countries	LSDV, PCSE, Driscoll-Kraay FE, Pooled OLS, and Panel IV-FE
Cevik and Nanda (2020)	Cyclically Adjusted Primary Balance	0.028 - 0.049 (LSDV) 0.015-0.023 (sGMM)	16 Caribbean countries	LSDV and system GMM
Small, Brown and Canavire-Bacarreza (2020)	Primary Balance	0.04 – 0.07	44 countries (mixture of developing and developed)	Dynamic Difference GMM regressions using Forward Orthagonal Deviations (FOD)
Hernández and González (2023)	Primary Balance	0.031 - 0.039	26 LAC countries	Panel FE + AR(1)

Notes: AR(1) refers to the assumption that errors (residuals) follow an autoregressive behavior with a lag of 1; LSDV refers to "Least Squares Dummy Variable", FE refers to fixed effects, IV-FE refers to fixed effects models with fixed effects; GLS refers to "Generalized Least Squares" and GMM refers to "Generalized Methods of Moments".

Data

Our unbalanced dataset includes 28 SIDS[5] between 1983 and 2022 for a total of 867 observations and an average of 31 years of observations per country. Our dataset includes the variables: primary balance, general government debt-to-GDP, government expenditure gap, output gap, average annual inflation, dependency ratios (both total and age), and dummy variables for fiscal rules, natural disasters, IMF programs and election years.[6] The election year dummy is defined as the year prior to and of an election. Both the output gap and the government expenditure gap were estimated using the filter designed by Hodrick and Prescott (1997).[7] Unlike Cevik and Nanda (2020), who used a lagged dummy variable for natural disasters, we define the natural disaster dummy as the year it occurs and only include tropical storms and hurricanes. A detailed description of the source and definition of each variable can be found in the Annex.

We identified which variables had a unit root using the Im-Pesaran-Shin (2003) panel root test, which is suited for unbalanced datasets. All variables were stationary either at levels or after first or second differencing. The following is a table of the summary statistics of several variables of interest.

Table 2. Descriptive Statistics

	N	Mean	SD	Min	Max
GG Debt (% of GDP)	867	64.231	43.757	7.066	410.142
Primary Balance (% of GDP)	867	0.008	5.078	-22.202	29.365
Current Account (% of GDP)	867	-7.308	10.249	-68.779	84.849
Output Gap	867	-0.091	3.308	-26.802	14.134
Inflation	866	5.541	9.979	-44.359	142.841
Financial Development	865	38.685	22.026	0.403	134.714
Dependency Ratio	867	-0.113	14.252	-26.453	33.081
Age Dependency Ratio	867	0.008	0.091	-0.963	0.936

Source: Authors calculations using databases listed in Annex 1.

[5] Antigua and Barbuda, The Bahamas, Barbados, Belize, Cabo Verde, Comoros, Dominica, Dominican Republic, Fiji, Grenada, Guinea-Bissau, Guyana, Jamaica, Maldives, Mauritius, Micronesia (Federated States of), Papua New Guinea, Solomon Islands, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, São Tomé e Príncipe, Seychelles, Suriname, Tonga, Trinidad and Tobago, Tonga, and Vanatu.

[6] For most SIDS, we used the data series for central government debt as it was longer and both series where equivalent, where overlaps existed, as confirmed using graphical comparisons. Exceptions were Dominican Republic, Jamaica, Mauritius, Federated States of Micronesia, and St. Vincent and the Grenadines. Although, there were observable discrepancies, the correlations between both data series were high (between 0.5 and 0.95) and so the growth rates for central government debt were used to extrapolate missing data.

[7] To mitigate the known end-point estimation bias, we used five-year ahead forecasts from the IMF's WEO database (Kaiser and Maravall 2012).

Methodology

First, we design our primary model using 2-step feasible Generalized Method of Moments (GMM) with Driscoll-Kraay standard errors and small sample correction. We use the model to test three specifications—linear, quadratic, and cubic—with the contemporaneous output gap.

Consequently, our baseline analysis will be based on an extension of equation (II)—a linear, quadratic and cubic version of the following:

$$pb_t = \gamma pb_{t-1} + \beta_1 d_{t-1} + \beta_2 d_{t-1}^2 + \beta_3 d_{t-1}^3 + \varphi_1 OG_t + \sum_i^n \rho_i X_{i,t} + \varepsilon_t \qquad (III)$$

$$\text{Where,} \quad \varepsilon_t = \sum_i^k \theta \varepsilon_{i,t-k} + \mu_{i,t}$$

In addition to these three specifications, we propose an variation to account for potential heterogeneous responses to business cycles, i.e. a separate fiscal response for actual output above and below potential.

$$pb_t = \gamma pb_{t-1} + \beta_1 d_{t-1} + \beta_2 d_{t-1}^2 + \beta_3 d_{t-1}^3 + \varphi_1 OG_t^{Upper} + \varphi_2 OG_t^{Lower} + \sum_i^{n-1} \rho_i X_{i,t} + \varepsilon_t \qquad (IV)$$

$$\text{Where,} \quad \varepsilon_t = \sum_i^k \theta \varepsilon_{i,t-k} + \mu_{i,t}$$
$$OG_t^{Upper} = OG_t \ if \ OG_t > 0 \ , 0 \ otherwise$$
$$OG_t^{Lower} = OG_t \ if \ OG_t < 0 \ , \ 0 \ otherwise$$

Equations (III) through (IV) will be used in tables 3 and 4 in our results.

As an additional robustness check, we conducted the same econometric analysis with a lagged output gap—both for single (V) and heterogenous (VI) business cycle responses. The latter modification partly resolves the endogeneity issue that may arise, and it is possible that policy makers respond to historical information about the business cycle (Golinelli and Momigliano 2008).

$$pb_t = \gamma pb_{t-1} + \beta_1 d_{t-1} + \beta_2 d_{t-1}^2 + \beta_3 d_{t-1}^3 + \gamma_1 OG_{t-1} + \sum_i^n \rho_i X_{i,t} + \varepsilon_t \qquad (V)$$

$$pb_t = \gamma pb_{t-1} + \beta_1 d_{t-1} + \beta_2 d_{t-1}^2 + \beta_3 d_{t-1}^3 + \varphi_1 OG_{t-1}^{Upper} + \varphi_1 OG_{t-1}^{Lower} + \sum_i^{n-1} \rho_i X_{i,t} + \varepsilon_t \qquad (VI)$$

$$\text{Where,} \quad \varepsilon_t = \sum_i^k \theta \varepsilon_{i,t-k} + \mu_{i,t}$$
$$OG_{t-1}^{Upper} = OG_{t-1} \ if \ OG_{t-1} > 0 \ , 0 \ otherwise$$

$$OG_{t-1}^{Lower} = OG_{t-1}\ if\ OG_{t-1} < 0\ ,\ 0\ otherwise$$

In all estimations, the lagged dependent variable, pb_{t-1}, we include to mitigate serial correlation that can occur from its exclusion. In our GMM (as well as 2SLS models), we instrument contemporaneous current account balance, and credit to the private sector, by their respective first and second lags while the output gap, as in Plödt and Richter (2016), is instrumentalized by the first lag of the output gap and the difference between the potential output growth rate and the real GDP growth rate.[8] The second lag of primary balance is also added as an instrument, as there is evidence of persistence up until the second lag using correlation tests. Additionally, the Driscoll-Kraay standard errors are preferred to correct for serial correlation up until lag k, cross-sectional dependence, and heteroskedasticity. Furthermore, the GMM model corrects for the presence of Nickell Bias.[9] We use levels, instead of first differences, as suggested by Haque et al. (1999) for datasets with time dimensions greater than 20 years.

Controlling for government expenditure gap, which measures the deviation of actual government expenditure from the trend, can "hide" effects of other such as the election cycle. Therefore, we will also conduct a series of regressions without the government expenditure gap variable as a robustness check.

As a robustness check, we conducted the same econometric analysis with a lagged output gap. This may partly resolve the endogeneity issue that may arise, and it is possible that policy makers respond to historical, rather than contemporaneous, information about the business cycle. Following Everaert and Jansen (2017), after identifying our preferred model specification, we will also iteratively re-run our preferred model, each time dropping a single country. Finally, we will also undertake a form of recursive analysis, similar to the one used in Mauro et. al. (2009), starting with the subset 1983 until 2007. We will re-run our base linear model adding a year (2005, 2006, 2007 and so on) until we attain the full dataset.

Finally, we incorporated a variety of additional robustness checks. We utilized several econometric techniques— two-stage least squares (2SLS), Pooled OLS with Driscoll-Kraay standard errors, Panel-Corrected Standard Errors (PSCE)and panel regression using Generalized Least Squares with autoregression for residuals up to 1 lag.[10] To

[8] We find that using the first two lags of output gap are not sufficient to reject the null hypothesis of under-identification of instruments, and, due to data constraints, we are unable to use trade-weighted output gaps of key trade partners, as done in Galí and Perotti (2003).
[9] Bond (2002) suggests that this bias may be limited in datasets where T > 20; however, other studies suggest a higher threshold of 30 time periods (Judson and Owen 1999).
[10] Several papers used Panel-Corrected Standard Errors (PSCE); however, Reed and Webb (2010) argue that PCSEs perform poorly in the presence of serial correlation in the errors, and high degree of persistence of regressors (usually above 0.9). In our dataset, we find a high degree of persistence in credit to the private sector as a percent of GDP. Despite known caveats, we include it as one of several alternative estimation methods.

account for endogeneity in models without instruments, we used the second lag of the aforementioned endogenous variables instead of their contemporaneous values. In all model specifications, we include time and country fixed effects.[11]

The control variables included are current account balance, inflation, and dummy variables for fiscal rules, meteorological natural disasters (specifically tropical storms and hurricanes), and IMF programs. In recent years, fiscal reaction functions typically include the current account balance as a control variable.

Discussion of Results

(a) Base Models

Our initial results indicate that the response of the primary balance to lagged debt is possibly non-linear. The coefficient for lagged debt is statistically significant for all specifications—both linear and non-linear—and is positive, which suggests that sovereign debt is weakly sustainable for small island states. Interestingly, models (3) and (6) do suggest the presence of fiscal fatigue as the coefficient for the cubic term is negative. However, the coefficient for the cubic term is only statistically significant for model (6), but, as confirmed by a Wald test, the polynomial for the debt term is jointly significant in model (3).

Table 3. Results from Regressions using Equations (III) and (IV)

	(1) Linear	(2) Quadratic	(3) Cubic	(4) Linear Het.	(5) Quad. Het. OG	(6) Cubic Het.
Lag of Primary Balance	0.509***	0.509***	0.514***	0.548***	0.533***	0.527***
	(0.042)	(0.040)	(0.039)	(0.093)	(0.087)	(0.085)
Lagged Debt	0.031**	0.036***	0.045***	0.043*	0.039**	0.048***
	(0.014)	(0.010)	(0.012)	(0.023)	(0.015)	(0.016)
Lagged Debt^2		0.000*	-0.000		0.000*	-0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Lagged Debt^3			-0.000			-0.000*
			(0.000)			(0.000)
Output Gap	0.040	0.033	0.049			
	(0.068)	(0.070)	(0.067)			
Expenditure Gap	-0.145***	-0.146***	-0.147***	-0.154***	-0.152***	-0.151***
	(0.016)	(0.016)	(0.015)	(0.017)	(0.016)	(0.015)
Inflation	0.008	0.007	0.008	0.016	0.016	0.018*
	(0.011)	(0.009)	(0.009)	(0.012)	(0.011)	(0.010)
Meteorological Disasters	-0.743***	-0.751***	-0.734***	-0.910***	-0.906***	-0.877***

[11] Time fixed effects should limit the size of cross-sectional variances (Roodman 2006).

	(0.268)	(0.266)	(0.270)	(0.307)	(0.301)	(0.303)
IMF Program	0.284	0.259	0.313	0.135	0.130	0.179
	(0.446)	(0.438)	(0.430)	(0.462)	(0.455)	(0.445)
Age Dependency Ratio	2.390	2.348	2.380	2.647	2.734	2.713
	(1.483)	(1.478)	(1.487)	(1.629)	(1.646)	(1.665)
Dependency Ratio	-0.227	-0.244	-0.207	0.021	-0.053	0.002
	(0.177)	(0.154)	(0.151)	(0.240)	(0.201)	(0.201)
Current Account	0.105**	0.104***	0.099***	0.079	0.096**	0.095**
	(0.040)	(0.023)	(0.022)	(0.059)	(0.042)	(0.041)
Restructure	1.034**	1.028**	1.097**	1.251***	1.123***	1.182***
	(0.395)	(0.381)	(0.422)	(0.442)	(0.377)	(0.416)
Election	-0.033	-0.029	-0.037	0.072	0.096	0.084
	(0.153)	(0.152)	(0.148)	(0.201)	(0.201)	(0.198)
Financial Dev.	-0.018	-0.018	-0.020	-0.027**	-0.025**	-0.027**
	(0.012)	(0.012)	(0.012)	(0.011)	(0.010)	(0.011)
Fiscal Rule	0.713	0.679	0.687	1.072*	1.113**	1.204**
	(0.546)	(0.521)	(0.519)	(0.575)	(0.516)	(0.506)
Output Gap - Above				-0.474***	-0.467***	-0.466***
				(0.158)	(0.156)	(0.157)
Output Gap - Below				0.230	0.221	0.236
				(0.182)	(0.171)	(0.181)
Individual FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Number of obs.	809	809	809	809	809	809
R-squared adjusted	0.358	0.363	0.365	0.359	0.362	0.366
Hansen J p val.	0.449	0.426	0.421	0.371	0.374	0.327
Kleibergen-Paap p	0.0654	0.0553	0.0568	0.0928	0.0820	0.0849

Notes: p-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 1%, 5% and 10%, respectively. Country fixed effects and time fixed effects are not reported, robust standard errors are reported. Regressions are produced using a 2-step feasible GMM model. "Het." refers to split (i.e. "heterogenous") output gap cycles. The dependent variable is general government primary balance (% GDP).

Across all specifications, similar to Khadan (2019) and Cevik and Nanda (2020), we see evidence of persistence of primary balances, the negative association of financial depth with primary balances, and confirmation of the "twin deficits hypothesis". SIDS, more so than other developing countries, tend to be net importers of food and energy needs, and thus usually have more volatile current account balances. Therefore, they are vulnerable to commodity shocks, which in turn may negatively (positively) affect, i.e. decrease (increase), their primary balances through several channels. This behavior is in line with expectations under the twin-deficits hypothesis that suggest that both fiscal and current account balances move in tandem.

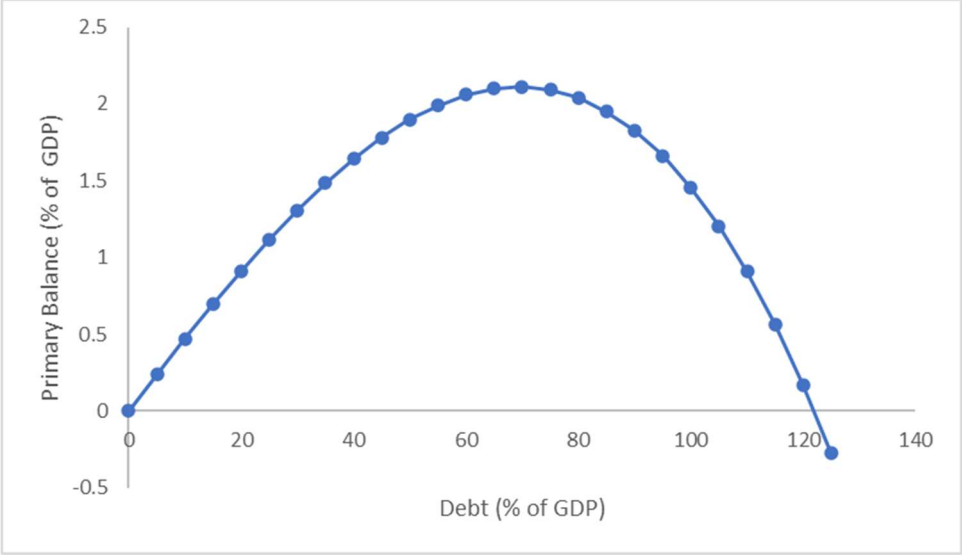
Unlike Khadan (2019) and Cevik and Nanda (2020), we do not see evidence of a homogenous (i.e. singular) fiscal response to the business cycle but rather a heterogenous (i.e. "split") response. Specifically, there is only a fiscal response during upswings and this relationship is procyclical. Fiscal rules only have a statistically

significant (and positive) effect under the assumption of asymmetrical responses to different periods of the business cycle. We do not see evidence—Models (4) to (6)—of the political cycle in driving deficits as seen in several prior studies (Cevik and Nada 2020; Checherita-Westphal and Žďárek 2017; Everaert and Jansen 2017; Khadan 2019).

Unlike Cevik and Nanda (2020), we do see a clear negative and statistical impact of tropical storms and hurricanes on contemporaneous fiscal balances across all model specifications. This difference is likely due to the use of a contemporaneous (rather than lagged) dummy, and specifying tropical and hurricanes rather than all natural disasters. We also see evidence in models (4) to (6) of fiscal rules increase primary balance.

Following Ghosh et. al. (2013), we find that the turning point for the fiscal reaction function corresponds to 65% debt-to-GDP (see Figure 2 below). That is after 65%, the primary balance with respect to increasing debt levels tend to decrease (and eventually becomes negative at around 120% debt-to-GDP). This result is surprisingly in-line with standard practice for debt rules (e.g. EU's Maastrict rule, the debt rules found in the Eastern Caribbean Currency Union and Jamaica) that target a debt-to-GDP of 60%. However, as shown in Fig. 1 above, this is only half the story, as sustainability is also a function of expected debt service payments. Even if primary balances are decreasing, if they are above the required debt service, then debt can still be considered "sustainable".

Figure 2. Plot of Primary Balances against General Government Debt (% GDP)

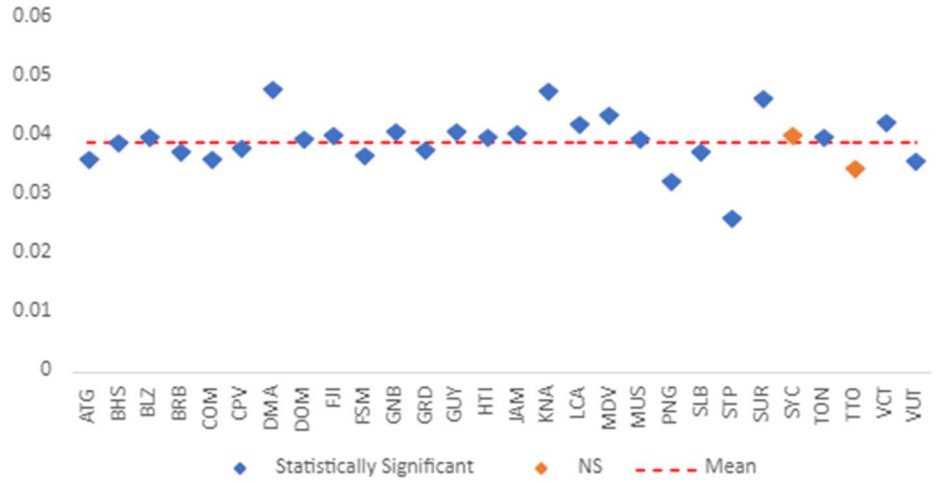


Notes: Based on the cubic polynomial found in regression (6) of Table 3.

(b) Outlier Analysis

Outliers can have outsized effects on empirical estimates, including the values of coefficients. Fournier and Fall (2015) find that the argument for fiscal fatigue, as described by Ghost et. al. (2013), does not hold when Japan is excluded from the sample of OECD countries. A cross sectional analysis where we drop one country from the full dataset and re-run the linear model (4) suggests that the linear coefficient is broadly within the range of 0.025 and 0.05 and, for most iterations, is statistically significant. Excluding São Tomé and Príncipe, results in a coefficient that is approximately two-thirds the size estimated in Model (4) and the cubic term is no longer statistically significant, suggesting that São Tomé and Príncipe may be driving the "fiscal fatigue" phenomenon observed. Like Japan in Fournier and Fall (2015), there is evidence that São Tomé and Príncipe had an usually large influence on the estimated fiscal response to debt levels.

Figure 3. Country Variation



Excluding São Tomé and Príncipe

Re-doing the regressions without São Tomé and Príncipe produces near identical results. However, there are a few key differences. Firstly, the results suggest that a linear relationship is more likely, which precludes the "fiscal fatigue" phenomenon described by Ghosh et. Al. (2013). These results suggest that the "fiscal fatigue" that was observed earlier was driven primarily by one country. Secondly, the fiscal response expected is halved, compared to what we estimated in previous models. We do not see evidence for the electoral cycle. The linear and quadratic models suggest a coefficient of 0.025 which is in line with the estimates found by Khadan (2019) and Cevik and Nanda (2020).

Table 4. Results from Regressions using Equations (III) and (IV) without São Tomé e Príncipe

	(7) Linear	(8) Quadratic	(9) Cubic	(10) Lin. Het.	(11) Quad. Het.	(12) Cubic Het.
Lag of Primary Balance	0.615***	0.614***	0.627***	0.627***	0.625***	0.660***
	(0.069)	(0.065)	(0.054)	(0.068)	(0.068)	(0.055)
Lagged Debt	0.025***	0.026***	0.018*	0.026***	0.026***	0.023**
	(0.008)	(0.008)	(0.010)	(0.008)	(0.008)	(0.011)
Lagged Debt^2		0.000	0.000		-0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Lagged Debt^3			0.000**			0.000
			(0.000)			(0.000)
Output Gap	0.046	0.045	0.057			
	(0.061)	(0.065)	(0.049)			
Expenditure Gap	-0.145***	-0.145***	-0.142***	-0.149***	-0.150***	-0.142***
	(0.013)	(0.012)	(0.010)	(0.013)	(0.013)	(0.008)
Inflation	0.005	0.005	0.004	0.016	0.016	0.016
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Meteorological Disasters	-0.766***	-0.766***	-0.794***	-0.847***	-0.850***	-0.860***
	(0.229)	(0.228)	(0.218)	(0.239)	(0.237)	(0.233)
IMF Program	0.058	0.061	0.105	-0.082	-0.065	0.035
	(0.391)	(0.317)	(0.293)	(0.387)	(0.385)	(0.356)
Age Dependency Ratio	2.022	1.976	1.850	2.396	2.336	2.453*
	(1.262)	(1.248)	(1.239)	(1.452)	(1.447)	(1.424)
Dependency Ratio	-0.082	-0.077	-0.068	-0.059	-0.046	-0.043
	(0.138)	(0.129)	(0.123)	(0.141)	(0.135)	(0.133)
Current Account	0.074***	0.073***	0.069***	0.059**	0.058**	0.053**
	(0.017)	(0.016)	(0.015)	(0.022)	(0.022)	(0.020)
Restructure	0.744**	0.736*	0.766*	1.024***	1.017**	1.079***
	(0.357)	(0.402)	(0.393)	(0.376)	(0.396)	(0.393)
Election	-0.180	-0.185	-0.212	-0.042	-0.041	-0.118
	(0.183)	(0.181)	(0.163)	(0.202)	(0.202)	(0.184)
Financial Dev.	-0.021*	-0.024**	-0.021*	-0.027**	-0.028**	-0.019*
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)
Fiscal Rule	0.770	0.773	0.740	1.163***	1.192**	1.126**
	(0.460)	(0.466)	(0.451)	(0.427)	(0.443)	(0.438)
Output Gap - Above				-0.469***	-0.468***	-0.511***
				(0.168)	(0.170)	(0.155)
Output Gap - Below				0.321*	0.314*	0.382***
				(0.171)	(0.171)	(0.140)
Individual FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Number of obs.	763	763	763	763	763	763
R-squared adjusted	0.423	0.423	0.420	0.420	0.420	0.407

Hansen J p val.	0.283	0.422	0.547	0.273	0.263	0.288
Kleibergen-Paap p	0.0413	0.0751	0.116	0.181	0.190	0.261

Notes: p-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 1%, 5% and 10%, respectively. Country fixed effects and time fixed effects are not reported, robust standard errors are reported. Regressions are produced using a 2-step feasible GMM model. "Het." Refers to split (i.e. "heterogenous") output gap cycles. The dependent variable is general government primary balance (% GDP).

Robustness Checks

(a) Without Government Expenditure Gap

Removal of expenditure gap variable results in a smaller, but still statistically significant, fiscal response to debt levels across all specifications. Additionally, inflation, election and fiscal rule variables become statistically significant. In the case of elections and fiscal rules, it is likely that these variables impact primary balances through the expenditure channel, which would account for their statistical insignificance in the absence of the expenditure gap variable. For example, de Haan et. al. (2023) find that elections correspond with an increase in primary expenditures and wage bills in a sample of 104 emerging market and developing countries. Furthermore, of the twelve countries that have fiscal rules, all have or had budget balance rules, which indirectly target expenditures. On the other hand, we would expect inflation, at least contemporaneously, to affect primary balances through revenues, rather than expenditures (Small et. al. 2020). However, conventional wisdom suggests expansionary fiscal policy, which can be captured by the government expenditure gap, may be inflationary.

Table 5. Results from Regressions using Equations (III) and (IV) without the Government Expenditure Gap

	(13) Linear	**(14) Quadratic**	**(15) Cubic**	**(16) Lin. Het.**	**(17) Quad. Het.**	**(18) Cubic Het.**
Lag of Primary Balance	0.574***	0.578***	0.574***	0.566***	0.569***	0.583***
	(0.067)	(0.064)	(0.060)	(0.072)	(0.071)	(0.067)
Lagged Debt	0.017*	0.018*	0.006	0.015	0.015	0.006
	(0.010)	(0.009)	(0.013)	(0.009)	(0.009)	(0.014)
Lagged Debt^2		-0.000	0.000		-0.000	-0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Lagged Debt^3			0.000**			0.000*
			(0.000)			(0.000)
Output Gap	0.107*	0.110**	0.100*			
	(0.054)	(0.054)	(0.051)			
Inflation	0.024**	0.024**	0.025**	0.033***	0.034***	0.030***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Meteorological Disasters	-0.658**	-0.650**	-0.629**	-0.783***	-0.780***	-0.848***
	(0.281)	(0.284)	(0.258)	(0.283)	(0.284)	(0.271)

IMF Program	0.475	0.497*	0.486*	0.282	0.300	0.285
	(0.302)	(0.280)	(0.281)	(0.358)	(0.359)	(0.359)
Age Dependency Ratio	1.712	1.774	1.688	2.511	2.486	2.565
	(1.380)	(1.366)	(1.369)	(1.682)	(1.683)	(1.654)
Dependency Ratio	-0.086	-0.082	-0.093	-0.114	-0.100	-0.062
	(0.167)	(0.161)	(0.158)	(0.166)	(0.164)	(0.154)
Current Account	0.086***	0.086***	0.085***	0.076***	0.075***	0.072***
	(0.016)	(0.016)	(0.016)	(0.021)	(0.020)	(0.019)
Restructure	0.771**	0.800*	0.799*	1.184***	1.239***	1.276***
	(0.353)	(0.421)	(0.419)	(0.401)	(0.454)	(0.447)
Election	-0.349**	-0.339**	-0.327**	-0.176	-0.172	-0.227
	(0.153)	(0.139)	(0.138)	(0.161)	(0.161)	(0.148)
Financial Dev.	-0.028***	-0.027**	-0.028***	-0.032***	-0.031***	-0.027***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)
Fiscal Rule	0.924*	0.934*	0.907*	1.454***	1.508***	1.350***
	(0.470)	(0.474)	(0.456)	(0.435)	(0.446)	(0.420)
Output Gap - Above				-0.453***	-0.457***	-0.481***
				(0.149)	(0.150)	(0.148)
Output Gap - Below				0.387***	0.390***	0.397***
				(0.123)	(0.128)	(0.123)
Individual FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Number of obs.	763	763	763	763	763	763
R-squared adjusted	0.338	0.336	0.338	0.335	0.333	0.330
Hansen J p val.	0.435	0.605	0.747	0.494	0.463	0.482
Kleibergen-Paap p	0.0406	0.0738	0.114	0.180	0.189	0.258

Notes: p-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 1%, 5% and 10%, respectively. Country fixed effects and time fixed effects are not reported, robust standard errors are reported. Regressions are produced using a 2-step feasible GMM model. “Het.” Refers to split (i.e. “heterogenous”) output gap cycles. The dependent variable is general government primary balance (% GDP). Sample does not include São Tomé e Príncipe.

(b) Lagged Output Gap

Using the prior period’s output gap, instead of the contemporaneous output gap, mostly did not produce a material change in the results. Using the lagged output still indicates that the fiscal response to the business cycle is procyclical and there is evidence for the argument that this procyclicality is only observable during business cycle upswings (or “booms”). Primary balances are, again, most responsive under the assumption of asymmetrical effects of the business cycle. However, unlike models using contemporaneous business cycles, there is some evidence of a relationship between fiscal responses and the electoral cycle.

Table 6. Results from Regressions using Equations (V) and (VI) and Lagged Output Gaps

	(19)	(20)	(21)	(22)	(23)	(24)
	Linear	**Quadratic**	**Cubic**	**Lin. Het.**	**Quad. Het.**	**Cubic Het.**
Lag of Primary Balance	0.619***	0.582***	0.580***	0.578***	0.579***	0.577***
	(0.069)	(0.048)	(0.049)	(0.049)	(0.049)	(0.051)
Lagged Debt	0.017**	0.010	-0.004	0.014*	0.014*	-0.002
	(0.008)	(0.007)	(0.012)	(0.007)	(0.008)	(0.012)
Lagged Debt^2		-0.000	0.000		-0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Lagged Debt^3			0.000**			0.000***
			(0.000)			(0.000)
Expenditure Gap	-0.143***	-0.139***	-0.138***	-0.142***	-0.142***	-0.142***
	(0.012)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Inflation	0.013	0.008	0.008	0.007	0.007	0.007
	(0.012)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Meteorological Disasters	-0.625**	-0.780***	-0.807***	-0.737**	-0.738**	-0.773***
	(0.291)	(0.273)	(0.263)	(0.280)	(0.281)	(0.269)
IMF Program	0.013	0.026	-0.015	0.053	0.058	0.006
	(0.392)	(0.404)	(0.406)	(0.416)	(0.415)	(0.415)
Age Dependency Ratio	1.981	2.027	2.027	2.189	2.200	2.207
	(1.316)	(1.367)	(1.366)	(1.369)	(1.370)	(1.370)
Dependency Ratio	-0.100	-0.158	-0.180	-0.139	-0.136	-0.162
	(0.154)	(0.165)	(0.166)	(0.172)	(0.171)	(0.169)
Current Account	0.073***	0.078***	0.077***	0.070***	0.070***	0.068***
	(0.023)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)
Restructure	0.740**	0.711*	0.697*	0.675**	0.695*	0.686*
	(0.353)	(0.366)	(0.362)	(0.331)	(0.374)	(0.370)
Election	-0.259	-0.290**	-0.280**	-0.260*	-0.260*	-0.246
	(0.161)	(0.136)	(0.137)	(0.150)	(0.150)	(0.153)
Financial Dev.	-0.023*	-0.020*	-0.019*	-0.020*	-0.020*	-0.019*
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Fiscal Rule	0.597	0.828*	0.791*	0.914**	0.918**	0.878**
	(0.455)	(0.427)	(0.418)	(0.421)	(0.423)	(0.412)
Lagged Output Gap - Above				-0.261***	-0.261***	-0.260***
				(0.058)	(0.058)	(0.058)
Lagged Output Gap - Below				0.017	0.014	0.023
				(0.040)	(0.037)	(0.038)
Lagged Output Gap	-0.099***	-0.102***	-0.097***			
	(0.028)	(0.024)	(0.025)			
Individual FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Number of obs.	790	790	790	790	790	790
R-squared adjusted	0.437	0.439	0.440	0.443	0.442	0.443
Hansen J p val.	0.411	0.301	0.293	0.299	0.297	0.283

Kleibergen-Paap p	0.00857	0.0746	0.0752	0.0718	0.0716	0.0721

Notes: p-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 1%, 5% and 10%, respectively. Country fixed effects and time fixed effects are not reported, robust standard errors are reported. Regressions are produced using a 2-step feasible GMM model. "Het." Refers to split (i.e. "heterogenous") output gap cycles. The dependent variable is general government primary balance (% GDP). Sample does not include São Tomé e Príncipe. We use only one (instead of two) lag of the LDV.

(c) Temporal and Cross-Sectional Recursive Regressions

Excluding São Tomé and Príncipe from our recursive temporal analysis, and re-running the linear model (10) from Table 4, we see that between 2012 and 2022, the coefficient was between 0.02 and 0.03 and statistically significant (Figure 4).[12] However, before, 2011, i.e. from 2007 until the end of the Global Financial Crisis (GFC), the fiscal response was either too weak or non-existent. On the other hand, the coefficient is relatively stable, between 0.015 and 0.038, and statistically significant regardless of which country is excluded (Figure 5).

Figure 4. Time Variation

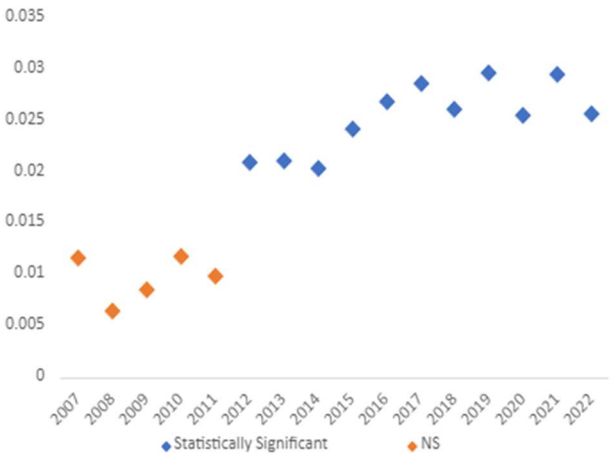
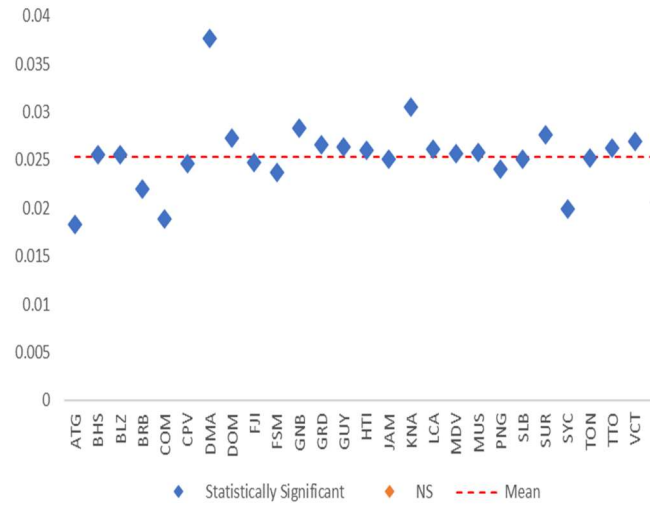


Figure 5. Country Variation



Notes: Figures 4 and 5 do not include Tomé e Príncipe.

(d) Alternative Model specifications

Using the same dataset but with different econometric techniques, and with second lagged variables to control for endogeneity, produces comparable results.[13] All models

[12] Checherita-Westphal and Žďárek (2017) find evidence of the debt response becoming less positive (i.e. sustainable) after the Global Financial Crisis.

[13] Bellmare et. al. (2017) show that lagging (by one period) independent variables may be insufficient to ensure exogeneity unless key conditions are met. Based on their prescribed tests, we find that one lag may not be sufficient for exogeneity. We also include in the Annex a

suggest evidence for the persistence of the primary balance and a weakly sustainable fiscal response to debt. Additionally, tropical storms, on average, do have a sharply negative impact on fiscal balances and the electoral cycle may be a drag on budgets. The response of the primary balance to debt is again comparable to what was found in Khadan (2019) and Cevik and Nanda (2020).

Table 7. Results from Regressions using Equations (V) and (VI) and Alternative Models

	(25)	(26)	(27)	(28)	(29)
	2SLS	Driscoll-Kraay	Pooled OLS	PCSE	GLS
Lag of Primary Balance	0.633***	0.597***	0.597***	0.551***	0.526***
	(0.066)	(0.050)	(0.051)	(0.047)	(0.030)
Lagged Debt	0.020**	0.022***	0.022**	0.023*	0.017*
	(0.008)	(0.006)	(0.010)	(0.013)	(0.010)
Expenditure Gap	-0.140***	-0.149***	-0.149***	-0.143***	-0.137***
	(0.015)	(0.016)	(0.036)	(0.013)	(0.010)
Inflation	0.018	0.012	0.012	0.019	0.004
	(0.011)	(0.013)	(0.011)	(0.014)	(0.011)
Meteorological Disasters	-0.740**	-0.647**	-0.647**	-0.517**	-0.335*
	(0.316)	(0.295)	(0.246)	(0.240)	(0.171)
IMF Program	0.023	0.058	0.058	-0.008	-0.080
	(0.447)	(0.372)	(0.349)	(0.354)	(0.245)
Age Dependency Ratio	2.769*	2.225	2.225*	1.996	2.072*
	(1.636)	(1.603)	(1.248)	(1.464)	(1.135)
Dependency Ratio	-0.104	-0.022	-0.022	0.039	0.093
	(0.219)	(0.219)	(0.260)	(0.217)	(0.156)
Current Account	0.056**				
	(0.025)				
Restructure	0.895**	0.910***	0.910**	0.949***	0.619***
	(0.371)	(0.323)	(0.355)	(0.332)	(0.240)
Election	-0.133	-0.314**	-0.314	-0.305	-0.174
	(0.194)	(0.151)	(0.207)	(0.186)	(0.141)
Financial Dev.	-0.020				
	(0.013)				
Fiscal Rule	1.038**	0.274	0.274	0.088	0.056
	(0.419)	(0.458)	(0.395)	(0.412)	(0.290)
Lagged Output Gap - Above (-2)		-0.015	-0.015	-0.025	-0.025
		(0.064)	(0.049)	(0.068)	(0.052)
Lagged Output Gap - Below (-2)		-0.156***	-0.156*	-0.154**	-0.130***
		(0.057)	(0.083)	(0.060)	(0.046)
Lagged Current Account (-2)		0.018	0.018	0.026	0.028**
		(0.015)	(0.020)	(0.016)	(0.012)

version of this table where regressions (20) to (23) use contemporaneous values for the business cycle, financial development and current account (See Table A.2 in Annex).

Lagged Financial Dev. (-2)		-0.015	-0.015	-0.021**	-0.007
		(0.014)	(0.012)	(0.010)	(0.008)
Output Gap - Above	-0.532***				
	(0.182)				
Output Gap - Below	0.316*				
	(0.186)				
Constant		-0.716	-0.716	2.371***	2.748***
		(0.763)	(1.034)	(0.756)	(0.684)
Individual FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Number of obs.	790	791	791	791	791
R-squared adjusted	0.419		0.506		
Hansen J p val.	0.367				
Kleibergen-Paap p	0.0491				

Notes: p-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 1%, 5% and 10%, respectively. Country fixed effects and time fixed effects are not reported, robust standard errors are reported. The dependent variable is general government primary balance (% GDP). Sample does not include São Tomé e Príncipe. We use only one (instead of two) of the LDV.

Conclusion and Policy Implications

The previous literature on fiscal reaction functions focused on either advanced economies or regional groups of countries. In our paper, we focused on countries where fiscal authorities are governing over economies that have unusual endowments in common—small populations and (mostly) small geographic areas—combined with varying degrees of distance or limited infrastructure linkages to large market economies. These characteristics create challenges for fiscal authorities. Most notably, they need to maintain fiscal sustainability in the face of high per capita costs of government services (OECD 2018).

Despite these challenges, we find that weak fiscal sustainability has been maintained, but mostly due to the more recent period of the analysis, and with the exclusion of the outlier of São Tomé and Principe. The magnitudes of the coefficient of the increasing primary balance in response to increasing debt-to-GDP is in line with the estimates from the literature, including, for example past work on Caribbean SIDS. One novel finding is that extreme weather events are indeed associated with deteriorations in the primary fiscal balance.

The results also broadly suggest the following:

1. *Governments in the sample broadly engage in procyclical behaviors during economic upswings.* During economic booms, especially those that may result from external factors—tourism inflows and commodity exports—governments

may spend more than they should which leaves them vulnerable during the inevitable downturns.[14]

2. *Fiscal rules generally are associated with containing primary deficits and, in our sample, likely do so through the expenditures channel.* Most countries in the sample do not have in place transparent fiscal rules that are both monitored and enforced. The lack of a strong institutional environment may decrease compliance with fiscal rules and thus may increase the likelihood of fiscal deficits that can arise during economic upswings (Ardanaz, Ulloa-Suarez, and Valencia 2023). The responsiveness of primary balances to fiscal rules are also more apparent under the assumption of heterogenous responses to output gaps. Ardanaz et al. (2023) also find evidence of heterogenous responses to fiscal rules—Latin America and the Caribbean countries are less compliant during downturns and compliance does not improve during business cycle upturns. Furthermore, these results also raise the question of how business cycles should be modeled—the assumptions underlying their inclusion can influence whether some explanatory variables are statistically significant or not.
3. *Storms are, unsurprisingly, broadly a fiscal risk for the region*. As storms become more frequent and more powerful, the resulting negative fiscal shocks are more likely to occur. Therefore, SIDS that are unprepared, i.e. lacking an emergency fund or limited ability to borrow affordably, will be less likely to have the fiscal space for fiscal stimuli. This risk also raises the issue that "safe" levels of public indebtedness might be lower for SIDS than for countries less susceptible to weather risks.

There are caveats that should be considered and areas for future research. The "weakness" of this statistical test for fiscal sustainability is already discussed in the previous literature. There are broader conceptual concerns. Other strands of the literature on fiscal sustainability explore liquidity risks (and "sudden stops"), credibility issues, the "original sin" of high foreign currency exposures, contingent liabilities, and broader balance sheet approaches that consider both assets and liabilities.[15] All these issues suggest that the level and structure of debt have an impact on the risk of debt distress. Finally, fiscal responses are inherently a national decision function. One may question whether panel data approaches are appropriate, even with all the alternative model specifications and robustness checks. On this latter point, a promising area for future research would be to construct longer time series datasets for developing economies, including SIDS.

[14] McManus and Ozkan (2015) find that countries that have procyclical fiscal policy have lower economic growth, higher inflation and more volatility.
[15] See Debrun et al (2020) for a survey.

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Annex

Table A.1. Description and Sources of Variables

Variable	Description	Source
Lag of GG Debt	General Government Debt (% of GDP)	(Mbaye, Moreno Badia, and Chae 2018).
Output Gap	(Actual GDP – Potential GDP) / Potential GDP Potential GDP is derived from passing real Gross Domestic Output through a HP filter	(IMF 2023)
Government Expenditure Gap	Derived from passing real government expenditure (% of GDP) through a HP filter	(IMF 2023)
Inflation	Average year inflation rate	(IMF 2023)
Current Account Balance	Current Account Balance (% of GDP)	(IMF 2023)
Financial Development	Domestic Credit to the Private Sector (% of GDP)	https://data.worldbank.org/
Dependency Ratio	Age dependency ratio, old, is the ratio of older dependents--people older than 64--to the working-age population (15 - 64 years)	https://data.worldbank.org/
Age Dependency Ratio	Age dependency ratio is the ratio of dependents—people younger than 15 or older than 64—to the working-age population	https://data.worldbank.org/
Severe Weather Event	Storms and hurricanes	(EM-DAT 2023)
IMF Program Dummy	Start and end of IMF Program	(IMF 2023a)
Fiscal Rule Dummy	A single dummy for the presence of either expenditure, revenue, budget balance, or debt rules	Davoodi, et. al. (2022)
Restructure Dummy	Sovereign Restructurings and Defaults. Includes Debt Service Suspension Initiative recipients	https://sites.google.com/site/christophtrebesch/data
Election Cycle	Year of and prior to a presidential or parliamentary election(s). By-elections are not included.	(Pemstein, D. et. al. 2023; Kollman et. al. 2019; Carr 2022; IFES 2023)

Table A.2. Results from Regressions using Equations (V) and (VI) and Alternative Models

	(30)	(31)	(32)	(33)
	Driscoll-Kraay	Pooled OLS	PCSE	GLS
Lag of Primary Balance	0.562***	0.562***	0.528***	0.498***
	(0.041)	(0.041)	(0.042)	(0.027)
Lagged Debt	0.014**	0.014	0.012	0.009
	(0.006)	(0.009)	(0.012)	(0.009)
Expenditure Gap	-0.137***	-0.137***	-0.130***	-0.130***
	(0.015)	(0.035)	(0.013)	(0.010)
Inflation	0.012	0.012	0.015	0.002
	(0.010)	(0.014)	(0.012)	(0.010)
Meteorological Disasters	-0.638**	-0.638**	-0.531**	-0.447***
	(0.302)	(0.245)	(0.227)	(0.164)
IMF Program	0.093	0.093	0.100	-0.015
	(0.429)	(0.312)	(0.342)	(0.239)
Age Dependency Ratio	2.641	2.641*	2.350*	2.458**
	(1.610)	(1.479)	(1.394)	(1.068)
Dependency Ratio	-0.146	-0.146	-0.044	0.008
	(0.216)	(0.276)	(0.194)	(0.142)
Current Account	0.080***	0.080***	0.091***	0.074***
	(0.022)	(0.028)	(0.014)	(0.012)
Restructure	0.789**	0.789**	0.809**	0.518**
	(0.323)	(0.313)	(0.315)	(0.227)
Election	-0.194	-0.194	-0.160	-0.088
	(0.154)	(0.181)	(0.165)	(0.134)
Financial Dev.	-0.018	-0.018	-0.028***	-0.016**
	(0.011)	(0.011)	(0.008)	(0.008)
Fiscal Rule	0.773**	0.773*	0.545	0.460*
	(0.360)	(0.405)	(0.351)	(0.268)
Output Gap - Above	-0.212***	-0.212***	-0.194***	-0.179***
	(0.062)	(0.072)	(0.065)	(0.051)
Output Gap - Below	0.116	0.116	0.094*	0.137***
	(0.069)	(0.086)	(0.053)	(0.042)
Constant	0.409	0.409	3.461***	4.163***
	(0.388)	(0.815)	(0.634)	(0.612)
Individual FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Number of obs.	809	809	809	809
R-squared adjusted		0.540		

Notes: p-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 1%, 5% and 10%, respectively. Country fixed effects and time fixed effects are not reported, robust standard errors are reported. Regressions are produced using a system GMM model. “Het.” refers to split (i.e. “heterogenous”) output gap cycles. The dependent variable is general government primary balance (% GDP). Sample does not include São Tomé e Príncipe.