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A Possible Approach to Fiscal Rules in Small Islands  
— Incorporating Natural Disasters and Climate Change

by Ryota Nakatani

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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

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Asia and Pacific Department

**A Possible Approach to Fiscal Rules in Small Islands — Incorporating Natural Disasters and Climate Change****Prepared by Ryota Nakatani<sup>1</sup>**

Authorized for distribution by Alison Margaret Stuart

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**Abstract**

A big challenge for the economic development of small island countries is dealing with external shocks. The Pacific Islands are vulnerable to natural disasters, climate change, commodity price changes, and uncertain donor grants. The question that arises is how should small developing countries formulate a fiscal policy to achieve economic stability and fiscal sustainability when prone to various shocks? We study how natural disasters affect long-term debt dynamics and propose fiscal policy rules that could help insulate the economy from such unexpected shocks. We propose fiscal rules to address these shocks and uncertainties using the example of Papua New Guinea. Our study finds the advantages of expenditure rules, especially a recurrent expenditure rule based on non-resource and non-grant revenue, interdependently determined by government debt and budget balance targets with expected disaster shocks. This paper contributes to the literature and policy dialogue by theoretically analyzing the impact of natural disasters on debt sustainability and proposing fiscal rules against natural disasters and climate changes. Our fiscal policy framework is practically applicable for many developing countries facing increasing frequency and impact of natural disasters and climate change. Our rules-based fiscal framework is crucial for sustainable and countercyclical macroeconomic policies to build resilience against devastating natural hazards.

JEL Classification Numbers: E32; E62; H5; H6; O23; O44; Q22; Q32; Q54; Q58

Keywords: Fiscal Rule; Expenditure Rule; Recurrent Expenditure; Natural Disaster; Climate Change; Resource Revenue; Countercyclicity; Debt Sustainability; Grants; Pacific Islands.

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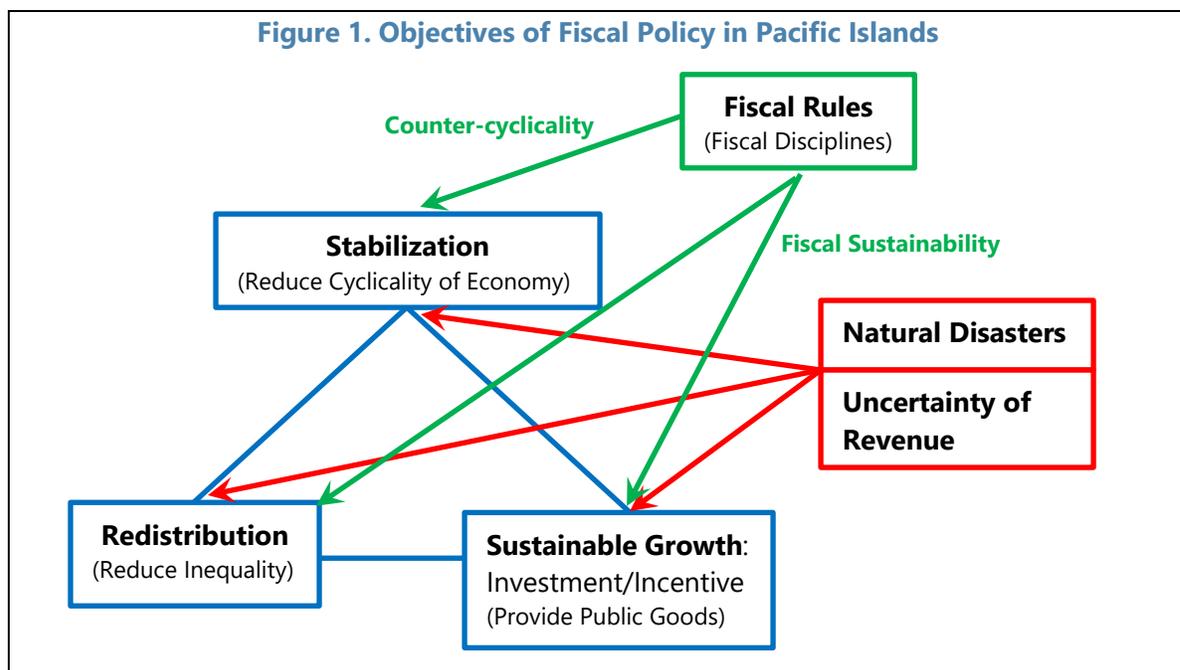
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## I. INTRODUCTION

**How should small, fragile island states in the Pacific formulate fiscal policy when vulnerable to various shocks such as natural disasters, climate change, commodity price fluctuations or uncertain donor grants?** This paper addresses this question by proposing fiscal rules that could help mitigate the effects of such shocks on the economy. The paper contributes to the policy dialogue by developing an analytical framework for a rule-based fiscal policy to ensure fiscal sustainability and economic stability in countries most prone to natural disasters, with a focus on Pacific island countries. The three main contributions of this paper are as follows:

- To show how permanent natural disaster shocks or climate change affect the sustainable, steady-state debt-to-GDP ratio;
- A proposal for a recurrent expenditure rule interdependently determined by government debt and budget balance targets, incorporating probabilistic disaster shocks;
- Defining a robust expenditure rule for not only natural disasters but also commodity price fluctuations and uncertain revenue from donor grants.



**Fiscal policy in the Pacific Islands needs to address region-specific factors in addition to basic objectives.** In principle, fiscal policy has three main functional objectives (Figure 1). The First, stabilize economic cycles by conducting countercyclical fiscal policy planning; second, redistribute national wealth across sectors and reduce poverty; third, support sustainable economic growth. Provision of public goods to address market failures such as externalities and incompleteness of markets can be classified under the third category. Investments in education, healthcare, and infrastructure are typical public goods. The Pacific island countries also typically have large gaps in infrastructure compared to other regions, and infrastructure needs to be

made more climate/disaster resilient. In addition to these three basic functions of fiscal policy planning, two factors are relevant for the Pacific island countries.

- **The Pacific Islands are vulnerable to natural disasters and climate change.** Box 1 provides examples of recent natural disasters in the Pacific Islands. Two important points are (1) natural disasters are frequent in the Pacific region (especially, cyclones); and (2) their economic impact tends to be intense compared with similar events in large countries. For example, the recent cyclones caused extensive damage in Fiji and Vanuatu. Papua New Guinea (PNG) experienced a severe drought and, later, an earthquake, which affected agricultural production and mining operations and fiscal and foreign exchange revenues (Nakatani 2017). Given the frequency and scale of such natural disasters, the fiscal authority is responsible for assessing the impact, providing emergency measures, and recovering the damages by building disaster-resistant infrastructure. The frequency and magnitude of the disasters and the portion of its economic impact covered by the fiscal authority determine the fiscal impact of such natural disasters.

#### **Box 1. Recent Episodes of Natural Disasters in the Pacific Islands**

Natural disasters in the Pacific Islands include storms, earthquakes, volcanic activity, floods, droughts and landslides.

- ① Cyclone Pam struck Vanuatu, Tuvalu, and Kiribati in March 2015. This cyclone caused damage and loss equivalent to 64 percent of Vanuatu's GDP (World Bank 2016).
- ② Papua New Guinea (PNG) experienced a severe drought caused by El Niño phenomena from May 2015 to March 2016, with negative impact on agricultural and minerals production. Operations at major mines were shut down for nine months because low river-water levels affected shipments. The drought reduced exports and resource revenues, creating a shortage of foreign exchange and revenue deficit for the government (Nakatani 2018). Moreover, the drought adversely affected food supplies and increased inflationary pressure.
- ③ In late February 2016, Cyclone Winston hit Fiji, and the total loss from the damage amounted to 2 billion Fijian dollars, equivalent to 25 percent of the country's GDP (World Bank 2017). In Fiji, with climate change, on average, loss from cyclones amounting to 2.5 percent of GDP is expected every year and a substantial 23 percent every 50 years (Pacific Catastrophe Risk Assessment and Financing Initiative 2015).
- ④ In February 2018, an earthquake of 7.5 magnitude hit PNG—the biggest earthquake in 100 years. The earthquake led to suspension of LNG, crude oil, and gold mining operations, lowering economic growth sharply. The GDP loss is estimated at 3 percent.

- **Uncertain donor grants.**<sup>2</sup> Not only uncertain foreign aid, but also remittances are important financial flows to mitigate the impact of natural disasters in the Pacific Islands. In the face of severe natural disasters, migrants from the Pacific Islands send remittances to the home country to support their community (Brown et al. 2014).<sup>3</sup> These two additional Pacific-specific factors may hamper economic growth and stabilization. Moreover, natural disasters are likely to affect poor households more as they do not have sufficient resources to insure themselves or to recover from the losses. Taupo et al. (2018) find that poor households are more vulnerable to disasters because they are more likely to reside closer to areas that are exposed to disasters, such as coastal areas and do not have the ability to migrate.
- **Higher macroeconomic volatility.** First, the Pacific island economies may face higher income volatility than larger economies because they have less scope for economic diversification.<sup>4</sup> This increases their vulnerability to terms of trade or commodity price shocks, implying a great deal of macroeconomic and revenue volatility in these economies. Moreover, the default fiscal policy framework in many disaster-prone states is procyclical. For example, if countries are facing limited borrowing capacity and have a budget balance rule, revenue volatility easily leads to expenditure volatility, resulting in procyclical fiscal policies. Another reason for the tendency to procyclical fiscal policy is that those disaster-prone countries do not have timely macroeconomic data. Without the timely macroeconomic data, it is more difficult for the fiscal authority to adjust to macroeconomic shocks, thereby weakening the scope for countercyclical policy measures. In fact, Noy and Nualsri (2011) find that fiscal policy is procyclical in developing countries due to natural disasters. Broadly, fiscal balance positively correlates with output in developing countries (Nakatani 2019). Frankel et al. (2013) documented evidence that 65 percent of developing countries show a procyclical fiscal policy. Hence, they need to frame rules that insulate spending from revenue volatility.

**This paper provides an analytical framework for formulating fiscal rules in small island economies prone to natural disasters.** We theoretically analyze the effects of natural disasters on fiscal rules:

- First, using a theoretical framework, we show how to calibrate a debt-to-GDP target in the event of natural disaster shocks.
- Second, we also study the impact of unexpected climate change shocks (or permanent natural disaster shocks) on debt sustainability.

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<sup>2</sup> Pacific island countries rely heavily on foreign aid versus the smaller Caribbean states (IMF 2018a) and bear the burden of more acute disasters compared to the Caribbean islands (Noy 2016).

<sup>3</sup> Remittances may increase after a natural disaster in low- and middle-income countries by substituting for less developed local financial systems (Bettin and Zazzaro 2018).

<sup>4</sup> The Pacific islands can be classified into three broad types. The first category comprises countries exporting commodities: PNG exports gas, oil, metals, agricultural products, logs and fish; Solomon Islands exports logs, and the main exports of Kiribati, Micronesia, Marshall Islands, Nauru, and Tuvalu are fish. The second is service exports, that is Fiji, Vanuatu, and Palau (as well as Samoa) export tourism. The third is countries reliant on remittances, namely Tonga and Samoa.

- Third, we show how the debt target with probabilistic natural disaster shocks can be connected to fiscal balance, expenditure, and revenues.
- Fourth, we recommend a recurrent expenditure rule, which has several desirable properties: it allows government expenditure required for recovery of damages caused by natural disasters; it does not need calculation of potential GDP growth rates, which are difficult to estimate for small islands; and it is free from a prerequisite for expenditure growth rule (initial fiscal position is in the steady state), which is not satisfied in these islands. The graphical exposition of such a recurrent spending rule is provided with economic intuition.
- Finally, we discuss a specific framework for commodity exporters to smooth the consumption/savings volatility arising from natural resources.

We provide an example of application of these theoretical models to PNG for policy makers.

**Fiscal rules can help Pacific island governments reduce procyclicality of economic performance and maintain fiscal sustainability while meeting infrastructure needs.** Fiscal rules can help control the pressure to overspend during good times and ensure fiscal responsibility, prudence, and debt sustainability. In particular, a debt rule is critical to maintain fiscal sustainability in the long run. To keep the debt-to-GDP ratio under certain limits, a budget balance rule is necessary to constrain the size of the budget deficit as an operational guide. Since the budget deficit is determined by expenditure and revenue, expenditure and revenue rules are also needed. Given the fact that revenue has automatic stabilizer effects on the economy, it is desirable to adjust fiscal policy on the expenditure side to achieve a budget balance rule. Furthermore, investment-friendly rules are required to reduce the procyclicality of spending (Guerguil et al. 2017). This is particularly important for the Pacific Islands because there are still large infrastructure needs, which could be amplified by natural disasters/climate change. On the revenue side, it may be important to set a floor for revenue, so that the government can secure adequate revenues for policy objectives, and to determine the use of windfall revenues, especially for commodity exporters.

**External and internal constraints and economic shocks affect the design and application of fiscal rules.** Pacific island economies also face external borrowing constraints, and these may be binding. Thus, it may be difficult to issue sovereign bonds internationally for the sake of preparation for future natural disasters. Also, most Pacific island countries have limited reserves, which are not enough to deal with catastrophic natural disasters. Therefore, this needs to be considered while designing fiscal rules. Fiscal sustainability is not only affected by permanent shocks such as climate change, but also changes in the long-term interest rates, or permanent shocks to revenues (e.g., new resource projects, change in fishing agreements, etc.) Thus, we need to take into account how these shocks will change the implications of fiscal rules and the ability to cope with substantial shocks. In this regard, operational simplicity is preferable when designing the fiscal rules for the Pacific Islands, given their institutional capacity.

## II. LITERATURE REVIEW

**Fiscal rules are of four types: (1) debt rules, (2) budget balance rules, (3) expenditure rules, and (4) revenue rules.** We discuss key objectives as well as pros and cons of each fiscal rule below. Schaechter et al. (2012) provide a more detailed discussion on each type of fiscal rule.

- **The key objective of debt rules is fiscal sustainability.** Debt rules and targets are essential for debt and fiscal sustainability. Debt rules set the limits or targets for public debt in percent of GDP to ensure debt sustainability. Although debt rules are easy to communicate, they do not provide clear short-run operational guidance.
- **Budget balance rules give operational guidance to achieve the debt target/rule.** To achieve the debt target, budget balance rules are needed. Operational guidance is a priority for countries with poor public financial management systems. In addition, budget balance rules are easy to communicate with public. Empirical literature finds that a budget balance rule constrains fiscal policy and has output-stabilizing effects (Sacchi and Salotti 2015; Heinemann et al. 2018). Bergman and Hutchison (2018) also find that balanced budget and expenditure rules are most effective in reducing fiscal procyclicality in emerging markets. According to Asatryan et al. (2018), the introduction of a constitutional balanced budget rule is associated with lower government debt-to-GDP ratios and lower probability of a sovereign debt crisis. This is achieved by decreasing government expenditure.
- **Expenditure rules are effective for macroeconomic stabilization.** Since the budget balance is a combination of expenditure and revenue, it is useful to have expenditure or revenue rules for clear operational guidance. Expenditure rules are more effective than revenue rules. **The** effectiveness of expenditure rules is supported by the empirical literature. For instance, Cordes et al. (2015) show empirically that countries that have expenditure rules typically have higher primary balances and lower primary spending than countries without such rules. Government revenue is more difficult to target or effectively control than expenditure. Expenditure rules are easy to understand, monitor and enforce, as the government directly controls the targeted part of the expenditure. IMF (2018b) documented that caps on expenditure growth (in line with potential growth) is an operational target well under control of policy makers, allowing for automatic stabilizers and being more transparent and more resilient to measurement errors. Cons of expenditure rules are they may reduce incentives to mobilize revenues.
- **Although capping expenditure growth is an important type of expenditure rule, it may not be suitable for the Pacific Islands.** In general, a simple expenditure growth rule related to trend GDP should be applied only when the initial fiscal position is deemed appropriate. In the case of Pacific island countries, capping expenditure growth may not be an appropriate strategy because it will constrain government expenditure required for recovery of damages caused by natural disasters. In addition, potential GDP growth rates are difficult to estimate for Pacific Islands, and it is hard to believe that they are currently close to steady state revenue-to-GDP ratios because the increasing frequency and impacts of natural disaster changes steady-state parameters. In this study, we address the issue of how to connect expenditure rules and revenue rules to debt sustainability, and we also analyze the new type of expenditure rule which is linked to the source of revenue.

- **Fiscal rules need to be easy to monitor for better compliance.** In practice, it is noteworthy that institutions matter for the effectiveness of fiscal rules. Bova et al. (2014) point out that strong legal and enforcement arrangements are important for reducing procyclicality.

**The most practical way to determine fiscal rules is to begin with a debt ceiling or target.**

Public expenditure and budget balance should be countercyclical to economic cycles for stabilization. Thus, budget balance can be positive or negative in the short run. However, in the long term, fiscal policy should be formulated in a way that the debt level is sustainable. Otherwise, governments may face fiscal crises and a debt overhang could constrain government activities. To avoid such a situation, the most practical way for policy making is to set a ceiling on public debt. In practice, the nominal public debt-to-GDP ratio is much easier to calculate than the present value of the debt-to-GDP ratio.

**Is there any literature that analyzed fiscal rules for the Pacific island countries?** Jayaraman and Lau (2009) find a positive relationship between economic growth and external debt, using a panel cointegration method for six Pacific island countries. However, as far as we know, very little attention has been paid in the literature to fiscal rules for the Pacific Islands. This may be partly because only limited information and data are available for these countries. Thus, in this study, we examine fiscal rules customized for Pacific island economies, which can be applicable to other small states in the Caribbean or Africa.

**Apparently, fiscal rules taking into account natural disasters or climate change have not been analyzed.** IMF (2016) suggests that small states should factor in the average economic impact of future natural disasters in macro baselines used for assessing policy sustainability. IMF (2018cd) analyze fiscal rules, but they do not study the relationship with natural disasters and climate change. IMF (2018e) argues that countries that employ fiscal rules should include escape clauses for natural disasters. Natural disaster funds are proposed as the main policy tool. However, this advice may be difficult to implement in the Pacific Islands who face frequent and sizable natural disasters and do not have enough savings in the fund. Thus, this study contributes to the literature on fiscal rules by analyzing the effects of natural disasters on the rules.

**Pacific island countries have various fiscal rules or targets.** As shown in Table 1, most Pacific island countries have fiscal rules (Cabezón et al. 2015). For example, Fiji has a 40 percent debt-to-GDP ratio as an indicative ceiling. Another type of fiscal rule is a budget balance rule, for instance, Palau has a non-negative budget balance rule. Some countries have a combination of debt and budget balance rules. For instance, Solomon Islands has a public debt limit of 30 percent of GDP and a budget balance rule in which recurrent spending should be financed by revenue (not by debt; golden rule<sup>5</sup>). Samoa has both debt (50 percent of GDP excluding contingent liabilities) and fiscal deficit limit of 2 percent of GDP, while Vanuatu has 40 percent anchor of the present value of government debt-to-GDP ratio and ex ante recurrent budget balance rule (i.e., recurrent revenue excluding grants should be the same as recurrent expenditure excluding development expenditure). Tonga has several fiscal rules and targets:

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<sup>5</sup> The golden rule improves welfare when the growth enhancing effect of new resources available for productive public spending exceeds the crowding-out effect of the debt burden arising from deficit on future economic growth (Minea and Villieu 2009). A golden rule exempting net public investment from the balanced-budget requirement allows for welfare gains to both current and future generations (Bom 2019).

external public ceiling of 50 percent of GDP; compensation for employees should be below 53 percent of domestic revenue and 45 percent of operating expense; minimum revenue target of 22 percent of GDP; and cash buffers equivalent to three months of recurrent spending. Similarly, PNG also has multiple fiscal rules and targets. First, PNG has a debt target that aims to limit gross central government debt-to-GDP ratio within a range of 30 to 35 percent of GDP. Second, PNG also has a zero average non-resource primary balance target over the medium term to address the volatile fiscal balance due to resource revenue as a commodity exporter. Furthermore, PNG has an expenditure rule that limits personnel emolument costs below 40 percent of non-resource and non-grant revenue. Given the size of the economy and its diversified economic structure, we choose PNG as an example of a Pacific island country in our analysis of fiscal rules.

**Table 1. Fiscal Rules or Targets in the Pacific Island Countries**

Type of Fiscal Rule or Target	Pros	Cons	Countries Using the Rule or Target
Debt Rule	Debt Sustainability; Easy Communication	No Operational Guidance	Fiji; Papua New Guinea (PNG); Samoa; Solomon Islands; Tonga; Vanuatu
Budget Balance Rule	Effective	Procyclicality	Palau; Samoa; Vanuatu
Golden Rule	Link to Debt	Creative Accounting	Solomon Islands
Permanent Income Hypothesis	Intergenerational Equity	Hard to Calculate	PNG
Expenditure Rule	Effective; Monitoring; Countercyclicality	Not Directly Linked to Debt Sustainability	---
Personnel Emolument Rule	Targeted; Simplicity; Operational Guidance	Narrow Coverage; Evasion to Unconstrained Category	PNG; Tonga
Recurrent Spending Rule	Broad Coverage; Development Needs	Not Directly Liked to Debt Sustainability	---
Revenue Rule	Automatic Stabilizer	Procyclicality	Tonga; Timor-Leste
Cash Buffers Rule	Economic Stabilization; Resilience	Opportunity Costs	Solomon Islands; Tonga

### III. ANALYSIS OF FISCAL RULES AND TARGETS: THEORY

**We analyze five different fiscal rules and targets against natural disasters.** We discuss debt, budget balance, expenditure, revenue, and cash buffer rules and targets. Note that fiscal targets are objectives to be achieved by the fiscal policy, while fiscal rules are the means or constraints to achieve the targets. Beginning with a debt target, we first discuss how natural disasters and climate change affect debt dynamics. It is noteworthy that we should distinguish between temporary shocks – natural disasters – which do not change the steady state, and permanent shocks – climate change – which do. Then, we study the implications of debt for budget balance. Next, we propose expenditure rules and their relationship with revenue structure and disaster funds.

### A. Long-Run Debt Target

**Fiscal rules for small islands are discussed from a normative perspective, incorporating a natural disaster shock into the debt sustainability framework.** We examine public debt dynamics, starting from the government's cash-flow constraint:

$$T_t + G_t + O_t + D_t + \Delta M_t = E_t + K_t + (1 + i_t)D_{t-1} + S_t N_t \quad (1)$$

where  $T_t$  is tax revenue;  $G_t$  is grants from donor countries;  $O_t$  is other revenue including dividends from state mineral companies;  $D_t$  is government debt;  $\Delta M_t = M_t - M_{t-1}$  is money issuance;<sup>6</sup>  $E_t$  is government recurrent expenditure;<sup>7</sup>  $K_t$  is capital expenditure (i.e., public investment);<sup>8</sup>  $(1 + i_t)D_{t-1}$  is the repayment of debt issued in previous periods;  $S_t$  is the share of the net fiscal cost of shock that is picked up by the government; and  $N_t$  is the GDP impact of the shock such as a natural disaster. It is to be noted that  $S_t N_t$  is the net effect of a disaster shock on the budget balance for analytical convenience, that is, the effect of spending minus revenue.<sup>9</sup> In other words, each component of revenue and expenditure without a natural disaster is expressed in equation (1).

Equation (1) can be rewritten by dividing it into resource and non-resource revenues. In many Pacific island countries, donor grants  $G_t$  are an important source of budget funding. In the case of commodity exporters, mineral taxes in  $T_t^{resource}$  and mining and gas dividends in  $O_t^{resource}$  are also important revenue sources.

$$\begin{aligned}
 & \text{Resource Revenue} = R_t^{resource} \quad \text{Stable Revenue} = R_t^{structural} \quad \text{Non-Resource Revenue} = R_t^{non-resource} \\
 & \underbrace{T_t^{resource} + O_t^{resource}}_{\text{Resource Revenue}} + \underbrace{T_t^{non-resource} + O_t^{non-resource}}_{\text{Stable Revenue}} + G_t + \Delta M_t + D_t \\
 & = E_t + K_t + (1 + i_t)D_{t-1} + S_t N_t \quad (2)
 \end{aligned}$$

If we divide equation (1) by nominal  $GDP_t = P_t Y_t$ , where  $Y_t$  is real GDP and  $P_t$  is the GDP deflator, all the variables can be expressed as shares of GDP in lower-case letters:

$$t_t + g_t + o_t + d_t + \mu_t = e_t + k_t + (1 + i_t)/\{(1 + y_t)(1 + \pi_t)\}d_{t-1} + s_t n_t \quad (3)$$

<sup>6</sup> Fiscal deficit can be financed by the central bank.

<sup>7</sup> Recurrent expenditure is defined as expense (which is expenditure excluding net acquisition of non-financial assets) minus interest in the Government Finance Statistics Manual (GFSM) 2014. Put differently, recurrent expenditure is calculated as a sum of compensation of employees, use of goods and services, grants, social benefits, and other expenses.

<sup>8</sup> Capital expenditure is called net acquisition of non-financial assets in GFSM 2014.

<sup>9</sup> This framework can be also applied to other types of shock, namely the terms-of-trade shock.

where  $y_t = Y_t/Y_{t-1} - 1$  is the real growth rate of output; and  $\pi_t = P_t/P_{t-1} - 1$  is the inflation rate (for GDP deflator). To simplify the notations, the real interest rate is denoted by  $1 + r_t \equiv (1 + i_t)/(1 + y_t)$ , and the primary balance is expressed as  $pb_t = t_t + g_t + o_t - e_t - k_t$ . Then, the budget constraint implies the following debt dynamics;

$$d_t = (1 + r_t)/(1 + y_t) d_{t-1} - pb_t - \mu_t + s_t n_t. \quad (4)$$

In the steady state where  $d^* \equiv d_t = d_{t-1}$ , equation (4) becomes:

$$d^* = (pb + \mu - sn)/\{(1 + r)/(1 + y) - 1\}. \quad (5)$$

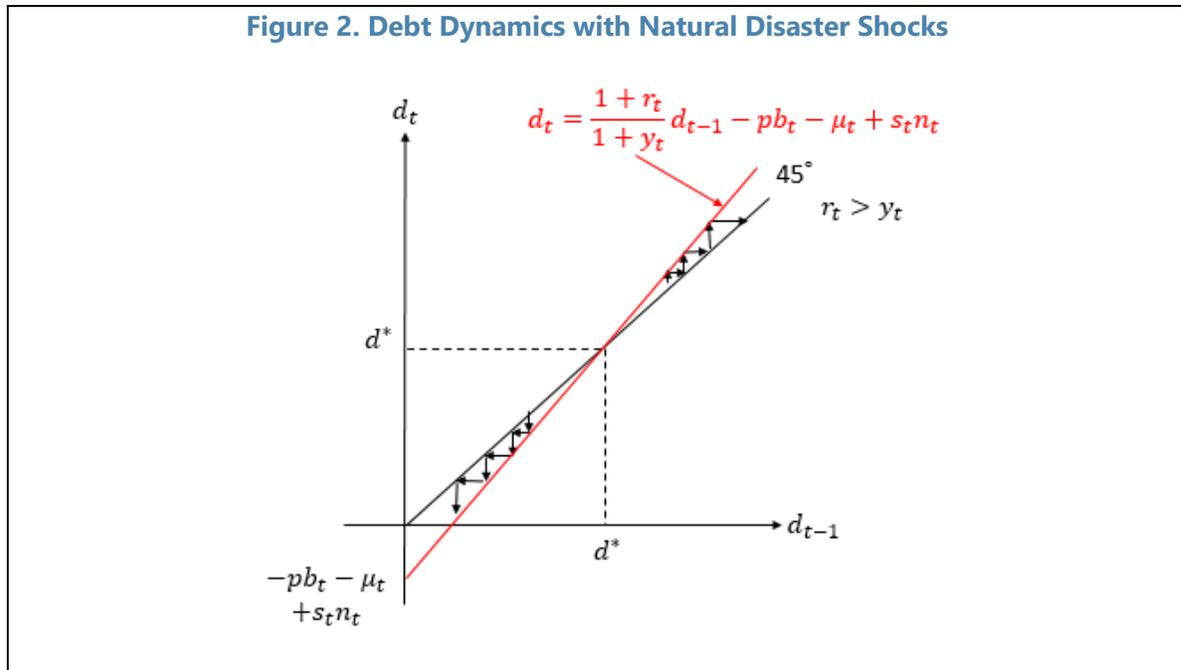
The debt dynamics in equation (4) are shown graphically in Figure 2, for the case where the real interest rate is higher than the growth rate.<sup>10</sup> This is a case when debt could diverge from the steady-state value  $d^*$ . Thus, it is crucial to have the debt level below the steady-state value to keep debt sustainable.<sup>11</sup>  $sn$  represents the long-term historic average of the impact of disasters. This approach is a straightforward way to include the effects of natural disasters when considering debt sustainability in the long term (IMF 2016).<sup>12</sup> An economic intuition is that the amount  $sn/\{(1 + r)/(1 + y) - 1\}$  can be understood as a debt buffer against natural disasters. Note that steady-state parameters can be affected by the governmental activity. For instance, the government can choose the primary balance ( $pb$ ) in the steady state to change the steady-state debt level ( $d^*$ ). In this sense, we can think of the primary balance as a choice variable for the government.

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<sup>10</sup> The primary balance is assumed to converge toward a certain point in the steady state. If we include the fiscal authority's nonlinear reaction to the debt level, the debt limit can be determined by the intersection of fiscal reaction function and the interest payment schedule, as graphically shown in Appendix.

<sup>11</sup> The sustainability of debt depends on the concessional element of debt in the steady state. Concessional debt is more sustainable than commercial debt, owing to the lower interest rate.

<sup>12</sup> Another approach to calibrate the debt target is by doing stochastic simulations (via e.g., VAR) to know the debt threshold over which the debt becomes unsustainable (IMF 2018c). However, due to limited availability of economic data in the Pacific island countries, this approach is not practically useful.



**In our example of PNG, simple calculation indicates that the steady-state debt level is around 30 percent.** In this exercise, the following steady-state values are assumed:

- A 0.4 percent of GDP primary budget surplus ( $pb = 0.004$ )
- A money creation rate of 0 percent (i.e., no central bank financing for budget deficit;  $\mu = 0$ ),
- A real interest rate of 4.5 percent ( $r = 0.045$ ),
- A real potential growth rate of 3.8 percent ( $y = 0.038$ ),
- An expected natural disaster shock per year of 0.2 percent of GDP ( $n = 0.002, s = 1$ ), as calculated by Dongyeol et al. (2018).<sup>13</sup>

These values are chosen by taking into account various long-term factors and assumptions so that they are consistent with the IMF's macro framework at the end of the projection period. For example, when we make an assumption about the real interest rate, it is calculated as the nominal interest rate minus the inflation rate. The nominal interest rate assumption reflects the trend and level of interest rate before the country experienced large negative commodity price shocks in 2014, and thereafter, fiscal crunch and foreign exchange shortages. However, a drawback of this steady-state analysis is that the result is sensitive to parameters and it is not

<sup>13</sup> The magnitude of disaster shocks should be the effect on budget balance ( $s_t n_t$ ). However, it is very difficult to estimate it in the Pacific islands because of limited information. The 0.2 percent shock used here is the effect on GDP assuming that the government can offset the adverse impact on the economy in the steady state ( $s = 1$ ). This is the lower bound of the impact of extreme weather events on budget balance, as Lis and Nickel (2010) find the fiscal impact ranges between 0.2 and 1.4 percent of GDP.

easy to know true steady-state values. Thus, the exercise presented in this paper should be treated as an illustration rather than true values for PNG.

**We also analyze the effects of permanent natural disasters or climate change shocks on debt dynamics.**<sup>14</sup> We analyze two cases because the impact of disasters on economic growth and the risk premium is ambiguous. The existing literature finds that the effects of natural disasters on economic growth can be either negative or positive (Kousky 2014). Although it is likely that climate change or natural disasters affect economic growth negatively in the long term,<sup>15</sup> some empirical studies found positive effects. For example, Skidmore and Toya (2002) find that climate disasters are positively correlated with long-run economic growth rates and higher total factor productivity. Loayza et al. (2012) show that moderate disasters (such as moderate flooding) can have a positive impact on medium- and long-term economic growth. According to Cavallo et al. (2013), catastrophic natural disasters do not have a significant effect on economic growth in either the short term or the long run. Natural disasters can also affect country risk premiums. Klomp (2015) finds that geophysical and meteorological disasters (e.g., earthquakes, tsunamis, volcanic eruptions, and storms) increase the sovereign risk premium, whereas hydrological and climatic disasters (e.g., flood, droughts, and wildfires) do not affect the premium in the long term. Therefore, the effects of natural disasters on growth and interest rates in the steady state are somewhat ambiguous.<sup>16</sup>

**The first case considered is an unexpected permanent natural disaster shock or climate change shock that increases long-term economic growth.** For example, imagine the case where a massive earthquake occurs unexpectedly in the rural areas of PNG and one-way wooden bridges are replaced by two-way steel bridges. Then, better-quality infrastructure helps agricultural workers to transport a higher number of coffee bags for export. We can interpret this as a case in which economic disruptions caused by natural disasters trigger positive technological shocks during the recovery process.<sup>17</sup> In such a case, the steady-state debt level could be higher than before the shock because of the improved long-run economic growth, as shown in the left panel of Figure 3.

**By contrast, let us consider a second case, in which climate change dampens economic activity permanently.** For example, if global warming causes the sea levels to rise in the Pacific Ocean, climate change shocks increase the probability and severity of natural disasters as a small island country loses land for economic activities. This is a serious concern for the northern islands in the Pacific region, and it corresponds to the case shown in the right panel of Figure 3. In this case, the steady-state debt level should be lower than earlier because of lower economic growth

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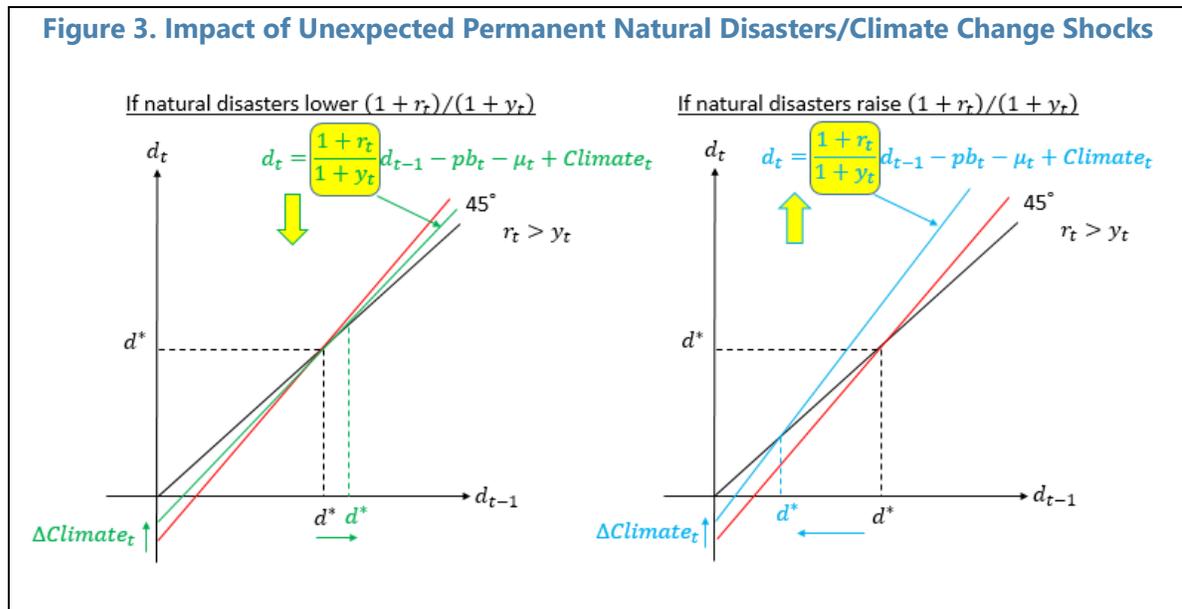
<sup>14</sup> Halac and Yared (2014) showed that the ex-ante optimal fiscal rule is no longer sequentially optimal in the presence of persistent shocks.

<sup>15</sup> See Lazzaroni and van Bergeijk (2014) for a meta-analysis of the literature on impact of disasters.

<sup>16</sup> Note that the introduction of fiscal rules itself also reduces sovereign yield spreads (Afonso and Jalles 2019; Thornton and Vasilakis 2018).

<sup>17</sup> Note that this oversimplifies and overestimates the impact because we are comparing to a case in which the poor-quality infrastructure is never replaced. In reality, it would eventually be replaced, so that the disaster really only brings the replacement date forward. Essentially we are treating a temporary total factor productivity shock (which could be quite long) as permanent.

relative to the interest rate in the steady state. This exercise implies that if an unexpected permanent shift in the probability of natural disasters is observed, the debt target should be reconsidered or revised.



**Note that this argument can be also applied if the government changes the preference of covering the disaster loss.** In other words, a shock to variable " $Climate_t = s_t n_t$ " does not have to be more destructive or more frequent disasters, but could come from the government covering a larger share of the cost ( $s_t$ ) of a natural disaster shock to the GDP.<sup>18</sup> This could also be relevant to terms-of-trade shocks if the government tax or subsidy policy provides better for the private sector.

## B. Budget Balance Target

**We have so far analyzed how to adjust the debt target to include the effects of natural disasters.** The next step is to derive a budget balance target. Small states typically have no well-defined economic cycles, which makes it difficult to define the structural budget balance (IMF 2018a). Even if we can calculate the structural budget balance by using some filtering techniques, it is well known that the structural balance is very sensitive to calculation methods. Additional complexities of defining the business cycle arise in the case of a resource-rich economy, such as PNG or Solomon Islands. Given these technical problems, we recommend using the headline budget balance as an anchor when formulating budget balance targets in the Pacific Islands.

**How can we derive the budget balance target from the debt target?**<sup>19</sup> Since the change in debt ( $\Delta D_t$ ) equals the budget deficit ( $-B_t$ ), the debt equation can be written as:

<sup>18</sup> When choosing the value of share ( $s_t$ ), the government needs to consider the disaster recovery efforts made by the private sector and the local communities.

<sup>19</sup> Here we focus on the overall budget balance rather than the primary balance for analytical simplicity.

$$D_t = D_{t-1} + \Delta D_t; \Delta D_t = -B_t \quad (6)$$

where  $B_t = T_t + G_t + O_t + \Delta M_t - E_t - K_t - i_t D_{t-1} - S_t$  is the budget balance. Dividing this equation by nominal GDP with nominal growth rate  $\gamma_t$ , the debt equation can be expressed as shares of GDP.

$$d_t = d_{t-1}/(1 + \gamma_t) - b_t \quad (7)$$

In the steady state, the budget balance as a percentage of GDP is given by<sup>20</sup>

$$b^* = -\gamma/(1 + \gamma) d^* \quad (8)$$

**For PNG, the implied budget deficit target is 1.4 percent of GDP.** Nominal GDP growth is assumed to be 5 percent in PNG ( $\gamma = 0.05$ ). Given the 30 percent debt target derived above ( $d^* = 0.3$ ), budget deficit in the steady state is calculated as 1.4 percent of GDP in PNG ( $b^* = -0.014$ ). Again, please note that this value is presented as an illustration rather than the recommended value.

**If the actual budget balance  $b_t$  deviates from the target  $b^*$  in practice, the fiscal authority can decide the adjustment period with a time span of  $\lambda$  years.** This is because that sticking with a fixed budget deficit target implies that the impact of shocks moving the debt/GDP ratio away from target will only be eliminated asymptotically. The fiscal adjustment (or budget balance rule) to achieve the target each year during the adjustment period (from year  $t + 1$  until year  $t + \lambda$ ) is;

$$(b_t - b^*)/\lambda, \forall b_t \neq b^*. \quad (9)$$

This equation (9) is a simple linear adjustment rule. Depending on the preference of the fiscal authorities, other nonlinear adjustment rules are possible, too.

### C. Expenditure Rule

**It is more important to have an expenditure rule than a revenue rule to reduce the procyclicality of the economy.** This is because some countercyclical fiscal policies are already embedded in government revenues. For example, if the economy is experiencing a downturn, profits and incomes of corporations and households decline; therefore, the base for direct taxation also diminishes. Sales of goods and services shrink, and indirect tax revenues such as value added tax decrease. In this respect, automatic stabilizer effects prevail as the tax burden decreases during the phase of economic contraction. The opposite effects occur during economic expansion. By contrast, government expenditure does not have the tendency to reduce procyclicality in the absence of fiscal rules. Procyclicality may be more likely if there are numerous financially autonomous statutory authorities, as they may not have independent borrowing authority, and may also have little incentive or capacity to save.

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<sup>20</sup> The difference between primary balance and the budget balance in the steady state is just an interest expense in the steady state.

**An expenditure rule can be derived from the budget balance target or rule, assuming a revenue target.** If we assume a 14.8 percent revenue-to-GDP target ratio, consistent with PNG's Medium Term Fiscal Strategy (MTFS) 2018–22, with 5 percent nominal GDP growth, the budget balance target can be interpreted as (1) a constant 16.2 percent of expenditure-to-GDP ratio (=14.8 percent+1.4 percent deficit), or (2) a ceiling of 5 percent nominal expenditure growth if PNG is already in an expenditure position consistent with the budget balance target.

**Table 2. Volatility of GDP, Revenue, and Expenditure in the Pacific Island Countries**  
(■ Most Volatile Item, ■ Second Most Volatile Item, ■ More Volatile Ratio)

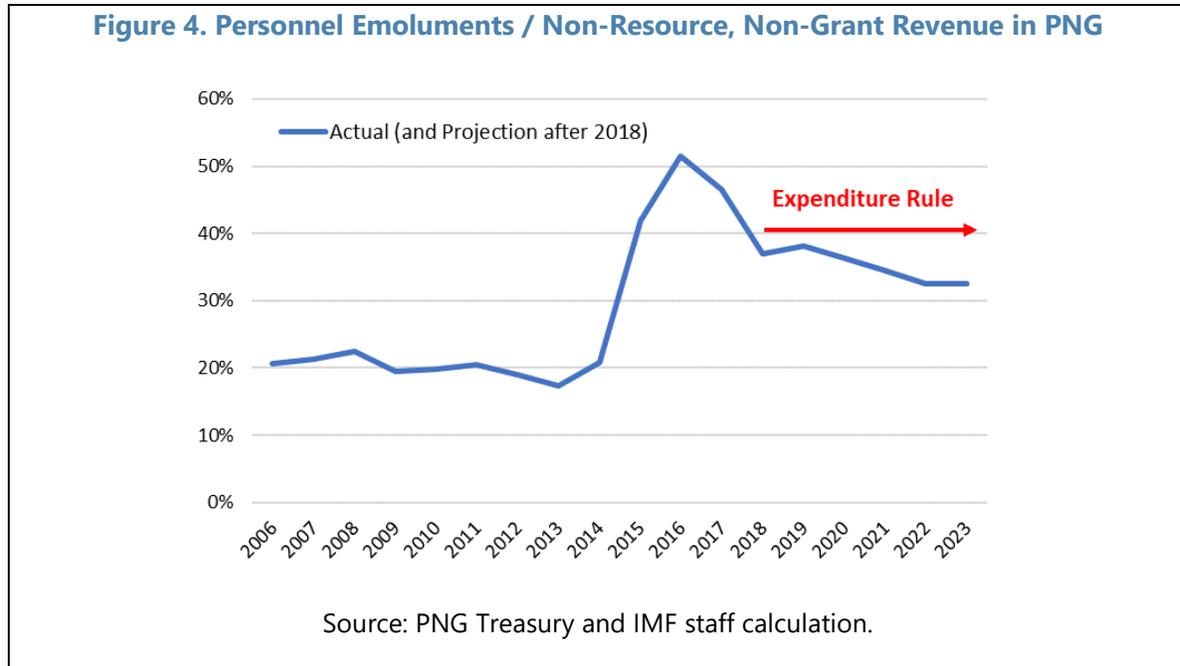
Country	GDP	Revenue	Expenditure	Expenditure/ GDP	Expenditure/ Revenue
Unit	Standard Deviation (SD)			SD divided by average	
Papua New Guinea	18.77	3.74	4.48	0.12	0.15
Fiji	2.31	0.66	0.74	0.077	0.078
Timor-Leste	1.91	1.31	0.55	0.65	0.24
Solomon Islands	3.13	1.60	1.57	0.37	0.24
Vanuatu	22.09	7.00	8.77	0.23	0.10
Samoa	0.56	0.19	0.21	0.19	0.10
Tonga	0.21	0.11	0.11	0.27	0.10
Micronesia	0.04	0.03	0.02	0.09	0.10
Palau	0.05	0.02	0.01	0.13	0.16
Marshall Islands	0.03	0.02	0.02	0.13	0.12
Kiribati	0.06	0.09	0.08	0.18	0.15
Nauru	0.03	0.05	0.04	0.30	0.12
Tuvalu	0.01	0.02	0.01	0.18	0.19

Source: IMF World Economic Outlook Database, October 2018.

**For PNG, an expenditure rule related to non-volatile revenue has advantages in terms of volatility and cyclical stability, operational simplicity, and ease of understanding.** Our example above has so far defined expenditure rules as a percentage of GDP for simple analytic purposes. However, GDP is more volatile than revenue in most Pacific island countries (Table 2). In such circumstances, defining expenditure rules as a percentage of GDP may add procyclicality to economic performance.<sup>21</sup> In fact, the last two columns of Table 2 show that eight countries among thirteen countries would exhibit higher volatility if an expenditure rule is defined as a percentage of GDP rather than revenue. Thus, expenditure rules defined as a percentage of stable revenue (non-resource, non-grant revenue) is preferable, for several reasons. First, release of GDP data takes longer than estimation of revenue, and the impact of GDP revision is relatively large in the Pacific island countries. This is quite an important point in terms of operational feasibility. Second, since income tax revenues are based on the previous year's income of households and companies, expenditure rules based on revenue will be less volatile than if it is based on GDP, as it will not be affected by natural disaster shocks to GDP in the current year due to lags. Third, if the expenditure rule is defined as a percent of revenue, there is a direct link between expenditure and revenue and, as a result, the level of overall balance is uniquely

<sup>21</sup> Another argument for reducing cyclicity of GDP is to use potential GDP like the European Union. However, the Pacific island countries do not have long GDP series time wise, and the presence of frequent natural disasters make it technically difficult to estimate potential GDP.

determined and it will be easy to compute the level of spending irrespective of GDP. This is important for small fragile states because it is difficult to estimate the impact of natural disasters on GDP in a timely manner. All three reasons support the recommendation of revenue when formulating fiscal rules for the Pacific island economies.



**Expenditure ceilings on certain spending categories (e.g., recurrent spending or personnel emoluments) may be useful in some circumstances.** Ceiling on certain expenditure categories, particularly subject to pressure (e.g., wage bills, subsidies), may be considered. This is because the rule can give policy-makers clear operational guidance for enforcement. Operational guidance is a priority for countries with limited public financial management capacity. For instance, compensation for public employees has been an area of over-expenditure or under-budgeting in PNG during the past few years, and personnel costs have more than doubled over the past five years, partly reflecting the new Tuition Fee Free Policy. To address this situation, the MTFS introduced an expenditure ceiling to cap personnel emolument costs below 40 percent of non-resource, non-grant revenue as shown in equation (10) and Figure 4. Using non-resource, non-grant revenue (stable revenue) as a base is a good strategy, as it can help avoid volatile resource revenue and uncertain grant elements, which have been a common fiscal concern in the Pacific Islands. It would be practical to exclude foreign grants in the revenue as Becerra et al. (2014) find that foreign aid in the aftermath of massive natural disasters only covers 3 percent of total economic damages caused by the disasters.<sup>22</sup> Designing an expenditure rule to cap personnel emolument costs could be also useful for other Pacific Islands as this category is

<sup>22</sup> Becerra et al. (2015) did not find evidence to substantiate that donors reallocate post-disaster foreign aid between the recipient countries. However, the results by Becerra et al. (2014) may be underestimated because they used data between 1970 and 2008, although massive natural disasters occurred in the Pacific islands after this period.

typically the largest expenditure item and some Pacific island countries (e.g., Kiribati; Vanuatu) have recently experienced a large increase in wages.<sup>23</sup>

$$(Personnel\ Emolument_t)/R_t^{structural} * 100 < 40\% \quad (10)$$

**For the Pacific island countries, an investment-friendly expenditure rule, such as recurrent spending as a percentage of stable revenue, is a practically useful rule for stabilization purposes (equation (11)).** Put differently, the net acquisition of non-financial assets<sup>24</sup> should be excluded from expenditure rule coverage since the government needs to rebuild infrastructure, such as coastal protection, in the event of natural disasters and there are still larger infrastructure requirements.<sup>25</sup> Recurrent spending rules are more robust than personnel emolument rules because (1) increases in use of goods and services are more serious concerns than personnel emoluments in some countries (e.g., Marshall Islands), and (2) salaries of public employees may be included in grants to local government in some countries (e.g., Fiji).<sup>26</sup> In practice, to implement expenditure controls, public financial management systems need to be strengthened.

$$E_t/R_t^{structural} * 100 < X\% \quad (11)$$

#### D. Relationship with Revenue Structure

**How different are the revenue structures among the Pacific island countries?** We need to take note of different revenue structures because revenue appropriation strategy depends on specific characteristics of the economy. For example, the permanent income hypothesis (PIH) is useful for commodity exporters,<sup>27</sup> especially for countries that collect revenue from non-renewable resources (PNG; Timor Leste). In this case, the non-resource primary balance as a percentage of non-resource GDP can be an option as a fiscal target to smooth resource earnings and promote intergenerational equity. Consumption from resource revenue should be a fixed proportion of the nation's annuity provided by the natural resource wealth, and it should be consistent with the PIH (van der Ploeg 2014). Our calibration for PNG based on IMF (2012) indicates that the non-resource primary balance should be close to zero (-0.3 percent of non-resource GDP) to be consistent with the PIH. It is important to exclude volatile resource revenue from the fiscal rule to avoid procyclicality. The volatile resource revenues in the Pacific island countries are listed in Table 3. It would be useful to point out the risks associated with each type of economy's revenue structure below. For countries whose main industries are renewable

<sup>23</sup> In practice, fiscal space has to be created if the country has already exceeded the limit.

<sup>24</sup> This paper focuses on recurrent expenditure and excludes analysis of government capital expense, which needs to be backed by good public investment management through better infrastructure governance (IMF 2018f).

<sup>25</sup> In the Pacific, countries usually receive grants and loans from foreign governments or multilateral donors for reconstruction of infrastructure in the event of natural disasters. If public investment is financed by such grants, it will not affect the debt target.

<sup>26</sup> See Burret and Feld (2018) for empirical analysis of unintended effects of fiscal rules by shifting or evading fiscal burden into accounts unconstrained by the rules.

<sup>27</sup> There is considerable scope of boosting revenue from taxes on goods and services in resource-rich countries because there are empirical findings that higher resource revenues are associated with lower non-resource revenues by discouraging domestic tax efforts (Crivelli and Gupta 2014; Bornhorst et al. 2009).

resources, such as fishing (Kiribati, Micronesia, Marshall Islands, Nauru, and Tuvalu) and logging industries (Solomon Islands), license fees can be an important indicator. If the countries relying on fishing industries increase recurrent spending when fishing revenue is high, it will be difficult to sustain fiscal policies when climate change adversely affects fishing activity. However, for small island economies like Kiribati, Marshall Islands, and Tuvalu, it may be difficult to exclude fishing revenue as a volatile component from the revenue base because fishing license fees are a major source of revenue as other revenues are small. For countries exporting services such as Fiji, Vanuatu, and Palau, tourism revenues such as airport tax or taxes from service industries are important. The question arising is how to deal with countries relying on remittances, such as Tonga and Samoa? It could be cyclically synchronized with Australia/New Zealand business cycles where emigrant workers from these countries live. Finally, it could be important to set the minimum revenue requirement like Tonga to secure adequate revenues for the fiscal policy.

<b>Table 3. Volatile Resource Revenue Items in the Pacific Island Countries</b>	
Country	Resource Revenue Items
Fiji	-----
Kiribati	Fishing License Fees
Marshall Islands	Fishing License Fees
Micronesia	Fishing License Fees
Nauru	Fishing License Fees
Palau	-----
Papua New Guinea	Mining and Petroleum Taxes; Mining, Petroleum and Gas Dividends
Samoa	-----
Solomon Islands	Logging Revenues; Fishing License Fees
Timor-Leste	Petroleum Revenue
Tonga	-----
Tuvalu	Fishing License Fees
Vanuatu	-----

### **E. Stabilization Fund / Cash Buffers**

**Fiscal surpluses during good years should be put in a stabilization fund (or natural disaster fund).**<sup>28</sup> If an actual fiscal outcome is better than the situation defined by the fiscal rule (expenditure rule), the fiscal surplus should be saved in the fund. These surpluses are needed in non-disaster years to build up reserves in the fund for emergency relief in disaster years. Holding reserves in the stabilization fund is necessary to meet cash outflows, particularly as the country's

<sup>28</sup> For commodity exporters, stabilization funds can be funded from resource revenue windfalls. For example, the Organic Law on Sovereign Wealth Fund in PNG legislates that 50 percent of all mining and petroleum taxes, 60 percent of the proceeds of sale of mineral or petroleum assets, and 75 percent of all distributions from the State's mining or petroleum projects will be deposited in the stabilization fund.

borrowing ability is constrained. In practice, due to the increased frequency<sup>29</sup> of natural disasters, the targets<sup>30</sup> may be more difficult to achieve.

**Pacific island countries can also build cash buffers against natural disasters.** For example, Tonga has a cash buffer rule, which requires the government to hold cash deposits equivalent to three months of recurrent spending. Solomon Islands had a similar cash buffer rule when the country implemented an IMF program in recent years. The idea of holding such cash buffers is similar to the stabilization fund discussed above.<sup>31</sup> This type of buffer ensures quick and easy access to funds in the event of economic shocks or natural disasters to reinforce the objective of operational fiscal sustainability. Although the cash buffer rule is defined as holding of cash reserves equivalent to three months of operating expenditure in most cases, it is neither calibrated nor aligned with other fiscal anchors. Although calibration of fiscal buffers is beyond the scope of this paper, IMF (2018e) argues that the size of buffers should depend on expected fiscal costs, ability to borrow, opportunity cost of building up buffers, and funding needs after a disaster.

#### IV. ANALYSIS OF FISCAL RULES AND TARGETS: PRACTICE

##### A. Policy Mix and Coverage

**Recurrent spending rules to deal with natural disasters.** The pros and cons of each fiscal rule are compared in Table 1, which also shows which countries adopted each fiscal rule. As discussed, debt targets are important for fiscal sustainability and expenditure rules; especially, the recurrent spending rules, defined in relation to non-resource and non-grant revenue, are critical for economic stabilization in the Pacific island countries.<sup>32</sup> To define the recurrent expenditure correctly, authorities should use the expenditure classifications following GFSM 2014. This is quite important because some countries may misclassify constituency development funds as capital expenditure rather than recurrent expenditure. If expenditure is misclassified, or classification is susceptible to manipulation, it may be better to have a rule that includes all expenditure (IMF 2018d). Note that capping expenditure does not discourage tax collection efforts because our proposed recurrent expenditure rule allows recurrent spending, provided the government collects more stable revenues.

##### B. Escape Clauses

**Well-defined and predetermined escape clauses may help budget execution in the presence of unexpected massive natural disaster shocks.** If the size of a natural disaster shock

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<sup>29</sup> The frequency and severity of natural disasters in low-income countries and small states are expected to increase (Bettin and Zazzaro 2018).

<sup>30</sup> Nishizawa et al. (2019) discuss how fiscal buffers should be saved against natural disasters.

<sup>31</sup> Marto et al. (2018) show that the preemptive policy by building fiscal buffers in the contingency fund leads to lower public debt levels than the post-disaster reactive policy adopted in Vanuatu.

<sup>32</sup> This combination of an expenditure rule and debt target is also supported empirically for other types of economy (e.g. see Bruck and Zwiener [2006] for the case of European Monetary Union). Bergman et al. (2016) find that multiple fiscal rules enhance fiscal solvency.

is too big to be covered by the stabilization fund, the escape clause should be applied.<sup>33</sup> In this situation, the debt target and fiscal rules can be recalculated as we elaborated in Figure 3. The government may breach fiscal rules only in the event of an unexpected disaster or a severe economic shock, which should be clearly defined in the law beforehand. However, we should note that flexibility provisions (such as escape clauses) could complicate the budget process by allowing fiscal targets to change with circumstances. Since triggering an escape clause involves a costly review process in practice, it is generally optimal to have an escape clause if the cost of review is cheap, the volatility of shocks is high, and the government deficit bias is severe (Yared 2018). The existing literature reports mixed results on the impact of escape clauses on fiscal stance. For example, Guerguil et al. (2017) find that escape clauses in fiscal rules do not seem to affect the cyclical stance of fiscal policy and public spending. In contrast, Combes et al. (2017) find that fiscal rules with escape clauses are harmful for stabilization in high-debt countries by making fiscal policy more procyclical. Thus, country authorities should be very careful when applying escape clauses to violate fiscal rules.

**A suggested approach to handle escape clauses is to have a forward-looking explanation mechanism similar to inflation targeting regimes in monetary policy.** If unexpected and devastating natural disasters happen and trigger the escape clause, fiscal authorities should provide the future fiscal path to explain how fiscal targets will be met over the medium term. This is similar to the inflation targeting approach adopted by central banks worldwide. Namely, if a drought causes inflation to deviate from the inflation target, the monetary authority needs to explain how this effect from climate change or natural disaster dissipates over time and type of policy action required to meet the inflation target in the medium term. The same forward-looking approach is useful for fiscal policy-making. In other words, the fiscal authority needs to analyze and explain how natural disasters affect revenues, expenditures, and debt projections in the medium term and what kind of fiscal consolidation plan is required to meet the target over time. This will increase the credibility of the fiscal policy.

### C. Procedural Issues

**Strong political leadership with good communication is needed for the government to adopt fiscal rules.** Fiscal rules should be reviewed periodically, because the assumptions on which they are based may be subject to change. However, the revision process should be made as non-political as possible to avoid damaging the credibility of the rules-based approach. Regular intervals for amendment should not be linked to the election cycle to keep the fiscal rules independent from changes in the government.<sup>34</sup> Transparency of the process is extremely important. Designing fiscal rules that can be easily communicated has more significance. People often use a debt-GDP rule because of its simplicity and good understanding.

**Strong legal and institutional arrangements are also important to commit and implement fiscal rules.** The recent literature points out the importance of independent monitoring or enforcement bodies for better compliance of rules. Reuter (2019) finds that covering larger parts

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<sup>33</sup> Jalles (2018) find that escape clauses reduce counter-cyclicality of fiscal policy in developing countries.

<sup>34</sup> Tóth (2019) shows that fiscal rules contribute to disciplined fiscal policy after a change in government.

of general government finance and independent enforcement bodies issuing real-time alerts significantly increases the likelihood of compliance with fiscal rules.<sup>35</sup> Beetsma et al. (2019) find that the presence of a fiscal council promotes greater compliance with fiscal rules. A fiscal council could act as an enforcer and revise the rules (Wyplosz 2011). It is recommended that proposals for fiscal rules be published for transparency purpose so that outsiders—such as academic professionals—can provide inputs as independent opinions. Another finding by Bergman and Hutchison (2015) is that government efficiency is also important for the effectiveness of fiscal rules to reduce procyclicality of fiscal policy.

## V. CONCLUSION

**Fiscal rules for small island economies vulnerable to natural disasters and commodity price fluctuations as well as foreign aid are discussed in this study, using the Pacific island countries as an example.** The Pacific island countries are highly vulnerable to natural disasters and climate change shocks. To handle such shocks, we propose fiscal rules that include the expected impact of shocks on fiscal balances. We also provide an analytical framework to calibrate the debt and budget balance targets and expenditure rules. Our theoretical framework shows that an appropriate level of debt target depends on individual country parameters. We demonstrate that these parameters can be affected by unexpected permanent climate change shocks. Furthermore, alternative fiscal rules for commodity exporters based on PIH are discussed. We also use the example of PNG to demonstrate the practical application of our fiscal rule framework for policy-makers. Our main argument is that a recurrent expenditure rule may be the most useful fiscal rule in the Pacific Islands as a countercyclical policy tool to handle natural disasters, volatile resource revenues, and uncertain foreign grants, together with the debt target, which is linked to the budget balance target. It would be useful to apply similar analytical methods to other Pacific, Caribbean, or Indian Ocean countries.

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<sup>35</sup> According to Reuter (2015), introduction of fiscal rules leads to a strong tendency of the constrained fiscal variables toward the numerical targets in the EU even if countries do not comply with the rules.

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