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Fiscal Buffers for Natural Disasters in Pacific Island Countries

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Fiscal Buffers for Natural Disaster in Pacific Island Countries[1]

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Abstract

Pacific island countries (PICs) are vulnerable severe natural disasters, especially cyclones, inflicting large losses on their economies. In the aftermath of disasters, PIC governments face revenue losses and spending pressures to address post-disaster relief and recovery efforts. This paper estimates the effects of severe natural disasters on fiscal revenues and expenditure in PICs. These are combined with information on the frequency of large disasters to calculate the rate of budgetary savings needed to build appropriate fiscal buffers. Fiscal buffers provide self-insurance against natural disaster shocks and facilitate quick disbursement for recovery and relief efforts, and protection of spending on essential services and infrastructure. The estimates can provide a benchmark for policymakers, and should be adjusted to take into account other sources of financing, as well as budget risks from less severe as well as more frequent disasters.

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I. OVERVIEW

In recent years, Pacific islands have been hit by several major national disasters, including cyclones, droughts, earthquakes, and tsunamis. The scale of these disasters and the prospect of increasing severity and frequency of such disasters has forced policymakers to consider how to adapt to them. Investment in resilient infrastructure can reduce damages, and good civil defense preparations can save lives and speed recovery. But damage is unavoidable and means that such disasters will be costly to both the private and public sectors.

To build financial resilience to natural disasters, countries can take a variety of measures, including purchasing insurance, ensuring that they have enough room to be able to borrow following a disaster, or building financial buffers to self-finance recovery from a disaster. In this paper we focus on estimating the appropriate size of fiscal buffers, with the aim of providing practical guidance to countries considering building fiscal buffers against natural disasters.

To assess the potential fiscal needs following a natural disaster, this paper provides estimates of the historical impact of severe natural disasters on fiscal revenues and expenditure in Pacific island countries (PICs).[2] Our estimates suggest that the main fiscal impact of natural disasters is on expenditures and that, on average, a severe disaster in the region has a fiscal cost of around 14–21 percent of GDP over 3 years. These estimates are combined with data on the frequency of natural disasters to estimate the potential scale of budgetary savings needed to build adequate fiscal buffers. The frequency of severe disasters varies greatly across the region, but with a country average of about 14 years between severe disasters, this implies an average annual fiscal cost of 1-1.5 percent of GDP. From the country-specific estimates would need to be subtracted reasonable estimates of the budget support and other sources of financing that could be used to cover the estimated budget needs. This should probably be considered as a minimum, since it only covers the fiscal cost of particularly large disasters. Larger buffers would be needed to cover smaller or more frequent natural disasters.

In Section II, the empirical vulnerability of PICs to natural disasters is estimated. In Section III the role and design of fiscal buffers for natural disasters is discussed. Section IV provides estimates for the fiscal cost of natural disasters in PICs. Section V discusses the appropriate size of fiscal buffers for natural disasters, taking into account estimated fiscal costs and various financing sources. Section VI describes policy implications and the limitations of our analysis.

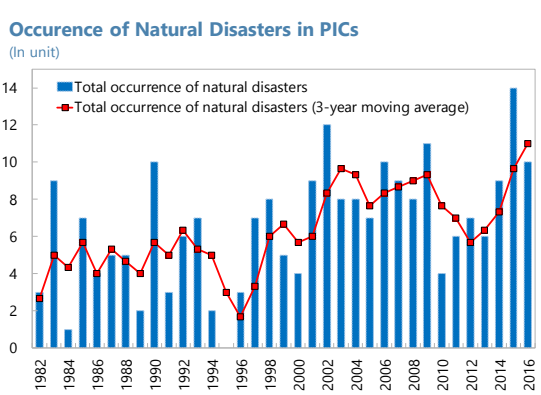
II. VULNERABILITY OF PICS TO NATURAL DISASTERS

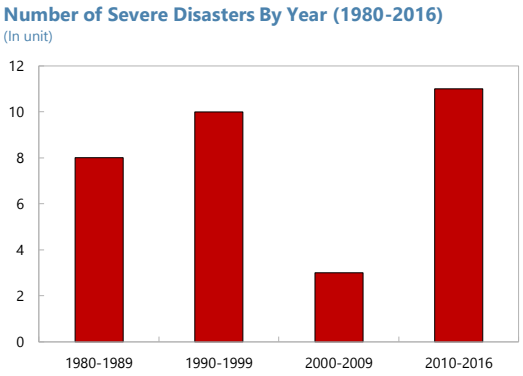
PICs are highly vulnerable to natural disasters and climate change. The UN World Risk Index indicates that natural disaster risks in PICs are much higher than elsewhere. Moreover, both the frequency and severity of disasters in PICs have been increasing. As shown in Figure 1, the total number of natural disasters in PICs has increased noticeably since the late 1990s (based on EM-

[2] Fiji, Kiribati, Marshall Islands, Micronesia, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu.

DAT data, the standard source for such information). Since the relatively benign first decade of the century, the number of severe disasters has increased sharply, and already exceeds the number experienced in the 1980s and 1990s.[3]

Figure 1: Natural Disasters in PICs





Sources: EM-DAT and author calculations

Measuring the frequency of natural disasters is challenging in several respects. As in other regions, environmental events vary greatly in size and impact. In this paper we focus on disasters that are most likely to have a substantial fiscal impact. In this we are guided by Dongyeol and others (2018), who propose focusing on disasters having a significant impact on GDP. A second challenge is to assess the typical interval between disasters, as this is important for calculating how quickly buffers need to be built up. One way is to use the average interval between disasters.[4] However, in such a small sample, often with only a few disasters over 30 years, the sample average may not be a statistically robust estimator, especially when the underlying population distribution may well not be normal. For these reasons, we also consider the median interval between disasters as an indicator. Finally, with climate change, the underlying population distribution of weather-related natural disasters is probably changing. In this paper, we do not make any allowance for that likelihood in our estimates, but it is clearly relevant to the interpretation of our results.

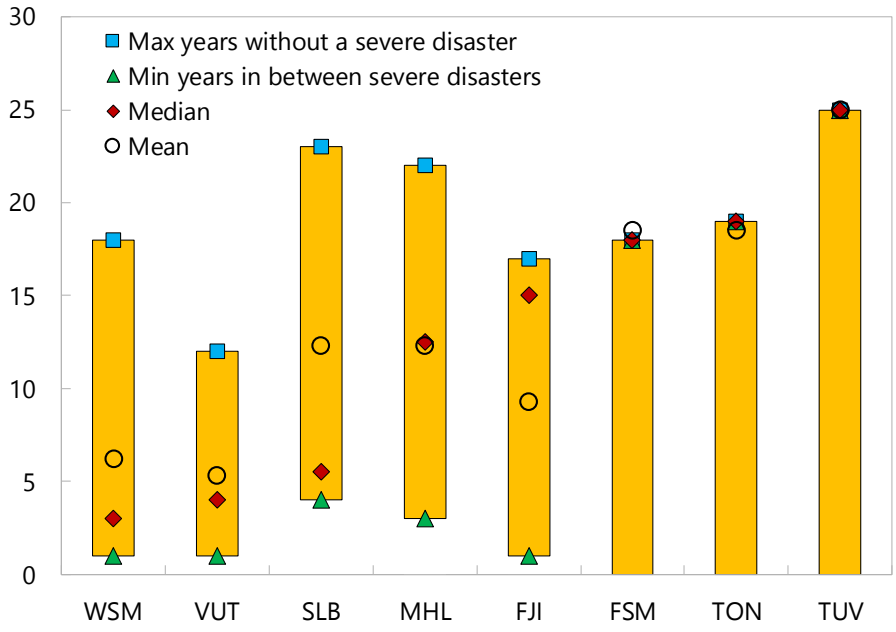
The vulnerability of individual countries in the region varies considerably. Figure 2 shows the intervals between severe disasters in PICs over the period since 1980. Because at least two severe disaster observations are needed to calculate the disaster interval, several Pacific island countries with only one disaster observation are excluded from Figure 2. In Samoa, for example, the interval between severe disasters varied between 1 and 18 years, with a median interval of just 3 years. Vanuatu and Solomon Islands are also very vulnerable. In Fiji, Micronesia (FSM),

[3] The paper defines the severe disasters that could be economically destructive as disasters that are above 75th percentile in the damage-to-GDP ratio and in the population affected-to-total population ratio. This corresponds to 7.0 percent of GDP and 7.5 percent of total population, respectively.

[4] In this case, it would be calculated as the number of years in the sample (30) divided by the number of disasters during that period.

Tonga and Tuvalu, severe disasters have typically been much less frequent over the period as a whole. Nonetheless, it appears that the interval between natural disasters is shortening for these countries as well. An important implication is that countries in the region will typically have less time to recover from greater damage than in the past. This underscores the importance both of adaptation to contain or reduce damages, and of being able to recover quickly.

Figure 2: Intervals Between Natural Disasters in PICs (1980-2016)



1/: MHL – Marshall Islands, WSM – Samoa, VUT – Vanuatu, SLB – Solomon Islands, FJI – Fiji, TON – Tonga, FSM – Micronesia.
2/: FSM, TUV and Ton have only one disaster interval observation.
3/ Mean is calculated using total number of disasters divided by the sample years.
Sources: EM-DAT and IMF staff calculations.

Severe natural disasters do not only disrupt current economic activity but can also have a significant impact on long-term growth. Lee et al. (2018) estimate that a severe natural disaster tends to reduce GDP growth by an average of 1.8 percentage points in the Pacific region. Due to differences across PICs in the historical probability that each country has been struck by severe natural disasters, some PICs have seen larger reductions in growth than others (e.g. 0.5-0.6 percentage points for Vanuatu and 0.2-0.4 percentage points for Samoa).

III. Design of Fiscal Buffers for Natural Disasters

A. The Role of Fiscal Buffers

Following a natural disaster, the government needs to secure funding for emergency relief and reconstruction efforts at the same time as revenues may be adversely affected. The government may reallocate budget spending towards disaster relief (often by cutting planned capital spending) and draw down its deposits in the central bank or commercial banks to address immediate relief needs. The international community (including other governments, international organizations, NGOs and the private sector) may also provide grants and aid to help the disaster-devastated country to recover quickly, though the amounts and timing of disbursements are quite uncertain. External insurance, including catastrophe bonds, is another option for financing, though it might be costly and has limited triggers for payouts.

Beyond the immediate response to a disaster, in order to finance recovery and reconstruction, the government may also seek to borrow from domestic or external sources, though the borrowing has an adverse effect on debt sustainability, especially for highly indebted countries. In the absence of sufficient funding for reconstruction, much of the financial burden of recovery will fall on the private sector, especially those who have been most adversely affected by the disaster. In addition, government resources will tend to be redirected away from previously planned investments and current expenditures towards relief efforts.

Fiscal buffers have a crucial role to play in managing the fiscal impacts of natural disasters and achieving sustainable and inclusive growth. Adequate fiscal buffers would reduce dependence on uncertain foreign donations, ensure quick disbursement for recovery and relief efforts, minimize disruption of pre-existing spending plans on health, education, and infrastructure, and provide flexibility in addressing post-disaster liquidity needs.

B. Definition of Fiscal Buffers

In general, fiscal buffers refer to fiscal space available to cover unexpected expenditure increases or revenue shortfalls, created by saving budgetary resources and reducing public debt in good times. Fiscal space is defined as the extent to which a government can raise spending or lower revenues without endangering market access and putting debt sustainability at risk (IMF, 2016).

In this paper, we define fiscal buffers for natural disasters as government financial assets which can be used to address relief and reconstruction needs, helping to insulate budgeted government spending from major disruption. They include government deposits and funds, which can be disbursed expeditiously in the event of natural disaster shocks without much restriction. They also include funds, which can be disbursed if withdrawal rules are changed, but do not include funds which are established for other purposes and which are not intended for use in dealing with substantial fiscal shocks. Consequently, although government cash buffers have great flexibility, they would normally be too small to be considered as a buffer for natural disasters. Conversely, a

sovereign wealth fund (SWF) may be large, but may not be able to be used to cover natural disaster costs (Appendix).[5]

Currently, there are six PICs with contingency funds for natural disasters (Table 1). Fiji has established the National Disaster Relief and Rehabilitation Fund in 2004, which receives an annual contribution of F$ 1 million (US$ 0.5 million) from the government. In Marshall Islands and Micronesia, the Disaster Assistance Emergency Fund was established as part of the Compact of Free Association with the U.S. and is used by those countries to assist with disaster-related expenses (Box 1).

In Tonga, a National Emergency Fund with around US$ 7.8 million was established in 2008. Tuvalu established a Climate Change and Disaster Survival Fund in 2015, with initial funding of AUD 5 million. The Consolidated Investment Fund (CIF) in Tuvalu can be considered as a fiscal buffer for natural disasters, as the government can freely draw down the CIF to finance budget spending. In Solomon Islands, the National Disaster Council Fund, which was established in 1989, was misused and often diverted away from disaster response activities. The fund has not received an appropriation since 2008.

The Compact Trust Funds (CTFs) in Marshall Islands and Micronesia, and the Climate Change Trust Fund (CCTF) in Tonga, however, do not fit the definition of a fiscal buffer for natural disasters. The CTFs will be disbursed as grants from 2024 onwards and no disbursement is allowed prior to 2024, while the purpose of the CCTF is to finance small, community-based climate adaptation and mitigation projects and fund the climate component of non-community-based projects.

Table 1: Natural Disaster Funds in PICs

	Fund	Year Established
Fiji	National Disaster Relief and Rehabilitation Fund (known as the Prime Minister's Fund)	2004
	Ongoing Contingency Funds for Disaster Risk	2015
Marshall Islands	Disaster Assistance Emergency Fund	2004
Micronesia	Disaster Assistance Emergency Fund	2004
Solomon Islands	Natural Disaster Council Fund	1989
Tonga	National Emergency Fund	2008
Tuvalu	Climate Change and Disaster Survival Fund	2015

\1. Pacific Disaster Contingent Savings Facility under the ADB-supported Pacific Disaster

[5] SWFs in the PICs were set up with revenue from non-renewable sources (Kiribati, Timor-Leste, Papua New Guinea, Nauru), revenue windfall (Tonga, Tuvalu), or donor contributions (Tuvalu, Marshall Islands, Micronesia, Palau) (Le Borgne, 2007).

Box 1. Disaster Assistance Emergency Fund (DAEF) in Marshall Islands

The Disaster Assistance Emergency Fund (DAEF) was established in 2004 under the Compact of Free Association with the U.S. The agreement for the establishment and use of the DAEF prescribes financial contributions from the governments of the Marshall Islands and the U.S., and withdrawal rules and limits.

From Fiscal Year (FY) 2005 to 2023, the governments of the Marshall Islands and the U.S. need to deposit US$ 200,000 annually in the DAEF. The government of the Marshall Islands may invest part or all of the DAEF in low-risk instruments such as insured certificates of deposit, money market funds and Treasury bills and notes. After the government declares a state of national emergency, it can withdraw from the fund up to US$ 50,000 per state of emergency. No more than US$ 100,000 could be withdrawn in any one calendar year. At the end of FY2023, full ownership of the DAEF will pass to the government.

The ADB has been working with several PICs to help strengthen their resilience to natural disasters under the Pacific Disaster Resilience Program by establishing Pacific Disaster Contingent Savings Facility as well as by strengthening the framework for disaster risk management. In December 2017, the ADB decided to provide a total of US$ 15 million in financing to Samoa, Tonga and Tuvalu.[6] After Cyclone Gita hit Tonga in February 2018, the ADB provided US$ 6 million to the Government of Tonga to help fund priority early recovery activities.

C. Institutional Framework for Fiscal Buffers for Natural Disasters

An effective institutional framework is needed to avoid the misuse of fiscal buffers, especially natural disaster funds, and enhance the transparency and accountability of the funds. The IMF (2016) recommends that a well-designed framework should have the following characteristics:

- The fund should be consolidated with budget information to allow the assessment of the overall fiscal situation; at a minimum, the fund balance should appear in financial statements, and drawdowns from the fund should appear in budget execution reports.
- There should be a standing appropriation that allows for spending immediately after a certain trigger event, such as a declaration of a disaster emergency by the executive.
- The fund should generally apply normal PFM rules. It should have clear rules governing the use of the resources; follow normal government accounting standards; prepare and publish audited financial statements; and define governance rules. Following these rules promotes transparency. However, procurement rules for immediate disaster response should be adjusted to allow for quicker procurement.

[6] For both Samoa and Tonga, total assistance is US$ 6 million ($3.1 million for loans and $2.9 million for grants). For Tuvalu, only grant financing worth US$ 3 million is provided.

- It should be limited to respond to disasters with large fiscal impacts: hence, drawdowns should only start above a minimum fiscal cost. Smaller expenditure needs should be covered through budget contingencies.
- It may not be appropriate to let the fund get too large if: (i) its primary purpose is to cover immediate relief and recovery expenses while longer-term rebuilding is financed by borrowing, or (ii) it may generate pressures to tap it for other purposes or discourage international donors from providing grants or loans.
- The financial investment strategy of the fund should be to maintain a high degree of liquidity, given the potential urgency of relief expenditures. For PICs, these assets may be better kept offshore because domestic financial markets may be under stress after disasters and because relief and recovery efforts may involve substantial import content. Post-disaster repatriation of offshore investments would also strengthen the balance of payments at a time of economic weakness.

D. Opportunity Cost of Holding Fiscal Buffers

Given the high infrastructure needs in PICs, an argument can be made that there is a tradeoff between public spending on infrastructure and holding fiscal buffers. Accumulating public savings instead of investing in productive infrastructure projects forgoes the rate of the social return on the associated public investment. However, this argument does not reflect the fact that eventually the saved funds will be used for relief and recovery. There is a cost to waiting to use the buffer. But in the absence of a buffer, there would be a high cost to either delayed recovery owing to lack of resources, or the cost of borrowing to rebuild.

A slightly different argument is that investing in resilient infrastructure can directly reduce the cost of recovery from disasters, so that the two are to some extent substitutes. While this is likely to be true up to a point, there are limits to the amount of physical resilience that can be achieved (it is hard to protect crops from a cyclone, or houses from a tsunami), so financial and physical resilience become complements beyond that point.

Paying down debt might be better than accumulating fiscal buffers, especially for countries with high indebtedness. If the cost of public debt is higher than the benefits of holding fiscal buffers, the authorities may consider early debt repayment. A reduction of expensive debt may enhance future borrowing capacity with favorable terms. Nonetheless, reducing debt is not equivalent to building a buffer in an important way. Buffers can be used essentially immediately, which may be extremely important following a sudden disaster such as a cyclone, tsunami, or earthquake. Lower debt implies more room to borrow, but arranging a loan may take some time. In practice, authorities could consider a combination, with an asset buffer to cover immediate needs, and enough room to borrow to finance some of the longer-term recovery needs.

One way to reduce the delay associated with borrowing to finance post-disaster recovery is to have a pre-arranged line of credit that can be activated quickly. The World Bank has a program called the development policy loan with a Catastrophe Deferred Drawdown Option (Cat DDO),

which is a contingent financing line that provides immediate liquidity following a natural disaster. Funds become available for disbursement after the drawdown trigger, which is typically the declaration of a state of emergency, is met. At approval a country must have an adequate macroeconomic policy framework and a satisfactory disaster risk management program in place (or under preparation). Some PICs, such as Vanuatu, are currently discussing the Cat DDO with the World Bank.

The attractiveness of a line of credit rather than building a buffer of own funds is not clear. For countries where natural disasters are quite infrequent, a line of credit may be preferred since it does not tie up valuable capital which could be used for development purposes. But for countries that are particularly vulnerable to frequent disasters, the line of credit is highly likely to be drawn. And such borrowing also needs to be repaid. In this case, the budgetary implications may be very similar to saving in a buffer fund. A buffer of own funds will have fewer strings attached, and can be as large as the country wishes. However, precisely because activating a line of credit is more restrictive, it may be less likely to be used for unintended purposes than a buffer of own funds. In other words, the differences between a buffer and a line of credit are not simply financial, but may be most significant in terms of governance.

IV. Estimating the Fiscal Cost of Natural Disasters

This section estimates the effects of natural disasters on government revenues (excluding grants) and expenditures, using a panel vector autoregressive model (VAR). Section A gives a short review of previous research on this topic. Sections B to G explain the data, model specification, the results from the regressions, and implications for PICs. The last section explains data limitations and caveats.

A. Literature Review

Most studies estimating the economic costs of natural disasters use data from Emergency Events Database (EM-DAT) and focus on the impact on growth (e.g. Klomp And Valckx, 2014; Felbermayr and Gröschl, 2014; Fomby et al., 2013; Loayza et al., 2012; Cavallo et al., 2013)[7]. Recent studies on the fiscal effects of natural disasters generally use a broad range of countries as samples. Lis and Nickel (2010) examine the effect of extreme weather events on budget balances, using annual data for 138 countries in a fixed effects regression model. They conclude that, on average, budget balances would narrow by 0.23 percent to 1.4 percent of GDP, depending on the country income. Noy and Nualsri (2011) include quarterly data from 22 developed countries and 20 developing countries in a panel VAR model to quantify the fiscal consequences after natural disasters. They find that fiscal behavior is counter-cyclical in developed countries, and pro-cyclical in developing countries in the aftermath of disasters. This

[7] EM-DAT database was established by the Center for Research on the Epidemiology of Disasters (CRED), and provides more than 22,000 mass disasters observations worldwide since 1900.

paper contributes to the literature by estimating the fiscal impacts in 12 PICs from severe natural disasters, and the lagged effects from disasters on fiscal indicators.

B. Data

We use annual natural disaster data during the period 1980–2016 from the EM-DAT database, which records disasters that meet the following criteria: (i) 10 or more people dead; (ii) 100 or more people affected; (iii) a declaration of a state of emergency; and (iv) a call for international assistance.[8] All the economic indicators used in the estimation are from the World Economic Outlook and World Development Indicators databases. The panel is unbalanced mainly because of the limited availability of fiscal data.[9]

C. Natural Disaster Intensity Measure

Not all-natural disasters have significant economic effects on a country, either because the event is relatively small, or because it affects a sparsely populated or scarcely developed area (Table 2). For our purposes, we want to focus on disasters likely to have a substantial macroeconomic and fiscal impact. Previous literature constructed disaster intensity measures using information on the population affected and the numbers of deaths (Fomby et al, 2013; Becker and Mauro, 2006). However, different types of natural disasters influence the country's economy and population differently. Historical data show that droughts affect more people than other types of disasters, but storms cause the most economic damage. This paper adopts the same intensity measure as proposed by Lee, et al. (2018), which takes account of both the population affected and economic damage.

Table 2: Average Damage per Disaster, by type (1980-2016)

	Population Affected (number of person)	Total Damage (USD thousands)
Storm	36,629	62,463
Drought	290,931	45,000
Flood	27,177	26,843
Earthquake	3,942	20,952
Others	9,992	70,825

Note: Others includes volcanic activity, epidemic, landslide, mass movement, and wildfire

Sources: EM-DAT

Population and damage are used as follows. Among the 204 observations in the sample period, not all have information on both economic damage and population affected. Therefore, the intensity of natural disasters is based primarily on the percentile rank of economic damage to GDP ratio and, secondarily, on the percentile rank of population affected in cases where damage

[8] The sample period used begins in 1980, mainly owing to lack of sufficient fiscal data prior to 1980, but also reflecting concern over the comparability of earlier data with later data on disasters.

[9] Only annual fiscal data are available for the sample countries.

to GDP is not available. In this paper, we define severe disasters as those that are above 75th percentile. This threshold is chosen based on trial and error approach. The results from regressions with different percentile natural disaster dummies show that disasters that are above 75th percentile have a statistically significant impact on GDP.

D. Definition of Fiscal Cost

The fiscal cost of natural disasters is defined as the sum of the increase in expenditure and decrease in revenue of the central government, excluding grants, in the aftermath of natural disasters. The data, therefore, do not include the impact on other levels of government or state enterprises.

Fiscal cost for natural disasters = Increase in government expenditure + Decrease in government revenue, excluding grants

The fiscal cost of a natural disaster is different from the economic cost, which usually covers damage and loss. Economic costs include not only costs borne by the government sector but also those borne by the private sector. For instance, the total economic value of the effects caused by Tropical Cyclone Pam, which struck Vanuatu in March 2015, is estimated to be approximately 64 percent of GDP (39 percent for damage and 25 percent for loss), while total fiscal costs after Pam are estimated to be around 16 percent of GDP. The fiscal cost of natural disasters is estimated below.

E. Empirical Specification

This paper uses a panel VAR to estimate the impact of natural disasters on fiscal expenditure and revenue in PICs, similar to Noy and Nualsri (2010). The panel VAR approach is adopted to capture the linear interdependencies between government revenue and government expenditure. Natural disasters are treated as exogenous shocks with contemporaneous and lagged macro-fiscal impacts. Given that individual PICs do not have enough high frequency data to run time-series analysis, this paper pools the experiences of the PICs to generate a regional average impact of disasters. While country-specific estimates might be preferred at first glance, it should also be borne in mind that the impact of natural disasters vary greatly even for a single country. Consequently, the within-country variance of disaster effects may be as great as the across-country variance. In estimated models, we estimate separately the impact of disasters on expenditure and revenues. In addition, we use a measure of revenues excluding grants. Most PICs depend on official transfers as a major source of government revenue. After natural disasters, these countries tend to get more grants to help cover the cost of rebuilding infrastructure and disaster relief. The basic model specification is:

$$Y_{i,t} = AY_{i,t-1} + BX_{i,t} + u_i + \lambda_t + e_{it} \quad (1)$$

This model includes two main endogenous variables, $Y_{i,t}$: (i) government expenditure (in percent of GDP) and (ii) government revenue excluding grants (in percent of GDP). $X_{i,t}$ represents

exogenous variables: natural disaster dummy (over 75th percentile) and grants (in percent of GDP).

$Y_{i,t}$ is a (1x2) vector of dependent variables, $X_{i,t}$ is a (1x2) vector of exogenous variables; u_i is a vector of country fixed effects; λ_t is a vector of time fixed effects; and e_{it} is a vector of idiosyncratic errors. The country fixed effects capture the country-specific characteristics that are not quantified in this model, e.g. political system, infrastructure capacity, or land area. A and B are both (2x2) matrices of parameters to be estimated.

Since the economic impact of natural disasters last several years, we included lags of the natural disaster dummy in the following model:

$$Y_{i,t} = AY_{i,t-1} + B_1 D_{i,t} + B_2 D_{i,t-1} + B_3 D_{i,t-2} + B_4 X_{i,t} + u_i + \lambda_t + e_{it} \quad (2)$$

$D_{i,t}$ is the natural disaster dummy, and $X_{i,t}$ is grants (in percent of GDP). To test the robustness of the model, we also include real GDP growth, and Australian and US real GDP growth as controls in alternative specifications.

The parameters can be estimated by using fixed effects or equation-by-equation ordinary least squares (OLS) (Abrigo and Love, 2015). For fixed effects estimators, within transformation eliminates country fixed effects, however, the estimator is still biased with the lagged dependent variable on the right-hand side (Nickell, 1981; Baltagi, 2013). Alternatively, the estimation can be done using the generalized method of moments (GMM), which gives the consistent estimates for a panel VAR and may yield efficiency gains from estimation a system of equations (Holtz-Eakin, Newey and Rosen, 1988). Therefore, we use GMM to estimate the model and specifically forward orthogonal deviation or Herlmert transformation, which was introduced by Arellano and Bover (1995). In contrast to the first difference transformation, the Herlmert transformation removes the mean of all available future observations, and therefore avoids data loss and enables lagged regressors to be used as instruments to estimate the coefficient in GMM. Country fixed effects are eliminated by this transformation.

F. Results

The estimation results show that the impact of natural disasters on government expenditure is likely to extend to the third year after the initial disaster year, while the impact on revenue excluding grants is not statistically significant. These findings were robust across numerous variations on the model specification. On average, a severe natural disaster is likely to increase government expenditure by 13.8-20.6 percent of GDP over a three-year period.[10] In the disaster year, government expenditure is likely to increase by 6.4 percent, and two years after the disaster, government expenditure tends to further increase by 6.8 percent. This paper's results

[10] From Table 3, results are based on model (1) (2). At 5 percent significance level, the sum of natural disaster dummy coefficients is 13.8, and at 10 percent significance level, the sum of natural disaster dummy coefficients is 20.6.

complement the economic impacts estimated by Lee et al (2018): one severe natural disaster would cause the country about a 2 percent decrease in real GDP growth in the disaster year. It may be noted that the finding that government (net) spending typically increases following a disaster implies that, with respect to this source of shocks, the fiscal response if generally counter-cyclical.

The persistent increase in public expenditure is not surprising. A rise in government spending on relief and emergency repairs to infrastructure in the immediate aftermath of a disaster is expected. However, beyond the immediate responses to a disaster, there is the longer process of rebuilding infrastructure, especially housing, schools, clinics and so on, and this may take several years. This is especially likely to be the case if rebuilding is dependent on external aid, as this may take time to deliver. Yang (2008) shows that the official development assistance flow increases significantly after natural disasters, but with a two-year lag.

The non-significant results on government revenues could be potentially explained by the special characteristics in PICs. Without highly diversified economies, most PICs depend on few sectors (e.g. tourism, fishing license fees, or natural resources) for government revenues. Natural disasters could have significant negative effects on tourism-oriented countries, including Fiji, Vanuatu and Palau, if the tourism infrastructure is significantly damaged. However, the impact of natural disasters countries dependent on fishing license fees is limited. Government revenues of countries that are big oil or commodity exporters are highly sensitive to the global oil/commodity prices and may not be significantly vulnerable to natural disasters.

Table 3: Estimation Results

VARIABLES	(1) Expenditure	(2) Revenue excl grants	(3) Expenditure	(4) Revenue excl grants	(5) Expenditure	(6) Revenue excl grants	(7) Expenditure	(8) Revenue excl grants
Expenditure (1st lag)	0.590***	-0.235**	0.591***	-0.228**	0.611***	-0.235*	0.580***	-0.236**
	(0.125)	(0.109)	(0.126)	(0.110)	(0.136)	(0.121)	(0.123)	(0.107)
Revenue excl grants (1st lag)	0.274**	1.186***	0.283**	1.163***	0.290**	1.193***	0.260**	1.187***
	(0.133)	(0.0994)	(0.137)	(0.100)	(0.146)	(0.103)	(0.127)	(0.100)
Natural Disaster Dummy	6.420**	-0.0918	6.175**	0.325	5.373*	-0.379	6.112**	-1.145
	(2.922)	(2.562)	(2.986)	(2.645)	(2.892)	(2.537)	(2.773)	(2.783)
Natural Disaster Dummy (1st lag)	6.780*	-2.396	6.353*	-1.691	5.521	-2.189	8.290*	-5.265**
	(3.731)	(1.661)	(3.731)	(1.774)	(4.245)	(1.662)	(4.232)	(2.521)
Natural Disaster Dummy (2nd lag)	7.374**	-0.673	7.028**	-0.294	6.585**	-0.265	6.558**	-0.675
	(3.199)	(2.176)	(3.156)	(2.583)	(3.094)	(1.623)	(2.931)	(1.711)
Grants	0.466***	0.280***	0.464***	0.291***	0.482***	0.306***	0.472***	0.282***
	(0.152)	(0.106)	(0.149)	(0.106)	(0.164)	(0.116)	(0.149)	(0.106)
Real GDP growth			-0.0604	0.223*				
			(0.105)	(0.123)				
Real GDP growth (lag)					0.0673	0.0205		
					(0.121)	(0.108)		
Australia RGDP growth							-0.0336	-0.0804
							(0.0388)	(0.0497)
US RGDP growth							0.0163	0.373*
							(0.265)	(0.218)
Observations	230	230	230	230	227	227	230	230
Hansen	0.728	0.728	0.735	0.735	0.899	0.899	0.646	0.646

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

G. Fiscal Cost of Natural Disaster for Individual PICs

As Table 4 below shows, the cumulative fiscal cost of a severe natural disaster is estimated, on average, at 13.8 to 20.6 percent of GDP.[11] Because each country has a different frequency of disaster, each would face a different timeframe to build a fiscal buffer able to cover the fiscal cost of one disaster. Assuming the estimated fiscal cost for one disaster in each country is the regional average, the annual fiscal cost can be calculated as below:

Annual Fiscal Cost per disaster = Total Fiscal Cost (regional average) / Disaster Interval (country specific)

Table 4. Fiscal Cost of Severe Natural Disasters (in percent of GDP)

Total Fiscal Cost (In percent of GDP)					
	Disaster year	1st yr post-disaster	2nd yr post-disaster	Cumulative fiscal cost for one disaster	
Regional Level	6.4	6.8	7.4	13.8 ~ 20.6	
Probability and Intervals for a Severe Disaster (by country)					
	Actual Average Probability	Implied Average Interval	Actual Median Interval	Implied probability	Annual Fiscal Cost (based on median interval)	Annual Fiscal Cost (based on average interval)
Samoa	16.2	6.2	3.0	33.3	4.6 ~ 6.9	2.2 ~ 3.3
Vanuatu	18.9	5.3	4.0	25.0	3.5 ~ 5.2	2.6 ~ 3.9
Solomon Islands	8.1	12.3	5.5	18.2	2.5 ~ 3.7	1.1 ~ 1.7
Marshall Islands	8.1	12.3	12.5	8.0	1.1 ~ 1.6	1.1 ~ 1.7
Fiji	10.8	9.3	15.0	6.7	0.9 ~ 1.4	1.5 ~ 2.2
Micronesia	5.4	18.5	18.0	5.6	0.8 ~ 1.1	0.7 ~ 1.1
Tonga	5.4	18.5	19.0	5.3	0.7 ~ 1.1	0.7 ~ 1.1
Tuvalu	5.4	18.5	25.0	4.0	0.6 ~ 0.8	0.7 ~ 1.1
Kiribati	2.7	37.0	*NA*	*NA*	*NA* ~ *NA*	0.4 ~ 0.6
Timor-Leste	2.7	37.0	*NA*	*NA*	*NA* ~ *NA*	0.4 ~ 0.6
Papua New Guinea	2.7	37.0	*NA*	*NA*	*NA* ~ *NA*	0.4 ~ 0.6
Palau	0.0	*NA*	*NA*	*NA*	*NA* ~ *NA*	0.0 ~ 0.0

Note: Average probability is calculated using the total severe disaster observations divided by the total number of years (37) in sample period 1980–2016. Based on this probability, implied average disaster interval can be calculated, and could be compared with the median disaster interval. NA indicates that median interval can't be calculated because they only have one severe disaster observation, and to calculate an interval needs at least two severe disasters.

[11] The fiscal cost numbers are taken from the regression coefficients in Table 3. The lower bound is at 5 percent significance level and the higher bound is at 10 percent significance level.

The annual fiscal cost based on the regional level median disaster interval (13.8 years) is 1–1.5 percent of GDP. We use the median interval as a more robust estimator than the sample mean, which can be strongly influenced by a few outlier observations. Applying the same approach to each PIC, we can see the results in Table 4. Samoa, Vanuatu, and Solomon Islands have the highest annual fiscal cost, reflecting the high frequency of disasters, which leaves less time to rebuild buffers than for countries hit less frequently.

It should be emphasized that these figures are indicative rather than precise. Part of this is because we use pooled data to estimate a "typical" disaster fiscal cost in the region. In addition, the intervals between disasters that we use are based on data over the whole period since 1980. We have made no allowance for the impact of climate change, which may be significantly shortening the interval between disasters. Nor has allowance been made for the fiscal costs of smaller disasters. Consequently, the fiscal costs shown in Table 4 should be probably be regarded as lower bound estimates. Moreover, because both the timing of disasters is stochastic, and the magnitude of the impact can vary greatly from one disaster to the next, this means that even if a country saved at the rates indicated in Table 4, there is no guarantee that this would be sufficient to cover all major disasters. Sometimes these savings rates would be more than sufficient, and other times not.

H. Data Limitations/Caveats

The estimation results are based on an average across countries and disasters. But each country is different. So too is each disaster, even in the same country. The damage and fiscal cost of a cyclone, for example, will tend to be less in sparsely populated countries than in densely-settled countries, and less in countries with very limited infrastructure than in more developed countries with more, and more vulnerable, infrastructure.

The estimated costs focus only on relatively severe natural disasters, so the fiscal costs of small natural disasters are excluded from our analysis.[12]

To keep the consistency of our analysis, we use information from EM-DAT as our only source of natural disaster data. For some natural disasters, EM-DAT has different damage or population affected numbers compared with numbers from other sources (e.g. World Bank). Therefore, in certain cases, the damage of a natural disaster might be under or over estimated.

No allowance is made for the impact of climate change on the frequency or severity of disasters. The estimates can therefore be seen as optimistic, although they do take into account the experience of PICs in the 1980s and 1990s, which saw more frequent large disasters than the first decade of the 2000s. Certainly the experiences of Fiji, Tonga, and

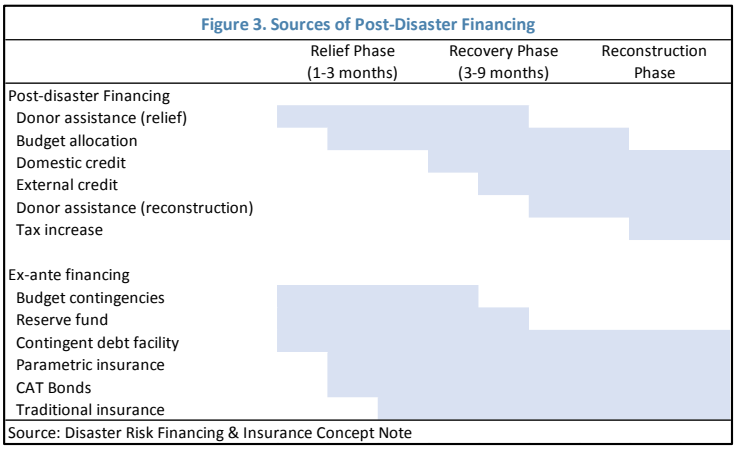
[12] The analysis could, of course, be conducted using a lower threshold for disaster severity. This would increase the estimated frequency of disasters and likely lower the estimated cost per disaster. The overall cost would be likely to rise.

Tuvalu in recent years suggest that the frequency with which they are affected by severe cyclones has increased sharply.

V. Determining the Appropriate Size of Fiscal Buffers for Natural Disasters

The appropriate size of fiscal buffers for natural disasters should take into account not just the fiscal cost of disasters, but also the availability of: (i) external financing (loans and grants, including insurance payments), (ii) domestic financing, and (iii) contingency credit or provision in the annual budget and budget reallocation. The fiscal cost borne by the government can be reduced by the involvement of other organizations following a natural disaster, including international donors, non-governmental organizations, local business community, and remittance from relative abroad. The World Bank summarizes financing sources, depending on three phases (relief, recovery, and reconstruction) (Figure 3).

Figure 3. Sources of Post-Disaster Financing



Source: Disaster Risk Financing & Insurance Concept Note

Fiscal buffer for natural disasters = Fiscal cost of natural disasters – External financing – (Domestic Financing + Contingent provisions / credits)

In Subsection A (External financing), B (Domestic financing), and C (Contingent Credit / Provision and Budget Reallocation), the paper provides some figures from the recent natural disasters to get a sense of how much the governments in PICs relied on those instruments.

A. External Financing

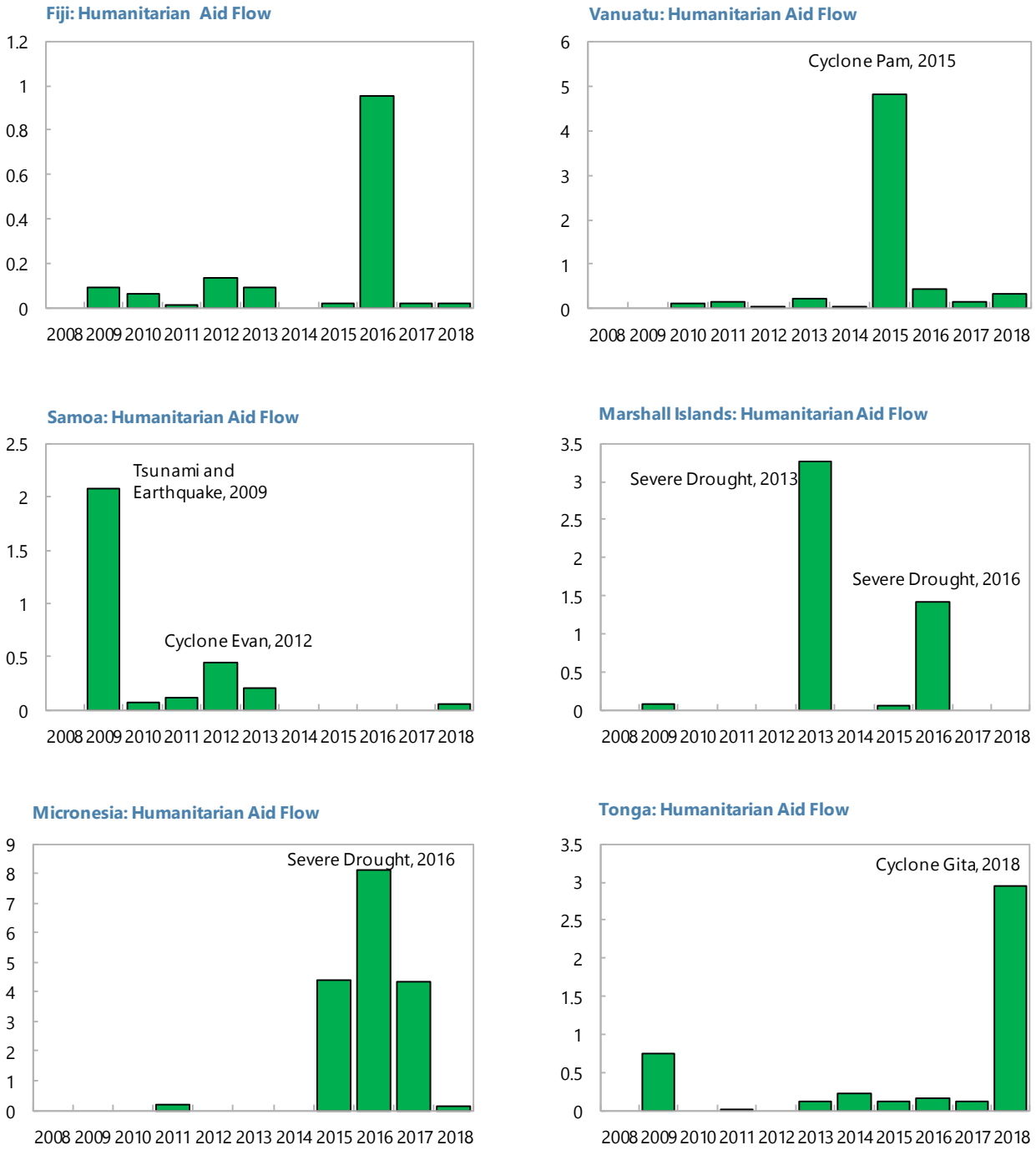
The size of external financial support is generally determined by the degree of the damage by natural disasters. The larger the damage and loss is, the larger are likely to be the grants provided from international community. Figure 4 shows the humanitarian aid flows for the PICs that were struck by severe natural disasters in the past ten years. The international community expressed their large commitment for humanitarian aid right after natural disasters took place. It ranged from US$ 2.8 million to US$ 43.7 million, depending on the severity of disasters. Regarding insurance payment, Vanuatu and Tonga received a payout of US$ 1.9 million (about 0.25 percent of GDP) and US$ 3.5 million (about 0.8 percent of GDP), following the Tropical Cyclones Pam and Gita, respectively, under the Pacific Disaster Risk Financing and Insurance (DRFI) Program.

International Financial Institutions (IFIs) also provide loans to alleviate balance-of-payment pressures after natural disasters and to support reconstruction activities. The World Bank (WB), Asian Development Bank (ADB), and IMF, can provide loans on concessional terms. In the case of Vanuatu, the IMF provided emergency loans (US$ 23.8 million, about 3.0 percent of GDP) in June 2015 with no interest payment, while the ADB and WB are expected to provide Vanuatu with a total of around US$40 million (about 3.8 percent of GDP) for the purpose of the reconstruction of roads, schools, and public buildings during 2017–2022, with grant elements more than 50 percent (Box 2). In the case of Fiji, the ADB and WB provided US$ 50 million emergency assistance loan, respectively, to the country for disaster recovery program (Box 3). High concessionality of loans reduces the debt service pressure in the medium term. Excessive borrowing would raise the issue of debt sustainability, especially for some PICs with high debts. The PICs with high debts would face not only debt service pressure in the medium term but also the limited capacity to borrow in the event of future natural disasters.

We can roughly calculate the total of humanitarian aid and loans as a percent of GDP by adding humanitarian aid in the disaster year and loan disbursement from disaster year onwards. The total external support the PICs received after the disasters is expected to range from 1.7 to 18.5 percent of GDP, depending on the type and severity of natural disasters. This is a very wide range and makes it difficult for policy makers to gauge how much assistance they should count on in the wake of a severe disaster. Moreover, the bulk of such assistance may go directly to the private sector, so that only a small part may be available for budget support. In such circumstances, PIC governments should probably make quite conservative assumptions regarding post-disaster external budget support.

Figure 4: Pacific Island Countries: Humanitarian Aid after Severe Disasters [1/]

(In US$ millions)



1/: Severe disasters as defined in section III.
Sources: UNOCHA Financial Tracking Service.

B. Domestic Financing

Given relatively small financial markets in PICs, the scope for governments to borrow domestically is very limited and the cost of borrowing is generally high. Moreover, domestic borrowing by the government risks crowding out private sector borrowing to finance recovery.

In Vanuatu the government did not borrow from domestic sources after Cyclone Pam for the purpose of recovery and reconstruction efforts. In Fiji, domestic borrowing increased partly to fund recovery efforts. In FY16-17, infrastructure bonds amounting to almost 2 percent of GDP were sold, largely to the Fiji National Provident Fund (FNPF), commercial banks, and insurance companies. Another potential source of domestic financing is the central bank, but in general central bank financing should be strictly limited on account of risks of fiscal dominance that would destabilize the economy through possible higher inflation.

National Provident Funds (NPFs) in PICs would be a possible source for financing rebuilding, though more likely for the private sector than for the government (Box 3). Some PICs have mobilized pension funds, but as a disaster relief instrument instead of as a government financing source. For example, Fiji allowed the members of its FNPF to withdraw up to 30 percent of their pension account balance after Cyclone Winston. Vanuatu's NPF allowed its members to withdraw up to 20 percent of their retirement savings, with total drawdowns amounting to VUV 1.7 million (2.1 percent of GDP) for three months after Cyclone Pam. Si et al. (2018) suggested that early pension withdrawal could improve welfare by helping households finance necessary expenditure when they recover from the damage caused by a natural disaster. Without any subsequent measures to strengthen the financial position of NPFs, such as adjusting the mandatory pension contribution rate, a contingent government liability for under-saving for retirement would likely materialize.

The need to ensure that the domestic financial system is able to support private sector post-disaster recovery efforts suggests that, in general, governments should not plan to draw heavily on domestic borrowing as a significant part of public sector post-disaster financing.

C. Contingency Credit / Provision and Budget Reallocation

A contingent provision in the annual budget allows the government to fund unforeseen expenditure, including from natural disaster shocks. Some PICs, such as Fiji, Solomon Islands and Vanuatu, have a contingency provision in place in their annual budget (Box 4). Solomon Islands puts aside SI$ 26 million (about 0.2 percent of GDP and 0.7 percent of total expenditure), while Vanuatu reserves VUV 50 million (about 0.05 percent of GDP and 0.2 percent of total expenditure, excluding grants-funded expenditure) in the 2018 budget. Clearly these contingency funds are very limited, especially relative to the costs associated with natural disasters, and cannot realistically be considered as a significant source of disaster financing.

The government may use its own resources to cope with natural disasters through budget reallocation in a supplementary budget. Vanuatu has spent VUV 402 million (about 0.5 percent of GDP) for Cyclone Pam. Budget reallocation allows for spending for immediate relief needs, while awaiting legislative process of appropriating funds for relief and reconstruction. However, substantial budget reallocation from budgeted spending earmarked for other purposes to recovery-related expenditure may complicate budget execution and fiscal policy. In Fiji, following Cyclone Winston, significant budgetary reallocation also took place. Budget reallocation is, in effect, a means of limiting additional spending rather than a source of additional financing. Moreover, although it is natural for governments to reallocate funds following a major disaster, some reallocations may be very disruptive or costly. For example, if some investment projects are halted to divert funds to disaster relief, it may be very costly to later re-start the projects.

Box 2. Cyclone Pam in Vanuatu

Cyclone Pam, one of the most damaging natural disasters in Vanuatu's history, hit the country in March 2015. It caused overall damages amounting to more than 60 percent of GDP and affected almost 72 percent of the population (more than 188,000 inhabitants). Key sectors such as tourism, transportation, and agriculture were highly damaged. In its aftermath, development partners contributed significant amounts of aid-in-kind, grants, and loans. Vanuatu received around US$ 40.2 (4.6 percent of GDP) of grants from bilateral and multilateral donors and around 85 percent of the total funds was disbursed as of end-2017. Regarding loans, the IMF provided financial assistance (about US$ 23.8 million, equivalent to about 3 percent of GDP) in June 2015 under the RCF and RFI to address an urgent balance of payments need. While the IMF's quick disbursement catalyzed the international community's efforts to support Vanuatu's recovery from Cyclone Pam, the fund has not been used due to limited BOP pressure. The IDA is expected to provide US$ 50 million (about 4.7 percent of GDP) in the form of loans (50 percent) and grants (50 percent) during 2017–2022 to support reconstruction and improvement of roads, schools, and public buildings, while the ADB is expected to provide about US$29 million (about 3 percent of GDP) in the form of loans (50 percent) and grants (50 percent) during 2017–2019. The government itself used its own resources, amounting to VUV 401.6 million (about 0.5 percent of GDP), for the relief and recovery efforts as well as refunds for the disaster-related expenses.

Table 4. Financial Supports from International Community for Cyclone Pam

	Source	Amount (US$ million)	Amount (In Percent of GDP)
Grants	International community	40.2	4.6%
	IDA for reconstruction projects	25.0	2.3%
	ADB for reconstruction projects	14.5	1.5%
	Total	79.7	8.5%
Loans	IMF Facility	23.8	3.0%
	IDA for reconstruction projects	25.0	2.3%
	ADB for reconstruction projects	14.5	1.5%
	Total	63.3	6.8%

Source: Vanuatu authorities; and IMF staff estimates.

Box 3. Post-Cyclone Winston Financing in Fiji

In early 2016, Fiji was struck by Cyclone Winston (TC Winston), one the most severe tropical cyclones in the Southern Hemisphere. The cyclone caused US$ 1.42 million (about 31 percent of GDP) damage and losses and affected more than 60 percent of population[1]. In the Disaster Recovery Framework (DRF)[2] published by the Fijian government responding to the TC Winston, the government dedicated the recovery efforts on restoring public assets and services, providing assistance and support to affected populations, and increasing resilience to future disasters. The DRF identified recovery priorities and estimated the costs of recovery at F$ 730 million for the period covering fiscal year 2016 to 2018. The government was able to allocate F$ 136 million from its own sources and received F$ 22 million from donors, leaving a financing gap of F$ 575 million. Recognizing the long-term nature of recovery and reconstruction, the Fijian government has integrated recovery efforts beyond the first two years into its National Development Plan.

Projected Costs of Recovery from TC Winston, in F$ millions

Recover Priority	Total Budget	Government	Donors	Financing Gap
Priority 1: Rebuilding homes	183.94	72.14	0	111.8
Priority 2: Restoring Livelihoods	169.65	36.17	9.89	123.7
Priority 3: Repairing and Strengthening Critical Infrastructure	353.39	25.79	12.04	315.57
Priority 4: Building Resilience	23.88	2	0	23.88
Total	730.87	135.99	21.93	574.95
In percent of GDP	*7.41*	*1.38*	*0.22*	*5.83*

Sources: Disaster Recovery Framework by MOE.

Post-disaster financing after TC Winston includes humanitarian aid from UN agencies, bilateral donors, and private non-profit organizations and external loans from multilateral organizations like World Bank and ADB. In total, Fiji received about US$ 42.1 million humanitarian aid[3], of which US$ 21.5 million was from UN Flash Appeal, making TC Winston the best funded emergency response in year 2016. The major bilateral donors were Australia (US$ 27 million), New Zealand (US$ 10.3 million) and the EU (US$ 4.8 million), and about 75 percent recovery support is in-kind[4]. At the same time, Fiji signed US$ 50 million loan agreements with both World Bank and the Asian Development Bank, bringing the total loan amount to US$ 100 million. These loans are mainly used for post-disaster school reconstruction and Help for Homes program. As part of the disaster relief efforts, Fiji National Provident Fund (FNPF) allowed members to withdraw up to F$ 1000 (US$ 465) plus additional F$ 5,000 (US$ 2,325) if proof of damaged housing was provided. Within two months of the disaster, FNPF approved 170,000 withdraw application and disbursed about F$ 250 million cash to affected population.

[1] *Fiji: Post Disaster Needs Assessment on Tropical Cyclone Winston, February 20*, 2016, Government of Fiji. May 2016
[2] *Disaster Recovery Framework: Tropical Cyclone Winston*, Ministry of Economy, Republic of Fiji. September 2016
[3] *UNOCHA Financial Tracking Service Website,* retrieved in October 2018.
[4] *Post-Cyclone Winston Emergency Development Policy Operation,* World Bank, June 2016.

Box 4. Contingency Provision and Exceptional Borrowing in Solomon Islands

Solomon Islands' budget framework allows for an issuance of contingency warrants for unforeseen expenditures, including from national emergencies and disaster. The 2018 budget strategy budgets SI$ 26 million (about 0.2 percent of GDP and 0.7 percent of total expenditure, excluding grants-funded expenditure) as a contingency warrant provision for the first time, which is in line with the IMF recommendation in the 2017 Article IV consultation. In the past, contingent warrants were not budgeted, resulting in a cut in other expenditures or revenue increases to fund unforeseen expenditure in the event of the shocks. The Public Financial Management Act (PFMA) 2013 stipulates that the use of contingent warrants should be tabled in the next sitting of National Parliament and disclosed within 30 days after it is tabled.

The PFMA 2013 allows short-term borrowing to deal with exceptional circumstances like a major economic shock or a natural disaster. In the 2017 budget, the government can undertake short-term borrowing up to SI$ 100 million (about 1.0 percent of GDP). However, given a small domestic market, it is not clear whether the government can secure the funding.

VI. Policy Implications

PICs are more vulnerable than most countries to natural disasters. The frequency of severe natural disasters in the region has increased sharply in the past decade after a relatively benign period in the first decade of the 2000s. With climate change, this may become the new normal in the Pacific. The cost of such disasters in terms of GDP is substantial, as shown by Lee and others (2018). This paper shows that the fiscal cost of disasters—mainly through higher expenditures—is also substantial. Yet, almost without exception, the fiscal risks of natural disasters are not taken systematically into account in the fiscal planning and budgetary policies of PICs.

In the absence of any significant self-insurance, the governments of PICs are highly dependent on foreign aid and budgetary reallocations, in coping with natural disasters. The uncertain scale of such external assistance, and the disruption of budget plans, especially public investment spending, may inhibit full recovery from such disasters, slowing long-term growth and achievement of development goals.

These considerations suggest that PIC governments should start to build natural disaster risk into their fiscal and budgetary planning. This should include budgetary funding of natural disaster buffers as self-insurance against natural disaster shocks in the medium- and long-term. The appropriate size of fiscal buffers and the pace of buffer accumulation should be determined on a case-by-case basis, taking into account country's specific circumstances. These include the estimated frequency and fiscal costs of natural disasters, the current level of fiscal buffers, the availability of alternative financing options, including external loans and grants.

Our analysis estimates an average of 13.8-20.6 percent of GDP for the cumulative fiscal cost of one severe natural disaster that strikes PICs. Considering a median severe natural disaster interval of 13.8 years, the annual fiscal cost is estimated to be around 1-1.5 percent of GDP,

but with substantial variation within the region, reflecting differences in exposure to natural disasters. These figures should be interpreted carefully. First, there is considerable uncertainty over the magnitude and frequency of natural disasters. An exceptionally large disaster may have a much higher fiscal cost, and the interval between severe natural disasters varies substantially even for a single country. Moreover, the severity and frequency of severe disasters are expected to rise due to climate change effects in the future. Additionally, the analysis excludes natural disasters that are below 75th percentile. Nonetheless, our estimation can be used as a benchmark for beginning to assess the appropriate level of fiscal buffers as well as the budgetary implications. Donors can also use these estimates to plan more systematically the likely cost of post-disaster assistance to PICs.

In assessing the appropriate scale of fiscal buffers, PIC governments need to consider:

(i) Investment in resilient infrastructure. Such investment would reduce the damage from natural disasters and could lessen the need for fiscal buffers. The IMF (forthcoming) concludes that, in addition to reducing expected losses from natural disasters, investing in resilient infrastructure should raise returns to private investment, employment and output, and facilitate continuous provision of public services. Nonetheless, building resilient infrastructure and building financial resilience should normally be considered as complements rather than substitutes.

(ii) The extent to which they can rely on external donor finance following a disaster. The evidence suggests that the amount provided is likely to be quite uncertain, and much of it goes directly to the private sector rather than to budget support.

(iii) Risk transfer mechanisms. These include the issuance of catastrophe bonds, insurance of physical assets, and regional risk transfer mechanisms, such as the Pacific Disaster Risk Financing and Insurance Program. Currently, however, the cost of such insurance in the Pacific is high, and its coverage quite limited, so that payouts meet only a small fraction of needs.

(iv) The scope for domestic borrowing to finance rebuilding. Such borrowing should probably be kept to a minimum so as not to crowd out private sector borrowing to support recovery.

(v) Budget contingency provisions. Funds should be set aside in the annual budget to prepare for frequent shocks, such as relatively small natural disasters. The authorities whose budget systems have a contingency provision in place should assess the level of the provision and raise it when necessary to take into account actual disbursements for previous disaster events and the internationally common practice of setting aside up to 3 percent of spending. Unused contingency provision should be transferred to a precautionary saving fund, such as a natural disaster fund, which could be used during a disaster in the future.

(vi) Scope for external borrowing, especially contingent lines of credit, including World Bank's Cat DDO and ADB's Pacific Disaster Contingent Savings Facility. Such borrowing is a potential substitute for building independent fiscal buffers. Nonetheless, governance properties surrounding access are somewhat different, and the scale of borrowing will likely be limited by the country's debt sustainability profile. Consequently, even if the country makes use of such facilities, it may well need to build and replenish its own buffers.

Appendix: Sovereign Wealth Funds in PICs

	Fund	Year Established	Revenue	Purpose	Fund Size	Withdraw rules
Kiribati	Kiribati Revenue Equalization Reserve Fund	1956	Mineral royalties (phosphate exhausted in 1979), fishing license revenues, budget supluses and investment income	Countering significant revenue volatility and balance future (recurrent) budgets.		The Kiribati budget and the RERF are integrated, with fiscal surpluses deposited into the fund and any fiscal deficits financed via drawdowns. The government has committed to no drawdowns from the RERF at least until a target balance of A$1 billion (about 400 percent of GDP) is reached—the balance stood at A$994 million as of November 2018. The government is also working on setting a new strategy for the RERF, likely featuring a commitment to preserve the real value of the fund and to limit withdrawals for projects that benefit both current and future generations.
Marshall Islands	Compact Trust Fund	2004	US grants, money from Taiwan, and RMI government	Help achieve budgetary self-reliance as US grants to the budget set to expire by 2023	$200.96 million in USD	In 2024 and thereafter, the income revenue from the previous year can be transferred up to a limit equivalent to the annual grant assistance in 2023 (in real terms). Prior to 2024, no disbursement is allowed and the Fund's assets can't be used as collateral
Micronesia	Compact Trust Fund	2004	US grants, FSM government	Help achieve budgetary self-reliance as US grants to the budget set to expire by 2023	$310.41 million in USD	In 2024 and thereafter, the income revenue from the previous year can be transferred up to a limit equivalent to the annual grant assistance in 2023 (in real terms). Prior to 2024, no disbursement is allowed and the Fund's assets can't be used as collateral
Nauru	phosphate royalties trust fund	1968	Insolvent now			
	Intergenerational Trust Fund for the people of the republic of Nauru	2015	Government of Nauru, Government of Australia, ADB, Government of Taiwan	To generate future investment earnings that can be used to provide a source of revenue to the Republic of Nauru post-2035, or at a time sooner as determined by the Committee, for investments in education, health, environment and infrastructure. The fund will help to smooth out windfall income streams in the medium term and replace all or part or supplement volatile future revenue	$40 million in AUD	The Fund will begin Distributions when the Committee determines that the Fund has reached a Current Value that the Committee considers feasible to provide the Government of the Republic of Nauru with a source of revenue to replace revenue reductions of any naturally based resource stream
Palau	Compact Trust Fund	1994	US Government	Help achieve budgetary self-reliance as US grants to the budget set to expire by 2009	$580 million in USD	Withdrawals of up to US $5 million inflation adjusted per year from 2000-2009, US 15 million inflation adjusted from 2010 onwards
		2010	US Government	Direct economic assistance, infrastructure project grants, establishment of an infrastructure maintenance fund, establishement of a fiscal consolidation fund (assis Palau in debt reduction, and contribution to the Compact Trust Fund	$229 million through FY 2024	Under the 2010 agreement, Palau would withdraw $5 million annually through 2013 and gradually increase its maximum withdrawal from $5.25 million in 2014 to $13 million in 2023. From 2024-20144, Palau can withdraw up to $15 million annually.

Appendix: Sovereign Wealth Funds in PICs (continued)

Papua New Guinea	Mineral Resource Stabilisation Fund (MRSF)	1974	Mineral Revenues			
	Sovereign wealth fund	2012	LNG project revenues and dividends, all mineral and petroleum revenues	Macroeconomic stabilisation, inter-generational equity and asset management in relation to assets accrued from mineral and petroleum receipts [Stablisation fund and Saving fund, based on Organic Law 2014]		Withdrawals during each fiscal year from the Stabilisation fund should be made through National Budget, and should not exceed the five year long-term moving average of mineral and petroleum receipts as a share of the non-mineral and non-petroleum receipts of the state, and should not be used for a purpose that is inconsistent with the goals
Timor-Leste	Petroleum Fund	2005	All petroleum revenue (includes revenue emanating directly or indirectly from petroleum resources) and investment income	Promote long-term fiscal sustainability and inter-generation equity	Around $15.8 billion	Withdrawals from the Fund can exceed the Estimated Sustainable Income (ESI), set at 3% of the total Petroleum wealth under certain conditions and subject to Parliamentary approval. Total transferes in a fiscal year cannot exceed a ceiling set by parliament as part of the approval of the budget.
Tonga	Tonga Trust Fund	1988	Sale of Tonga paspports, revenue from lease of Togan satellite space	Accumulate reserves for use in exceptional circumstances and for major development projects		(1)Cabinet may authorize the transfer of such amount from the Tonga Trust Fund to be used for any national development project approved by the Legislative Assembly in the Development Estimates. (2) The Tonga Trust Fund may be applied for the purposes of Clause 19(ii) of the Constitution. (3) Cabinet may authorise the payment from the Tonga Trust Fund in any one financial year of an amount not exceeding the latest audited annual interest of the Tonga Trust Fund, into the general revenue to meet the repayments of external public debt.
Tuvalu	Tuvalu Trust Fund (since 1993, the fund contains two accounts, one for long term saving and the other one for stablization; in 2002 these become two separate funds: the CIF "Consolidated Investment Fund" and TTF respectively)	1987	Government of Australia, New Zealand, United Kingdom, and Tuvalu. A small portion from Japans and South Korea	To cover budget shortfalls; underpin economic development; and support financial autonomy for the country.	Initial value is $27.1 AUD million, additional contribution of $38.6 AUD million	A distrubution from TTF to the CIF is only possible when the market value of the fund exceeds the maintained value, being the real value as measured by the Australian CPI. Withdrawals from the CIF are at discretion of MoF, although there is a Target Minimum Balance (16% of the maintained value of the TTF).

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