WP/15/125

IMF Working Paper

Enhancing Macroeconomic Resilience to Natural Disasters and Climate Change in the Small States of the Pacific

by Ezequiel Cabezon, Leni Hunter, Patrizia Tumbarello, Kazuaki Washimi, and Yiqun Wu

INTERNATIONAL MONETARY FUND

 WP/15/125

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Asia and Pacific Department

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Prepared by Ezequiel Cabezon, Leni Hunter, Patrizia Tumbarello, Kazuaki Washimi, and Yiqun Wu[1]

Authorized for distribution by Hoe Ee Khor

June 2015

Abstract

Natural disasters and climate change are interrelated macro-critical issues affecting all Pacific small states to varying degrees. In addition to their devastating human costs, these events damage growth prospects and worsen countries' fiscal positions. This is the first cross-country IMF study assessing the impact of natural disasters on growth in the Pacific islands as a group. A panel VAR analysis suggests that, for damage and losses equivalent to 1 percent of GDP, growth drops by 0.7 percentage point in the year of the disaster. We also find that, during 1980-2014, trend growth was 0.7 percentage point lower than it would have been without natural disasters. The paper also discusses a multi-pillar framework to enhance resilience to natural disasters at the national, regional, and multilateral levels and the importance of enhancing countries' risk-management capacities. It highlights how this approach can provide a more strategic and less ad hoc framework for strengthening both ex ante and ex post resilience and what role the IMF can play.

JEL Classification Numbers: Q54; O44; H84; F33

Keywords: natural disasters; climate change; panel VAR; Pacific islands, small states; disaster risk management

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[1] We are grateful to the Pacific island country authorities for their thoughtful comments and suggestions. We also wish to thank Sebastian Acevedo, Vladimir Klyuev, Nicole Laframboise, Wojciech Maliszewski, Catherine McAuliffe, Christine Richmond, Mariusz Sumlinski, and Sofia Bettencourt for their useful comments and Hoe Ee Khor for his guidance throughout the project. We thank Rosanne Heller and Antoinette Kanyabutembo for excellent editorial and administrative assistance, and Tlek Zeinullayev for outstanding research assistance.

Contents Page

List of Figures

List of Tables

Acronym List

ADB	Asian Development Bank
CRED	Centre for Research on Epidemiology of Disasters
DSA	Debt Sustainability Analysis
EM-DAT	Emergency Event Database
FAO	Food and Agriculture Organization of the United Nations
IMF	International Monetary Fund
IMO	International Maritime Organisation
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PEFA	Public Expenditure and Financial Accountability
PICs	Pacific Island Countries
PIF	Pacific Islands Forum
RCF	Rapid Credit Facility (IMF)
RFI	Rapid Financing Instrument (IMF)
PRGT	Poverty Reduction Growth Trust
RTSM	Regional Technical Support Mechanism
SPC/SOPAC	Secretariat of the Pacific Community

I. Introduction and Motivation

The Pacific island countries are among the most susceptible to natural disasters in the world. The combination of location and small size heightens their vulnerability to earthquakes and such weather-related extremes as cyclones, tsunamis, hurricanes, and floods. In addition, climate change poses risks to the continued survival of some Pacific islands.

This study is the first IMF study to quantify the impact of natural disasters on Pacific islands' economies using a cross-country approach. Previous IMF analyses have been conducted on a country-by-country basis. After a disaster occurs, the IMF typically assesses the impact of the event on the macroeconomic framework and on debt. It assesses the latter using the debt sustainability analysis (DSAs), jointly prepared with the World Bank Group and in collaboration with the Asian Development Bank (ADB).

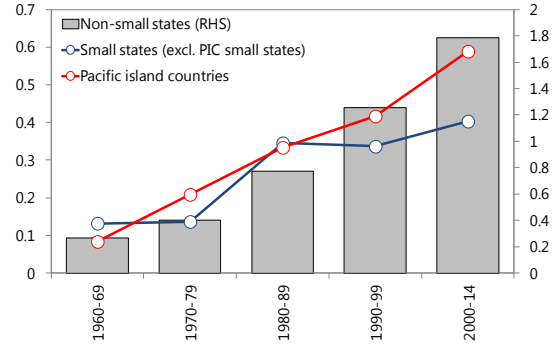
Assessing the prospective fiscal costs and growth impact of natural disasters is key to evaluating the Pacific island countries' long-term prospects. Mainstreaming estimates within the macro framework before the event occurs can help enhance countries' disaster risk management and thus their ability to cope with such events. Integrating such prospective costs into the DSA could determine ex-ante the magnitude of the need for fiscal and financial buffers and other sources of financing. And it can determine the fiscal space available for building infrastructure to address natural disasters and climate change, thereby helping better tailor IMF policy advice. The paper presents also a multi-pillar strategy which involves national, regional, and multilateral responses, including the engagement of the IMF. This integrated framework can provide a more strategic and less ad hoc approach for strengthening both ex-ante and ex-post Pacific islands' resilience to natural disasters and climate change.

II. Stylized Facts

The Pacific islands have, on average, been more heavily affected by natural disasters relative to other small states. This evidence holds across a large range of metrics:

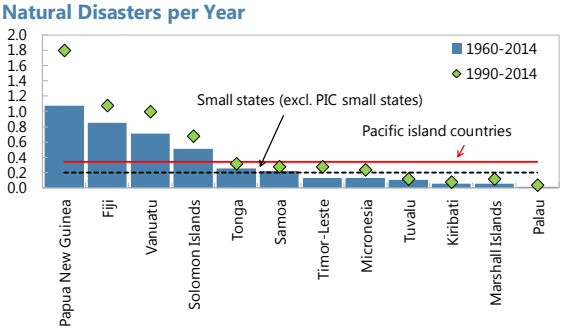
- *Occurrence*. Over the last four decades, PICs have suffered more natural disasters than small states in other regions. The region has experienced about 2,400 tropical cyclones in the last 60 years (World Bank Group, 2013a) and their occurrence has increased over time in line with global trends.

Figure 1. Average Number of Natural Disasters per Year



Sources: EM-DAT; and IMF staff estimates.

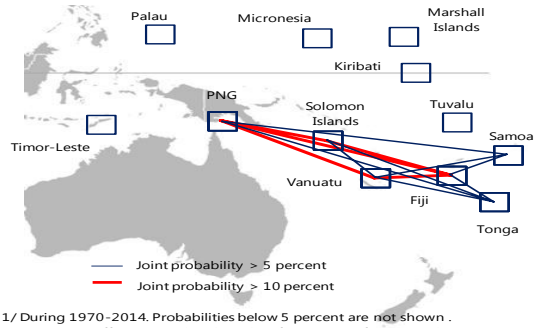
Figure 2. Pacific Island Countries: Average Number of Natural Disasters per Year



Sources: Center for Research on Epidemiology of Disasters, International Disaster Database; and IMF staff estimates. The averages refer to 1960-2014.

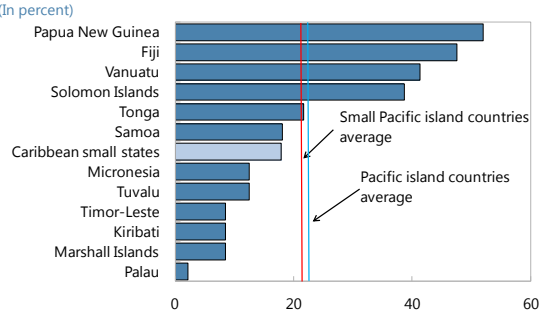
- *Probability of a natural disaster.* Based on historical frequency, the probability of a natural disaster averages more than 20 percent a year across the small Pacific states and Papua New Guinea (PNG). Given that PICs are geographically dispersed, natural disasters do not hit all at once--although they may hit more than one country, as in the recent case of Cyclone Pam, which inflicted heavy damage on both Vanuatu and Tuvalu. The probability that natural disasters will occur at the same time in more than one Pacific island country (i.e., joint probability) is generally below 5 percent, with a maximum of 12 percent for Fiji and Papua New Guinea.

Figure 3. Pacific Island Countries: Joint Probability of Occurrence of a Natural Disaster [1]



1/ During 1970-2014. Probabilities below 5 percent are not shown .
Source: IMF staff estimates baed on data from Center for Research on Epidemiology for Disasters, International Disaster Database.

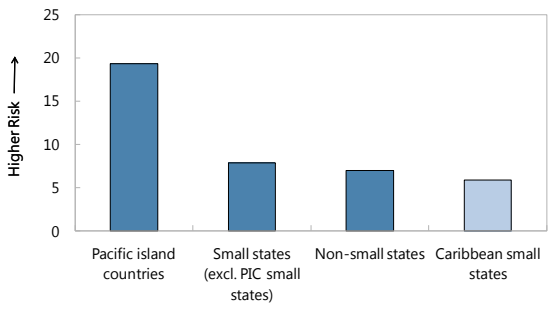
Figure 4. Probability of Occurrence of Natural Disasters[1]
(In percent)



1/ During 1970-2014.
Sources: Center for Research on Epidemiology for Disasters, International Disaster Database; IMF staff estimates.

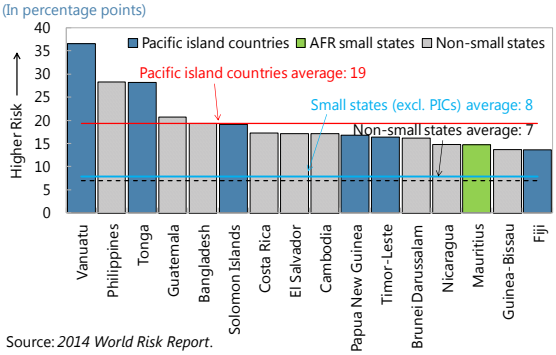
- *World Risk Index.* According to the World Risk Index--a composite measure of a country's exposure to natural hazards and of its ability to cope with them--the Pacific islands rank highest on the risk of suffering a disaster. Among 171 countries, 6 Pacific islands rank among the first 16 countries at the highest risk of experiencing a natural disaster—the first being Vanuatu.

Figure 5. Natural Disaster Risks - World Risk Index, 2014
(In percentage point)



Note: High value *indicates* high risk. Maximum risk country = 36 percentage points.
Sources: Alliance Development Works, *World Risk Report 2014*; and IMF staff calculations.

Figure 6. Natural Disaster Risks - World Risk Index, 2014, Top 16
(In percentage points)

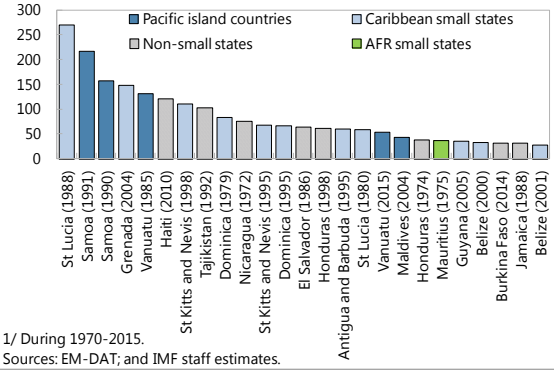


Source: *2014 World Risk Report*.
Note: Index combines exposure to natural hazards, coping, and adaptive capacities. Samoa is not included in the database.

- *Damages and losses.* Annual damage and losses, a better measure of countries' vulnerability to natural disasters, averaged 2.3 percent of GDP in the Pacific islands during 1980-2014—higher than in other peers and non-small states. For example, despite disasters being more frequent in Papua New Guinea and Fiji, damage and losses seem to be far higher in Samoa and Vanuatu. This suggests that the intensity of the natural disasters and/or the resilience to these events vary across countries. Cross-country studies (Raddatz, 2009; Cavallo and Noy, 2010) show that the economic effects of natural

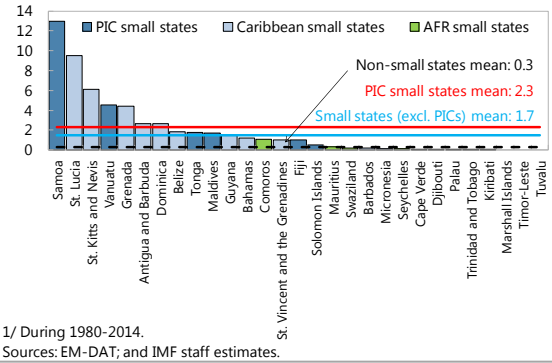
disasters depend on a range of variables, including income levels, stage of development, country size, disaster type, and disaster severity. Moreover, less developed economies are generally hit harder by natural disasters than developed economies. Although developed economies are more highly exposed to wealth losses, large and diversified economies can better absorb the shocks (Auffret, 2003). Damage and losses are in fact lower in Papua New Guinea—despite having the highest occurrence of disasters—which is not a small state, and in Fiji, which is a middle-income country. Lack of economic diversification also heightens vulnerability to natural disasters and other shocks.

Figure 7. Damage and Losses of Extreme Disaster Events, Top 25
(In percent of GDP)



1/ During 1970-2015.
Sources: EM-DAT; and IMF staff estimates.

Figure 8. Average Annual Damage and Losses[1]
(In percent of GDP)



1/ During 1980-2014.
Sources: EM-DAT; and IMF staff estimates.

The March 2015 Cyclone Pam, which devastated Vanuatu and Tuvalu, and typhoon Maysak, which hit Micronesia, are recent reminders of the Pacific islands' vulnerability to these events. Other recent events include flash floods in Solomon Islands (April 2014), Cyclone Lusi in Vanuatu (March 2014), Cyclone Ian in Tonga and Fiji (January 2014), Typhoon Haiyan in Palau (November 2013), Cyclone Evan in Fiji and Samoa (December 2012), and a tsunami in Samoa (September 2009). Damage and losses in percent of GDP averaged (median) 9.5 percent of GDP.

Table 1. Pacific Island Countries—Most Recent Natural Disasters: Damages and Losses

	(In millions of U.S. dollars)	(In percent of GDP)
Fiji	108.8 (2012)	2.6
Micronesia	8.5 (2015)	3.0
Palau	1.2 (2013)	0.5
Samoa	210.0 (2012)	30.0
	152.1 (2009)	25.0
Solomon Islands	100 (2014)	9.0
Tonga	45.4 (2014)	10.0
Tuvalu	11.9 (2015)	33.6
Vanuatu	20.0 (2014)	2.5
	467.0 (2015)	61.0
PICs mean	112.5	17.7
PICs median	72.7	9.5

Sources: Country authorities; EM-DAT; and IMF staff estimates

Climate change also poses risks to the continued survival of some Pacific islands. Low-lying atolls (e.g., Kiribati, the Marshall Islands, and Tuvalu) are the most vulnerable to rising sea levels. But climate change also threatens agricultural income in such high-elevation islands as Solomon Islands and PNG, especially in rural areas, by increasing water salinity. While sea levels are already rising, recent studies (ADB, 2013; IPCC, 2013) suggest that they will rise further, between 1 and 1.7 meters in some cases. For example, a rise of 50cm would lead to a loss of 80 percent of the land in the Majuro Atoll of Marshall Islands, and the habitability of other islands would be threatened well before lands are lost.

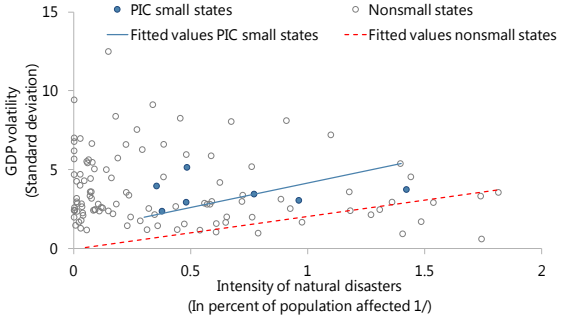
The interaction of climate change and natural disasters affects the Pacific islands to varying degrees. Rising temperatures are widely predicted to increase the frequency of, and risks associated with, natural disasters. Higher-elevation islands would also be hit hard, given their concentrations of population, socioeconomic activity, and infrastructure in coastal zones.[2]

III. Macroeconomic Impact of Natural Disasters

Framing the issue

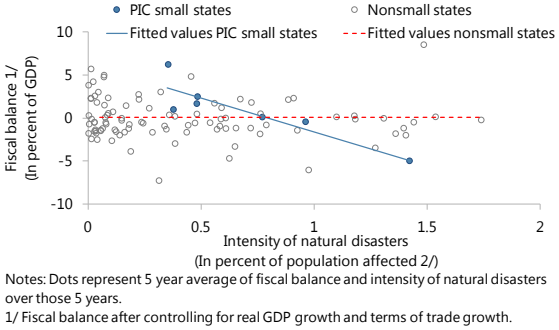
Natural disasters and climate change pose severe macro-critical challenges to the Pacific island countries to varying degrees. In addition to their devastating human cost, natural disasters and climate change destroy or damage infrastructure and other capital, creating considerable macroeconomic volatility. Natural disasters contribute to the higher revenue volatility experienced by the Pacific islands, relative to both other small states and non-small states. Disasters can damage growth prospects and contribute to the low potential growth rates of PICs. They typically also worsen PICs' fiscal positions. A recent IMF analysis shows that a natural disaster that affects 1 percent of the population in the Pacific islands causes a drop in real revenue of 0.4 percentage point, double that in other small states (Table B.1. Appendix B).[3] Natural disasters often expand public debt by triggering more borrowing owing to lower revenues or increased spending, thus intensifying balance of payments pressures.

Figure 9. GDP Volatility and Intensity of Natural Disasters 1990-2013



1/ Intensity = [(number of deaths + 0.33*number of people affected)/population]*100.
Sources: EM-DAT; and IMF staff estimates.

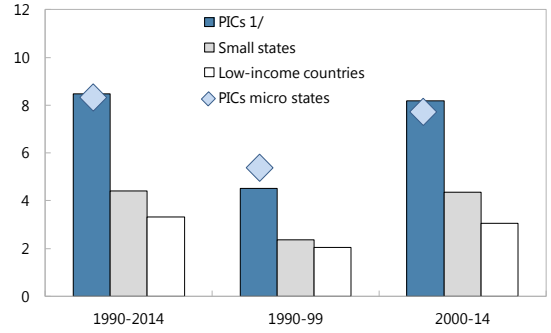
Figure 10. Fiscal Balance and Intensity of Natural Disasters 1990-2013



Notes: Dots represent 5 year average of fiscal balance and intensity of natural disasters over those 5 years.
1/ Fiscal balance after controlling for real GDP growth and terms of trade growth.
2/ Intensity = [(number of deaths + 0.33*number of people affected)/population]*100.
Sources: EM-DAT; and IMF staff estimates.

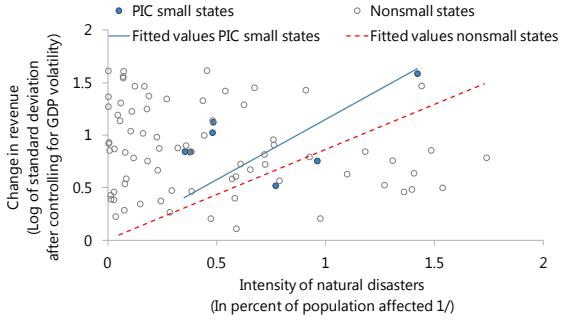
[2] Indeed, a study (IOC/UNESCO, IMO, FAO, UNDP, 2011) finds that more than half the population of the Pacific islands lives within 1½ km of the coast.
[3] "Strengthening Fiscal Frameworks and Improving the Spending Mix in Small States," 2015, Chapter 2 of *Macroeconomic Developments and Selected Issues in Small Developing States*, IMF. The econometric results mentioned above are reported in Appendix B. Table B1 of this paper.

Figure 11. Volatility of Revenue (excl. Grants)
(Standard deviation of revenue in percent of GDP)



Source: IMF staff estimates.

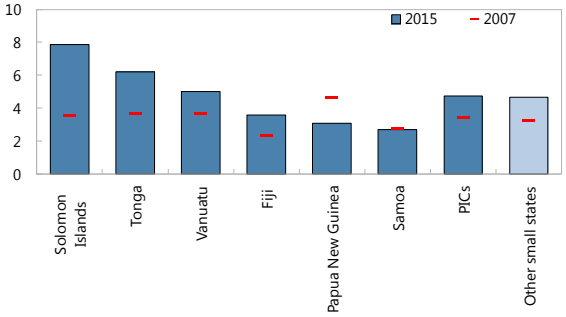
Figure 12. Revenue Volatility and Intensity of Natural Disasters, 1990-2013



1/ Intensity = [(number of deaths + 0.33*number of people affected)/population]*100.
Sources: EM-DAT; and IMF staff estimates.

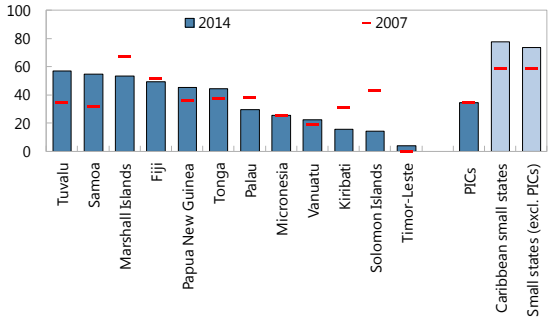
Policies that support strong economic fundamentals can foster resilience. Some Pacific island countries have made progress in rebuilding buffers (lower debt, higher fiscal balances and reserves) after the 2008-09 crisis, but more than half still have less comfortable buffers than before the crisis.

Figure 13. Pacific Island Countries: International Reserves, March 2015
(In months of next year's imports of goods and services)



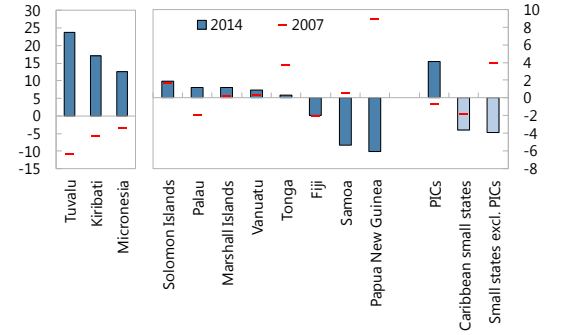
Sources: Country authorities; and IMF staff estimates.

Figure 14. Pacific Island Countries: Public and Publicly Guaranteed Debt, 2014
(In percent of GDP)



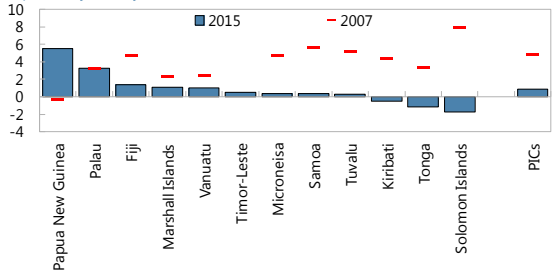
Sources: Country authorities; and IMF staff estimates.

Figure 15. Pacific Island Countries: Fiscal Balance, 2014
(In percent of GDP)



Sources: Country authorities; and IMF staff estimates.

Figure 16. Pacific Island Countries: Headline Inflation, March, 2015
(In percent; year on year)



Note: December 2014 for Bhutan, Kiribati, Palau, Papua New Guinea, Tuvalu, and Vanuatu; and March 2014 for the Marshall Islands.
Sources: Country authorities; and IMF staff estimates.

Recent empirical analyses

The literature reveals that the economic impact depends on the type of disaster and its magnitude, despite the stimulus of rehabilitation activity. Fomby and others (2013) find negative effects on growth from droughts and storms, and no statistically significant effect on aggregate GDP growth from earthquakes. Raddatz (2009) finds small countries are hurt more by windstorms, but helped by moderate floods. The latter result seems to derive from the higher electricity-generating capacity following a moderate flood as a result of plentiful water supply. Acevedo (2014) finds negative effects from both storms and floods in Caribbean countries. Loayza and others (2009) find that although small disasters may have a positive effect in the short run (e.g., owing to reconstruction boosting growth), the short-run effect of large disasters on growth is always negative.

Other international organizations have estimated the cost of natural disasters and climate change in terms of reduced economic growth. According to the World Bank Group, natural disasters in the PICs cause damage, every year on average, of nearly 2 percent of GDP (about US$248 million).[4] For climate change, the Asian Development Bank estimates economic costs for the Pacific islands of 2.2-3½ percent of GDP annually, rising to as high as 12.7 percent by 2100 (ADB, 2013). The ADB also estimates that preparing for the effects of climate change may cost between 1½-2½ percent of GDP a year.[5]

IV. Estimating the Macro-fiscal Impact of Natural Disasters

This is the first cross-country IMF study assessing the impact of natural disasters on growth in the Pacific islands as a group. Natural disasters include earthquakes, storms, floods, and droughts using the Emergency Events Database (EM-DAT) maintained by the Centre for Research on the Epidemiology of Disasters (CRED).

We use the following three methodologies:

- A panel vector autoregression (VAR) model to estimate the short-term impact on growth and on the fiscal balance and its components (revenue and expenditure).

- A panel autoregressive distributed lag (ARDL) model to estimate the long-term effect on GDP growth.

[4] Helping Small Island States Cope with the Aftermath of Natural Disasters, World Bank Group.

[5] The ADB study's policy recommendations include: mainstreaming climate change actions in development planning; adopting a forward-looking adaptation strategy; using a risk-based approach to adaptation and disaster-risk management to help prioritize climate change actions and increase the cost-efficiency of adaptation measures; climate proofing of infrastructure; and improving knowledge and capacity to deal with climate uncertainties.

- An event analysis to study growth and fiscal performance during and after natural disasters.

A. Econometric Analysis

VAR Model

We use annual panel data for five countries (Fiji, Samoa, Solomon Islands, Tonga, and Vanuatu) for the period 1970-2013 to measure the impact of natural disasters on fiscal aggregates and growth. The panel is unbalanced since a long time series for the PICs is unavailable owing to data weaknesses and because many of these countries became independent in the late 1970s.

The model specification includes the following variables: real GDP growth, total government spending as a percent of GDP, tax revenue as a percent of GDP, the overall fiscal balance as a percent of GDP, and a measure of natural disaster intensity. Following Fomby and others (2013), the disaster intensity is proxied by the share of the fatalities and of the overall affected population and defined as:

$$Intensity_{i,t} = 100 * \left(\frac{fatalities + 0.3 * total\ affected}{population}\right).$$

The identification strategy assumes that natural-disaster damage affects real GDP growth and fiscal variables in the current period, while natural disasters are exogenous.[6] This assumption is implemented with a Choleski decomposition. The VAR is described by the equations below, with the lag structure set to one in order to minimize the number of parameters estimated:

$$Y_{i,t} = A_{i,0} + A_{i,1}Y_{i,t-1} + B_{i,0}X_{i,t} + B_{i,1}X_{i,t-1} + u_{i,t,}$$

where

$$y_{i,t} = \begin{bmatrix} \Delta Overall\ fiscal\ balance_{i,t} \\ \Delta Tax\ revenue_{i,t} \\ \Delta Total\ government\ expenditure_{i,t} \\ Real\ GDP\ growth_{i,t} \end{bmatrix}$$

$X_{i,t} = \left[Natural\ disaster\ instensity_{i,t}\right]$,
with i = {Fiji, Samoa, Solomon Islands, Tonga, and Vanuatu}.

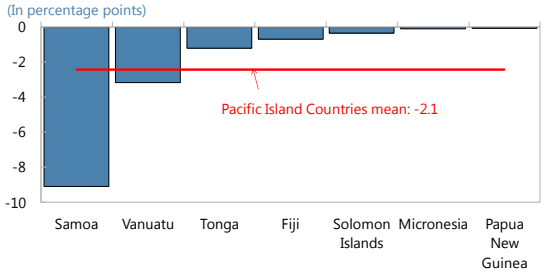
[6] The fiscal variables are first-differenced to guarantee stationarity. For further details see the appendices.

The estimation results show that natural disasters reduce short-term growth. The effects of a natural disaster, with an intensity affecting 1 percent of the population, are shown in the impulse responses plotted (Figure 18). The shock causes growth to contract by about 0.5 percentage point in the year of the disaster. A natural disaster that causes damage and losses equal to 1 percent of GDP causes an average drop in GDP of 0.7 percentage point in the year of the disaster; this is equal to an annual drop on average of 2.1 percent for all the Pacific islands, based on historical data on damage and losses.

Natural disasters also worsen Pacific islands' fiscal positions. For damage and losses equal to 1 percent of GDP, the fiscal balance deteriorates by 0.5 percent of GDP in the year after the disaster. Spending rises by 0.7 percentage point of GDP in the year of the shock while tax revenue falls by 0.2 percentage point of GDP, before rising by the same amount in the following year. The fiscal deterioration is not as large as the drop in tax revenue and increase in expenditure suggest. This can be explained by the role that grants play in those Pacific islands experiencing natural disasters. Tax revenue seems to rebound faster than GDP.[7]

Figure 17. Pacific Island Countries: Short-Run Impact of Natural Disasters on GDP Growth[1]

(In percentage points)



1/ According to the VAR model, for every damage and losses equivalent to 1 percent of GDP, GDP growth drops by 0.7 percentage point.
Sources: EM-DAT; and IMF staff estimates.

These results are robust to an alternative definition of disaster intensity (Figure 19). This includes damage and losses in percent of GDP as the disaster variable instead of disaster intensity.[8] The results are broadly similar. The main difference is that GDP growth returns to the pre-disaster trend faster than in the first specification and that spending consistently picks up in the year after the disaster, with possible delays in reconstruction activity. It also takes longer for the fiscal balance to return to the pre-shock trend.

The results are also robust to global shocks and different lag specifications. Estimations that include two and three lags present analogous impulse responses, in terms of the sign of the responses (Appendix C). Including real world GDP growth and changes in oil prices as measures of global shocks affects the estimations minimally (Appendix D).

---

[7] A natural disaster reduces tax revenue for two reasons: first because of lower GDP and second because of possible disruption in the payment infrastructure system (or the infrastructure used to collect taxes). The year of the disaster there could be a disruption of the services through which taxes are collected (e.g. banks or tax office). The year after the disaster this issue dissipates and tax revenue starts to growth at a higher rate than GDP. Also firms and households allocate funds to emergency expenditure and delay tax payments which are resumed the year after the disaster.

[8] The EM-DAT glossary notes that: "The economic impact of a disaster usually consists of direct consequences (e.g., damage to infrastructure, crops, and housing) and indirect consequences (e.g., loss of revenues, unemployment, and market destabilization) for the local economy. The estimated damages and losses are in thousands of U.S. dollars.

Figure 18. Response of Growth and Fiscal Aggregates to a Natural Disaster with Intensity Equivalent to 1 Percent of the Population Affected

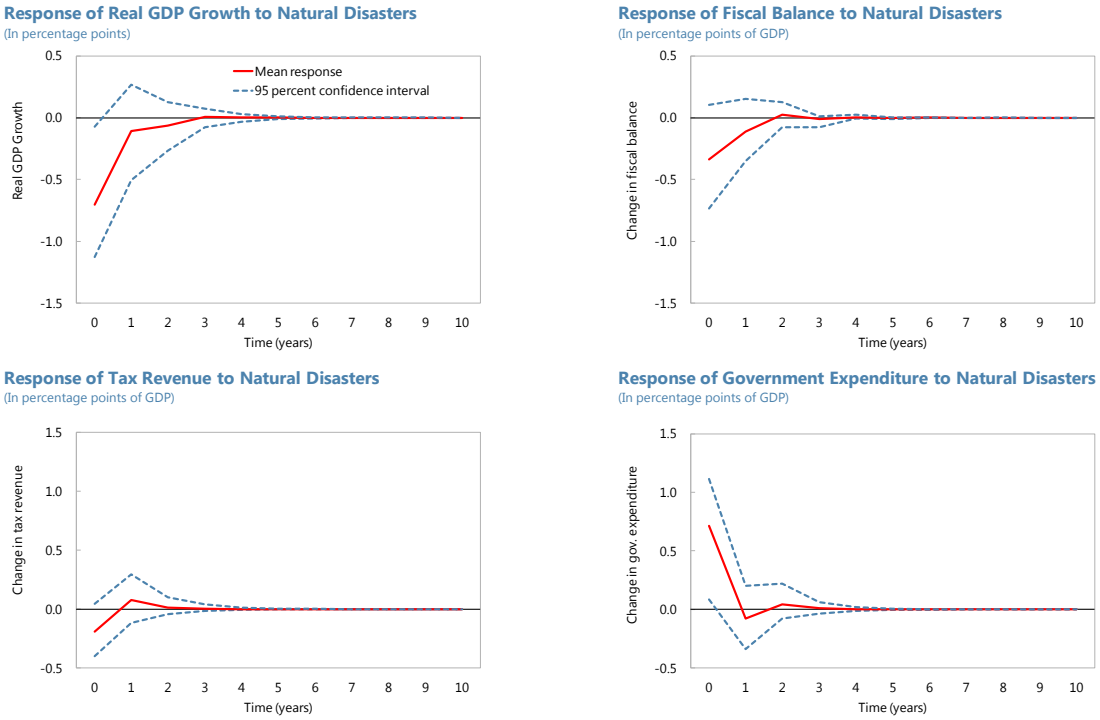
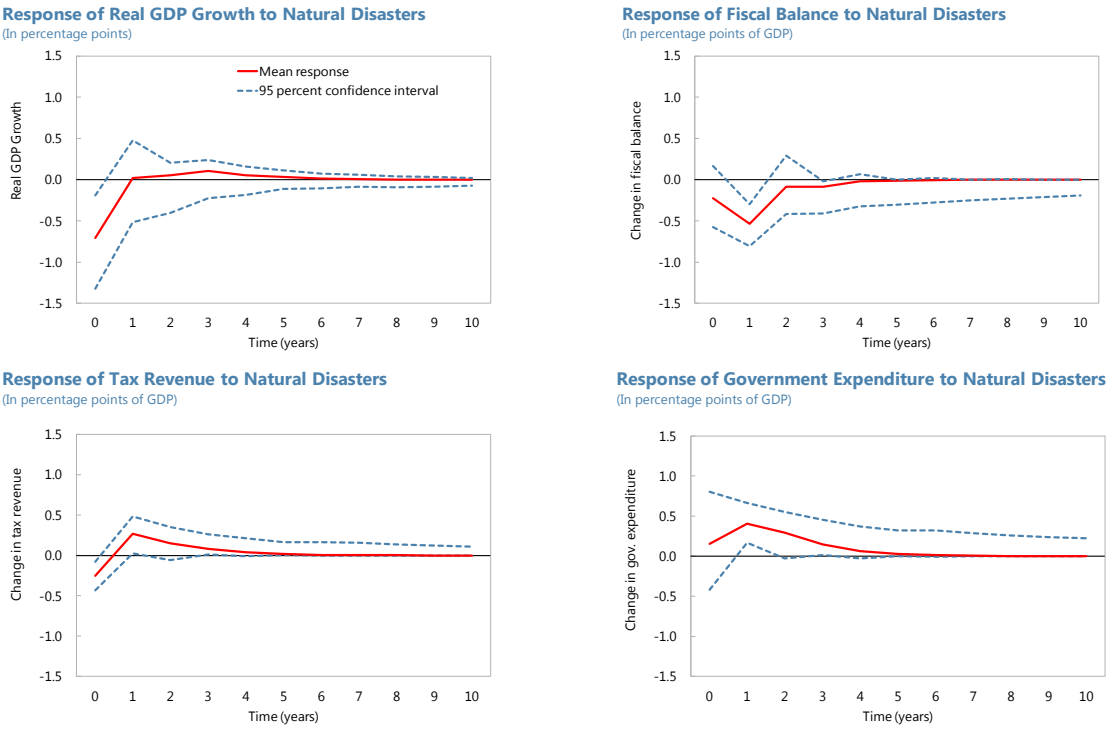


Figure 19. Response of Growth and Fiscal Aggregates to 1 Percent of GDP Damage Shock

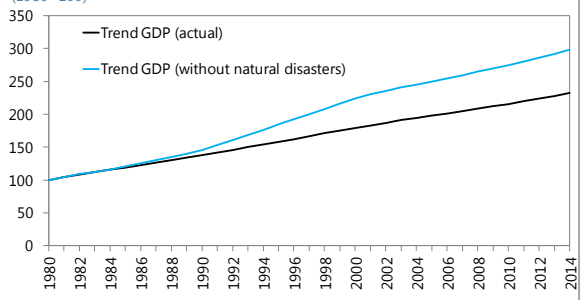


Autoregressive distributed lag (ARDL) model

We estimate the impact of natural disasters on long-term growth using a panel ARDL model with fixed effects. We use annual panel data for five countries (Fiji, Papua New Guinea, Samoa, Tonga, and Vanuatu) for the period 1970-2014. The dependent variable is real GDP (in log). The explanatory variables are population, capital stocks (both in log), and damage and losses (in percent of GDP). The capital stock series is constructed applying the perpetual inventory method.

Figure 20. Pacific Island Countries: Long-Run Impact of Natural Disasters on Trend GDP[1]

(1980=100)



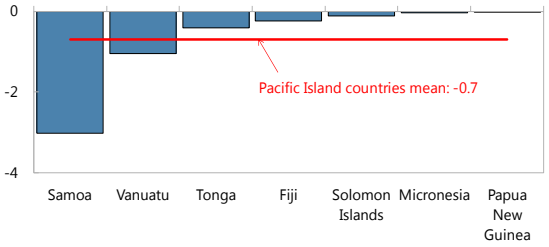
1/ Trend GDP is calculated as a 10-year moving average of real GDP.
Sources: EM-DAT; and IMF staff estimates.

The econometric result shows that for damage and losses equal to 1 percent of GDP, growth in the Pacific islands falls on average by 0.3 percentage point over 10 years. This means that the actual damage and losses during 1980-2014 reduced trend growth by 0.7 percentage point. Given the actual average growth for the Pacific islands during 1980-2014 averaged 2.6 percent, the average growth would have been 3.3 percent without natural disasters.

The long-run impact of natural disasters on GDP growth is substantial. Assume that before the natural disaster, GDP grows at 3 percent. The 10-year growth on a cumulative basis would then be 34 percent. After a natural disaster, with damage and losses equal to 60 percent of GDP, growth falls by 18 percentage points (i.e., 60 multiplied by 0.3), resulting in a 10-year growth loss of 16 percent on a cumulative basis.[9]

Figure 21. Pacific Island Countries: Long-Run Impact of Natural Disasters on Trend Growth[1]

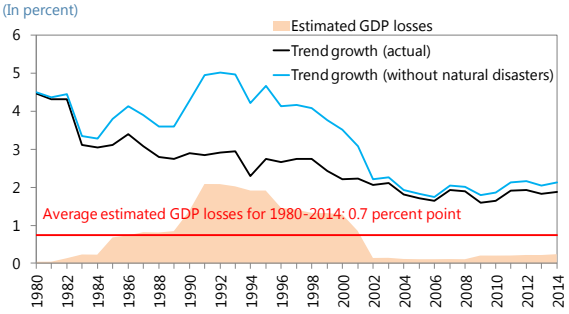
(In percentage points)



1/ According to the panel autoregressive distributed lag model, for every damage and losses equivalent to 1 percent of GDP, GDP growth drops by 0.3 percent over 10 years. Given historical data on damages and losses, the average GDP growth drop during 1980-2014 has been 0.7 percentage point.
Sources: EM-DAT; and IMF staff estimates.

Figure 22. Pacific Island Countries: Long-Run Impact of Natural Disasters on Trend Growth[1]

(In percent)



1/ Trend growth is calculated as a 10-year moving average of real GDP growth.
Sources: EM-DAT; and IMF staff estimates.

[9] Appendix D, Table 1 shows that in explaining the impact of natural disasters on GDP growth, the coefficient of damage and losses as a percent of GDP is -0.003. Because real GDP is expressed in logarithm, while damage and losses are expressed in percent of GDP, the coefficient is multiplied by 100. Hence, in the example above the number 60 is multiplied by 0.3.

Table 2. Illustration of Long-Run Impact of Natural Disasters on GDP Growth[1/]

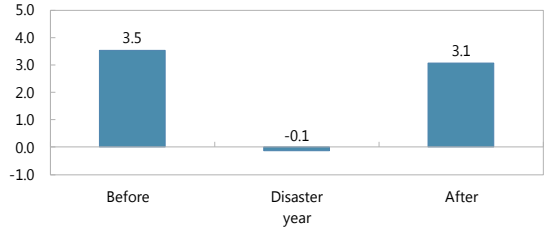
	Before natural disaster	After natural disaster	Difference
Annual GDP growth (in percent)	3.0	1.3	1.7
Cumulative GDP growth over 10 years (in percent)[2/]	34.0	16.0	18.0

1/ Assumes damage and losses of 60 percent of GDP.
2/ Calculated as (1+annual growth rate).[10]
The number 18 is equivalent to 0.3*60. See table Appendix D. Table 1 for the coefficient on damage and losses. Since real GDP is in log while damage and losses are expressed in percent of GDP, the coefficient 0.003 is multiplied by 100.

B. Event analysis

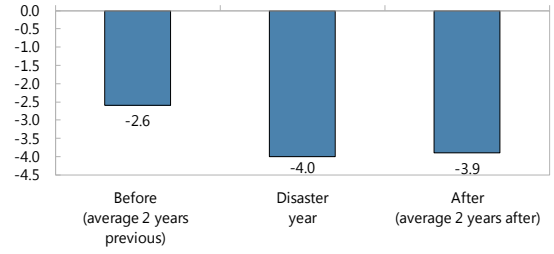
Using an event analysis, we study growth performance during and after natural disaster episodes. We define a natural disaster episode as one that results in damage and losses of at least 10 percent of GDP. In contrast to the econometric models presented above, event analysis focuses on the relationship between growth performance and natural disaster shocks before, during, an after an episode. While event analysis does not attempt to determine the direction of causality, it represents a useful complement to econometric models because it allows us to uncover the non-linear dynamics of economic relationships that are likely to be missed by standard econometric specifications.

Figure 23. Event Analysis—Real GDP Growth Before and After Natural Disasters
(In percent)



Note: Based on *natural* disasters with damage and losses larger than 10 percent of GDP during 1970-2013. Average of two years before and average of two years after. The median damage of these natural disasters was 26 percent of GDP.
Sources: Center for Research on Epidemiology for Disasters, International Disaster Database; and IMF staff estimates.

Figure 24. Event Analysis—Fiscal Balance Before and After Natural Disasters
(In percent)



Note: Based on *natural* disasters with damage and losses larger than 10 percent of GDP during 1970-2013. Average of two years before and average of two years after. The median damage of these natural disasters was 26 percent of GDP.
Sources: Center for Research on Epidemiology for Disasters, International Disaster Database; and IMF staff estimates.

A main finding is that a loss in output relative to the pre-disaster GDP growth trend persists after two years, with the fiscal balance remaining as negative as in the year of the disaster. While not a conclusive determinant of the growth effects of natural disasters, these events were probably dominant factors affecting the economies at the time. On average for these events, growth was zero in the year of the disaster. While growth rebounds fairly quickly, on average two years after the disaster, it is below the growth rate prior to the natural disaster shock. The still-large fiscal balance deterioration is consistent with the results of the VAR and may reflect infrastructure rehabilitation and rebuilding.

V. Increasing Macro-Fiscal Resilience by Enhancing Disaster Risk Management—A Multi-Pillar Framework

Enhancing resilience to natural disasters and climate change demands a multi-pillar strategy at the national, regional, and multilateral levels. It also requires enhancing countries' risk-management capacity. The key pillars of disaster risk management, before the event occurs, include[10]:

- *identifying and undertaking risk assessment*; at the national level, ex ante resilience entails identifying risks and explicitly integrating risks into the fiscal frameworks and budget planning.

- *providing self-insurance* by building policy buffers to enhance resilience to shocks (lower debt, higher fiscal balances and reserves);

- *reducing risks* by enhancing preparedness, including by investing in "smart" infrastructure that can better cope with climate change and natural hazards and by enhancing debt-management capacity; and

- *transferring risk* through private or sovereign insurance and through multilateral risk-sharing mechanisms (e.g., international safety net).

    - ✓ Insurance is provided through the Pacific Catastrophe Risk Insurance Pilot for the Pacific islands, a joint initiative between the Secretariat of the Pacific Community, the World Bank Group, and the Asian Development Bank—with financial support from the government of Japan and the Global Facility for Disaster Reduction and Recovery. This very innovative scheme was launched in January 2013 and concluded its second year pilot phase in October 2014. The pilot began its third phase in November 2014 and is now expected to be concluded in October 2015. The scheme offers immediate funding in the wake of severe natural disasters (World Bank, 2013a) to current participating countries: the Cook Islands, the Marshall Islands, Samoa, Tonga, and Vanuatu.[11] The government of Japan provided an additional US$1 million

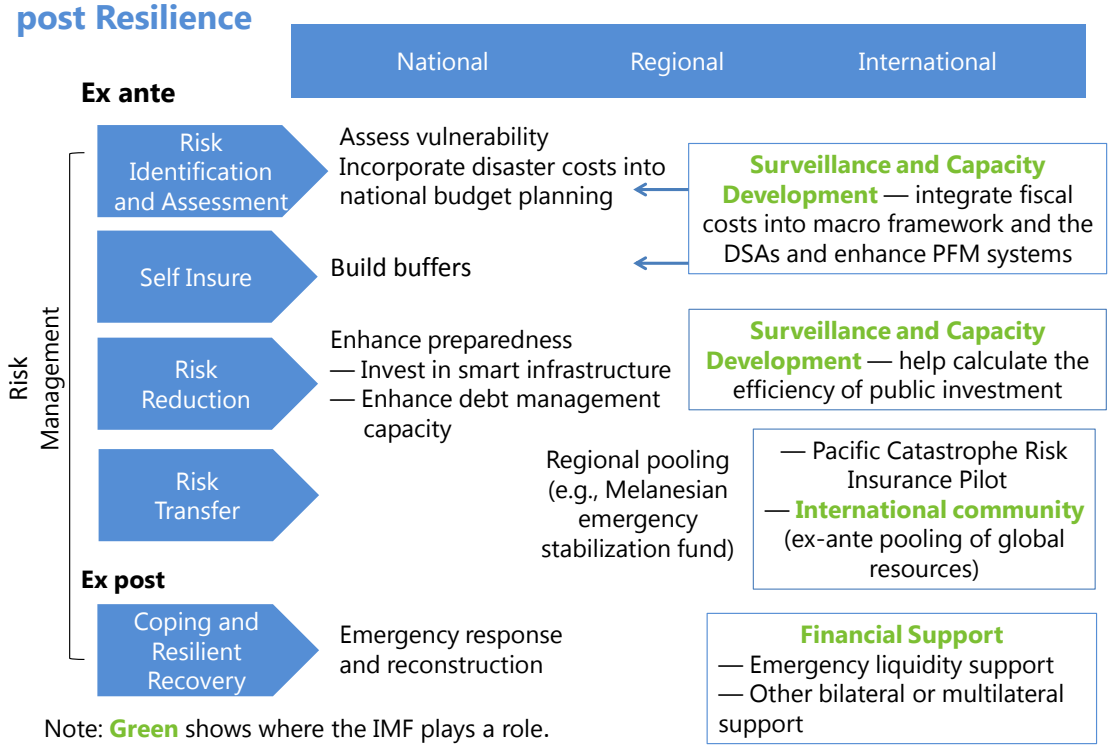
[10] Laframboise and Loko, 2012.

[11] Solomon Islands chose not to continue with its participation in the insurance pilot because it did not qualify for a payout after the flood in April 2014. Disbursements are linked to specific physical parameters (e.g. the wind's speed triggering a cyclone) that were not triggered during the flood.

to fund premium subsidies for four of the participating countries (Cook Islands is self funding). The World Bank Group acts as an intermediary between the Pacific island countries and a group of reinsurance companies, which were selected through a competitive bidding process.[12] The pilot uses "parametric triggers," such as cyclone intensity or earthquake magnitude, to determine payouts. In January 2014, Tonga became the first country to benefit from a payout under the pilot of US$1.3 million, while Vanuatu received US$1.9 million after Cyclone Pam. Damages and losses were respectively US$45.4 million in Tonga and US$467 million in Vanuatu.

- ✓ Membership in multilateral organizations by ex ante pooling global resources could be seen as a "risk-pooling mechanism."
- ✓ Some PICs are currently discussing the establishment of a subregional reserve pooling arrangement. The Melanesian Spearhead Group (MSG) (which includes Fiji, Papua New Guinea, Solomon Islands, and Vanuatu) is holding discussions on setting up an emergency Stabilization Fund to assist members in balance of payments crisis situations, in particular when members encounter imminent risks of erosion of foreign exchange and the consequent inability of members to finance imports and external debt.

Figure 25. Multi-Pillar Framework: Strengthening ex ante and ex post Resilience



[12]The reinsurance companies are: Sompo Japan Insurance, Mitsui Sumitomo Insurance, Tokio Marine & Nichido Fire Insurance, Swiss Re, and Munich Re. AIR Worldwide provides the underlying risk modeling for the transaction. See World Bank Group's web site.

Coping in the wake of a natural disaster, together with ensuring a resilient recovery, is the main pillar of the ex post disaster risk management. At the national level the main actions include the emergency response and reconstruction efforts. A sound reconstruction program should consist of measures to reduce risks such as resettlement away from the coastline where feasible and infrastructure investment. Reconstruction can provide an opportunity to accelerate broader growth-enhancing structural reforms.

Donor financing will remain important in enhancing the ability to cope with natural disasters and climate change as these countries are too small and the costs too high to be fully internalized by building buffers. And building buffers has also an opportunity cost. Participation in insurance mechanisms is very promising, but so far the disbursement has been limited. Increasing global resources are being made available for climate change finance, with a new target of raising US$100 billion a year by 2020 to cover rising climate change costs established at the 2010 United Nations Climate Change Conference in Cancun. But access to global funding for the Pacific island countries is challenging because of capacity constraints and bilateral funding remains critical. Moreover, the complexity of numerous financing instruments can add to the overall donor coordination challenge (Appendix D). Donor funding is a necessary part of resilience for small Pacific island states. Donor coordination should also be strengthened among multilateral institutions, donors, the authorities, and civil society, especially given the limited administrative capacity.

VI. THE ROLE OF THE IMF

The macro-critical challenges posed by natural disasters and climate change are being increasingly incorporated into the IMF's work. The Fund has been looking at how to help countries respond through policy advice (surveillance), financial support, and technical assistance and training to build capacity. The IMF recently published a staff guidance note on small states that recognizes the importance of natural disaster management and climate change (IMF, 2014a). Among other policy messages, the note emphasizes the need to enhance resilience to shocks and climate change. The guidance note recognizes the complex nature of climate-change-financing arrangements, and the problems posed by lack of capacity in accessing climate change resources. As such, in their consideration of fiscal space in the surveillance context, IMF staff is advised to be sensitive to the long-term implications of climate change for the public investment needs of small states, and be ready to consider how these might be financed.

A. Surveillance

As reported in the 2013 IMF Board Paper on small states, fostering resilience before the fact requires:

- integrating natural disaster risks into macro frameworks to determine the magnitude of the buffers (or self-insurance) needed and of outside insurance;[13]
- allowing sufficient flexibility to help redeploy spending rapidly; and
- ensuring sufficient policy space (external reserves and low debt) to help mitigate potential balance of payments shortfalls.

After the event, an efficient response (i.e., resilience) requires: greater transparency to ensure the effective use of disaster assistance, strengthening coordination among development partners and authorities, and pursuing growth-enhancing structural reforms.

The costs of natural disasters and climate change are also included in debt sustainability analysis and in scenario analysis in Article IV consultations. Kiribati's recent Article IV reports have described climate change vulnerabilities that have slowed Kiribati's achievement of poverty reduction goals owing to the need to divert resources from development spending to building seawalls.[14] DSAs on Kiribati have highlighted the fiscal risks arising from uncertain climate change costs and the importance of external assistance for concessional finance. The 2014 Article IV Consultation Staff Report for Tonga assessed the impact cyclone Ian that hit the country in January 2014 provoking damages and losses for about 10 percent of GDP. The 2015 Article IV Consultation Staff Report for Samoa analyzed the impact of natural disasters on debt.

B. IMF Financial Support

The IMF offers financing to meet a broad range of urgent balance of payments needs, including those arising from natural disasters. Although sometimes limited in magnitude, IMF financial support catalyzes external finance from other sources. IMF financing to support countries hit by natural disaster includes:

- The *Rapid Credit Facility (*RCF) provides rapid financial support in a single, up-front payout for low-income countries facing urgent financing needs. Financial assistance under the RCF is provided as an outright disbursement to Poverty Reduction and Growth Trust (PRGT)-eligible members that face an urgent balance of payments need, and where a full-fledged economic program is either not necessary or not feasible. Financing under the RCF carries a zero interest rate through 2016, has a grace period of 5½ years, and a final maturity of 10 years. The *Rapid Financing Instrument (*RFI) is similar to the RCF and designed for situations where a full-fledged economic program

[13] The costs and policy frameworks will differ from country to country; therefore policy advices will need to be carefully tailored.

[14] IMF, 2011 Kiribati Article IV Consultation, Staff report and DSA (IMF 2011) and 2014 Article IV Consultation, Staff report. (IMF, 2014b).

is either not necessary or not feasible. Financial assistance provided under the RFI is subject to the same financing terms as the Flexible Credit Line, the Precautionary and Liquidity Line and Stand-By Arrangements, and should be repaid within 3¼ to 5 years. Both lending facilities are designed for members that do not require a full-fledged economic reform program (e.g., because of the transitory and limited nature of the shock), or where such a program is not feasible because the need is urgent or policy implementation capacity is limited.

- ✓ ***Samoa*** was hit by Tropical Cyclone Evan in December 2012, leading to loss of life and damage estimated at 30 percent of GDP. A request for a one-off disbursement of US$8.6 million under the RCF facility was approved by the IMF Board in May 2013 (IMF Country Report No 13.162). In 2009, Samoa was hit by a tsunami whose damage and losses were estimated at 25 percent of GDP, and IMF financial assistance (equivalent to US$9.3 million) was also provided (IMF Country Report No. 10/46).

- ✓ ***Vanuatu***, in June, 2015 received financial support by the IMF following the devastating cyclone of March 2015. The IMF Board approved a disbursement of about US$11.9 million under the RCF and disbursement of about US$11.9 million under the RFI (IMF, 2015; IMF Country Report No. 15/149). As in the case of Samoa, this financial assistance was intended to help Vanuatu cope with its immediate balance-of-payments needs and to catalyze critical donor support for the recovery.

- *IMF Catastrophe Containment and Relief (CCR) Trust.* This new trust transformed the previous Post-Catastrophe Debt Relief (PCDR) Trust in February 2015. It allows the Fund to join international debt relief efforts when poor countries are hit by catastrophic natural disasters or public health disasters. The IMF can provide debt relief to free up resources to meet exceptional balance of payments needs created by the disaster, rather than having to assign those resources to debt service. The CCR Trust is available to 38 low-income countries eligible for concessional borrowing through the PRGT and which also have either a per capita income below US$1,215—or, for small states, a population below 1.5 million and a per capita income below US$2,430. Among the PICs, only *Solomon Islands* meet these criteria. A country qualifies under the CCR Trust if it is hit by a disaster that directly affects at least one third of the population and destroys more than a quarter of the country's productive capacity (as estimated by such early indications as destroyed structures and the impact on key economic sectors and public institutions, or caused by damage exceeding100 percent of GDP); and

- *Augmentation of an existing program*. When a country with an IMF-supported program is hit by a natural disaster, augmented financing under the existing program could be the usual channel for providing additional financial support. In other cases (as in 2014 for Solomon Islands), an IMF program plays a catalytic role in mobilizing international

assistance even when an augmentation of resources under the existing program does not take place.

C. Capacity Development

IMF policy advice on coping with natural disasters is also supported by its technical assistance (TA) and training. For example, TA on public financial management, which improves budget planning and enhances transparency of public funds, helps improve the foundation on which PICs seek natural disaster and climate change assistance. A sound PFM system is essential to enhancing risk management related to these events by incorporating disasters risk into fiscal planning. The IMF supports the Public Financial Management (PFM) reform needed also contributing to Public Expenditure and Financial Accountability (PEFA) assessments.[15]

Public financial management reform and more transparent aid management policies enhance the effectiveness and quality of public expenditure, thus offering benefits that extend beyond climate change and natural disaster management. A recent report by the Pacific Islands Forum (PIFS, 2013a, Nauru case study) offers several lessons. These include the benefits of integrating climate change into national plans, policies and budgets, and of tracking spending through budget systems. The report also cites the difficulties in quantifying the extent of external financing available for climate change and distinguishing this financing from existing development assistance. These challenges are likely to divert capacity from other aspects of core policy management.

The IMF also provides TA to all members interested in adopting environmental tax reforms. Fiscal policies should take center stage in trying to get energy prices to reflect the harmful environmental side-effects associated with energy use, notably climate change.[16]

The Pacific Financial Technical Assistance Centre (PFTAC) also provided training to enhance Pacific islands' disaster risk management capacity. PFTAC in coordination with the World Bank's Disaster Risk Financing and Insurance (DRFI) Program delivered a regional workshop hosted by the Pacific Islands Forum Secretariat on incorporating natural disaster risks into the fiscal planning process. The workshop held in March 2015 addressed such issues as:

- special budgetary procedures for providing rapid access to emergency funding,

[15] PEFA framework is one of the tools that helps assess the health of the PFM systems. The Pacific Islands Forum Secretariat (2013b) has developed a Pacific Climate Change Financing Assessment Framework which assesses a country's ability to access and manage climate change resources. PEFA reports provide a baseline for the Pacific Climate Change Financing Assessment Framework.

[16] De Mooij and others, 2012; and Ian Parry and others, 2014. See also a speech by IMF Managing Director Christine Lagarde at the Center for Global Development in July 2014.

- the macroeconomic and fiscal impact of natural disasters,
- incorporating disasters risks into the fiscal planning process, and
- disaster risk financing.

VII. CONCLUSIONS

Pacific island countries face severe challenges from natural disasters and climate change. These events have an impact on both potential growth and public finances.

Going forward, a more strategic approach is needed to help countries deal with the increasing frequency and magnitude of these events. Explicit recognition of the costs of natural disasters and climate change in baseline macro-frameworks and debt sustainability analyses is important, particularly given the risks that these events become increasingly severe over time. While building policy buffers is especially relevant in the small states of the Pacific to enhance resilience before these events occur, these countries will need to continue to be supported by access to external assistance and insurance schemes. In addition to providing financing support, the IMF can also help by continuing to provide technical assistance and training to enhancing countries' risk management capacities thereby continuing to foster also ex ante resilience.

APPENDIX A: DATA SOURCES

Data were collected from different sources depending on data availability. The data were built based on the series and sources described in Table A.1. The series were built backward based on the information and provided that no inconsistencies are generated in splicing the series.

Table A.1. Data Sources

	Natural Disaster (In U.S. millions)	Nominal GDP (In millions of national currency)	Real GDP Growth (In percent)	Fiscal Balance (In millions of national currency)	Tax revenue (In millions of national currency)	Government expenditure (In millions of national currency)
Fiji (1970-2013)	EM-DAT	WEO, WDI and IMF staff reports	WEO, WDI and IMF staff reports	IMF staff reports	IMF staff reports	IMF staff reports
Samoa (1970-2013)	EM-DAT	WEO, WDI and IMF staff reports	WEO, WDI and IMF staff reports	IMF staff reports	IMF staff reports	IMF staff reports
Solomon Islands (1974-2013)	EM-DAT	WEO, WDI and IMF staff reports	WEO, WDI and IMF staff reports	IMF staff reports	IMF staff reports	IMF staff reports
Tonga (1981-2013)	EM-DAT	WEO, WDI and IMF staff reports	WEO, WDI and IMF staff reports	IMF staff reports	IMF staff reports	IMF staff reports
Vanuatu (1981-2013)	EM-DAT	WEO, WDI and IMF staff reports	WEO, WDI and IMF staff reports	IMF staff reports	IMF staff reports	IMF staff reports
World (1970-2013)			WEO, WDI and IMF staff reports			

Notes:
EM-DAT: Centre for Research on the Epidemiology of Disasters, The International Disaster Database.
WDI: World Bank, World Development Indicators.
WEO: IMF, World Economic Outlook.

APPENDIX B: DETERMINANTS OF REAL REVENUE

Separate dynamic panel regressions were run for different groups (small states, Pacific island small states, LICs, emerging markets, resource-rich small states, and non-resource-rich small states) to identify the variables that explain real revenue. The dependent variable (real revenue) is regressed on GDP (and its lag), weighted terms of trade (and its lag), a variable on natural disasters, lagged real revenues and fishing license fees. Revenue shows strong procyclicality, especially in small states that are net commodity importers. And revenue procyclicality is a source of revenue volatility. Coefficients on real GDP growth variables higher than 1 suggest revenue pro-cyclicality (i.e., revenue is growing faster than GDP during upturns and slower than GDP during downturns). For small states, the sum of the coefficients on real GDP growth (current period and one-period-lagged)—a proxy for cyclical components of revenues—is equal to 1.7. After controlling for GDP, revenue depends on terms-of-trade shocks, especially in resource-rich small states. Natural disasters also heighten revenue volatility, especially in the Pacific islands. Staff analysis suggests that a natural disaster that affects 1 percent of the population causes a drop in real revenue of 0.4 percentage point in the Pacific islands, larger and more statistically significant than any other country groups, including all small states.

Table B.1. Determinants of Real Revenue[1]
(Year-on-year percent change)

	Small states	Pacific island small states [2]	Low-income countries	Emerging markets	Resource-rich small states	Non-resource-rich small states
Real GDP growth	1.093***	1.672***	1.622***	1.41***	0.933***	1.249***
Real GDP growth (lagged)	0.607*	0.568	0.236	-0.124	0.512	0.556*
Weighted terms of trade growth	0.390**	0.659**	0.468***	0.821**	1.401**	0.120**
Weighted terms of trade growth (lagged)	0.227	0.352	0.130	-0.180	0.260	0.136
Intensity of natural disasters (lagged)	-0.248**	-0.429***	0.039	-0.189	-0.294	-0.239**
Real revenue growth (lagged)	-0.410	-0.375	-0.181	0.024	-0.237	-0.545
Fishing license fees		0.206***				
Constant	0.009	-1.667	-1.223	-0.895	2.498	-0.684
Observations	591	92	730	745	100	466
Number of countries	33	6	49	49	6	27

1/ Panel regressions, 1990-2013 using the generalized method of moments (GMM) to correct for endogenity by instrumenting with lagged explanatory variables. Combined coefficients higher than 1 on real GDP growth and lagged GDP growth imply revenue procyclicality. Asterisks indicate p-values:
*** p<0.01, ** p<0.05, * p<0.1.
2/ Includes countries dependent on fishing license fees.

APPENDIX C: VAR MODEL

Table C.1.shows the unit root test over the time series and Im-Pesaran-Shin (IPS) test. Real GDP growth is to be stationary, according to the tests. This is derived from the fact that for all the countries the Dickey-Fuller test rejects the unit root hypothesis and the IPS signals no unit roots (p-value equal to zero).

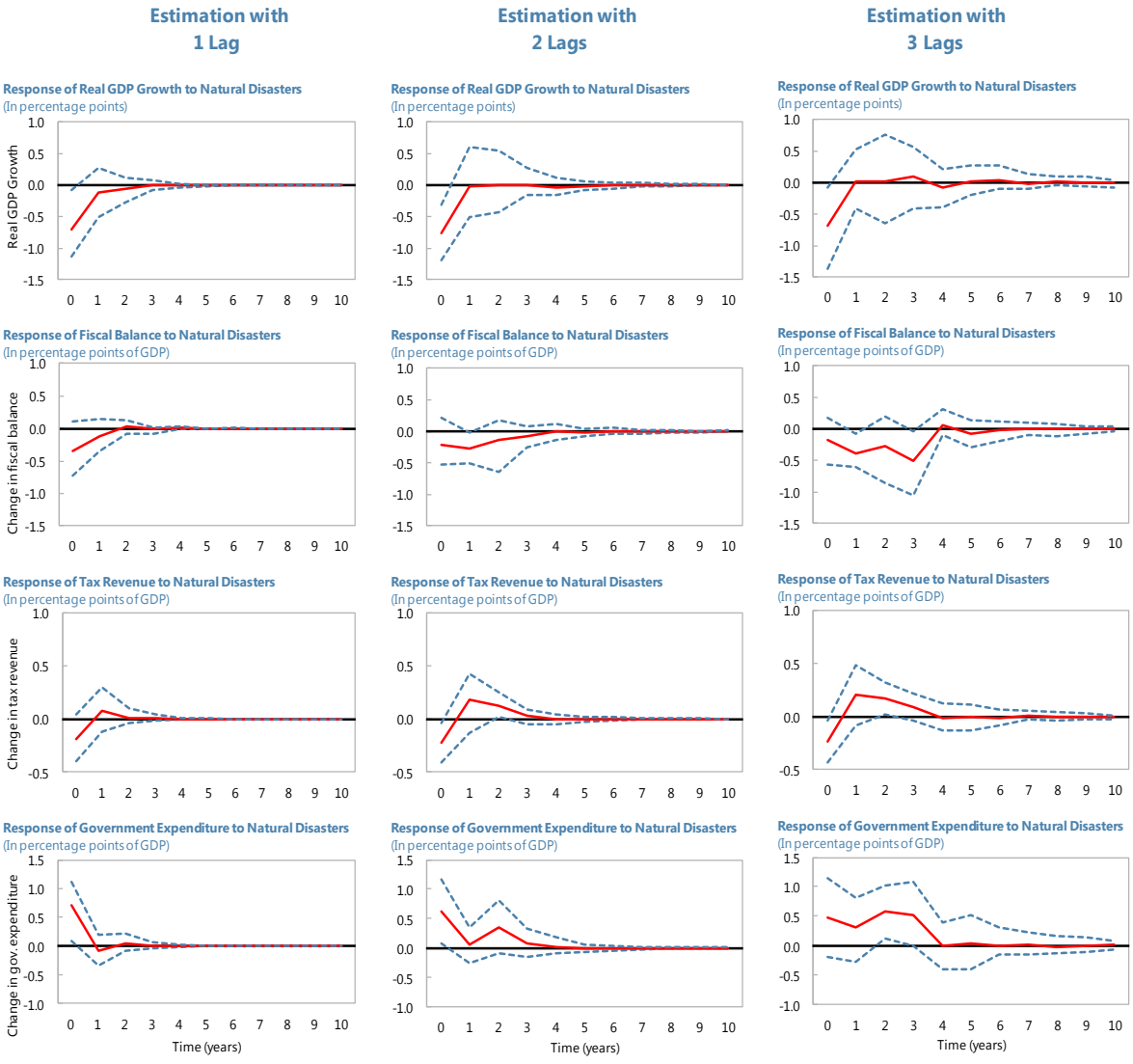
The fiscal variables seem to be only stationary in first difference. While the fiscal deficit seems to be stationary in levels--as individual series are stationary for four out of five countries and the IPS points out no unit root--expenditure and tax revenue are not stationary as the Dickey-Fuller and Perron-Phillips test show that only one out of five countries reject to unit root hypothesis. The test on first difference of all the fiscal variables indicates that the series are stationary as all the Dickey-Fuller, the Perron-Phillips and the IPS signal no unit root.

Table C.1. Unit Root Test

Test	Dickey-Fuller Test (Fraction of series rejecting unit root)	Perron-Phillips Test (Fraction of series rejecting unit root)	Im-Pesaran-Shin Test (Probability of unit root)
Real GDP Growth	5/5	5/5	0.0000
Fiscal balance	4/5	4/5	0.0000
Tax revenue	1/5	1/5	0.2908
Expenditure	1/5	1/5	0.0578
Δ Fiscal balance	5/5	5/5	0.0000
Δ Tax revenue	5/5	5/5	0.0000
Δ Expenditure	5/5	5/5	0.0000

The lag structure was selected at one lag so as to minimize the number of parameters to be estimated. Estimation with two and three lags shows analogous impulse responses.

Figure C.1. Robustness to Lag Specification Response of Growth and Fiscal Aggregates to a Natural Disaster with Intensity Equivalent to 1 Percent of the Population Affected



In this appendix, we test the robustness of the results to global shocks. The world real GDP growth and variations in the price of oil are selected to proxy global shocks. We find that the estimation results presented in the text do not differ after controlling for the global variables mentioned. The estimation includes the following variables:

$$Y_{i,t} = A_{i,0} + A_{i,1}Y_{i,t-1} + B_{i,0}X_{i,t} + B_{i,1}X_{i,t-1} + u_{i,t}$$

Where

$$y_{i,t} = \begin{bmatrix} \Delta Overall\ fiscal\ balance_{i,t} \\ \Delta Tax\ revenue_{i,t} \\ \Delta Total\ government\ expenditure_{i,t} \\ Real\ GDP\ growth_{i,t} \end{bmatrix}$$

Exogenous shocks (or global variables) include:

$$X_{i,t} = \begin{bmatrix} Natural\ disaster\ instensity\ _{i,t} \\ World\ Real\ GDP\ growth_{i,t} \\ \Delta World\ Price\ of\ oil_{i,t} \end{bmatrix}$$

With i = {Fiji, Samoa, Solomon Islands, Tonga, and Vanuatu}.

Figure C.2. Response of Growth and Fiscal Aggregates to a Natural Disaster with Intensity Equivalent to 1 Percent of the Population Affected

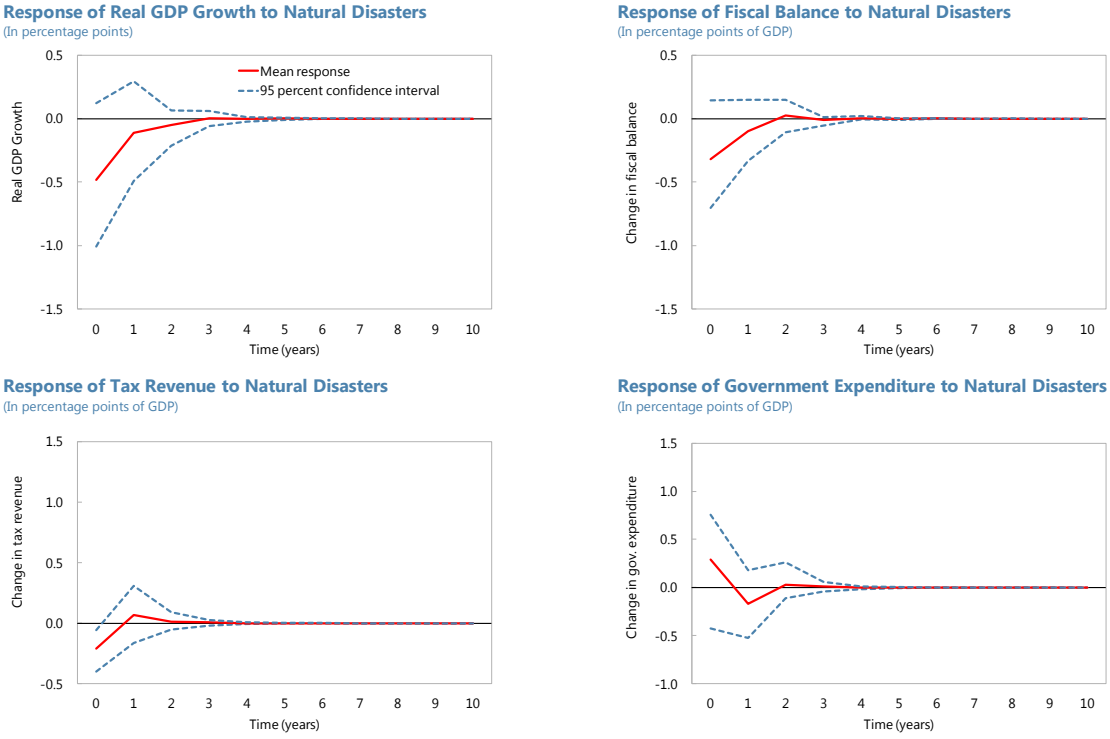


Figure C.3. Response of Growth and Fiscal Aggregates to 1 percent of GDP Damage Shock

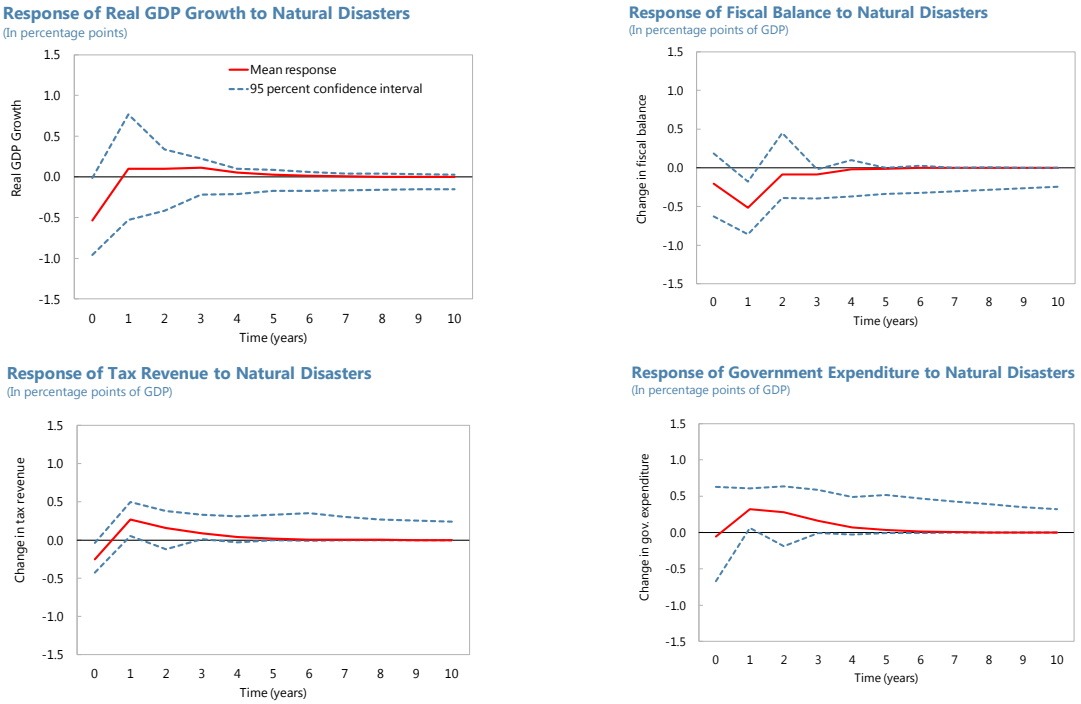
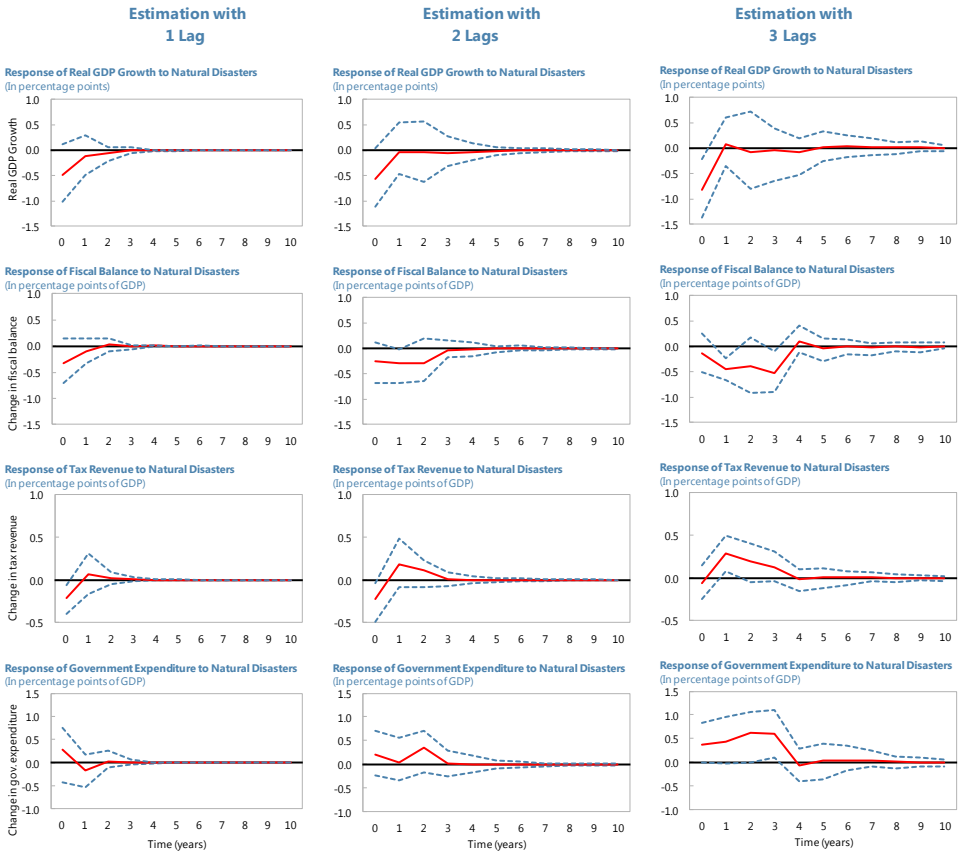


Figure C.4. Robustness to Lag Specification Response of Growth, and Fiscal Aggregates to 1 Percent of GDP Damage Shock



APPENDIX D: AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) MODEL

The ARDL methodology is valid regardless of whether the regressors are exogenous or endogenous, and irrespective of whether the underlying variables are integrated of order 1 or zero.

Appendix D. Table 1. Fixed Effects Estimates of the Long-Run Effects, Based on the ARDL Model

Dependent variable: real GDP (in log)	
Capital stock (in log)	0.344***
Population (in log)	0.628***
Damage and losses (in percent of GDP)	-0.003**
F-statisitcs for cointegration	4.851***
Observations	225
Number of countries	5

Notes: The lag length was selected using Schwarz's Bayesian criterion.
Asterisks indicate p-values: *** p<0.01, ** p<0.05, * p<0.1.
Estimation period: 1970-2014.

APPENDIX E: SELECTED PROGRAMS AND FUNDS

Institution	Programs / Funds	Purpose	Period	Amounts
Asian Development Bank (ADB)	**Pacific Climate Change Program (PCCP)**	Climate Change		2011-14 period, US$240 million
	The ADB is delivering an integrated program to its Pacific Developing Member Countries (DMCs) to address both mitigation and adaptation to climate change, focusing on climate and disaster proofing of the investment portfolio, and scaling up renewable energy. In the Pacific, the ADB has facilitated access to international climate change financing primarily as co-financing of investments. The ADB has set up dedicated climate facilities funded by its own resources and bilateral partners. Out of ADB's own funds, approximately US$172 million funded adaptation and mitigation costs of projects during the period of 2011-14. In addition, the ADB mobilized around US$68 million from global funds from the Least Developed Country Fund (LDCF) and the Climate Investment Fund's Pilot Program for Climate Resilience (PPCR).			
ADB	**Asia Pacific Disaster Response Fund (APDRF)**	Natural disasters		US$3 million per event
	Incremental grant resources to developing member countries impacted by a major natural disaster, with quick-disbursing grants to assist ADB DMCs to restore life-saving services, and augment aid provided by other donors. Since 2011, ADB has approved 8 APDRF projects in the Pacific.			
ADB	**Disaster Response Facility (DRF)**	Natural Disasters		Since 2011, US$26 million
	The DRF supports emergency assistance, restoration, and rehabilitation and reconstruction needs. The assistance is provided in the form of grants or loans depending on a country's status. In case of a disaster, an ADF-only country can get up to 100 percent of the country's annual Performance Based Allocation (PBA) or US$3 million per disaster, whichever is higher; a blend country can receive up to 3 percent of its annual PBA. Since 2011, the ADB has helped Pacific countries access US$26 million from the DRF through 3 projects (Solomon Islands, Tonga, and Samoa).			
European Union	**ACP-EU Building Safety and Resilience in the Pacific**	Disaster Risk Reduction & Climate Change Adaptation	2013-2018	€20 million
	Strengthen the capacity of PICs to address existing and emerging challenges with regards to the risks posed by natural hazards and related disasters, while maximising synergies between Disaster Risk Reduction (DRR) strategies and Climate Change Adaptation (CCA).			
European Union	**ACP-EU Natural Disaster Risk Reduction Programme (ACP-EU NDRR)**	Disaster Risk Reduction & Climate Change Adaptation	2011-20	Total: €80 million Indicative Pacific: €13.7 million
	Address prevention, mitigation and preparedness to natural hazards in ACP States, focussing on: mainstreaming of disaster risk reduction; risk identification and			

	assessment; early warning systems and communication on Disaster Risk Reduction (DRR); risk transfer and integration of DRR into recovery.			
European Union	**Intra-ACP Global Climate Change Alliance (GCCA)**	Climate Change Adaptation / Mitigation	2012-16	€37 million Indicative Pacific: €8.0 million
	Integrated strategies, mainstreaming climate change in national development planning and budgeting, institutional and capacity strengthening and fostering dialogue and exchange of experiences to address climate change in developing countries.			
European Union/ UNESCAP/ ILO/UNDP	**Enhancing the Capacity of Pacific Island Countries to Address the Impacts of Climate Change on Migration**	Climate change and migration	End in 2016	€2.1 million
	Capacity building on climate change induced migration financed through the European Initiative for Democracy and Human Rights (EIDHR).			
European Union	**Global Index Insurance Facility (GIIF)**	Disaster Risk Reduction	2008-16	€24.5 million (all ACP countries)
	Reduce the vulnerability of the ACP population to external shocks/natural disasters through the expansion of the use of index insurance as a risk management tool in ACP countries. GIIF seeks to introduce a new and more efficient approach (indexed or parametric insurance) for mitigating weather/CAT risks in developing countries.			
European Union	**Global Climate Change Alliance (GCCA) South Pacific**	Mainstreaming Adaptation	2011-15	€10 million
	Secretariat of the Pacific Community, Secretariat of the Pacific Regional Environment Programme: Overall development and poverty reduction, coastal zone management, health, infrastructure and water and sanitation.			
European Union	**Global Climate Change Alliance (GCCA) Papua New Guinea**	REDD – Forest	2013-17	€8.6 million
	Contributes to the implementation of the national REDD readiness Plan (FAO UN-REDD).			
European Union	**Global Climate Change Alliance (GCCA) Samoa**	Mainstreaming Adaptation / disaster risk reduction	2012-15	€3.0 million
	Contributes to the implementation of the national Water for Life sector Plan - Water and sanitation.			
European Union	**Global Climate Change Alliance (GCCA) Salomon Islands**	Mainstreaming Adaptation	2011-14	€2.8 million
	Overall development and poverty reduction. Contributes to the implementation of the NAPA priorities and the National Disaster Risk Management Plan.			
European Union	**Global Climate Change Alliance (GCCA) Timor Leste**	Mainstreaming Adaptation	2013-18	€4.0 million
	Overall development and poverty reduction, forests, agriculture and natural resource management.			

European Union	**Global Climate Change Alliance (GCCA) Vanuatu**	Mainstreaming Adaptation / disaster risk reduction	2010-14	€3.2 million
	Overall development and poverty reduction, agriculture, natural resource management and water and sanitation. Contributes to the implementation of the measures identified in the NAPA.			
European Union	**Pro-Resilience Action**	Building resilience in response to food crises	2014-20	Indicative €65 million/ year (worldwide)
	Supporting the poor and food insecure to react to crises by addressing the effects of the crises and strengthening their resilience. The action is worldwide and Pacific SIDS can access support in case they are stricken by a food crisis. The program does not respond specifically to natural disasters. However, the program can be activated if a natural disaster has impacts in terms of food and nutrition security.			
European Union	**Adapting to Climate Change and Sustainable Energy (ACSE)**	Climate Change	2014-2019	€35.5 million
	ACSE will help 15 PICs to adapt to adverse effects of climate change and to enhance their energy security at the national, provincial and local/community level. The objectives are: (1) create and/or strengthen national technical expertise on climate change adaptation and sustainable energy, (2) improve cost-effective and efficient energy systems to reduce fossil fuel dependency, (3) improve communities' adaptive capacity to cope with climate change challenges. Another aim of the ACSE programme is to enhance sustainable livelihoods through the support of government institutional efforts and empowering communities to increase their self-reliance and their ability to cope with the effects of climate change through appropriate practices in agriculture and coastal fishery, by disseminating improved plant varieties which are resistant to salt water, by securing their daily water supply and by improving their access to energy, among other initiatives.			
United Nations	**Adaptation Fund (AF)**		Established 2001	
	The Adaptation Fund was established to finance concrete adaptation projects and programs in developing country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change. The Adaptation Fund is financed from the share of proceeds on the clean development mechanism (CDM) project activities and other sources of funding. The share of proceeds amounts to 2 percent of certified emission reductions (CERs) issued for a CDM project activity. The Adaptation Fund is supervised and managed by the Adaptation Fund Board (AFB). The AFB is composed of 16 members and 16 alternates and meets at least twice a year (Membership of the AFB).			
UNDP	**UNDP investment in DRR & Recovery**	Disaster Risk Reduction and Recovery	2005-14	US$1.7 billion

	On disaster risk reduction, in the 10 years since the launch of the Hyogo Framework for Action (HFA) in 2005, UNDP has invested just under US$1.7 billion in 163 countries to build capacity to prevent, prepare for and recover from disasters. Specifically, in 2014, UNDP invested a total of US$252 million on disaster prevention and risk management, supporting the development of 98 new disaster-risk reduction and adaptation plans, frameworks or multi-stakeholder coordination mechanisms in 23 countries, new early warning systems in 17 countries and new disaster response and recovery plans in 14 countries. Also in 2014, UNDP has invested US$281 million on Early recovery and rapid return to sustainable development pathways.			
UNDP	**UNDP investment in Climate Change**	Climate Change Adaptation and Mitigation	2004-14	US$1.4 billion
	As the UN's development agency, UNDP's mandate on climate change is rooted in ensuring that countries are able to address the challenges of climate change whilst advancing sustainable development goals, and safeguarding existing development gains. Over the past five years, UNDP's climate change portfolio in support of over 140 countries has totaled US$1.4 billion, of which 48 percent is Adaptation, 40 percent Mitigation and 12 percent Cross cutting programmes- including UN REDD and Climate Finance. UNDP's climate change portfolio extends to over 140 countries, with geographical coverage in all regions (32 percent in Asia Pacific, 31 percent in Africa, 17 percent in Eastern Europe and CIS, 12 percent in Latin America and Caribbean, 8 percent in Arab States). In 2014, results included channeling over US$200 million to support more than 100 countries in implementing adaptation and mitigation initiatives			
World Bank/United Nations	**Global Facility for Disaster Reduction and Recovery (GFDRR)**	Reduce vulnerability to natural disasters and climate change	Established 2006	For projects sized US$100 thousand-US$1 million
	GFDRR is a partnership of 35 countries and six international organizations committed to helping developing countries reduce their vulnerability to natural hazards and adapt to climate change. The partnership's mission is to mainstream disaster risk reduction and climate change adaptation in country development strategies by supporting a country-led and country-managed implementation of the Hyogo Framework for Action (HFA).			
World Bank Group, IDA	**Immediate Response Mechanism (IRM)**	Natural disasters	Established Dec 2011	5 percent of undisbursed IDA project balances or SDR$5 million.
	The IRM allows IDA countries to rapidly access up to 5 percent of their undisbursed IDA investment project balances following a crisis (natural disasters and economic shocks). Small states and countries with small undisbursed project balances will be able to access up to $5 million. The IRM complements longer-term emergency response tools available to IDA countries, such as the Crisis Response Window.			
World Bank Group, IDA	**Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)**	Natural disasters	Nov 2012 to Nov 2014	US$45 million in aggregate coverage

	Participating countries select per-peril coverage and option of coverage attaching at loss levels of a severity of recurrence of 1 in 10, 15 or 20 years (or less frequent). Five PICs participated in the initial 2012-2013 pilot, which had an aggregate limit of US$45 million and an annual expected loss of US$1 million. The scheme covers the Marshall Islands, Samoa, Solomon Islands, Tonga, and Vanuatu, and the Cook Islands.			
World Bank Group (Trustee)	**Climate Investment Funds (CIF), including the CTF, FIP,PPCR, and SREP** The CIF provides funding to 48 developing and middle income countries. Funding is from contributor countries, with co-funding sought from the private sector. The CIF fosters partnerships through a programmatic approach, whereby CIF countries, with support from the MDBs, lead investment planning and implementation. The CIF has four funding windows: (1) the US$5.5 billion Clean Technology Fund (CTF); (2) the US$639 million Forest Investment Program (FIP); (3) the US $1.3 billion Pilot Program for Climate Resilience (PPCR); and (4) the $551 million Scaling Up Renewable Energy in Low Income Countries Program (SREP).	Climate Change	Established 2008	
World Bank Group	**IDA** The IDA-17 Replenishment requires Country Partnership Frameworks to incorporate climate and disaster risk considerations, and for all IDA operations to be screened for short- and long-term climate change and disaster risks, integrating resilience measures as appropriate. This includes both concessional credits and IDA grants that are used to support climate and disaster resilience.	Climate and Disaster Resilience	2011-15	US$150 million
World Bank Group	**IBRD** The IBRD aims to reduce poverty in middle-income countries and creditworthy poorer countries by promoting sustainable development through loans, guarantees, risk management products, and analytical and advisory services.	Climate and Disaster Resilience	2011-15	US$15 million
DFAT	**DFAT** Support to developing countries to adapt to climate change, reduce their carbon emissions and pursue cleaner development. Focus is on Least Developed Countries and small island developing states. Efforts will build on work to reduce emissions from deforestation, pilot low emission development pathways and engage in key international development and environment forums.	Climate Change	Total funding for 2010/11 and 2012/13 was AU$599 million	
Japan	**Japan's Assistance Package for Pacific Island Countries at the 7th Pacific Islands Leaders Meeting (PALM7)** Japan will provide the assistance to Pacific island countries that are battling rising sea levels and natural calamities as a result of global warming. Focus is on disaster risk reduction, climate change, environment, people-to-people exchanges, sustainable development, maritime issues and fisheries, and trade, investment and tourism.	Climate Change	2015-17	US$450 million

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