

The Macro-Fiscal Impacts of Post-Disaster IMF Financing: Evidence from a Synthetic Control Approach

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ABSTRACT: The IMF provides macro-stabilizing liquidity when others cannot. The IMF has developed a set of instruments designed to provide rapid financial assistance to countries facing urgent balance of payments needs without requiring a full-fledged economic program, triggered by exogenous natural disasters shocks. We evaluate the impact of IMF emergency financing after natural disaster using a synthetic control method. The results show that IMF post-disaster financing supports a faster GDP recovery, with an implied average IMF post-disaster multiplier larger than 1. The findings suggest strong liquidity and catalytic effects, enabling countercyclical fiscal responses. However, the resulting increase in public debt underscores the need for credible medium-term fiscal plans and post-disaster consolidation to maintain debt sustainability.

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WORKING PAPERS

The Macro-Fiscal Impacts of Post-Disaster IMF Financing: Evidence from a Synthetic Control Approach

Prepared by Pedro Juarros and Junko Mochizuki¹

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Introduction

The International Monetary Fund (IMF) provides timely, predictable, and subsidized liquidity to help stabilize macroeconomic conditions when market access is lost or severely constrained. As the frequency and impact of natural disasters grow, the urgency for timely and effective post-disaster financing has become increasingly critical. When a large natural disaster shock occurs, timely and effective external financing is critical to support the recovery, stabilize macroeconomic conditions, and avoid disorderly adjustments and long-lasting scarring. While long-term adaptation and resilience-building are essential, even well-prepared countries face temporary liquidity shortages when natural disaster shocks hit. The IMF's Emergency Natural Disaster Assistance (ENDA), Rapid Credit Facility (RCF, exclusively for low income countries) and Rapid Financing Instrument (RFI, for all countries) were specifically designed to provide short-term liquidity with low/no-conditionality, fast-disbursing emergency support to countries facing urgent balance of payments needs. The program is designed to disburse often within weeks or months of a large natural disaster, to allow countries to respond to situations where a full-fledged economic program is not necessary because the need is transitory and limited in nature, or not feasible, constituting a pure liquidity injection. Unlike traditional IMF arrangements that focus on macro-stabilization with medium-term structural reforms and policy conditionality, these instruments are tailored for immediate stabilization. This paper examines the macroeconomic role of the IMF's rapid post-disaster financing post-2001, excluding programs triggered by the COVID-19 pandemic, given the systemic and qualitatively different nature of that shock.

Between 2001 and 2019, the IMF approved 19 standalone post-disaster financing programs in 16 countries (mostly Small Island Developing States, SIDS), with average financing equivalent to 0.9 percent of GDP. Since the RCF and RFI replaced ENDA in 2009 and 2011, respectively, the frequency and scale of such programs have increased. Notably, about 70 percent of these programs (13 out of 19) were approved between 2010 and 2019, with average financing rising to 1 percent of GDP and reaching as high as 3 percent of GDP.¹ Despite the increasing use of these instruments, particularly through the dedicated natural disaster window, evidence on their macroeconomic effectiveness remains limited. We assess whether access to emergency IMF support can mitigate the economic consequences of natural disasters, focusing on the output recovery and the fiscal response. Specifically, this paper asks: (i) What is the implied GDP multiplier of IMF's post-disaster financing?; (ii) Does the IMF's emergency financing support countercyclical fiscal policy and boost recoveries?; (iii) do they catalyze foreign aid, and what is the impact on debt dynamics?

To address these questions, we use a synthetic control method that restricts the sample to events with comparable macroeconomic dynamics, disaster-related damages, and economic structure (i.e. SIDS). Our findings show that rapid IMF financing after a natural disaster shock has large positive recovery effects through both liquidity provision and catalytic effects, enabling countercyclical fiscal responses via higher deficits and reconstruction spending. However, this support is associated with significantly higher public debt levels, highlighting the need for credible medium-term fiscal frameworks to preserve debt sustainability post-recovery.

This paper fills that gap by estimating the macroeconomic effects of IMF post-disaster financing, using a synthetic control method (SCM) (Abadie et al. (2010); Kuruc (2022)). A major challenge in assessing the

¹ Kuruc (2022) documents that the average size of all IMF programs, defined generally as medium-term arrangements with fiscal, monetary, and structural conditionality, is relatively large, at approximately 2.1 percent of GDP. However, there is substantial variation across programs, with a median size of 1.3 percent and a standard deviation of 2.4 percent of GDP.

macroeconomic effects of IMF programs is selection bias, as countries often seek IMF support amid deep crises, making it hard to isolate the impact of the program itself. For each disaster event with IMF intervention, we construct a synthetic counterfactual composed of weighted combinations of comparable disaster events without IMF financing. Following the approach of [Abadie \(2021\)](#) and [Abadie et al. \(2015\)](#), to ensure the validity of the empirical strategy and comparability across treated and control units, we restrict the donor pool to untreated observations that are “local” in the covariate space, specifically, countries with similar disaster characteristics, pre-shock macroeconomic profiles, type of country (SIDS vs. no SIDS)², and no concurrent crisis. Specifically, we construct a sample of countries that experienced large natural disasters, as dated by the EM-DAT database.³ Furthermore, the analysis focuses exclusively on natural disaster events that are not preceded by macroeconomic crises. That is, we exclude from treated and untreated groups any country-year events where another conditional IMF program (SBA, ECF, EFF, FCL, among others), banking, currency, debt, or fiscal crises occurred in the year preceding the disaster (as defined by [Laeven and Valencia \(2020\)](#) and [Medas et al. \(2018\)](#)).⁴ This approach allows us to match on pre-treatment trends and disaster severity. By excluding overlapping macroeconomic crises, we ensure that treatment assignment is plausibly exogenous and that the estimated effects reflect the role of the IMF as a countercyclical and stabilizing force following large exogenous shocks.

Given that ENDA, RCF and RFI arrangements are triggered by exogenous natural disasters, they provide a cleaner identification strategy. These shocks are externally driven and unexpected, which reduces endogeneity concerns. Additionally, the rapid disbursement, minimal conditionality, and capped access design of these instruments enhance comparability across countries. Therefore, they provide a more credible setting to estimate the causal effects of IMF support on post-disaster recovery.

The findings show that IMF emergency support in disaster has large positive effects. The average IMF post-disaster multiplier, defined as total output gains divided by total access credit, is 4.6 (significantly larger for the 2005 Maldives’s Tsunami).⁵ Our results show output gains in each year after the disaster, with a peak 3 years after the disaster shock, where GDP level in IMF supported events is on average about 3 percent above events without IMF post-disaster financing (excluding Maldives 2005). In terms of dynamics, the average 1-year IMF multiplier is estimated at 1.1, while the cumulative 2-year multiplier reaches 2.1. This reflects output gains totaling 2.5 percent of crisis-year GDP compared to similar events without IMF post-

² To ensure credible counterfactuals for SIDS, the donor pool is restricted to other SIDS that experienced comparable natural disasters but did not receive IMF emergency financing under ENDA, RCF, or RFI. Similarly for non-SIDS countries. These restrictions mitigate selection bias and enhance the validity of the synthetic control estimates for SIDS events with IMF support. Importantly, this approach helps address concerns about selection into IMF programs based on market access, as most SIDS generally lack consistent access to international capital markets, reducing the likelihood that post-disaster financing alternatives, such as sovereign bond issuance, drive the observed differences in outcomes.

³ The EM-DAT database provides a valuable and widely used global record of disaster events. However, to enhance the granularity and consistency of disaster cost assessments and dating, particularly for major events, we complement EM-DAT with data from the United Nations Post-Disaster Needs Assessment (PDNA) reports, which offer standardized methodologies and country-validated damage estimates.

⁴ These restrictions ensure that growth fluctuations around the disaster are not driven by overlapping macroeconomic imbalances or structural adjustment episodes but instead reflect the shock and the policy response.

⁵ The Maldives’ strong recovery following the December 26, 2004, tsunami reflects both the unprecedented nature of the shock and the country’s economic structure. The once-in-500-years event devastated nearly all of its islands, causing GDP to contract by 11.2 percent. However, growth rebounded sharply to 23.6 percent the following year and remained above 7 percent in the subsequent two years. Key sectors, tourism and construction, suffered only temporary disruption and were quickly revived through ambitious, government led development that pushed the fiscal deficit to 7.8 percent of GDP in the disaster year. International aid also rose significantly, by about 4 p.p. of GDP, supporting reconstruction spending. Resilient fisheries, robust donor support, and sound macroeconomic policies (including a stable exchange rate) further anchored the recovery, making the Maldives an outlier among post-disaster cases.

disaster financing. The results are robust to exclusion of outliers (Maldives 2005 and Grenada 2004, which received financing from the ENDA program), restricting the sample further to disaster events with estimated damages above 5 and 15 percent, disaster events after 2010 (to exclude ENDA cases and control for the development of more comprehensive disaster risk financing strategies and availability of other disaster financing options), and adding other pre-disaster shock macroeconomic trends (as current account and debt levels).⁶

From a fiscal perspective, treated events with IMF post-disaster financing exhibit a stronger increase in government spending by about 1 p.p. of GDP relative to their counterfactual, consistent with a countercyclical fiscal response, alongside rising revenues over time. Post-disaster IMF financing had a large catalytic effect, crowded-in foreign support, as grants increased by about 1.8 p.p. of GDP in the immediate aftermath. Additionally, tax revenues also rise in subsequent years, suggesting that IMF-supported programs may help strengthen domestic revenue mobilization, possibly via policy advice rather than explicit conditionality (Newiak and Willems (2017)). Moreover, concessionality and debt maturity improve temporarily after the disaster for treated cases, though this effect fades over the medium term, indicating that market-based financing resumes as liquidity pressures ease. Overall deficits widen more in the disaster year for IMF-supported countries, facilitating needed reconstruction, before improving, in part due to rising revenues. Public debt increases in both treated and untreated events, underscoring the importance of credible medium-term fiscal frameworks. However, the increase in public debt is much front-loaded in the case of IMF-supported programs, supporting reconstruction, and boosting the recovery. On the external side, trade deficits widen more in treated events, consistent with IMF financing enabling higher post-disaster imports and cushioning the external adjustment. These findings support the view that IMF emergency programs not only provide timely liquidity but also help catalyze concessional financing, enable countercyclical fiscal responses, and facilitate faster macroeconomic recovery.

Our paper contributes to the literature employing synthetic control methods to assess the macroeconomic effects of large natural disasters. Cavallo et al. (2013) find that large disasters do not affect growth unless accompanied by radical political revolution. Barone and Mocetti (2014) show that post-disaster aid mitigated short-term GDP losses in Italy, but institutional quality shaped long-term outcomes. Coffman and Noy (2012) examine Kauai's recovery from 1992 Cyclone Iniki, noting limited economic rebound despite large aid flows. Maran (2023) find that catastrophe bonds significantly improved Mexico's fiscal balance after the 2017 earthquake.⁷ Therefore, this literature highlights the role of institutions and external support in shaping post-disaster trajectories. We build on this by focusing on IMF emergency financing and its macro-fiscal impacts using a systematic synthetic control framework.

While there is a large empirical literature evaluating the macroeconomic effects of IMF-supported programs in general, consensus remains elusive. In particular, there is virtually no empirical evidence on the macroeconomic impact of emergency IMF support following natural disasters, such as financing provided through the RCF, RFI, or the earlier ENDA mechanism. Earlier studies yield conflicting results: some find that programs support growth, investment, or external adjustment (e.g., Kuruc (2022); Bas and Stone (2014); Gunduz (2016)), while others emphasize adverse effects linked to conditionality, domestic political constraints, or moral hazard (e.g., Barro and Lee (2005); Vreeland (2003)). These mixed findings partly reflect the

⁶ While the analysis provides novel evidence on the macroeconomic effects of IMF post-disaster financing, the relatively small number of treated episodes limits the scope for broad extrapolation of the results.

⁷ SCM has also been used to assess disaster effects on unemployment duPont Iv et al. (2015), savings Luo and Kinugasa (2020), tourism Antonaglia et al. (2025), housing Diop et al. (2024), and inequality Cordoba and Uliczka (2021).

heterogeneity of IMF arrangements, country characteristics, and the endogeneity of program selection. Moreover, while prior work has explored the IMF's potential catalytic role in mobilizing donor aid (e.g., [Stubbs et al., 2016](#); [Bird and Rowlands, 2007](#)), empirical evidence in post-disaster contexts remains scarce. This paper contributes to these literatures by leveraging a quasi-experimental setting to estimate the macro-fiscal effects of IMF emergency financing following natural disasters, offering new insights into its role in supporting recovery, enabling countercyclical fiscal responses, and catalyzing aid flows in vulnerable developing economies.

The rest of the paper is organized as follows: Section 2 describes in more detail the IMF post-disaster toolkit; Section 3 presents the empirical strategy and design of counterfactuals. Section 4 presents the main results, robustness and thread to identification, and potential. Section 5 provides evidence about the potential transmission mechanisms at place, with the fiscal response, catalytic effect and debt dynamics. Section 6 concludes.

IMF Post-Disaster Emergency Financing Toolkit

The IMF has developed a set of instruments designed to provide rapid financial assistance to countries facing urgent balance of payments needs without requiring a full-fledged economic program, particularly in the wake of natural disasters or other exogenous shocks, constituting a pure liquidity injection. The IMF's Emergency Natural Disaster Assistance (ENDA) dates back to the 1960s, since 1962 the IMF has offered emergency assistance from the General Resources Account to member countries hit by natural disasters (e.g. floods, earthquakes, hurricanes, droughts) to meet urgent balance of payments needs, such as export shortfalls or increased imports, and to avoid reserve depletion. Over time, however, the IMF consolidated and modernized its emergency toolkit.

Over the past decade, the IMF has significantly evolved its emergency financing tools with the Rapid Credit Facility (RCF) and Rapid Financing Instrument (RFI) to better support countries facing urgent balance of payments needs, especially due to natural disasters. Introduced in 2009, the RCF replaced earlier instruments like ENDA and EPCA, offering concessional financing through regular and exogenous shock windows. The RFI followed in 2011, modeled after the RCF's shock window. Access limits were progressively increased between 2013 and 2019 to enhance flexibility, particularly for disaster-prone small states. Notably, a dedicated large natural disaster window was added in 2017, allowing higher access for countries suffering damage exceeding 20 percent of GDP. These arrangements operate outside standard IMF program conditionality, are typically disbursed in a single tranche, and differ in repayment terms: RFI credit is repaid within 3.25–5 years, while RCF loans carry a 5.5-year grace period with final maturity at 10 years. In practice, they are generally used as one-off support mechanisms to provide immediate liquidity and bridge financing until longer-term measures or donor support can be mobilized. By 2019, both instruments saw harmonized increases in annual and cumulative limits, reinforcing the IMF's commitment to providing timely and adequate support to vulnerable and fragile states.

Table 1 presents the countries that have accessed the IMF's emergency financing between 2002 and 2019, describing the type of natural disaster that triggered access, estimated damages, and size of financing. IMF post-disaster financing instruments, especially RCF/RFI, have been predominantly used by small, highly vulnerable economies, mostly SIDS in the Western Hemisphere (WHD) and Asia-Pacific (APD) regions, facing catastrophic natural disasters. These countries are highly exposed to natural disasters (cyclones, hurricanes, volcanic eruptions, tsunamis), economically vulnerable, with limited fiscal buffers, and

likely to experience large damages as a share of GDP, sometimes exceeding 100 percent⁸ (e.g., Dominica 2017 Hurricane Maria). The approval dates are within months of the disaster events, consistent with the rapid deployment goals of ENDA/RCF/RFI instruments, where most programs are approved within 3 to 6 months post-disaster (a key advantage over traditional IMF programs). While the nominal amounts are modest, the relative size (as a share of GDP or quota) is significant, and their frequency and scale have increased since the 2010s. These features, along with their catalytic potential for grant mobilization, suggest that RCF/RFI are key components of the disaster risk financing architecture, particularly for disaster-prone countries.

Table 1. IMF Post-Disaster Financing Programs 2002–2019

Country	Event Type	Region	Approval	Damage (% GDP)	IMF Program	% GDP	% Quota
Grenada	Hurricane	WHD	11/15/2004	242.7	ENDA	1.42	50.0
Maldives	Tsunami	APD	03/04/2005	72.1	ENDA	0.51	50.0
Sri Lanka	Tsunami	APD	03/04/2005	9.5*	ENDA	0.77	25.0
Dominica	Hurricane	WHD	02/04/2008	7.5	ENDA	0.74	25.0
Bangladesh	Floods	APD	05/02/2008	4.1*	ENDA	0.27	25.0
Belize	Floods	WHD	02/24/2009	0.8*	ENDA	0.40	25.0
St. Kitts and Nevis	Hurricane	WHD	05/19/2009	3.5**	ENDA	0.44	25.0
St. Lucia	Hurricane Tomas	WHD	01/12/2011	43.0	RCF	0.41	25.0
St. Vincent & Grenadines	Hurricane Tomas	WHD	07/25/2011	4.9	RCF	0.75	50.0
Samoa	Cyclone Evan	APD	05/15/2013	23.7	RCF	1.16	50.0
St. Vincent & Grenadines	Natural Disaster	WHD	08/01/2014	19.4	RFI-RCF	0.83	50.0
Vanuatu	Cyclone	APD	06/05/2015	74.6	RFI-RCF	3.04	100.0
Nepal	Earthquake	APD	07/31/2015	29.3	RCF	0.23	50.0
Dominica	Storm Erika	WHD	10/28/2015	119.4	RCF	1.58	75.0
Ecuador	Earthquake	WHD	07/08/2016	2.6	RFI	0.35	37.5
Haiti	Hurricane Matthew	WHD	11/18/2016	17.1	RCF	0.52	18.8
Mozambique	Cyclone Idai	AFR	04/19/2019	17.7	RCF	0.78	37.5
Comoros	Cyclone Kenneth	AFR	07/24/2019	44.5*	RFI-RCF	1.04	50.0

Note: Disaster date and estimated damaged sourced from EM-DAT database, and IMF program information from IMF's Monitoring of Fund Arrangements (MONA) database. *, when disaster shock occurred in the previous year; **, sourced from IMF's program request.

For the empirical analysis, we focus on natural disasters occurring between 2004 and 2016. This window allows for three years of pre- and post-treatment effects, while also avoiding the confounding impact of the COVID-19 pandemic in 2020, which was different in nature and triggered widespread IMF emergency support under the RCF and RFI. Disaster shocks are identified using the EM-DAT database, complemented by UN Post-Disaster Needs Assessments (PDNA). EM-DAT defines estimated damages as the economic impact on property, crops, and livestock in current USD, though it advises caution when using pre-2001 data due to limited coverage and consistency. We therefore start in 2004 to ensure data reliability.

⁸ Disaster damages measure capital losses, a stock concept, whereas GDP is a flow measure of annual output. Damages may therefore exceed 100 percent of GDP when the replacement cost of damaged capital surpasses total output produced in a year.

We focus on disasters with estimated damages above 2 percent of the previous year's GDP, relatively close to the lowest damage treated event in our sample, Ecuador's 2016 earthquake, which registered damages equivalent to 2.6 percent of the prior year's GDP, in order to concentrate on macro-critical shocks of comparable severity. Regarding the assignment of disasters to calendar years, we follow the IMF's World Economic Outlook (WEO) Statistical Annex, Table F, aligning shocks with the corresponding fiscal year. When disasters occur in the last quarter of the year, we assume their economic effects materialize predominantly in the following year. Finally, we use annual macroeconomic indicators from the IMF's WEO database and grants data from the World Bank's World Development Indicators (WDI).

Empirical Strategy

A key concern in evaluating the macroeconomic impact of IMF programs is the endogeneity of program participation: countries typically seek IMF assistance when facing severe balance of payments pressures or economic crises. This selection bias, where countries most likely to receive IMF support are also those most at risk of weak macroeconomic outcomes, complicates causal inference. As a result, it is difficult to disentangle whether poor economic performance is caused by the IMF program or by the underlying crisis that triggered the request for support.

However, ENDA/RCF/RFI arrangements triggered by exogenous natural disasters offer a quasi-experimental setting that helps mitigate this endogeneity issue. The key advantage is that these instruments are accessed in response to sudden, external shocks (such as earthquakes, hurricanes, or floods), which are plausibly exogenous to the country's economic fundamentals or policy choices. Furthermore, the limited conditionality, uniform design, and rapid disbursement of ENDA/RCF/RFI programs enhance cross-country comparability and reduce the influence of policy-based selection. This makes them well-suited for identifying the causal effects of IMF support in post-disaster contexts.

To estimate the causal effect of the IMF's emergency financing instruments on post-disaster GDP growth, we employ the synthetic control method (SCM). The treated units consist of countries that experienced extreme natural disaster shocks and subsequently received rapid IMF support. These are compared against synthetic controls constructed as weighted convex combinations of countries that suffered similar disaster events, but did not receive IMF assistance. This transparent, counterfactual framework ([Abadie \(2021\)](#)) allows us to directly observe and attribute differences in post-disaster recovery trajectories to the presence or absence of IMF support. To ensure comparability and mitigate selection bias, we restrict the synthetic donor pool in line with [Abadie et al. \(2015\)](#) and [Kuruc \(2022\)](#). Specifically, we include only countries that (i) faced disaster events exceeding 2% of GDP in damages or affected at least 50 percent of the population (the minimum severity observed among treated units); (ii) did not experience concurrent IMF programs or macroeconomic crises (e.g., banking, currency, or sovereign debt crises per [Laeven and Valencia \(2020\)](#), or fiscal stress episodes per [Medas et al. \(2018\)](#)).⁹ The donor pool is stratified by country type to ensure comparability: when a treated event occurs in a SIDS, the corresponding counterfactual are drawn exclusively from the SIDS pool, whereas non-SIDS treated events are matched with donor units from the non-SIDS group.

⁹ To ensure analytical consistency, we exclude non-ENDA/RCF/RFI programs with disaster-driven quota augmentation due to concerns on the exogeneity of the program trigger, the presence of conditionality, and potential delays in disbursement since the disaster shock.

This stratification ensures that differences in estimated impacts reflect program effects rather than structural heterogeneity across country types. We ended up with a sample of 7 treated events (of which, 5 are SIDS) and 27 untreated events (of which, 10 are SIDS).¹⁰

To estimate the causal effect of IMF post-disaster emergency financing (ENDA/RCF/RFI) on real GDP growth, we follow the empirical framework developed by Kuruc (2022), leveraging a direct forecasting and synthetic control design. Specifically, we model the h -period-ahead real GDP growth outcome $y_{i,h}$ after a disaster-event i as a function of pre-crisis characteristics and IMF support:

$$y_{i,h} = F^h(X_{i,h}, y_{i,h}^l) + \theta_h \cdot \text{IMF}_i + \mu_{i,h} \quad (1)$$

Here, $F^h(\cdot)$ is a horizon-specific, non-parametric mapping from known pre-disaster inputs, including disaster characteristics $X_{i,h}$ and lagged GDP growth, $y_{i,h}^l$, to future outcomes. The indicator variable IMF_i equals 1 for the treated unit (e.g., Vanuatu 2015) and 0 for donor pool units; θ_h captures the causal impact of IMF support at horizon h . The error term $\mu_{i,h}$ is assumed to be mean-zero and uncorrelated with IMF treatment assignment. We include five variables in the function $F(\cdot)$ to construct the synthetic control counterfactual: (i) real GDP growth for the three years prior to the disaster ($t-3$, $t-2$, $t-1$); (ii) real GDP growth in the disaster year, to avoid imposing an explicit elasticity between natural disasters and economic activity and to account for potential mismeasurement in disaster dating; and (iii) estimated damages as a share of GDP in the year preceding the shock. Including GDP growth in the disaster year also allows the model to partially absorb idiosyncratic transmission channels, such as differences in sectoral composition, exposure, or institutional response, that may influence how disasters affect economic output across countries. Identification rests on two key assumptions: (i) local linearity of the outcome function around the treated unit in the space of pre-disaster covariates (Abadie et al. (2010)), and (ii) the existence of a convex combination of untreated units that approximates the treated unit in that covariate space.

Under these assumptions, the treatment effect θ_h is identified by the difference between the observed outcome of the treated unit and the synthetic control, constructed as a weighted average of comparable, untreated disaster cases:

$$\theta_h = y_{i,h} - \sum_j \omega_i^j y_h^j \quad (2)$$

where ω_i^j are non-negative weights that sum to one, minimizing the distance between pre-disaster characteristics of the treated unit and its synthetic control. This estimator provides a transparent, horizon-by-horizon comparison of post-disaster outcomes between treated and counterfactual units.

This approach offers key advantages over standard regression methods: it avoids strong parametric assumptions on the dynamics of recovery, mitigates forecast compounding errors across horizons, and enables transparent, horizon-specific counterfactual comparisons (Abadie (2021)).

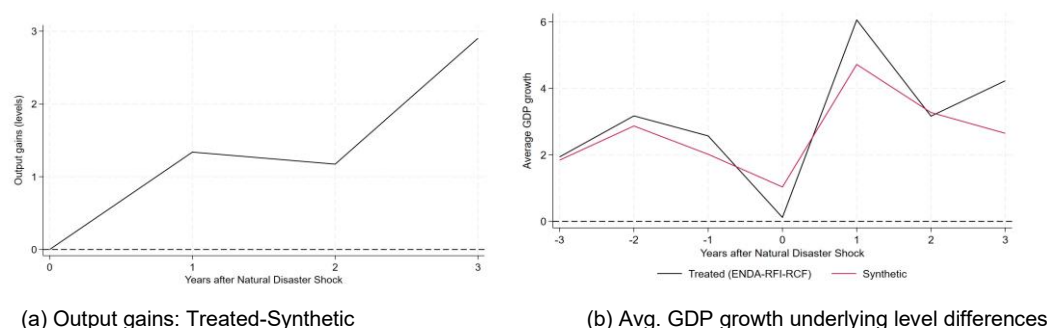
¹⁰ The treated events are: Grenada's Hurricane in 2003 and 2004, Maldives' Tsunami in 2004, St. Vincent and the Grenadines' Hurricane in 2013, Samoa's Cyclone in 2013, Ecuador's Earthquake in 2016, Vanuatu's cyclone in 2015, and Nepal's Earthquake in 2015. We exclude Dominica's Storm Erika in 2015 as the country was hit by Hurricane Maria in 2017 (or $t+2$) with damages above 300 percent of GDP. For more details, see Annex II.

Results

The results show that countries receiving rapid IMF support experience stronger and more sustained recoveries, with output levels remaining significantly higher for up to three years post-disaster. Figure 1 (a) presents the results from the main specification. The impulse response function is the average difference in cumulative growth (i.e., implied level differences) between IMF program recipients and their synthetic controls for the 6 large natural disaster shocks occurred since 2004 (of which, 4 are SIDS).

The synthetics come from a pool of 27 untreated large natural disasters crises (of which, 10 are SIDS). Of the treatment group, we exclude the Maldives 2004 tsunami case for our analysis as it would implied a remarkably high IMF multiplier, where GDP surged by 23.6 percent in the year following the disaster, an outcome that far exceeded IMF projections and reflects a sharp rebound in tourism and reconstruction activity, supported by large grant inflows and concessional IMF financing (ENDA).¹¹ Excluding this outlier, which also registers the largest pre-treatment Root Mean Squared Prediction Error (RMSPE) in the sample, show that an average loan of 1.2 percent of GDP is associated with an average cumulative output gain of 5.4 percent 3-years after the large natural disaster, implying a sizable cumulative IMF multiplier of 4.6. On average, the GDP level of the treated units is about 3 p.p. higher than the untreated events.¹² Figure 1 (b) illustrates that the observed differences in output levels are driven by divergent post-disaster growth trajectories between IMF program recipients and their synthetic controls. In terms of the dynamics, the average 1-year IMF multiplier is 1.1, and the cumulative 2-year multiplier is 2.1, as output gains are 2.5 percent of crisis-year GDP above their untreated events without IMF post-disaster financing. These findings confirm that IMF emergency support delivers a high return on investment and can play a central role in post-disaster recovery, particularly for vulnerable economies.

Figure 1. Output Gains of IMF-Post Disaster Financing



Note: Fig. 1. (a) shows the output gains associated with IMF post-disaster financing Implied real GDP level effects from main specification computed as the average treated observation's cumulative growth minus their respective synthetic control's cumulative growth at that horizon. Fig. 1(b) shows real GDP growth underlying the estimated output gains. The black line represents the average of the 7 treated large natural disaster events with IMF support (excluding Maldives 2005), while the red line shows the average of their synthetic controls. Pre-crisis real GDP growth (including the disaster year) and disaster-related damages (as a share of GDP) are matched by construction.

¹¹ The Maldives recovery benefited from a combination of strong government coordination, donor mobilization, and a rapid rebound in services exports (IMF (2007)). Figure AII.1 shows the baseline results, including this event.

¹² Annex III.2 reports, for each treated event, the weights assigned to each donor-pool event in the baseline specification.

On top of excluding the Maldives case, which yields very large average effects, and to demonstrate that the estimated main average effects are not driven by specific events, Annex III. 1 reports the dispersion around the average. It shows a scatter plot of the differential output responses for each treated event with IMF post-disaster financing relative to their corresponding counterfactuals, which experienced a large natural disaster shock but received no IMF support. The figure highlights why Maldives 2004 is an outlier and shows that, after three years, output gains are negative only for Ecuador in 2016. This event, an EM (non-SIDS) case, was followed by a decline in oil prices that reduced fiscal revenues, and a second oil price shock in the second half of 2018 ($t+2$), a political transition, ultimately leading Ecuador to request an IMF's Extended Fund Facility (EFF) program in 2019 ($t+3$).¹³ Furthermore, Annex III.3 demonstrates the robustness of the findings: the estimated average effect remains stable when each treated event is sequentially excluded. The resulting cumulative three-year IMF post-disaster multiplier consistently falls within the range of 2.8 to 6.3.¹⁴

As an additional robustness test, we conduct a leave-one-donor-out exercise in which each donor event is excluded one at a time from the baseline donor pool and the synthetic controls are re-estimated for the treated units affected by that exclusion, while untreated treated units retain their baseline estimates.¹⁵ Annex III.5 shows that the main average effect is not driven by any single donor-pool event, as the results remain broadly unchanged across these exercises. Importantly, in all cases, the average GDP level of treated events remains between 1 and 5 p.p. above that of their counterfactuals three years after the disaster, and the implied IMF post-disaster multiplier remains above one. This strengthens the interpretation of the baseline findings by showing that they are robust to the composition of the donor pool and are not the product of one particularly influential donor event.

A placebo test in the SCM serves as a validation check for the credibility of the estimated treatment effect. It helps determine whether the observed post-treatment differences for the treated unit could have occurred by chance, or whether they reflect a true causal effect. By applying the SCM framework to units that did not receive the treatment, we can examine whether similar patterns emerge spuriously, thereby assessing the specificity and robustness of the estimated effects for the actual treated case.

The placebo analysis further supports the robustness of the baseline specification by demonstrating that the positive estimated effect is unlikely to be random, with a near-zero average forecast error in untreated events. Specifically, across the 27 placebo cases, the average GDP growth gap between placebo “treated” events and their synthetic controls was -0.3 p.p. in the first post-disaster year, -0.1 p.p. in the second year, and $+0.2$ p.p. in the third year, resulting in a cumulative growth gap of just -0.2 p.p.. When translated into output level differences, the placebo group exhibits a cumulative GDP gap of -0.8 p.p. after three years. These values are all close to zero, reinforcing that untreated events, by design, exhibit no systematic divergence from their synthetic counterparts. Annex III.8 shows the results. Furthermore, following the placebo-in-space inference procedure standard in the synthetic-control literature, we reassign treatment to each donor-pool event in the corresponding stratified donor pool, re-estimate the synthetic control using the baseline specification, and compare the actual average effect with the distribution of placebo-average effects, excluding placebo runs with poor pre-treatment fit, as in Abadie, Diamond, and Hainmueller (2010) and Galiani and Quistorff (2017). The results in Annex III.8. indicate that the positive post-disaster effect is unlikely to be random. The one-sided

¹³ Furthermore, Annex III.7 shows the GDP growth trajectories underlying the level differences for each event individually.

¹⁴ Extending the pre-treatment matching window to five years before the disaster event by adding $t - 5$ and $t - 4$ does not materially alter the baseline results. Annex III.4 shows that the estimated dynamics remain very similar, and the implied IMF post-disaster multiplier remains significantly above one, at about 3.6; three years after the disaster, GDP in treated units is still about 2.6 percentage points above its counterfactual level.

¹⁵ The average treatment effect is then recomputed across the six treated events.

randomization p-values are 0.01 at $t + 1$, 0.07 at $t + 2$, and 0.08 at $t + 3$, while the joint one-sided p-value for the average effect over years $t + 1$ to $t + 3$ is 0.047. Taken together, these results suggest that the positive baseline effect is unlikely to be random and provide meaningful support for the interpretation that IMF post-disaster financing raises output relative to the counterfactual. This evidence suggests that the baseline GDP gains are not readily replicated in placebo exercises, strengthening the interpretation that the estimated effects are associated with IMF post-disaster support rather than with random variation or systematic bias in the synthetic-control procedure.

The average RMSPE across the 27 placebo events is 1.4, indicating a reasonably good pretreatment fit.

In comparison, the RMSPE for the treated event is 1.3, suggesting that the baseline synthetic control model achieves a similarly high-quality match. Furthermore, the pre-treatment forecast errors are centered around zero, and the post-treatment differences remain small in the placebo group. This supports the validity of the SCM specification and reinforces the interpretation that the observed output gains in the treated case are not driven by model misspecification or random noise, but reflect the effect of IMF post-disaster financing.

Lastly, assessing the Root Mean Squared Prediction Error (RMSPE) is critical in synthetic control analysis, as it quantifies how well the synthetic counterfactual matches the treated unit during the pre-treatment period—offering a benchmark for evaluating the credibility of post-treatment estimates. The average RMSPE across the 27 placebo events is 1.4, indicating a reasonably good pre-treatment fit. In comparison, the average RMSPE for the treated event is 1.3, suggesting that the baseline synthetic control model achieves a similarly high-quality match. Furthermore, the pre-treatment forecast errors are centered around zero, and the post-treatment differences remain small in the placebo group. This supports the validity of the SCM specification and reinforces the interpretation that the observed output gains in the treated case are not driven by model misspecification or random noise, but reflect the effect of IMF post-disaster financing.

Robustness

To assess the robustness of our main findings on the macroeconomic impact of IMF post-disaster financing, we perform a battery of sensitivity analyses designed to address concerns about sample composition, heterogeneity in disaster severity, and potential omitted variable bias. In all robustness exercises we exclude Maldives's tsunami in December 2004, an already identified outlier that received assistance under the earlier ENDA framework and exhibit exceptionally high damage-to-GDP ratio. Our results are robust, and in general identify an event higher IMF post-disaster multiplier than the baseline, indicating that our estimates are conservative.

First, as the treated units exhibit larger estimated damages than the donor pool, we restrict the donor pool to disaster events with estimated damages exceeding 5 percent and 15 percent of GDP to ensure comparability in shock magnitude between treated and control observations (albeit at the cost of reducing the number of events in the donor pool and worsening pre-disaster GDP growth dynamic). Second, we narrow the donor pool to post-2010 events to isolate the effect of the RCF/RFI instruments introduced following the 2009 reform of the IMF's concessional toolkit, and to better reflect the evolution of disaster risk financing frameworks in developing countries. Similarly, we restrict the donor pool to events that occurred before 2011. Third, we incorporate pre-disaster macroeconomic indicators, including current account balance, public debt, fiscal deficit, and inflation, into the synthetic control matching algorithm to control for structural conditions that may influence recovery dynamics. Fourth, we relax the requirement that counterfactual units must be drawn exclusively from the pool of SIDS and non-SIDS, thereby expanding the synthetic donor pool

while testing the sensitivity of results to country-type comparability. Fifth, we exclude the Grenada event, as it is the only non-RCF/RFI case after excluding Maldives 2004, and given that it had two separate disbursements in 2003 and 2004 due to consecutive hurricanes. Fifth, to account for heterogeneity across disaster types, we restrict the donor pool to events with the same type of natural disaster (flood, earthquake, storm, or volcanic activity) as the treated event. Furthermore, we include the change in the exports-to-GDP ratio in the disaster year as an additional predictor to proxy for disaster-induced disruptions in trade and production. This control helps capture the heterogeneity in economic impact that may arise from differences in sectoral exposure, particularly for small open economies where trade plays a significant role in aggregate output dynamics.

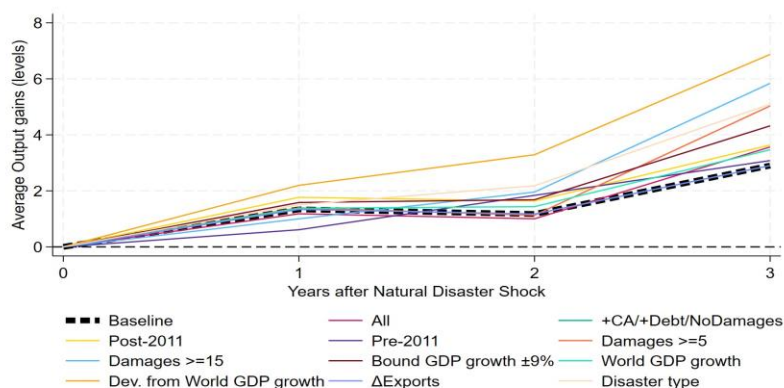
Lastly, to account for the vulnerability of SIDS and other treated countries to external shocks, particularly global demand shifts affecting tourism, commodity prices, and remittances, we include world real GDP growth as a predictor in the synthetic control estimation. Specifically, we run our baseline model with real GDP growth as deviations from world real GDP growth to incorporate global growth in both the pre-disaster and the treatment post-disaster period. The former allows the construction of counterfactual that match the treated units on global conditions experienced during and immediately after the disaster, improving the pre-treatment fit and internal validity. The latter controls for global macroeconomic exposure in the post-disaster recovery phase, helping isolate the effect of IMF post-disaster financing from broader global trends. This approach provides a robust test of the counterfactual, particularly for SIDS that are highly sensitive to external conditions. Furthermore, in another robustness test, we add pre-disaster world GDP growth by itself.

Figure 2 shows that our results are robust to these alternative specifications, reinforcing the credibility of our baseline estimates. The causal identification strategy remains valid even when including untreated events that occurred before the creation of RCF/RFI programs, as these countries may have been denied access not due to lack of need or eligibility, but rather because the instruments did not yet exist—rendering treatment assignment plausibly exogenous with respect to economic fundamentals. Moreover, restricting control units to those exhibiting similar pre-disaster GDP trajectories, within ± 9 percentage points of the treated unit, further strengthens the internal validity of the results by ensuring that growth patterns prior to the shock are aligned. Including additional predictors, such as world GDP growth or trade and macro variables, does not change the estimated synthetic weights because the original convex combination of control units already provides an optimal fit over the specified pre-treatment matching period; thus, the augmented predictors do not materially improve the mean squared prediction error (MSPE) and are effectively absorbed by the existing donor composition.¹⁶ Importantly, when our outcome variable is real GDP growth as deviations from world GDP growth, our results are even greater than the baseline, with slightly better goodness of fit (RMSPE decreased by 1 percent relative to the baseline).¹⁷ Across all robustness exercises, the estimated effects of IMF emergency financing on post-disaster recovery remain positive and quantitatively similar, supporting the interpretation that liquidity provision through the IMF's emergency instruments bolster recovery.

¹⁶ Following Ferman et al. (2020) recommendation of using only pre-treatment GDP growth lags as matching variables, excluding disaster damages and GDP growth the year of the disaster, Annex III.6 shows that the results remain quantitatively similar to the baseline (also with similar output gains dynamics).

¹⁷ As a robustness check, we re-estimate the model using the residuals from a regression of real GDP growth on world real GDP growth and a constant term. The results remain qualitatively similar, yielding a cumulative multiplier of 2.2. However, model fit deteriorates, with the RMSPE increasing by approximately 16 percent.

Figure 2. Robustness



Note: Fig. 2 shows the robustness test, excluding the event of Maldives in 2004: “All”, includes all types of events in the donor pool (SIDS and non-SIDS, irrespective of the type of country); “+CA/+Debt/No Damages”, adds to the baseline pre-disaster Current Account and Government Debt as percent of GDP and excludes damages; “Post-2011” and “Pre-2011”, restrict the donor pool to events that occurred after 2011 and before 2011, respectively; “Damages ≥ 5 ” and “Damages ≥ 15 ”, restrict the donor pool to events with damages (percent of GDP) greater than 5 and 15%, respectively; “Bound GDP growth $\pm 9\%$ ”, restrict the counterfactual to events within the range of GDP growth of ± 9 p.p. for each pre-disaster year and event; “World GDP growth”, adds pre-disaster world GDP growth as variable to match; “Dev. from World GDP growth”, redefines the outcome variable as deviations from world GDP growth and re-run the baseline; “ Δ Exports”, adds the change in exports (percent of GDP) the year of the disaster; and “Disaster type”, restricts the counterfactual to be drawn only by the same type of natural disaster.

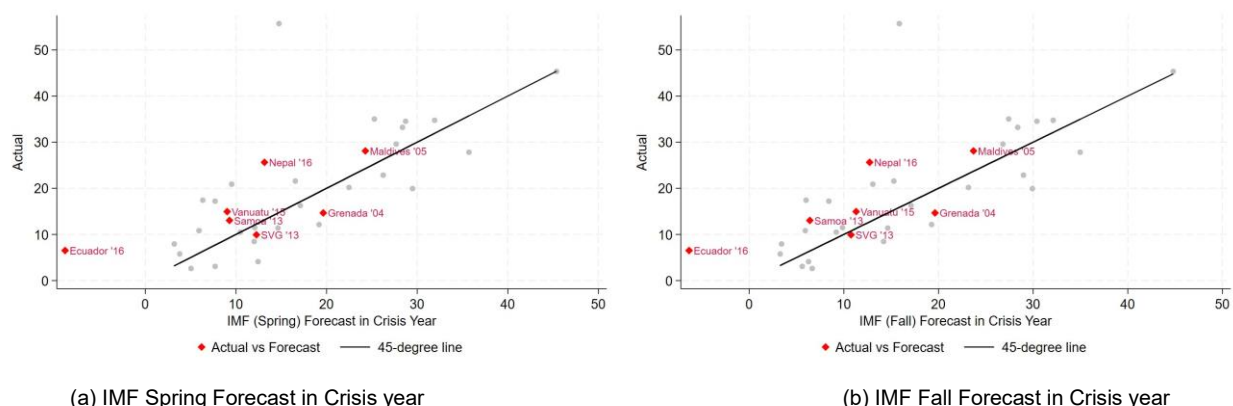
Among the various model specifications tested, the baseline delivers the lowest RMSPE, except when using the outcome variable defined as deviation from world GDP growth or when relaxing the SIDS donor pool restriction, which introduces heterogeneity in economic structures and institutional capacity. This reinforces the baseline’s selection as the preferred specification, given its superior in-sample fit and greater credibility of estimated impacts.

Threat to Identification

A potential concern in identifying the causal impact of IMF post-disaster financing is the selectivity in lending decisions, as the Fund typically provides support only when a country demonstrates adequate capacity to repay. This raises the possibility that countries receiving IMF support may already be systematically more resilient or better positioned for recovery, introducing endogeneity into treatment assignment. However, several features of the RCF and RFI mitigate this concern. These facilities are explicitly designed to provide rapid, low-conditionality support in response to exogenous shocks, such as natural disasters, with approvals typically occurring within weeks of the event. Moreover, our sample is limited to disaster events up to 2016, prior to the introduction of the 20 percent of GDP estimated damage threshold in 2017 for post-disaster access, further ruling out program selection based on damage magnitude thresholds. Importantly, Figure 3 shows that IMF staff did not systematically anticipate stronger recoveries in supported countries. For instance, in the case of Vanuatu, the IMF growth forecasts during the crisis year significantly underpredicted the country’s actual recovery path, suggesting that program approval was not based on foreknowledge of superior economic outcomes. By excluding events involving other macroeconomic crises (banking, currency, debt, or fiscal crises) and focusing solely on natural disasters as exogenous treatment triggers, we strengthen the plausibility of causal inference. Collectively, these features enhance the credibility of

our identification strategy and support the interpretation that observed recovery differences reflect the impact of IMF financing rather than selection bias.

Figure 3. Cumulative GDP Growth 3 Years After Disaster: Actual vs IMF Forecast Recovery



Potential Omitted Bias from other Financing Instruments

One potential concern in identifying the effects of IMF post-disaster financing is the possible confounding influence of other disaster risk financing (DRF) instruments that countries may have had in place at the time of the shock. Countries that accessed IMF emergency financing, may also have benefited from broader disaster risk financing strategies. These strategies could include ex ante instruments (e.g., contingency credit lines such as the World Bank's Catastrophe Deferred Drawdown Option, Cat- DDO), sovereign risk transfer mechanisms (e.g., regional insurance pools, catastrophe bonds), and ex post instruments such as the ability to issue external debt in international markets.

The concern is that the presence of these instruments may correlate with IMF support and may themselves contribute to better macroeconomic stabilization after disasters, thus confounding the estimated impact of IMF financing. In other words, if countries with better DRF preparedness also receive IMF support, our estimated effects may reflect this broader resilience, rather than the marginal effect of IMF financing alone.

To assess this concern, Table 2 provides a detailed mapping of the DRF instruments in place at the time of each disaster event in our sample, along with those of the respective counterfactual cases. The instruments included are sovereign insurance, contingent line of credit triggered by a natural disaster, and catastrophe bonds, among others. The table shows that most of these instruments, particularly contingent credit, and catastrophe bonds were not yet operational at the time of the disasters included in our sample. In many cases, they were introduced after the event studied, often in response to it. If available, as in the case of St. Lucia 2007 and Tonga 2014 (counterfactual), and Vanuatu 2015 (treated), these were pilot sovereign insurance risk transfer with limited size, relative to the exposure and disaster damages.¹⁸

¹⁸ While in the donor pool, Philippines 2013 and 2014 events had active contingent credit lines at the moment of the disaster, these two events are not selected to build the counterfactual of non-SIDS treated events.

This pattern provides suggestive evidence that omitted variable bias from other DRF instruments is likely limited in our setting, supporting the interpretation that the observed macroeconomic differences are primarily driven by IMF post-disaster financing.

Lastly, access to international capital markets can also be a confounding factor in estimating the macroeconomic effects of IMF post-disaster financing. Countries with the ability to issue sovereign bonds after a disaster may opt not to request IMF support, not because the support is unnecessary, but because alternative financing is available with fewer constraints or stigma. This selection mechanism introduces a downward bias in the estimated impact of IMF programs: countries without access to markets must rely on IMF emergency support, and their outcomes are compared against countries that might have had more financing flexibility but chose not to use the IMF.

Table 2. Disaster Risk Financing Instruments at Time of Disaster

Country-Event	Year	Ex-Ante Financing Instrument	Cat Bonds	Sov. Bonds	SIDS
Bhutan	2010	No	No	0.0	1
Bolivia	2008	No	No	0.0	0
Bulgaria	2014	No	No	.	0
Cambodia	2011	No	No	0.0	0
Cambodia	2013	No	No	0.0	0
China	2008	No	No	0.0	0
Dominica	2015	CCRIF (2015). US\$2.4m (0.5% GDP)	No	0.0	1
Ecuador	2008	No	No	0.0	0
Ecuador	2016	IADB's CCF (2014). US\$300m (0.3% GDP)	No	5.6	0
El Salvador	2005	No	No	2.6	0
Fiji	2009	No	No	0.0	1
Fiji	2012	No	No	0.0	1
Fiji	2016	No	No	0.0	1
Grenada	2004	No	No	6.9	1
Guatemala	2006	No	No	0.0	0
Lao P.D.R.	2009	No	No	0.0	0
Madagascar	2004	No	No	0.0	0
Maldives	2005	No	No	0.0	1
Micronesia	2015	No	No	.	1
Myanmar	2005	No	No	0.0	0
Myanmar	2016	No	No	0.0	0
Namibia	2009	No	No	.	0
Nepal	2015	No	No	0.0	0
Nigeria	2012	No	No	0.1	0
Philippines	2009	No	No	3.8	0
Philippines	2014	Contingent credits (JICA, Cat-DDO)	No	1.4	0
Samoa	2010	No	No	0.0	1
Samoa	2013	No	No	0.0	1
St. Lucia	2007	CCRIF (2007). US\$0.42m (0.03% GDP)	No	0.0	1
St. Vincent and the Grenadines	2011	CCRIF (2010). US\$1.1m (0.16% GDP)	No	0.0	1
St. Vincent and the Grenadines	2014	No	No	0.0	1
Thailand	2011	No	No	1.8	0
The Bahamas	2004	No	No	.	1
The Bahamas	2016	No	No	.	1
Tonga	2010	No	No	0.0	1
Vanuatu	2015	PCRAFI Pilot Insurance: US\$1.9m (0.25% GDP)	No	0.0	1

Note: Authors' calculations based on the CCRIF Payout database, official documents, World Bank, JICA, Asian Development Bank, IADB websites, and the World Bank's International Debt Statistics for sovereign bond issuance data. "." means that the country is not included in the database, but most likely to represent 0.0.

To address this potential confounding factor, we analyze the bond issuance behavior of all events in our sample—both treated events and those in the donor pool. The last column of Table 2 shows that most countries did not issue sovereign bonds in international markets during the year of the disaster. In a limited number of non-SIDS cases, some countries were able to issue debt internationally in the disaster year (e.g., El Salvador in 2005; the Philippines in 2009 and 2014—although not selected as a counterfactual in any event—Thailand in 2011; and Nigeria in 2012). Among the treated cases with IMF financing, Ecuador in 2016 and Grenada in 2004 also issued external debt in the same year as the disaster. However, the broader absence of market-based financing in SIDS and its limited availability in non-SIDS reinforces the credibility of our identification strategy. It reduces the likelihood that countries’ decision to engage with the IMF was driven by an ex-ante ability to self-finance through capital markets, particularly given our approach of restricting the donor pool by country type.

Beyond GDP: The Macro-Fiscal Impacts of IMF Post-Disaster Financing

While the short-term output effects of natural disasters are well known, their fiscal consequences, and the role of IMF post-disaster financing, remain less explored. In the wake of major disasters, governments must balance urgent recovery spending with fiscal and macroeconomic stability. IMF emergency instruments such as the ENDA, RCF, and RFI are designed to provide rapid financial support, catalyze donor aid, and alleviate financing constraints.

IMF staff assessments often underscore the scale of macro-fiscal shocks. After the 2015 Cyclone Pam in Vanuatu, for example, staff noted an expected economic contraction and a widening trade deficit, recommending grant financing and advising use of fiscal space for reconstruction. The government responded by suspending VAT and import duties on construction materials, deferring tax payments, and subsidizing key sectors, illustrating how IMF financing can enable countercyclical fiscal policy (IMF (2015)). This raises important questions: Does IMF emergency financing support proactive fiscal responses?; Does it crowd in aid or concessional loans?; What are its implications for debt and fiscal sustainability?; Understanding these dynamics is crucial for designing effective IMF interventions.¹⁹

We therefore estimate our model using a set of macro-fiscal outcome variables, $y_{i,h}$ in Equation (1). Specifically, we consider the following indicators, each expressed as a share of GDP: (i) total government expenditure, (ii) total revenues and grants, (iii) grants, (iv) average maturity of new external debt; (v) net fiscal lending/borrowing, (vi) total government debt, (vii) trade balance; and (viii) imports. For each specification, we add to our baseline specification, with damages and GDP growth dynamics, three years of pre-disaster data for the respective outcome variable to account for baseline fiscal dynamics. Figure 4 shows the results.²⁰

¹⁹ As shown in Marto et al. (2018), disaster-driven reconstruction can raise debt substantially, from 25% to over 90% of GDP in Vanuatu’s case, highlighting the need to balance recovery needs with long-term fiscal health.

²⁰ For the macro-fiscal outcomes, normalization is performed at $t - 1$ so that the figures preserve the contemporaneous response in the disaster year t . This is important for variables such as grants, debt, imports, and fiscal balances, where part of the adjustment may occur immediately after the shock. Normalizing at t would mechanically remove that initial effect. The synthetic-control specification for these outcomes mirrors the baseline—matching on real GDP growth in $t - 3$, $t - 2$, $t - 1$, and t , and disaster damages in year t , while additionally including lags of the fiscal outcome itself in $t - 3$, $t - 2$, and $t - 1$. The divergence at t therefore reflects the estimated impact in the disaster year relative to a counterfactual matched on pre-disaster macroeconomic and fiscal conditions.

The results reveal that countries receiving IMF rapid post-disaster financing engage in a significantly more countercyclical fiscal stance following natural disasters. Government spending (including consumption and investment spending) rises more strongly, by about 1 p.p. of GDP, relative to untreated events, with levels remaining elevated for up to three years before converging back to pre-disaster levels. Moreover, total government revenues, including grants, increase sharply in treated events. IMF post-disaster financing exhibits strong catalytic effects: official grants increase by about 2 p.p. GDP in the disaster year and remain about 1 p.p. higher one year after, before gradually converging to pre-disaster levels.²¹ At the same time, external debt maturity lengthens temporarily, alleviating immediate liquidity pressures and improving the concessionality of financing during reconstruction. These effects jointly ease fiscal constraints, support countercyclical public spending, and enhance short-term debt sustainability in the aftermath of major disasters.

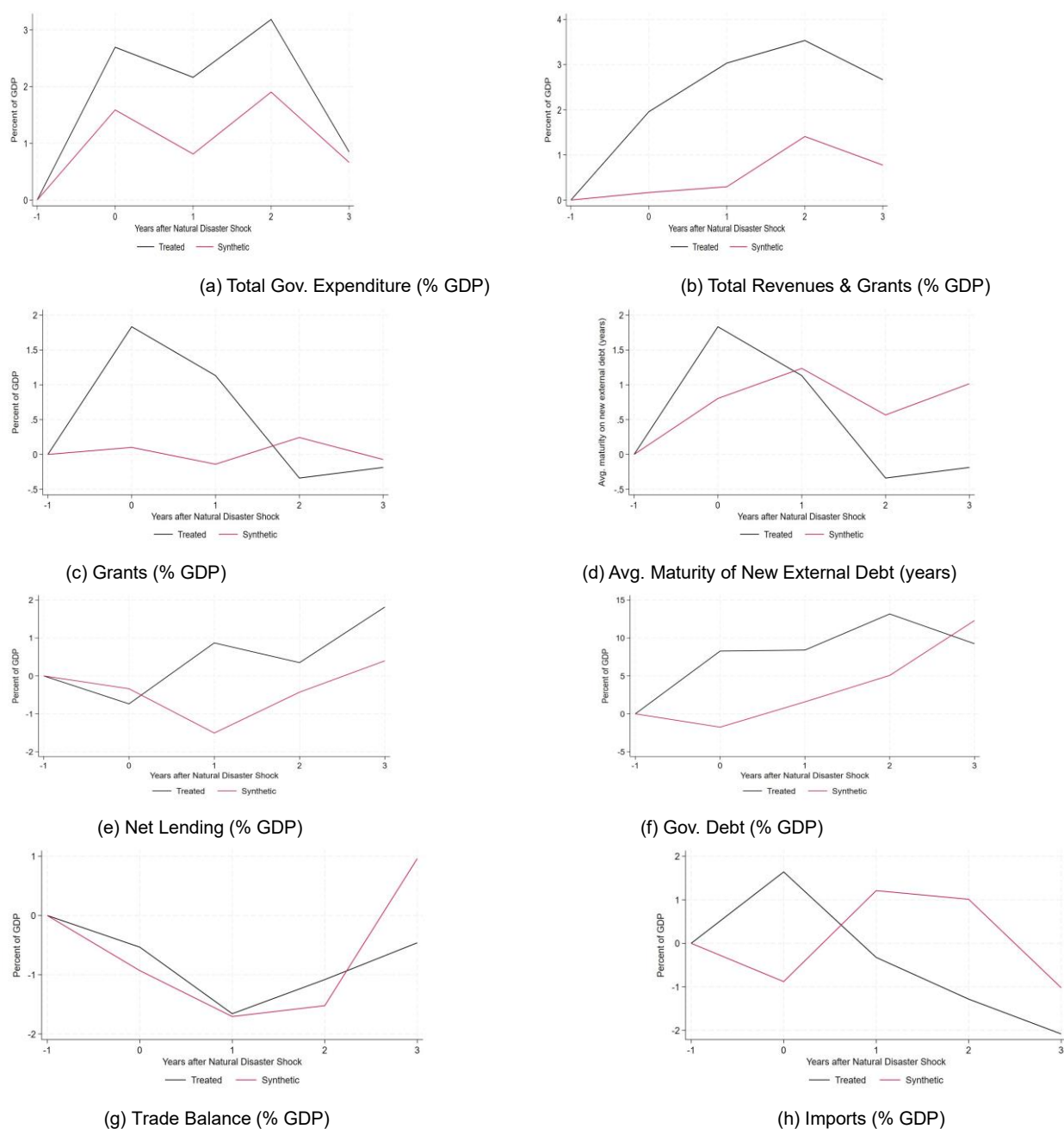
While external grants surge in the year of the disaster, domestic tax revenues rise over the medium term. This pattern suggests that IMF-supported programs may facilitate institutional and policy reforms aimed at boosting revenue mobilization, even in the absence of formal conditionality, emphasizing the catalytic role of multilateral institutions in strengthening the economy and tax systems [Newiak and Willems \(2017\)](#).²²

Because both spending and grants increased significantly during the disaster year, overall fiscal deficits in IMF-supported events deteriorate slightly more in the disaster year than counterfactuals, suggesting that the programs allow countries to maintain or even enhance fiscal space for reconstruction. In fact, relative to the pre-disaster year, while still in deficit, these are lower due to rising revenues, indicating that fiscal policy is simultaneously countercyclical and anchored. However, public debt rises significantly in both treated and untreated events. However, the dynamics are different: in IMF supported cases, debt increases are frontloaded, supporting reconstruction and faster recovery. These findings reinforce recent work showing the frameworks ([IMF \(2022\)](#)). On the external side, trade balances deteriorate sharply, by about 1.8 p.p. of GDP in both types of countries, highlighting the import surge needed for reconstruction and the potential eligibility of events for IMF financing given the BOP needs. However, countries with IMF financing are able to rapidly increase imports on the disaster year, consistent with a smoother external adjustment path enabled by liquidity support, in opposition of counterfactual events where imports decrease.

²¹ Our findings align with [He et al. \(2024\)](#), which documents that a 1 p.p. of GDP increase in IMF disbursements catalyzes about 2.7 p.p. of GDP in additional official aid, mainly from multilateral donors.

²² For example, Vanuatu introduced an economic citizenship program that, two years after Cyclone Pam, raised 3.7 percent of GDP in revenues, and increased its VAT rate from 12.5 percent to 15 percent three years after the disaster.

Figure 4. Exploring the Macro-Fiscal Channels



Note: This figure shows the average impact of large natural disasters on fiscal variables in treated events and their synthetic controls, relative to T-1 (one year before the disaster). Black line: average from the 6 treated large natural disasters with IMF support (excluding the Maldives 2004 event). Red line: average of their synthetic controls. Pre-disaster macro-fiscal variables as a share of GDP are matched by construction, including real GDP growth and damages in the year of the disaster. The disaster-year macro-fiscal outcomes are excluded from the predictor set to allow them to adjust freely post-disaster.

Taken together, these results provide empirical support for the view that IMF rapid post-disaster financing facilitates a more effective and timely macroeconomic response. By allowing higher government spending, catalyzing external grant inflows, and temporarily improving debt terms, IMF support

plays a critical role in fostering countercyclical policy responses that mitigate the adverse effects of large natural disasters. These findings contribute to the growing literature on macroeconomic management of disaster shocks and underscore the value of rapid multilateral assistance as both a liquidity buffer and a policy signal in the aftermath of catastrophic events.

Final Comments

Countries increasingly recognize the need for comprehensive DRF strategies to manage fiscal risks and mitigate the macroeconomic consequences of natural disasters (IMF (2019)). These strategies typically combine ex ante instruments, such as contingency funds, insurance, or catastrophe bonds, with ex post instruments, including concessional loans or donor support. In this context, post-disaster IMF financing, such as the early ENDA, the RCF or RFI arrangements, can serve as an additional ex post shock-response tool, providing swift and predictable liquidity injections to governments facing sudden financing gaps. For countries with limited fiscal buffers or restricted market access, this type of financing helps stabilize macroeconomic conditions, maintain essential public services, and catalyze additional support, thus playing a critical role in mitigating the short-term economic downturn and facilitating recovery. Notably, countries that have accessed the ENDA, RFI or RCF are often small island developing states that are highly exposed to frequent natural disasters, which impose disproportionately large economic costs relative to their GDP. As part of a broader DRF strategy, access to IMF emergency lending enhances a country's preparedness and improve the macro-fiscal response to disasters by complementing other risk-layered instruments (i.e., contingent credit lines (e.g., Cat-DDO), insurance schemes (e.g., CCRIF), and budgetary buffers).

Our results indicate that these instruments yield GDP multipliers greater than one, highlighting the strong countercyclical impact of IMF support in high-risk, disaster-prone economies. These findings support the use of rapid IMF financing as a key tool in the global disaster response toolkit. They suggest that maintaining or even increasing the availability of such funding (e.g., via the RCF/RFI's natural disaster windows) could have high returns in terms of economic stabilization. Introduced as a dedicated disaster risk financing window since 2017, the RCF/RFI instruments are specifically tailored to address large natural disasters, defined as those exceeding 20 percent of GDP in damages, and are particularly relevant for SIDS, which face disproportionate exposure to natural disaster-related shocks. The catalytic role of IMF post-disaster support is central to its effectiveness: by signaling macro-policy credibility and providing upfront liquidity, IMF financing can enable larger reconstruction spending, reducing the need for inefficient fiscal reallocation, and crowds in donor grants and concessional debt. In the post-disaster context, this high return reflects the urgency and magnitude of the financing gap, and the IMF's unique capacity to help close it rapidly and catalytically. At the same time, the resulting increase in public debt underscores the need for credible medium-term fiscal plans and post-disaster consolidation to maintain debt sustainability.

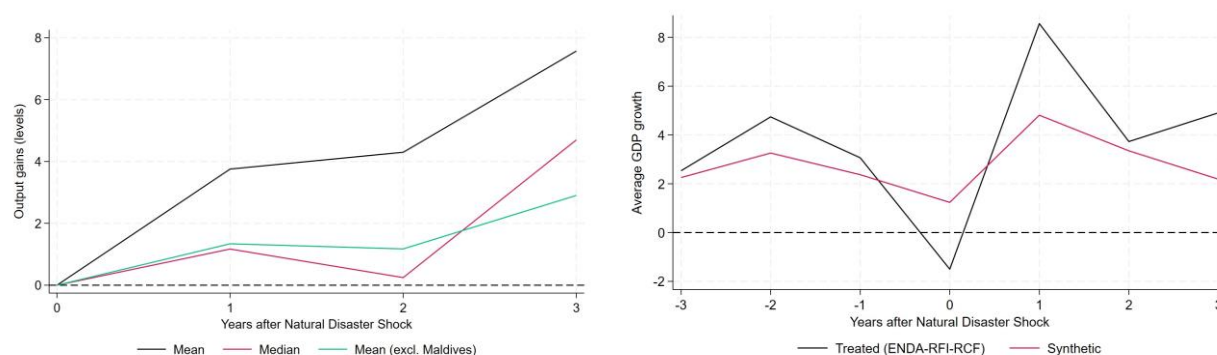
Annex I. Donor Pool

Annex Table AI.1. Treated (bold) and Untreated Natural Disaster Events

Country	Disaster type	Year	Damages (% GDP)	SIDS	Treated
Bolivia	Storm	2008	7.5	0	0
Ecuador	Flood	2008	2.8	0	0
Ecuador	Earthquake	2016	2.6	0	1
El Salvador	Flood	2005	4.0	0	0
Guatemala	Storm	2006	6.2	0	0
The Bahamas	Storm	2004	28.2	1	0
The Bahamas	Storm	2016	6.5	1	0
Grenada	Storm	2004	242.7	1	1
St. Lucia	Storm	2007	4.6	1	0
St. Vincent and the Grenadines	Flood	2014	19.4	1	1
Bhutan	Earthquake	2010	3.9	1	0
Myanmar	Flood	2005	9.7	0	0
Myanmar	Earthquake	2016	2.4	0	0
Cambodia	Flood	2011	5.1	0	0
Cambodia	Flood	2013	3.7	0	0
Lao P.D.R.	Storm	2009	2.4	0	0
Maldives	Earthquake	2005	72.1	1	1
Nepal	Earthquake	2015	29.3	0	1
Philippines	Storm	2009	2.4	0	0
Philippines	Storm	2014	6.2	0	0
Thailand	Storm	2011	16.0	0	0
Madagascar	Storm	2004	6.3	0	0
Nigeria	Flood	2012	4.1	0	0
Namibia	Flood	2009	2.5	0	0
Fiji	Flood	2009	2.1	1	0
Fiji	Flood	2012	3.2	1	0
Fiji	Storm	2016	16.3	1	0
Vanuatu	Storm	2015	74.6	1	1
Samoa	Earthquake/Storm	2010	25.8	1	0
Samoa	Storm	2013	23.7	1	1
Tonga	Earthquake/Storm	2010	3.9	1	0
Micronesia	Storm	2015	4.5	1	0
Bulgaria	Flood	2014	2.1	0	0
China	Flood	2008	3.6	0	0

Annex II. Main Specification Including Maldives Case

Annex Figure All.1. Output Gains of IMF-Post Disaster Financing Incl. Maldives 2004 Event



(a) Output gains: Treated-Synthetic

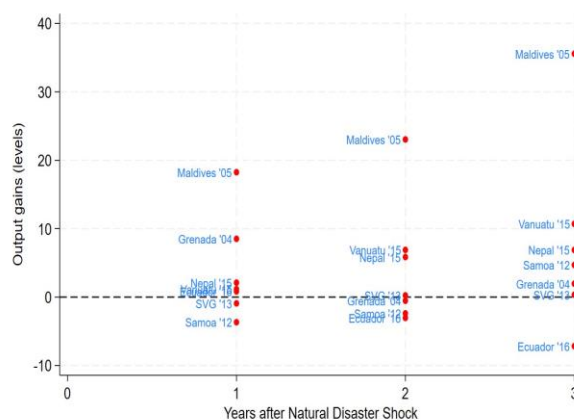
(b) Avg. GDP growth underlying level differences

Note: Figure (a) shows the output gains associated with IMF post-disaster financing. Implied real GDP level effects from main specification computed as the average treated observation's cumulative growth minus their respective synthetic control's cumulative growth at that horizon. Figure (b) shows real GDP growth underlying the estimated output gains. The black line represents the average of the 7 treated large natural disaster events with IMF support (including Maldives 2004), while the red line shows the average of their synthetic controls. Pre-crisis real GDP growth (including the disaster year) and disaster-related damages (as a share of GDP) are matched by construction.

Annex III. Robustness

AIII.1. Dispersion Around Estimated Main Average Effect

Annex Figure AIII.1. Scatter Plot of Estimated Effects for Treated Events



Note: This Figure shows the scatter plot of implied real GDP level effects for each treated event relative to their synthetic control at each horizon.

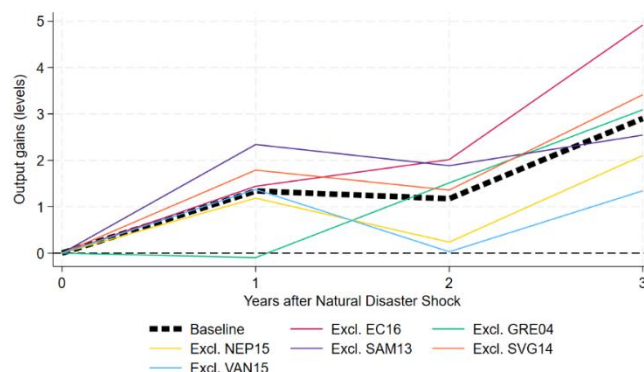
Annex Table AIII.2. Synthetic Control Weights across Donor Pool Events

Event		Damages (% of GDP)	Ecuador 2016	Nepal 2015	Samoa 2013	Vanuatu 2015	SVG 2014	Grenada 2004	Maldives 2005
Bolivia	2008	7.5	0	0	0	0	0	0	0
Ecuador	2008	2.8	0	0	0	0	0	0	0
El Salvador	2005	4.0	0	0	0	0	0	0	0
Guatemala	2006	6.2	0	0	0	0	0	0	0
The Bahamas	2004	28.2	0	0	0.726	0	0	0	0
The Bahamas	2016	6.5	0	0	0	0.559	0.312	0	0
St. Lucia	2007	4.6	0	0	0	0.389	0.171	0.172	0
Bhutan	2010	3.9	0	0	0	0	0	0	0
Myanmar	2005	9.7	0	0	0	0	0	0	0
Myanmar	2016	2.4	0	0	0	0	0	0	0
Cambodia	2011	5.1	0	0	0	0	0	0	0
Cambodia	2013	3.7	0	0	0	0	0	0	0
Lao P.D.R.	2009	2.4	0	0	0	0	0	0	0
Philippines	2009	2.4	0	0.614	0	0	0	0	0
Philippines	2014	6.2	0	0	0	0	0	0	0
Thailand	2011	16.0	0	0.027	0	0	0	0	0
Madagascar	2004	6.3	0	0	0	0	0	0	0
Nigeria	2012	4.1	0.197	0	0	0	0	0	0
Namibia	2009	2.5	0.512	0.359	0	0	0	0	0

Fiji	2009	2.1	0	0	0	0.003	0	0	0
Fiji	2012	3.2	0	0	0	0	0.397	0.828	0
Fiji	2016	16.3	0	0	0	0	0	0	1
Samoa	2010	25.8	0	0	0	0	0	0	0
Tonga	2010	3.9	0	0	0.274	0	0	0	0
Micronesia	2015	4.5	0	0	0	0.05	0.12	0	0
Bulgaria	2014	2.1	0.291	0	0	0	0	0	0
China	2008	3.6	0	0	0	0	0	0	0
Total			1.00	1.00	1.00	1.00	1.00	1.00	1.00

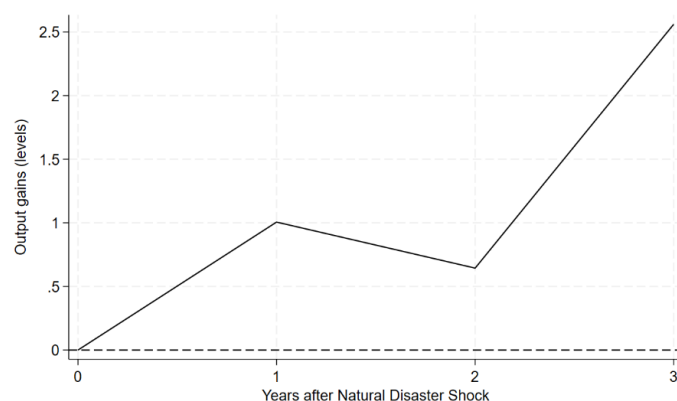
Note: This table reports, for each treated event, the weights assigned to each donor-pool event in the baseline specification. SVG = St. Vincent and the Grenadines.

Annex Figure AIII.3. Robustness: The Main Average Effect is not Driven by any Individual Case

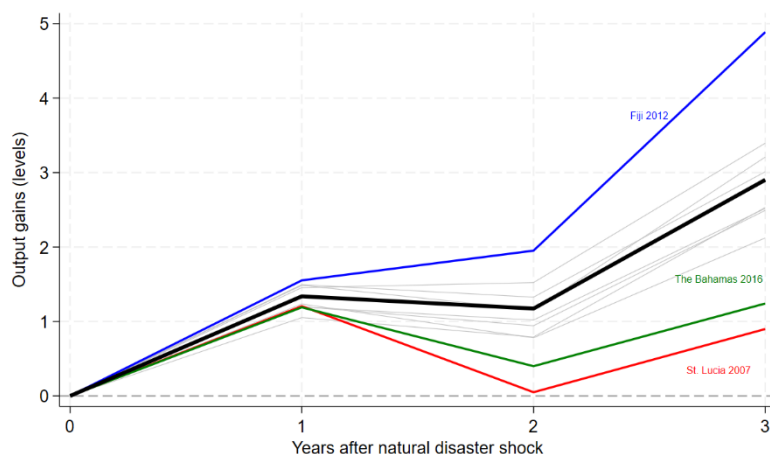


Note: This Figure shows the output gains associated with IMF post-disaster financing implied real GDP level effects from main specification computed as the average treated observation's cumulative growth minus their respective synthetic control's cumulative growth at that horizon, for the baseline (includes all treated events), and excluding one treated event at a time.

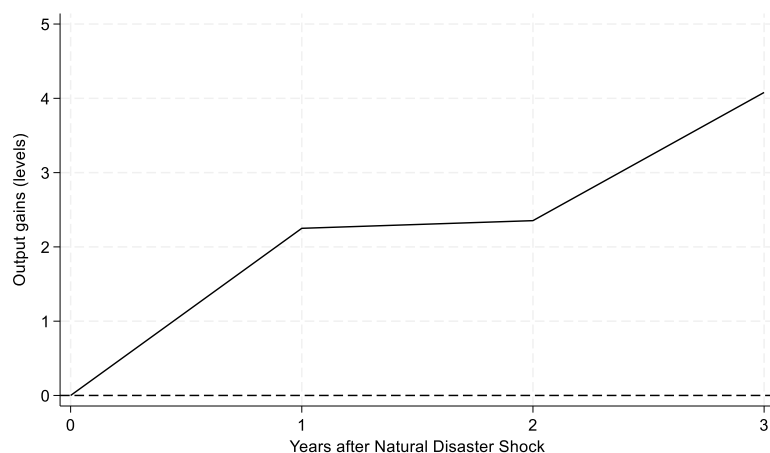
Annex Figure AIII.4. Robustness: Extending the Pre-treatment Matching Window to Five Years before the Disaster Event by adding $t - 5$ and $t - 4$ does not Materially Alter the Baseline Results



Note: This figure shows a robust exercise in which the synthetic-control model is re-estimated with a longer pre-treatment window, matching on real GDP growth in $t - 5$ through t and disaster damages in year t . Donor pools remain stratified between SIDS and non-SIDS events, and Maldives 2005 is excluded from the treated sample average, as in the baseline. The Figure reports the average cumulative treatment effect across treated events relative to their synthetic counterfactuals.

Annex Figure AIII.5. Robustness: The Main Average Effect is not Driven by any Donor Pool Event

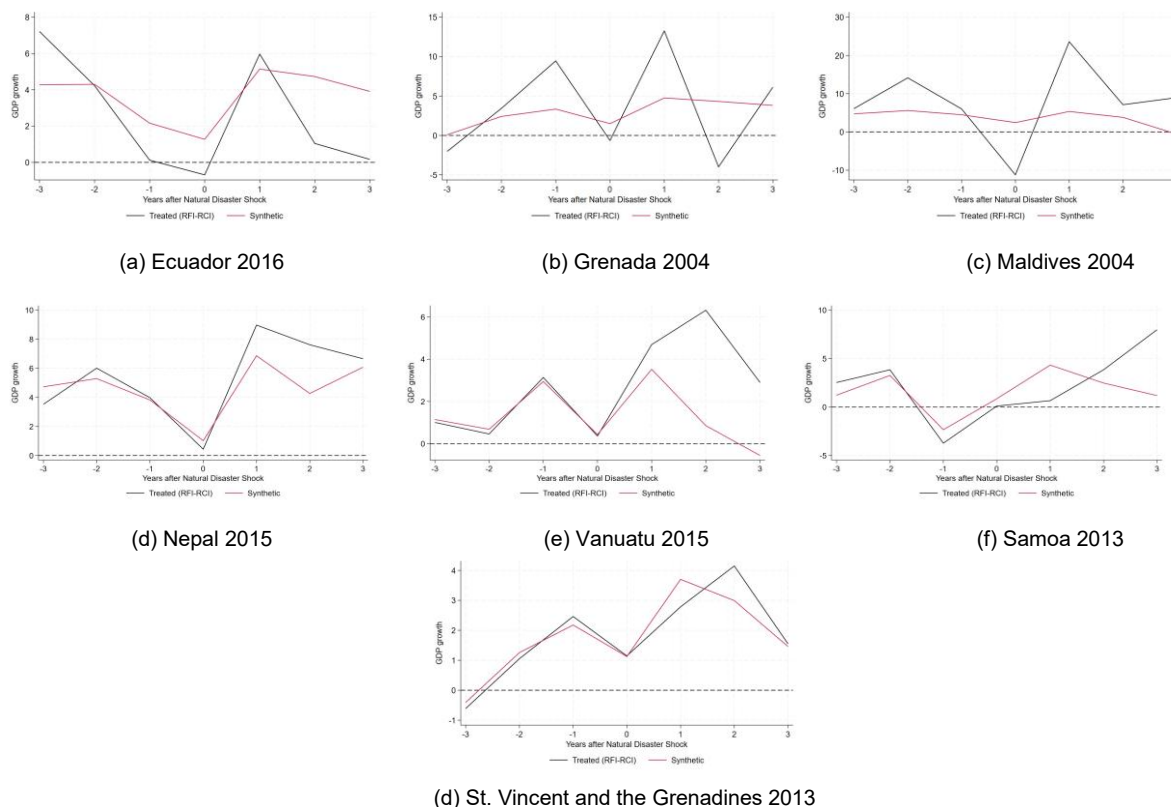
Note: This Figure shows the leave-one-donor-out robustness exercise, in which each donor-pool event is excluded one at a time and the average treatment effect is recomputed across the treated events. When the omitted donor belongs to the SIDS (non-SIDS) pool, only the synthetic controls for SIDS (non-SIDS) treated units are re-estimated, while treated units whose donor pool is unaffected retain their baseline estimates. Black line is the baseline average effect, and the gray lines are each leave-one-donor-out average effect. The highlighted lines correspond to the three donor-pool events whose exclusion generates the largest deviation from the baseline average effect: St. Lucia 2007 (red), Fiji 2012 (blue) and The Bahamas 2016 (green).

Annex Figure AIII.6. Robustness: No Covariates

Note: This figure shows a no-covariates robustness exercise in which synthetic control is estimated using only pre-treatment real GDP growth at $t - 3$, $t - 2$, and $t - 1$, excluding disaster damages and GDP growth in the disaster year. Donor pools remain stratified between SIDS and non-SIDS events, and Maldives 2005 is excluded from the treated sample average, as in the baseline. The chart reports the average cumulative output gain of treated events relative to their synthetic counterfactuals.

AIII.7. Individual Event Studies: GDP Growth Treated and Synthetic

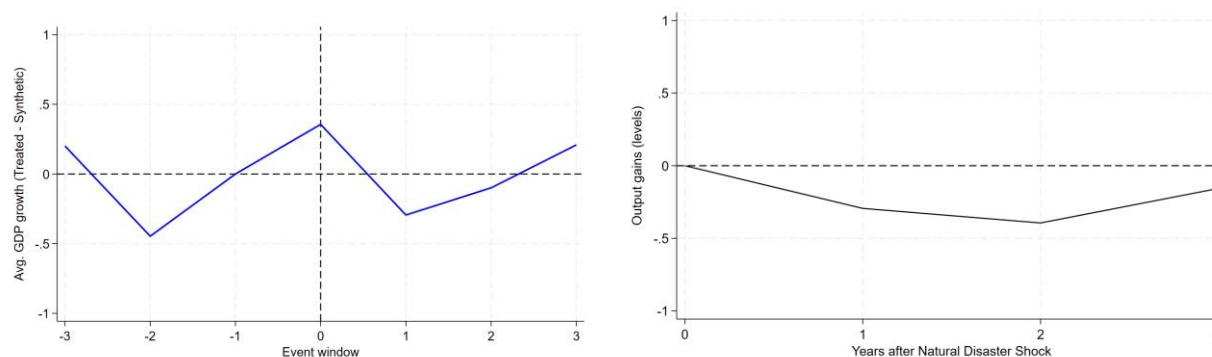
Annex Figure AIII.7. Event Studies: GDP Growth



Note: This shows, for each treated event (black line), the real GDP growth around the large natural disaster shock and their respective real GDP growth of their synthetic control (red line), estimated using Eq. (1) in the baseline specification. Pre-crisis real GDP growth (including the disaster year) and disaster-related damages (as a share of last year GDP) are matched by construction.

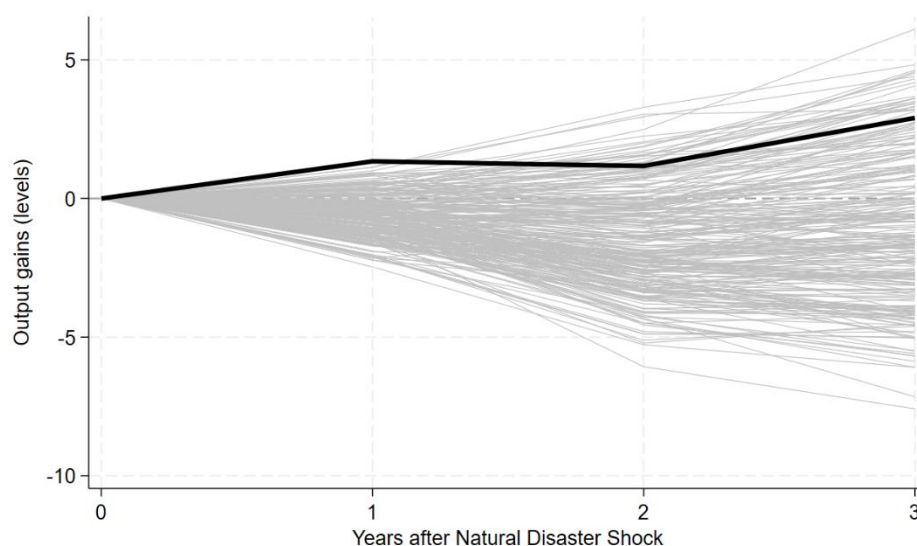
AIII.8. Placebo Test

Annex Figure AIII.8.1 Placebo: Average GDP Growth



Note: Figure (a) on the left shows the average GDP growth difference between the treated placebo and its synthetic for the 27 untreated disaster events. Figure (b) on the right shows the output difference in levels relative to the GDP level of the disaster year.

Annex Figure AIII.8.2 Placebo in Space Distribution Test



Note: This Figure reports placebo-in-space randomization inference for the average treatment effect. The black line reports the actual average treatment effect across the six treated events under the baseline specification. The gray lines report placebo-average effects obtained by reassigning treatment to donor-pool events within the corresponding stratified donor pools, re-estimating the synthetic control, and averaging one randomly drawn placebo path for each treated event. Placebo runs with poor pre-treatment fit are excluded based on an RMSPE filter. A baseline effect that lies above most placebo paths is consistent with the interpretation that the estimated effect is unlikely to be random.

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