INTERNATIONAL MONETARY FUND

IMF Country Report No. 19/63

EASTERN CARIBBEAN CURRENCY UNION

SELECTED ISSUES PAPER

February 2019

This Selected Issues paper on Eastern Caribbean Currency Union was prepared by a staff team of the International Monetary Fund. It is based on the information available at the time it was completed on December 21, 2018.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
PO Box 92780 • Washington, D.C. 20090
Telephone: (202) 623-7430 • Fax: (202) 623-7201
E-mail: publications@imf.org Web: http://www.imf.org
Price: $18.00 per printed copy

International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

EASTERN CARIBBEAN CURRENCY UNION

SELECTED ISSUES

December 21, 2018

Approved By
Western Hemisphere Department

Prepared By A. Guerson, B. Lissovolik (all WHD),

CONTENTS

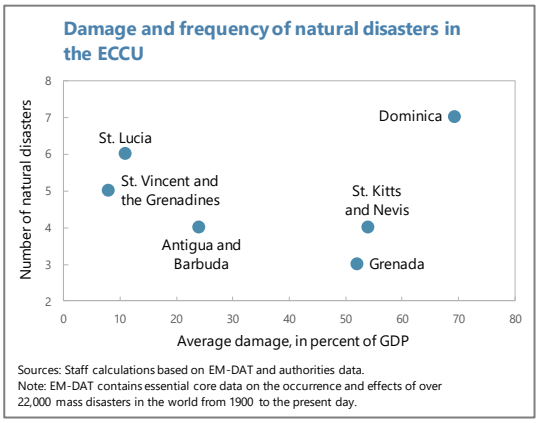
BOX

APPENDICES

BUILDING EX-ANTE RESILIENCE TO NATURAL DISASTERS[1]

A. Introduction

1. Natural disasters (NDs) recurrently affect the Easter Caribbean Currency Union (ECCU), resulting in human loss, destruction of infrastructure, and fiscal costs. Natural disasters put pressure on government's finances in the near and long term. In the near term, pressures arise from unanticipated needs for immediate social protection and rehabilitation expenditures, at a time when revenues typically decline. In the long term, the costs of ND contribute to the ratcheting up of public debt (Acevedo, 2014). For developing small states such as in the ECCU, which are subject to larger and more frequent disasters that affect the entire economy, NDs can have a large impact on the economy and on government finances (text chart).



2. Ex-ante buffers and insurance coverage in ECCU countries is insufficient. The private sector is in general uninsured or underinsured for ND, especially the most vulnerable segments of the population, typically the majority and most exposed. Because of insufficient market-based insurance, governments become the de-facto ultimate insurer, especially for extreme ND events. This means that governments are typically called to cover not only the costs of destruction of public infrastructure, but also a significant share of private losses. Government are also asked to provide for social support, adding to the fiscal pressures. The Caribbean Catastrophe Risk Insurance Facility (CCRIF), to which all ECCU countries have access, have been a valuable instrument, but most countries risk ceding remains below needs mainly because of the perceived high cost and competing developmental needs under fiscal sustainability challenges, and the imperfect correlation between parametric triggers for disbursement and damages.

3. Limited fiscal space constrains resilient investment. Resilient investment is limited, with countries' efforts and resources allocated mainly to ex-post recovery and reconstruction. Resilient investment is costlier than non-resilient, resulting in difficult spending allocation trade-offs. Political economy factors can also play against government incentives for investment in resilience, as benefits may not be clear to voters in the short term.

4. The results in this paper underscore the importance of a shift from ex-post recovery to a focus on ex-ante resilience building. The region currently invests little in resilience building, with policy response and financing occurring after counties have been hit, resulting in high population exposure and

[1] Prepared by Alejandro Guerson (WHD).

significant asset loss. Recurrence and relatively high frequency of NDs in the ECCU also imply that these costs are incurred multiple times, before structures are fully amortized.

5. Ex-ante resilient investment and insurance are key to the welfare and financial sustainability of the ECCU, given high intensity and recurrence of NDs. Government insurance can provide financing after a ND for immediate relief and rehabilitation. In addition, insurance can strengthen fiscal sustainability because the cost of insurance premia implies internalization of expected costs of NDs' damages, reducing the need for debt financing after NDs with insurance payouts. Acevedo (2014) finds that tropical storms and hurricanes have a negative effect on growth and a permanent effect on debt accumulation for a subsample of Caribbean countries. The recurrence of NDs implies that their fiscal costs can derail existing efforts to improve fiscal sustainability if this expected source of financial stress is not addressed. Resilient investment can limit asset loss and better support output recovery after NDs. Chapter 2 in this Selected Issues Paper (SIP) shows that including costs and returns of ex-ante resilient investment in robust fiscal frameworks for ECCU countries can accommodate the costs while supporting fiscal sustainability.

6. This paper presents a quantification of the long-term benefits of ex-ante resilient investment and insurance needs against NDs. The paper proceeds in two sections. Section B presents cost-benefit analysis of resilient investment based on a dynamic stochastic general equilibrium model tailored to small states and calibrated to all ECCU economies. Section C quantifies government insurance coverage needs and costs using an empirical stochastic model that simulates NDs fiscal costs. The insurance needs are framed within the World Bank insurance layering framework. Section D concludes.

B. Resilient Investment: Model Simulations

7. This section present cost-benefit analysis of investment in resilient structures in ECCU countries. Resilient investment is costly. It requires additional spending for a given level of investment in physical terms. Benefits, on the other hand, result from lower destruction and capital replacement costs and reduced output loss after NDs. In addition, resilient investment can have a multiplicative effect on output. The decline in losses and destruction implies higher expected returns to private investment when public infrastructure is resilient. This can induce an increase in private investment and capital stock. Moreover, higher investment and capital increase labor productivity. In countries affected by out-migration such as in the ECCU, this can imply an increase in employment by inducing inward migration or reducing out-migration (text chart). Ultimately, higher investment and employment reinforce each other with positive feedback, resulting in a potentially large multiplicative effect on output. This section seeks to quantify these output gains.

Key Model Assumptions

8. The analysis is based on a dynamic stochastic general equilibrium model tailored to capture key features of small states affected by NDs. The model includes four sectors (Appendix I includes a more detailed presentation):

- *Private Investor Household*. It invests physical capital and hires labor to produce a single tradable good competitively. It makes rational investment decisions to maximize the value of household consumption intertemporally. Output decisions depend on factor costs and productivity and also on the stock of public infrastructure invested by the government. Private capital can be destroyed by NDs. Private investors can also hold foreign assets, allowing externally financed investment –important in small island states with large tourism sectors financed with foreign direct investment (FDI). Investor households pay taxes on investment returns and consumption and receive government transfers.

- *Private Worker household*. It supplies labor in the domestic economy to private investors. It can also migrate to work outside the economy and send remittances to the household. It displays hand-to-mouth consumption behavior (no savings), implying it allocates labor to maximize concurrent consumption. It pays labor and consumption taxes to the government and receives government transfers.

- *Government Worker household*. It works in the public sector. It displays hand-to-mouth consumption behavior (no savings), consuming its income in the concurrent period. It pays labor and consumption taxes to the government and receives government transfers.

- *Government*. It collects tax revenues on consumption, capital returns, and wages. Nontax revenues are also collected –capturing mainly grants and Citizenship-by-Investment programs in ECCU countries. Expenditures include public wages, purchase of the tradable good, transfers to all households, interest on public debt, and public investment. Public investment can be of two types: resilient to NDs, and non-resilient. Resilient investment is not damaged by ND shocks, but it is costlier. Both types of capital are assumed to be perfect substitutes in production –their contribution to output is the same.[2]

9. The model's aggregate production function illustrates the interaction among the participating sectors and their contribution to output, ultimately informing the role of resilient investment. The production function takes the form

$$Y_t = A_t\, \theta_t {K_{t-1}^g}^{\alpha g} {K_{t-1}}^{\alpha k} L_t^{d\,\beta}$$

where Y_t is output; A_t is total factor productivity (TFP); $\theta_t \in (0,1]$ captures efficiency loss in periods t in which the economy has been hit by a ND; K_{t-1}^g is public capital stock determined by government investment; K_{t-1} is private capital stock; and L_t^d is private household labor allocated in the domestic economy. Changes to public capital, private capital, and labor as households react to government's

[2] This implies, for example, that a road or bridge resilient to natural disasters provides the same service as one that is non-resilient. Depreciation rates of both types of capital are assumed to be the same, except when affected by a natural disaster. In this case, non-resilient capital suffers a depreciation shock.

decisions on resilient investment underpin the model's predictions on output and other key economic indicators. $\alpha g < 1$; $\alpha k < 1$; $\alpha k + \beta = 1$. A is assumed to remain constant.

10. Non-resilient public capital and private capital are subject to a random depreciation shocks in periods with NDs. NDs are assumed to be randomly distributed in line with intensity and frequency in the data. Capital stocks evolve according with the following laws of motion:

$$K_t^r = K_{t-1}^r(1-\delta) + I_t^r$$

$$K_t^n = (1-D_t)K_{t-1}^n(1-\delta) + D_t \int K_{t-1}^n(1-\delta-\delta_t^D)\ f(\delta_t^D)d\delta_t^D + I_t^n$$

$$K_t = (1-D_t)K_{t-1}(1-\delta) + D_t \int K_{t-1}(1-\delta-\delta_t^D)\ f(\delta_t^D)d\delta_t^D + I_t$$

where K_t^r is resilient public capital; K_t^n is non-resilient public capital; $K_t^g = K_t^n + K_t^r$. D_t is a dummy variable that takes the value $D_t = 1$ in periods in which the economy is hit by a ND, $D_t = 0$ otherwise. D_t has a binomial distribution with two possible outcomes, "disaster" and "no-disaster", with annual probability of a ND $P(D) = P$ to be set in the calibration –therefore $1/P$ is the frequency of NDs. The probability density function $f(\delta^D)$ governs the distribution of capital destruction shocks δ_t^D by NDs. Notice that resilient capital is not affected by ND shocks, while non-resilient public capital and private capital are both destroyed by NDs.[3]

11. The government is assumed to follow a passive fiscal policy, with revenue and expenditure instruments set exogenously as policy variables. $K^g = K^n + K^r$ is determined by government investment, which in the model are set as an exogenous policy decision according to public investment allocations $I^g = I^n + I^r$. I^r is assumed to be costlier than I^n, with a price $p^r > 1$ – tradable output price is normalized to be equal to 1. The government is not assumed to follow any specific fiscal policy rule nor optimization decision process. It is assumed to follow a passive tax revenue and expenditure stance, maintaining recurrent and capital expenditures constant in real terms. This assumption allows the treatment of government revenue and expenditure parameters as policy variables –including tax rates, level and composition of public investment.

12. The government can borrow externally. Public debt evolves according to the identity

$$B_t = (1+r)B_{t-1} + G_t - R_t$$

where B_t is the sock of public debt; r is the interest rate on public debt. Primary expenditures G_t and revenues R_t are determined are by

$$G_t = (1+\tau^c)C_t^g + (1+\tau^L)w^g L_t^g + T_t + I_t^n + p^r I_t^r$$

[3] The assumption that resilient capital is completely unaffected by the natural disaster seems extreme considering real-life events, where even resilient structures can be damaged albeit by a lesser extent. This assumption simplifies the model solution, and it is not critical for the generality of the results. For example, the model could be calibrated so that the share of resilient vs. non-resilient capital matches the expected combined destruction of the aggregate capital stock, including of resilient structures.

$$R_t = \tau^c C_t + \tau^L\left(L_t^d + L_t^g\right) + \tau^K r_t^K + NT_t$$

where C_t^g is government consumption; L_t^g is public sector employment; $T_t = T_t^g + T_t^L + T_t^k$ is transfers to government worker, private worker households, and investors, respectively; and $I_t^n + p^r I_t^r$ is public investment. With τ denoting tax rates, government revenues are determined by consumption taxes $\tau^c C_t$; $C_t = C_t^g + C_t^w + C_t^k + C_t^{wg}$ consumption by the government, private workers, private investors, and government workers; labor taxes on domestic private and public sectors $\tau^L\left(L_t^d + L_t^g\right)$; taxes on capital returns $\tau^K r_t^K$; and non-tax revenues NT_t –which in the ECCU includes mainly donor grants and Citizenship-by-Investment (CBI) revenues.

13. The model assumptions imply that private investment, and thus private capital stock and output, are increasing in the share of resilient public investment. This can be illustrated by inspection of the expected output equation

$$E_{t-1}Y_t = (1-P)\,A_t\,(K_{t-1}^r + K_{t-1}^n)^{\alpha g} K_{t-1}{}^{\alpha k} L_t^{d\,\beta} + P\,A_t\theta_t \int [K_{t-1}^r + K_{t-1}^n(1-\delta_t^D)]^{\alpha g}[K_{t-1}(1-\delta_t^D)]^{\alpha k} L_t^{d\,\beta}\, f(\delta_t^D) d\delta_t^D$$

where E_{t-1} is the expectations operator as of period $t-1$. With probability $1-P$ there is no ND and output can be produced using the full amount of capital invested prior to period t. With probability P there is a ND which destroys non-resilient public capital and private capital by a share δ_t^D. The expected output equation implies that expected marginal productivities of private capital and labor are decreasing in the share of non-resilient public capital, as determined by δ_t^Din the second term. In other words, private capital and labor employment are high when resilient public capital is also high. This is because expected private output loss is smaller for given NDs' frequency $1/P$ and intensity distribution $f(\delta_t^D)$. As a result, expected private investment returns and thus private capital and output are higher with more resilient public investment. A change in the share of resilient vs. non-resilient capital has a positive permanent or "structural" impact on output.

14. Resilient public capital and the resulting increase in private investment improves labor marginal productivity, inducing upward wage pressure and inward migration. Labor employed in the domestic economy L_t^d can take different values depending on labor migration decisions and on the occurrence of a ND in each period. Domestic labor supply adjusts until domestic wages and domestic labor marginal productivity are equal to the international wage (labor opportunity cost), that is, when private sector labor is indifferent between working domestically vs. abroad (see Appendix I).[4] The increase in the share of resilient public capital with the corresponding increase in private capital explained above put upward pressure on marginal labor productivity and domestic wages, inducing inward migration -or reducing outward migration. This also reduces remittance flows to the private worker household –remittances are assumed to be a share of foreign wage

[4] The model assumes that public sector workers cannot migrate or work in the private sector. This is a simplifying assumption to capture the fact that public sector wages are significantly higher than in most other sectors in ECCU countries and are not set competitively. As public workers do not contribute to output in the model, any assumption with regards their migration decisions are not relevant to the results.

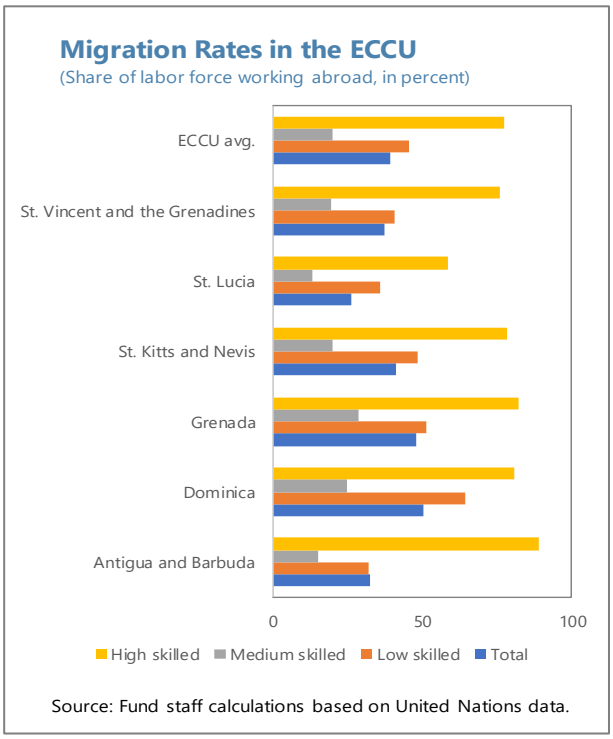
income. Notice that higher private investment and inward labor migration reinforce each other's marginal productivities with positive feedback, resulting in a multiplicative effect on output.

15. Higher output, consumption, and labor improve government revenues, allowing a cost-benefit analysis of the fiscal impact of costlier resilient investment per country. In principle, costlier resilient investment would have a "direct" negative impact on government finances and debt dynamics. However, the endogenous response of the economy also increases tax revenues, the "indirect effect", underpinned by the improvements in output, consumption, labor, and the stock of private capital. The balance on the economic benefit of the additional cost of resilient investment would therefore depend on how the direct and indirect effects balance out, as per the model calibration for each country.

16. An important remark is that resilient investment costs are effective immediately, while benefits materialize only gradually in the long-term. This implies that a government policy shift towards an increase in resilient investment will worsen fiscal performance in an initial phase, while the stock of resilient capital is gradually built. This implies that resilient investment will, *ceteris paribus*, increase public debt and financing needs before the output and revenue benefits materialize.

Calibration to ECCU Countries

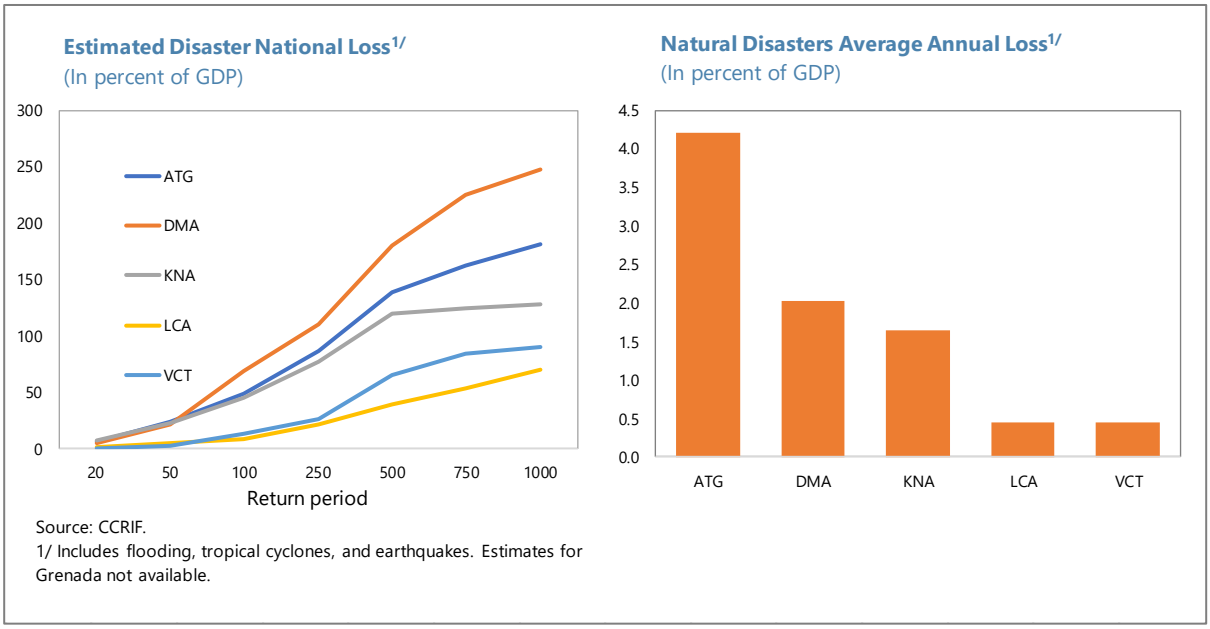
17. The model is calibrated to replicate key moments of ECCU economies. Public capital stock is calibrated based on public investment rates and depreciation rates. Depreciation rates are set consistent with standard parametrization in the literature. The NDs' depreciation rate shocks are calibrated based on CCRIF estimated average annual losses (AAL) (text charts), scaled in units of public and private capital, respectively.[5] The stock of private capital is obtained from steady-state endogenous investment decisions of private investors, plus foreign capital stock based on annual FDI flows in line with historical data. Domestic labor in private and public worker households is calibrated based on labor shares as per each country's social security data.



Source: Fund staff calculations based on United Nations data.

[5] Given no availability of AAL estimates for Grenada, the St. Lucia natural disaster depreciation rate calibration is used as a proxy, which is the ECCU country with closest income per capita.

Labor migration share, defined as the share of the total labor force working abroad, is set according to United Nations data (right text chart).



Source: CCRIF.
1/ Includes flooding, tropical cyclones, and earthquakes. Estimates for Grenada not available.

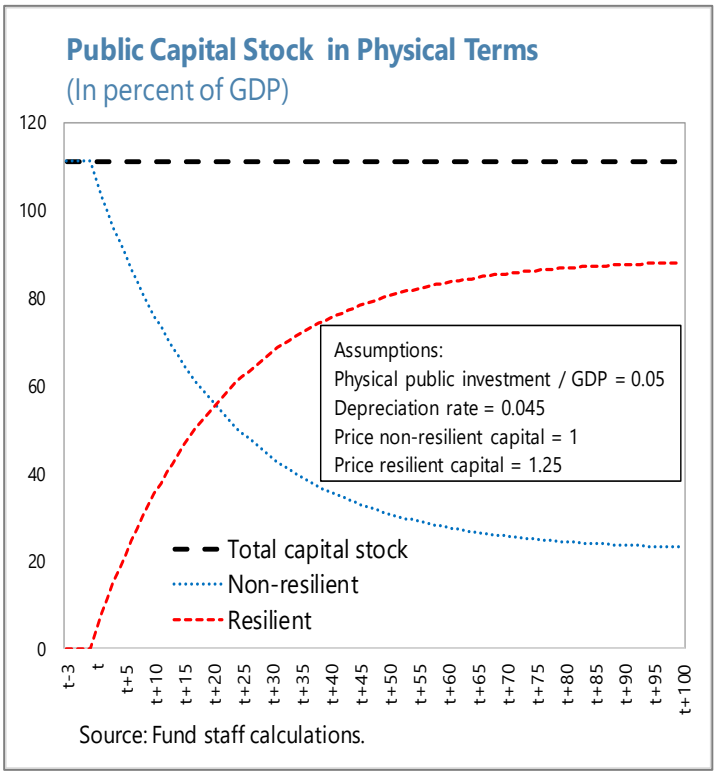
18. The government sectors are calibrated to match fiscal data. Model tax rates are set to match implicit tax rates in the data –revenue as a share of the corresponding tax base. Revenues per tax and non-tax category are calibrated to match shares to GDP. Expenditures by category are also calibrated to match ratios to GDP in the data. Public workers' wages are calibrated to match the wage bill, with public employment based on national social security statistics. Public investment is also calibrated to match capital expenditures to GDP ratios.

19. All government revenue and expenditure ratios are set to match long-term levels, with the aim to capture a structural fiscal position excluding transitory factors. The calibrations are based on country-specific averages of historical data and projected trends in the World Economic Outlook database. This is done to remove transitory factors that would distort long-term equilibrium calculations in the policy experiments, resulting in structural equilibria in the calibrations. This remark is important because it implies that transitory dynamics in the simulations, including public debt dynamics, need not match country projections which incorporate anticipated developments, transitory factors, and economic policy shocks. Appendix II presents calibrated parameters.

20. A critical parameter is the price of resilient investment structures, which is set 25 percent more expensive than non-resilient. In the model, this is included by setting the price of resilient capital to 1.25 (the price of the tradable good produced is normalized at 1). This parameter has been set in line with estimates in Ex-Post Damage Assessment Reports by The World Bank, which include estimates of replacement cost of destroyed non-resilient structures and estimated cost of rebuilding with resilience.

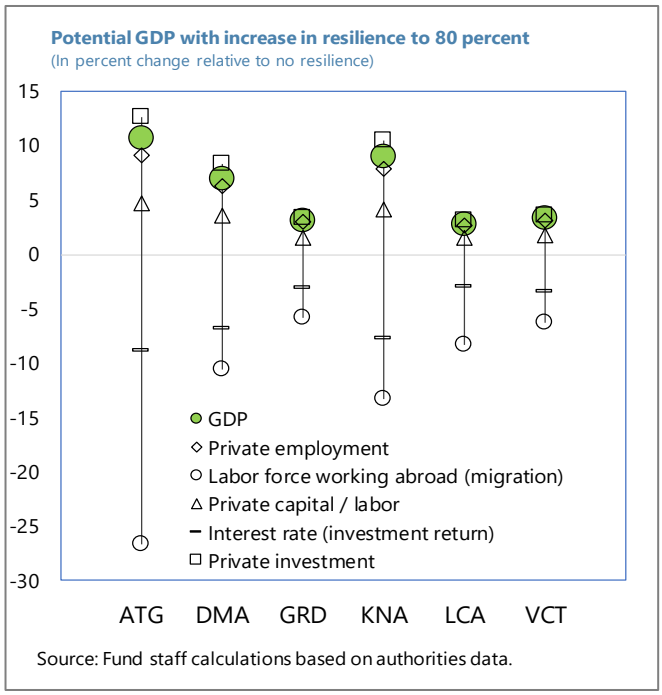
Results

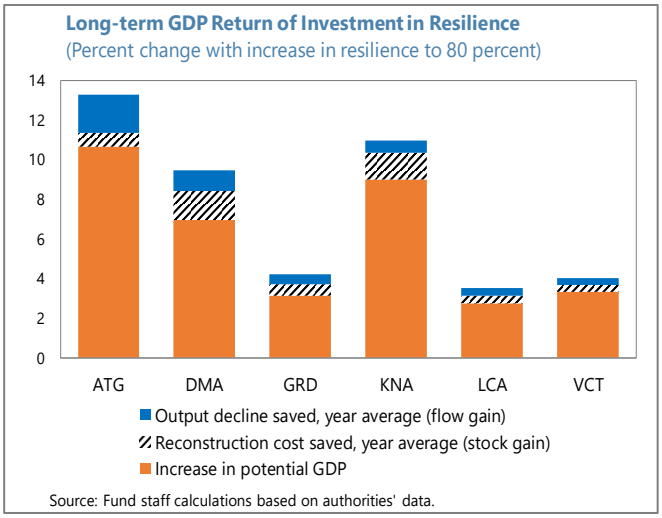
21. To evaluate resilience, an experiment is run that consists of increasing the share of resilient public investment to 80 percent of total public investment, while keeping total investment constant in physical terms. First, it is assumed that countries adopt sufficient fiscal consolidation to reach the regional public debt target of 60 percent of GDP by 2030. This ensures sustainable debt dynamics in all countries as a starting condition, thereby enabling the isolation of financing needs that belong to resilience costs exclusively. It is assumed a gradual fiscal consolidation over the initial 5-year period of the simulation, of amount needed to reach the debt target. Second, it is assumed that countries' initial level of resilient capital is zero –all public investment is non-resilient to NDs. This assumption determines an initial equilibrium under no resilience.[6] Third, it is assumed that the government increases investment in resilient structures to 80 percent of total investment permanently, while keeping the amount of physical investment constant in real terms. This policy shift gradually changes the composition of the public capital stock until it reaches a share of 80 percent of the total stock (text chart). Given the perfect substitutability assumption between resilient and non-resilient public capital, the shift in public investment composition does not increase output absent any reaction from other sectors. In other words, any changes to output and all underlying endogenous variables capture the endogenous economic response to resilient investment, a pure "resilience effect".



[6] This is a simplifying assumption to capture a low initial level of resilience. Some ECCU countries have started with some resilient public investment, but the process is still at an early stage.

22. The shift to resilient public investment reduces expected losses from NDs, increasing private investment and capital stock, employment, and output. Resilient public capital reduces private investors' expected output losses in the event of a ND. As a result, expected returns to private investment are higher relative to non-resilience, resulting in a higher capital stock. The simulations indicate that an increase in resilience from 0 to 80 percent would increase output in all ECCU countries, in the range of 3-11 percent (text chart). Higher private investment of 4-13 percent increases the stock of private capital and the returns to labor and wages, inducing inward labor migration with a reduction of the labor force working abroad of 5-25 percent and higher domestic employment.[7] Investment and inward labor migration reinforce each other with positive feedback, increasing output. Variations across countries are mainly explained by the size of public investment and capital stock; share of migrant labor; exposure to NDs (frequency and intensity); government size in the economy; share of public capital in total capital; and tax policy mix (i.e. direct vs. indirect taxation; investment returns vs. labor taxation).

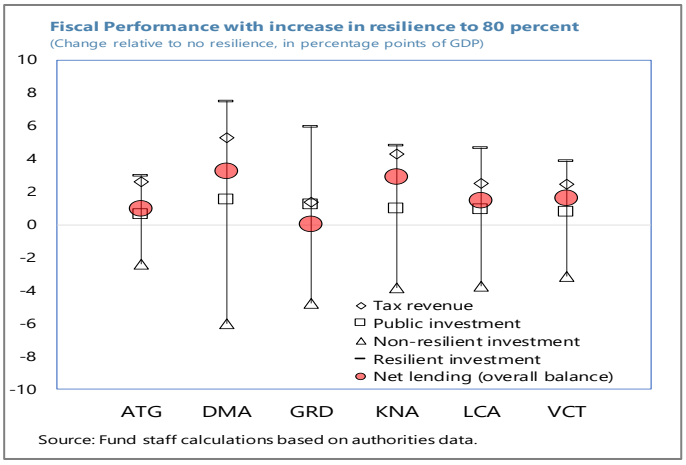




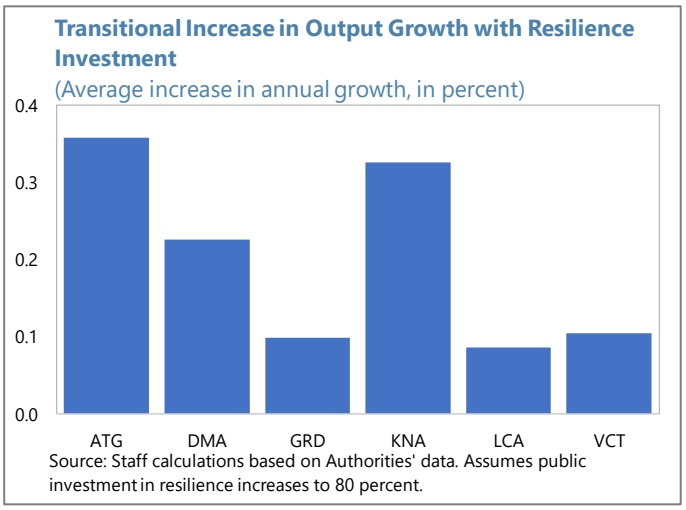
23. Countries also benefit in the near term with reduced asset loss and output after NDs. Resilient investment contains output decline after NDs by reducing capital destruction and labor out migration. Also, replacement capital needs and costs are lower. According to the model simulations, these two sources imply additional gains equivalent to 0.7-2.7 percent of GDP on average per year, in addition to the structural increase in the level of GDP (text chart).

[7] Average out-migration rates are about 40 percent on average, and near 80 percent for high-skilled workers, as reported by data estimates from the United Nations.

24. Fiscal performance improves in the long term, with resilient investment returns more-than-compensating costs. The long-term increase in tax revenues underpinned by higher output, labor, and consumption more-than-offsets the higher cost of resilient investments. As a result, overall fiscal balances improve in the range of 0-3 percentage points of GDP (text chart) with the increase in resilient investment to 80 percent.[8]



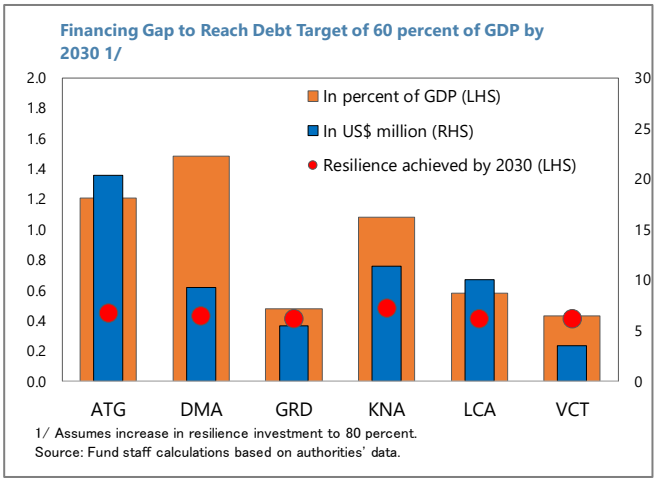
25. These output benefits, however, accrue in the long-term, while fiscal positions deteriorate in an initial phase. If ECCU economies start from a state of non-resilience, benefits from a shift to resilient public investment may take a long time, possibly over 40 years before the share of resilient capital becomes dominant. This implies that the growth and tax benefit accrue at a slow pace. The simulations in this paper indicate that if countries were to increase the share of resilient public investment to 80 percent of total investment, growth acceleration during the transition will be in the range of 0.1-0.4 percent per year on average (text chart). However small, these growth accelerations would compound over time.

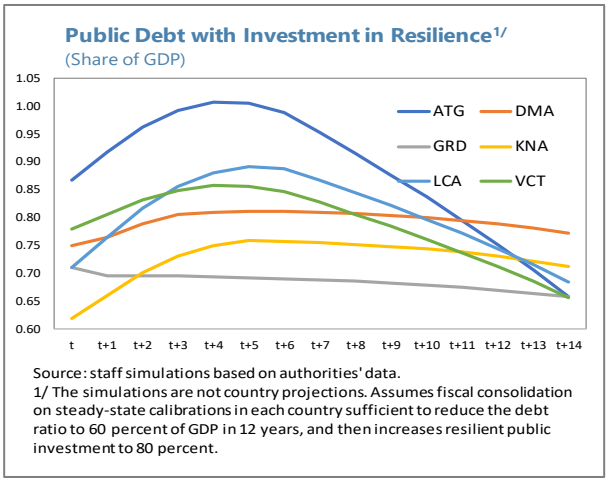


26. Fiscal performance deteriorates in an initial phase. Costlier resilient investment worsens the fiscal balance initially, because higher tax revenues from resilience takes time to materialize. For example, if a country has a public investment rate of 5 percent of GDP and increases resilient investment to 80 percent while keeping constant total physical investment, the fiscal balance deteriorates by 1 percent of GDP (5 x 0.8 x 1.25 + 5 x 0.2 x 1 = 6). The simulations indicate that the additional cost of resilience would increase public debt by 4-20 percentage points of GDP in the ECCU countries by 2030 above the regional target (text chart). The gap to be filled would be about 0.4-1.5 percent of GDP per year above historical levels to reach the regional debt target, or about US$ 60 million for the region annually. These financing gaps, however, should be interpreted as a financing floor. Public investment may need to be increased above historical norms to accelerate resilience building, especially in some cases with low public investment such as Antigua and Barbuda and Saint Vincent and the Grenadines, or countries under reconstruction that have been recently

[8] In Grenada these forces balance out resulting in no long-term improvement in fiscal performance.

affected by NDs such as Dominica. In the simulations, only about half of the public capital stocks would be resilient by 2030 at the current investment rates (text chart).





C. Quantifying Insurance Needs: A Layering Framework

27. As part of the strategy to build resilience ex-ante in the ECCU, this section presents estimates of insurance coverage needs and costs in ECCU countries. The results are based on a Monte Carlo experiment including stochastic simulations of output and fiscal revenues and expenditures as these are affected by ND shocks. NDs are identified as the tail of the distribution of fiscal deteriorations after other sources of large shocks have been controlled for in the model estimates. The results are used to estimate insurance coverage needs within a layering framework, in line with World Bank recommended practice. Two sets of simulations are produced, before and after resilient investment –the latter using the results in Section B for 80 percent resilient capital. The first set of simulations allows the quantification of insurance needs and costs in the near term, when resilient investment is low. The second set of simulations recalculates insurance needs and costs after incorporating the benefits of building resilience ex-ante. This exercise informs of plausible fiscal savings from lower insurance costs once ECCU economies are resilient.

28. The three layers included in the simulations are as follows[9]:

- *Layer 1.* Saving Fund (SF) for self-insurance against relatively small but more frequent NDs. This would be the first line of defense, but insufficient for large NDs. It is the least costly –the interest rate on public debt as the opportunity cost. It requires annual budget savings to remain sustainable in expected terms.

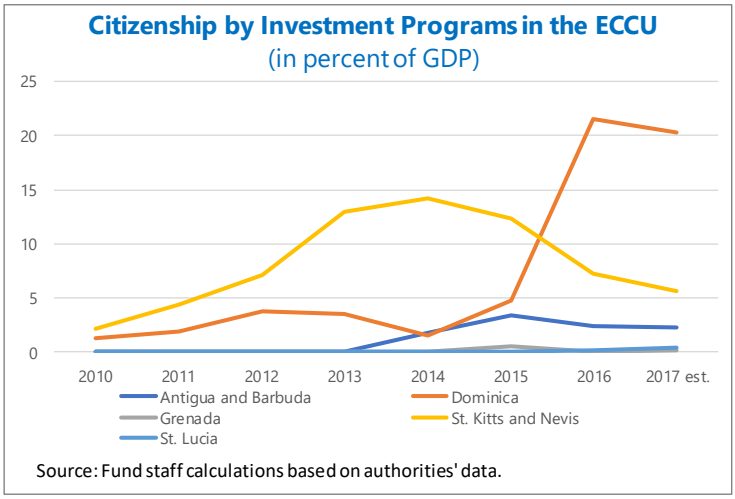
[9] The layering framework is in line with World Bank best practice recommendations. See for example "Sovereign Climate and Disaster Risk Pooling", 2017, International Bank for Reconstruction and Development.

- *Layer 2.* Caribbean Catastrophe Risk Insurance Facility (CCRIF). It would provide additional funding when financing needs after NDs are above the SF's depletion point, adding coverage for large disasters.

- *Layer 3.* State-contingent debt financing instruments could be used for extreme NDs. These instruments are typically the costliest, mainly because of low potential issuance scale (ECCU states are small) and high fixed cost of damage valuation. Issuance should therefore be limited to extreme events when needs are high and parametric triggers are likely to activate.

29. The instruments in the layers used in the simulations are specifically chosen with consideration of fiscal sustainability challenges prevalent in the region. They imply internalization of NDs expected costs in the form of savings for self-insurance and insurance premia on a recurrent basis. This cost internalization de facto works as a disciplinary device by preventing expenditure of these resources in other allocations, and effectively reducing the need for debt issuance to recover from NDs. This choice of instruments, however, remains illustrative and other options should be considered to balance befits and costs, in line with country-specific considerations. A key option is World Bank's Catastrophe Deferred Drawdown Option (CAT DDO), which could be second layer to reduce the need for costlier insurance, or to reduce the size of self-insurance needs, but implies debt issuance.

30. The simulations assume that the SFs are initially financed with revenues from the Citizenship by Investment (CBI) programs. In recent years, there has been a substantial windfall in budget revenues from CBI Programs in ECCU countries. These are significant and thus relevant from a macroeconomic perspective (text chart). Using CBI revenues would effectively reduce debt issuance after NDs. It will also avoid its allocation to recurrent expenditures, which is difficult to revert when CBI revenues decline, thus reinforcing fiscal sustainability.[10]



Source: Fund staff calculations based on authorities' data.

[10] In the case of St. Vincent and the Grenadines, with no CBI program, a SF for ND may require debt issuance or a period of increased fiscal savings.

Insurance Simulation Methodology – Summary Presentation

31. The methodology for the quantification of insurance needs and costs is based on a Monte-Carlo experiment for each country. It can be summarized in the following steps: (see Appendix II for a more technical presentation):

- *Step 1: Estimation of fiscal models for each ECCU country.* VAR(2) models are estimated for each ECCU country. The vector of endogenous variables includes GDP; non-grant revenue; grants; current primary expenditure; and capital expenditure. All variables are expressed in real terms and as deviations from trend. The vector of controls includes the U.S. real effective exchange rate; oil price; US cycle; and a September 11 2001 dummy –for the terrorist attack in the U.S. that severely disrupted tourism revenues in the ECCU. The control variables are selected to remove other competing sources of large shocks to output and fiscal performance from estimated residuals. This allows the interpretation of the tail of the estimated residuals' distribution as NDs shocks –the only remaining large shock.

- *Step 2: Monte-Carlo experiment.* Simulate 1000 off-sample stochastic projections with random shocks drawn from the historical distribution. Given the VAR approach, the simulated series display same volatility, persistence, and co-movement as in the historical data.

- *Step 3: Identification of NDs in the simulations.* NDs are identified as the tail X percent fiscal deteriorations in simulations. This is calibrated by setting a Probability of NDs of 1/X (NDs occur every 1/X years on average. X is set in line with NDs data.

- *Step 4: Define SF's inflow-outflow rules.* This includes a calibration of the SF stock amount, annual budget savings into the SF, and payouts to the budget after NDs. The SFs' size and annual savings are calibrated to cover the fiscal costs of NDs in 95 percent of the cases, thus resulting insufficient in the largest 5 percent NDs. The annual savings and size are calibrated to ensure the financial sustainability of the SF –no increase or decrease in expected terms.

- *Step 5: CCRIF coverage and state-contingent debt issuance.* The simulations assume that countries purchase parametric insurance targeting coverage of 99 percent of NDs expected fiscal costs. CCRIF's attachment point ("deductible") is set at the 10-year estimated loss according to each county's estimated loss function. The coverage limit is set at the 100-year loss.[11] If the coverage limit is insufficient to reach the 99 percent coverage target, it is assumed issuance of state contingent debt in the form of a CAT bond. The simulations include CAT bonds with 3-year maturity and 500 basis points spread over Libor.

32. CAT bonds do not increase net debt and pose no liquidity risk. Bond issuance proceeds are typically held in an Special Purpose Vehicle (SPV) that can only be accessed to service debt when

[11] The attachment point and maximum coverage are approximated values based on discussions with governments.

(continued)

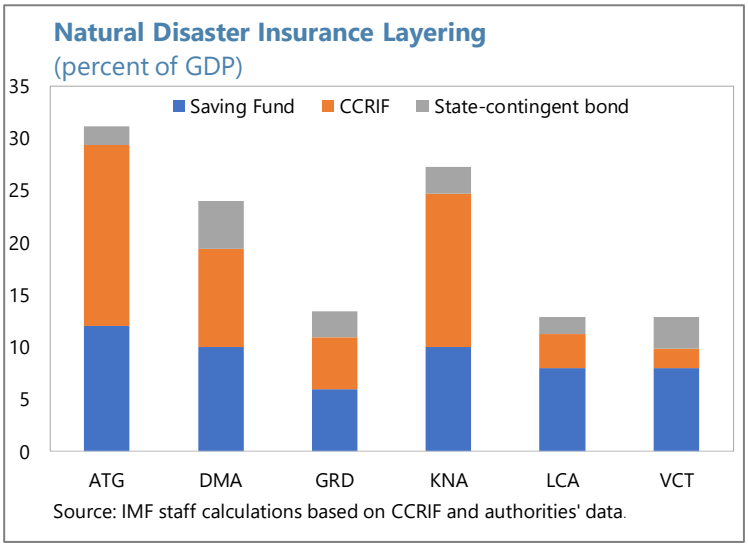
the call option is triggered by a ND.[12] The net fiscal cost of the CAT bond is therefore the difference between the SPV investments' return and the interest rate on public debt. Notice also that the debt service/liquidity risk of gross debt issuance of a typical bond is less applicable to the CAT bond because the CAT bond provides debt service relief, and it remains a liquid investment while unused.

Results: Quantitative Assessment of Insurance Needs

33. This section presents two sets of results: insurance needs and costs with low and high resilient investment. First, the insurance needs and costs with low levels of resilience, which is relevant in the near term. Second, the long term needs after resilient investment has been completed. The latter illustrates plausible declines in insurance costs –one of the benefits of resilient investment.

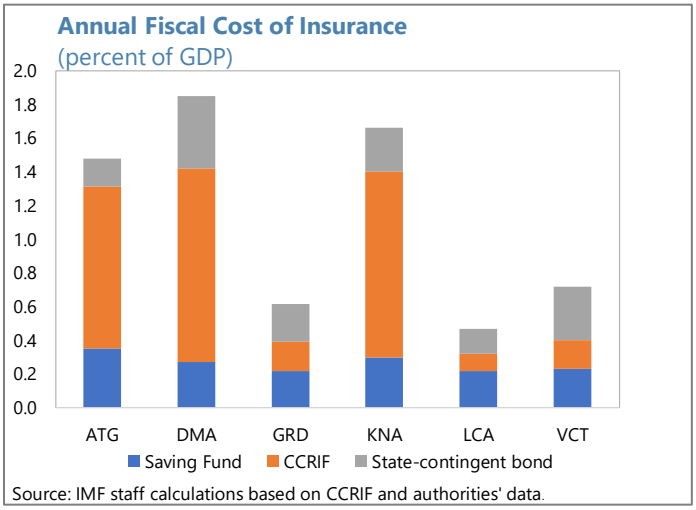
Insurance with Low Resilience

34. The simulations indicate that for the ECCU covering 99 percent of the fiscal costs of NDs requires coverage of 13-31 percent of GDP. Under the illustrative coverage assumptions in the simulations, SFs for self- insurance amount to 6-12 percent of GDP. All countries require maximum CCRIF access, with coverage estimated in the range of 2-17 percent of GDP. As this remains insufficient reach 99 percent coverage, all countries issue CAT bonds in the range of 2-5 percent of GDP (text chart). These thresholds and coverage levels are illustrative. Countries should choose coverage and instrument composition according to preferences towards risk aversion, fiscal space, capacity constraints, or other idiosyncratic considerations. Institutional capacity to safeguard the integrity of the SFs should also be taken into consideration.



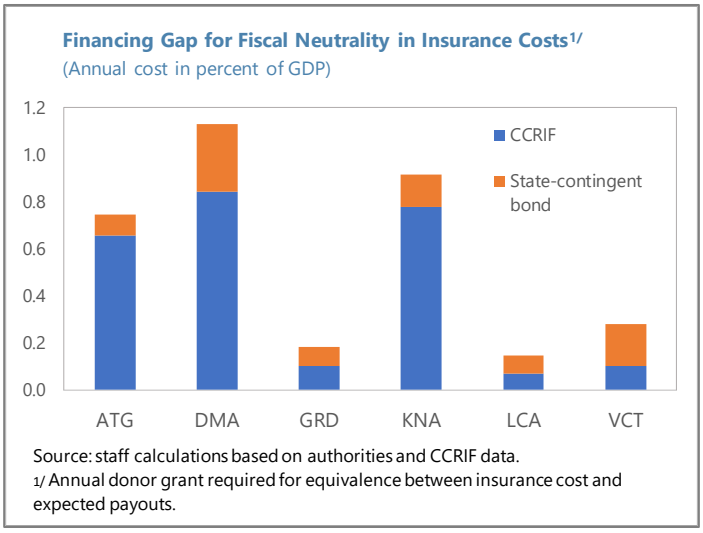
[12] Proceeds of CAT bond issuance are assumed to be invested in risk free liquid assets yielding international rates. As a result, only the net cost of CAT bond issuance, the insurance spread, is included in the simulations.

35. Annual fiscal costs of the insurance layers and targets above are in the range of 0.5-1.8 percent of GDP. The simulations indicate higher costs for Dominica, Antigua and Barbuda and St. Kitts and Nevis, reflecting higher estimated Average Annual Losses of NDs in those countries. The cost composition also points at the relatively expensive nature of insurance instruments. SFs are more cost effective relative to the significant level of coverage targeted (text chart). In the simulations, insurance costs have multipliers of 1.5-2.0 (ratio of insurance premia to expected payouts). Notice that multipliers above 1 imply that insurance worsen fiscal sustainability in expected terms.



36. The high insurance costs could be difficult to accommodate given fiscal sustainability challenges in the ECCU. Increasing the share of coverage with SFs could reduce costs, but it could prove challenging to maintain in practice given competing developmental needs and political pressures for spending. It is important to remark that targeting a lower coverage level does not reduce the expected costs of NDs, it only implies no internalization of these costs and need for additional debt issuance ex-post.

37. Insurance needs will open an additional financing gap. The international community, including climate funds, can reduce incentives for underinsurance with concessional financing to cover insurance costs, as part of a comprehensive ex-ante resilience strategy**.** Concessional financing could help equalize insurance costs with expected average annual losses of NDs –effectively resulting in fiscal multipliers of 1. This implies an incentive-compatible strategy for governments and donors. From the governments' perspective, it incentivizes the purchase of appropriate levels of insurance coverage without worsening long-term fiscal sustainability in expected terms. From the international community' perspective, it ensures the allocation of government resources in line with their fiduciary mandates –and could therefore result in an increase in donor grant flows. Under the simulation assumptions above, making insurance fiscally-neutral in expected terms implies grants in the range of 0.2-1.1 percent of GDP per year –equivalent to about US$40 million per year for all ECCU countries (text chart).

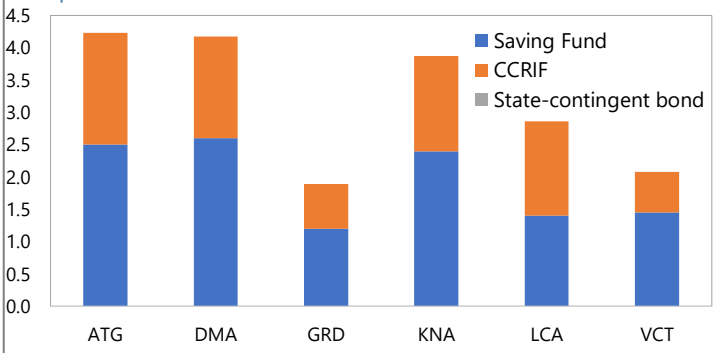


Insurance with High Resilience

38. Investment in resilient structures would reduce the cost of insurance in the long term. The results above on insurance coverage and costs are based on historical data, therefore capturing low resilience. However, if countries pursue resilient investment, the expected costs of reconstruction and the disruption of economic activity after NDs would gradually decline. This implies a decline in expected losses and tax revenue with NDs, and thus lower insurance needs. By incorporating the results in Section B on the long-term benefits of resilient public investment on output, tax revenues, and fiscal costs and savings from resilient investments in the Monte Carlo experiment, insurance needs decline to about ¼ relative to no resilience (text chart). To ensure results' comparability, the assumptions of 80 percent resilience in Section B and coverage levels of 95 percent of NDs fiscal costs with a SF and up to 99 percent with insurance are maintained. In this scenario, the 99 percent coverage is reached with a higher share of more cost-effective SFs, and without need for costlier CAT bond issuance.

Natural Disaster Insurance Layering with Resilient Investment [1/]

In percent of GDP



Source: Fund staff calculations based on authorities' data.
[1/] Assumes 80 percent of the public capital stock is resilient to natural disasters.

D. Conclusions: Putting it all Together

39. Recurrence and intensity of NDs affecting ECCU countries requires a comprehensive ex-ante resilience strategy. The quantitative exercises in this paper indicate that it can yield significant long-term benefits. First, investment in resilient physical infrastructure increases the level of output and tax revenues on a permanent basis. Second, it implies savings from reduced reconstruction costs and output decline after NDs. Third, when combined with a financial insurance layering strategy, it helps address fiscal sustainability concerns from NDs' shocks. Fourth, resilience and insurance coverage reinforce each other with positive feedback: over time, resilient investment reduces insurance needs, while insurance protects fiscal space for costlier resilient structures.

40. In the illustrative example simulation of 80 percent resilient investment as a share of total investment, output levels can increase by 3-11 percent in the long term. This is because the private sector internalizes higher returns to private investment and employment, including through a decline in labor out migration. The results also indicate that, despite its higher cost, resilient investment improves fiscal performance in the long term with the increase in tax revenues, underpinned by the increase in output, employment, investment, and consumption, assuming government spending remains constant in real terms.

41. The long-term benefits, however, imply up-front costs that deteriorate public finances in the near term, requiring a fiscal effort before resilience benefits materialize. Costlier resilient structures increase governments' capital spending. For example, in the simulations with an increase in resilient structures to 80 percent of total public capital, capital expenditures would increase by 0.6-1.5 percent of GDP for the same levels of investment in physical terms. Insurance costs are also significant, implying additional fiscal cost of 0.5- 1.9 percent of GDP in the near term, before substantial physical resilience is achieved.

42. Insurance costs, however, need not worsen fiscal sustainability if supported by grants with appropriate incentives. Annual insurance costs are largely recovered when payouts proceed after NDs:

- The net cost of maintaining SFs is small. It is determined by the spread between the interest rates on public debt (which in most cases is low given prevalence of concessional official financing) and returns on SFs' investments. Annual fiscal savings needed to achieve the financial sustainability of the SFs with low probability of depletion support fiscal sustainability by ensuring NDs' fiscal costs are appropriately internalized in the fiscal frameworks.

- CCRIF and state-contingent debt are needed to ensure coverage of large but less frequent NDs. However, high premia relative to expected payouts imply worsening of fiscal sustainability in expected terms –insurance costs are about twice expected payouts for high coverage options. Donor grants could play an important role by making insurance cost neutral, for example, in the form of an insurance subsidy that covers excess insurance costs above expected payouts.

43. The layers' triggers could be calibrated to achieve an efficient cost-minimizing insurance framework. Countries with particularly large CBI deposits in reserve could increase self-insurance and thus reduce the need of costlier options. Also, CCRIF's *attachment point* ("deductible") and *coverage limit* could be calibrated to ensure payouts are triggered when SFs are near depletion in expected terms. This might require tuning of CCRIF's coverage options to match insurance instruments in other layers' exhaustion and triggering points.[13]

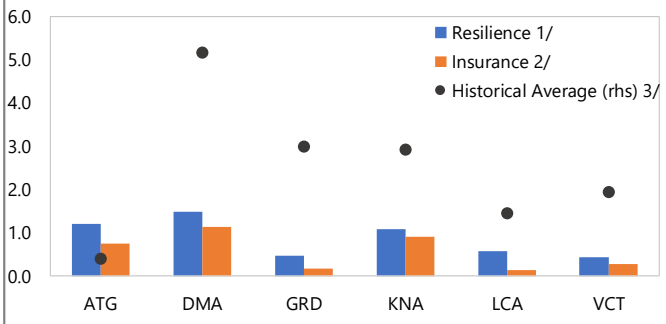
44. A framework to support fiscal sustainability is a necessary precondition for a consistent resilience financing strategy. Given limited fiscal space, the timing of resource allocation is key. The recurrence and potentially devastating impact of NDs implies SFs should be created as soon as feasible, in light of low initial levels of physical and financial resilience. CBI resources could finance startup costs. Increasing insurance coverage will aid fiscal sustainability by ensuring internalization of NDs' fiscal costs and mitigating the need for debt issuance. Meanwhile, ECCU countries should also pursue resilient public investment in all eligible projects given substantial returns. The amount of investment, however, would need to remain consistent with fiscal sustainability, a necessary condition given the long-term nature of resilience building, and mindful of capacity constrains (i.e.

[13] The cost-effective calibration of triggering points across insurance layers can be difficult given imperfect correlation of CCRIF and state contingent bonds' parametric triggers with natural disaster damages, and significant standard deviation of expected damages and losses.

availability of specialized labor, financial spillovers to the private sector, administrative and execution constraints). Over time, as resilience improves, insurance needs would need to be reassessed to internalize the savings from a decline in expected damages.

45. After fiscal consolidation, there will be financing gap to be filled. Resilient investment and insurance are costly, putting pressure on government finances in an initial phase, before the benefits of resilience materialize in meaningful amounts from a macroeconomic perspective. However, in light of insufficient fiscal space, most ECCU countries would find it difficult to afford the costs of resilient investment and insurance without support from the international community, including climate funds. For example, if all ECCU countries adopt fiscal consolidation to reach the regional debt target of 60 percent of GDP by 2030, the additional costs of resilient investment and insurance would add financing gaps of 0.4-1.5 and 0.2-1.1 percent of GDP per year on average through 2019-2030, respectively (text chart).

Financing Gaps for Resilient Investment and Insurance[1/]
(Annual flows, percent of GDP)



Source: IMF staff calculations based on authorities' data.
1/ Additional public spending to maintain observed public investment rates with costlier resilient structures.
2/ Annual insurance premia cost in excess of expected payouts.
3/Government grant revenue average through 2008-2017.

46. Early specification and communication of fiscal consolidation plans is necessary to ensure resilient investment can be sustained over time without financing disruption. This is critical given the long-term nature of resilience building. It is also key to facilitate donor grant financing eligibility. The simulations indicate that concessional financing would need to increase by about US$100 million for the region if they were to fill the financing gaps above, for public investment remaining at historical levels in physical terms. Supporting the fiscal plans with strong institutions, including in the form of fiscal rules, would signal commitment to fiscal sustainability and increase the chances of concessional financing, in light of the fiduciary responsibilities and due-diligence requirements of donor funds.

47. Concessional financing could also contribute to fiscal sustainability with appropriate contractual design. Donor grants' disbursement conditions can be specified to achieve incentive-compatible cost sharing of resilient investment and NDs' insurance costs. The simulations in this paper provide one such example with concessional financing, including grants, for resilient investment assumed to be disbursed after a credible fiscal consolidation framework is in place with specific fiscal consolidation targets, and with concessional financing to cover insurance premia to make it cost-neutrality –i.e. countries pay share of premia to reach an insurance multiplier of 1 or less.

References

Acevedo, S. 2014. "Debt, Growth and Natural Disasters: A Caribbean Trilogy" *IMF Working Paper* 14/125.

Barro, R. 2006. "Rare Disasters and Asset Markets in the Twentieth Century." *Quarterly Journal of Economics*, 121: 823-899.

Barro, R. 2009. "Rare Disasters, Asset Prices and Welfare Costs." *American Economic Review,* 99(1): 243-264.

Cavallo, E. A., and Noy, I., 2011. "Natural Disasters and the Economy: A Survey." *International Review of Environmental and Resource Economics*, 5: 63102.

Cavallo, E., Galiani,S., Niy, I., and Pantano, J., 2013. "Catastrophic Natural Disasters and Economic Growth." *Review of Economics and Statistics*, 95(5): 1549{1561.

Cummins, J.D. 2008. \CAT Bonds and Other Risk-Linked Securities: State of the Market and Recent developments." *Risk Management and Insurance Review*, 11(1): 23-47.

Cummins, J.D. 2012. "CAT Bonds and Other Risk-Linked Securities: Product Design and Evolution of the Market." In *Extreme Events and Insurance: 2011 Annus Horribilis*, ed. Christophe Courbage and Walter R. Stahel, 39-61. The Geneva Association.

Cummins, J.D., and O. Mahul. 2009. *Catastrophe risk financing in developing countries: principles for public intervention*. World Bank Publications.

El-Ashram, A., Gold, J. Xu, X., 2015. "Too Much of a Good Thing? Prudent Management of Inflows

under Economic Citizenship Programs." *IMF Working Paper* 15/93.

Froot, Kenneth A. 2001. "The Market for Catastrophe Risk: a Clinical Examination."

Journal of Financial Economics, 60(2): 529-571.

Lee, Jin-Ping, and Min-Teh Yu. 2007. "Valuation of Catastrophe Reinsurance with Catastrophe Bonds." *Insurance: Mathematics and Economics*, 41(2): 264{278.

Noy, Ilan. 2009. "The Macroeconomic Consequences of Disasters." *Journal of Development Economics*, 88(2): 221-231.

Rasmussen, T. N. 2004. "Macroeconomic Implications of Natural Disasters in the Caribbean." *IMF Working Paper* 04/224.

World Bank, 2017. "Sovereign Climate and Disaster Risk Pooling". International Bank for Reconstruction and Development, Chapter 1. Section 5.

Appendix I. Model Assumptions

The economy produces a single tradable good with the following aggregate production function

$$Y_t = A_t\, \theta_t {K_{t-1}^g}^{\alpha g} {K_{t-1}}^{\alpha k} L_t^{d\beta}$$

where $\boldsymbol{Y_t}$ is output; $\boldsymbol{A_t}$ is total factor productivity; $\boldsymbol{\theta_t} \in (\mathbf{0}, \mathbf{1}]$ captures efficiency loss in periods $\boldsymbol{t}$ in which the economy has been hit by a ND; $\boldsymbol{K_{t-1}^g}$ is public capital stock determined by government investment; $\boldsymbol{K_{t-1}}$ is private capital stock; and $\boldsymbol{L_t^d}$ is private household labor allocated in the domestic economy. $\boldsymbol{\alpha g} < \mathbf{1}$; $\boldsymbol{\alpha k} < \mathbf{1}$; $\boldsymbol{\alpha k} + \boldsymbol{\beta} = \mathbf{1}$. The different sectors contribute to output by supplying factors of production. The government supplies public capital; private investor households supply private capital; and private worker households supply labor.

In each period t, the sequence of events and decisions is as follows. First, the ND shock materializes. With the remaining undestroyed private and public capital, private investors hire labor from private worker households. Private worker households decide labor allocation in the domestic economy or to migrate and earn the foreign wage and send remittances to the household for consumption. Labor markets clear, output is produced and consumption and investment decisions proceed. The government collects taxes and makes transfers to households. Any gap between government revenues and expenditures is financed with foreign debt.

Private Investor Household

Private investors are assumed to be rational and to maximize expected welfare. It is assumed the representative private investor household chooses a consumption sequence $\{c_t^k\}_{t=0}^{\infty}$, makes investment decisions $\{i_t\}_{t=0}^{\infty}$, and hires labor l_t^d to maximize discounted utility

$$U = \sum_{t=0}^{\infty} \beta^t \log(c_t^k); \qquad \beta \in (0,1) \tag{1}$$

subject to the constraints

$$k_t + q_t = (1 - D_t)(1 - \delta)k_{t-1} + D_t \int k_{t-1}(1 - \delta - \delta_t^D)\ f(\delta_t^D) d\delta_t^D + i_t + (1 + r^*)q_{t-1} \tag{2}$$

$$i_t = y_t^e - (1 + \tau^c)c_t^k - w_t^d l_t^d - (1 + \tau^k)r_t^k k_{t-1} + T^k \tag{3}$$

$$y_t^e = (1 - P)\, y_t + P\, y_t' \tag{4}$$

$$y_t = A_t\, (K_{t-1}^r + K_{t-1}^n)^{\alpha g} {k_{t-1}}^{\alpha k} l_t^{d\beta} \qquad \text{if no ND}$$

$$y_t' = A_t \theta_t \int [K_{t-1}^r + K_{t-1}^n(1 - \delta_t^D)]^{\alpha g} [k_{t-1}(1 - \delta_t^D)]^{\alpha k} l_t^{d\beta} f(\delta_t^D) d\delta_t^D \qquad \text{if ND} \tag{5}$$

$$k_0 > 0; q_0 > 0 \tag{6}$$

where K_t^r is resilient public capital; K_t^n is non-resilient public capital; with $K_t^g = K_t^n + K_t^r$. D_t is a dummy variable that takes the value $D_t = 1$ in periods in which the economy is hit by a ND. It is assumed D_t has a binomial distribution with two possible outcomes (disaster and no-disaster), with probability of the ND state $P(D) = P$. The probability density function $f(\delta^D)$ governs the distribution of capital destruction

shocks δ_t^D by NDs. Resilient capital is not affected by ND shocks, while non- resilient public capital and private capital are both destroyed by NDs in the proportion δ_t^D.[1] (2) is the private assets accumulation identity, with first term determining available capital in periods with no ND, second term with ND, and third term representing investment in international risk free assets q_{t-1} yielding return r^*. (3) is the intra-temporal budget constraint: private investment i_t is the amount of realized output y_t and government transfers T^k remaining after investor' consumption c_t^k and retribution to production factors, and tax payments. Notice that investors rent/lend capital in the domestic economy or invest for own production, at the domestic interest rate r_t. (4) is expected output. (5) is the production technology, with output y_t depending on the occurrence of a ND at the beginning of t. k_0 is capital endowment and q_0 is the initial stock of international assets.

Competitive market and representative producer assumptions implies that in equilibrium the number of producing units is irrelevant, allowing the aggregation of firm-specific capital stock k_t into aggregate private capital K_t.

Private Sector Worker Household

Labor for domestic production is supplied by a representative household endowed with labor that can opt to migrate to work abroad and send remittances. It is assumed worker households exhibit hand-to-mouth behavior, thereby making no savings or investment decisions. Their only optimizing behavior is the allocation of labor endowment to maximize intra-temporal household consumption. The private sector worker problem can then be written as the maximization of worker household consumption c_t^w in each period t subject to the constraints

$$c_t^w = \left[(1-\tau^L)w_t^d l_t^d + \varphi\, w^f l_t^f\right](1-\tau^c) \qquad \text{and} \qquad l_t^d + l_t^f = l$$

The household labor endowment l can be allocated to the domestic labor market $l_t^d \leq l$ and earn the net wage $(1-\tau^L)w_t^d$, where τ^L is the tax rate on labor income, or work in foreign labor markets by allocating $l_t^f \leq l$, earn the foreign wage w^f, and remit the share $\varphi \in [0,1]$ to the household. It is assumed labor is mobile internationally, implying that in equilibrium

$$w_t^d = \varphi \frac{w^f}{(1-\tau^L)} = w^d.$$

Government Worker Household

Public sector workers are assumed to display hand-to-mouth behavior. It is assumed the public sector workers cannot migrate and can only work in the public sector earning wage w^g. This is a simplifying assumption that capture the ECCU empirical observation that public wages are set high relative to other sectors at a level that prevents workers in the public sector from choosing to work in the private sector or to migrate –except for the typically small portion of high skilled public workers. Under

[1] The assumption that resilient capital is completely unaffected by the natural disaster seems extreme considering real-life events, where even resilient structures can be damaged albeit by a lesser extent. This assumption simplifies the model solution, and it is not critical for the results. For example, the model could be calibrated so that the share of resilient vs. non-resilient capital matches the expected combined destruction of the aggregate capital stock, including of resilient structures.

these assumptions, the entire labor endowment of the worker household l^g is allocated to the government sector and used for domestic consumption intra-temporally, net of taxes,

$$(1-\tau^c)[(1-\tau^L)w^g l^g + T^g] = c_t^{wg}.$$

Government

The government supplies public capital, of types resilient and non-resilient to NDs, financed with taxes, nontax revenues, and debt issuance. The government does not follow any specific fiscal policy rule nor optimization decision process. It is assumed to have a passive fiscal policy stance: tax rates and expenditures are maintained constant. This assumption allows treatment of the parameters in the government budget constraint as policy variables –in particular, level and composition of public investment, as needed to simulate a change in investment decisions towards resilient structures.

Public debt is issued to external creditors. This captures the empirical observation that most public debt financing in ECCU countries is external, given narrow and illiquid domestic markets for sovereign debt instruments. Public debt evolves according to the identity

$$B_t = (1+r)B_{t-1} + G_t - R_t$$

where B_t is the sock of public debt; r is the interest rate, assumed to remain constant. Primary expenditures G_t and revenues R_t are determined by

$$G_t = C_t^g + w^g L_t^g + T_t + I_t^n + p^r I_t^r$$

$$R_t = \tau^c C_t + \tau^L\left(w_t^k L_t^d + L_t^g\, w^g\right) + \tau^k r_t^k + NT_t$$

where C_t^g is government consumption; L_t^g is public sector employment; $T_t = T_t^g + T_t^L + T_t^k$ is transfers to government worker and private worker households, respectively; and $I_t^n + p^r I_t^r$ is expenditure in public investment. The composition of the stock of public capital $K^g = K^n + K^r$ is thus a policy decision, which depends on public investment allocation $I^g = I^n + I^r$. I^r is assumed to be costlier than I^n, with a price $p^r > 1$ (tradable output price normalized to be equal to 1). This implies that a change in the composition of public investment towards the resilient type increases capital expenditures, even if the amount of physical investment remains unchanged. With τ denoting tax rates, government revenues are determined by consumption taxes $\tau^c C_t$ (aggregate consumption of investors, private and public workers, and the government), labor taxes on domestic private and public sectors' labor $\tau^L\left(L_t^d + L_t^g\right)$; taxes on capital returns $\tau^k r_t^k$; and non-tax revenues NT_t –mainly donor grants and CBI revenues.

As indicated above, NDs shocks also destroy a share of public capital. It is assumed that non- resilient public capital is subject to depreciation shocks in periods with NDs, which are assumed to be randomly distributed to capture NDs' intensity and frequency. The evolution of public capital stock follows the following laws of motion

$$K_t^r = K_{t-1}^r(1-\delta) + I_t^r$$

$$K_t^n = (1-D_t)K_{t-1}^n(1-\delta) + D_t \int K_{t-1}^n(1-\delta-\delta_t^D)\; f(\delta_t^D)d\delta_t^D + I_t^n.$$

Expected aggregate output is increasing in the stock of resilient public investment. Economy-wide expected output is thus given by

$$E_{t-1}Y_t = (1-P)\,A_t\,(K^r_{t-1}+K^n_{t-1})^{\alpha g}{K_{t-1}}^{\alpha k}{L^d_t}^{\beta} + P\,A_t\theta_t\int[K^r_{t-1}+K^n_{t-1}(1-\delta^D_t)]^{\alpha g}[K_{t-1}(1-\delta^D_t)]^{\alpha k}{L^d_t}^{\beta}\,f(\delta^D_t)d\delta^D_t$$

where E_{t-1} is the expectations operator as of period $t-1$. K_{t-1} and L^d_t are aggregate investor household capital and equilibrium domestic labor utilization, respectively. With probability $1-P$ there is no ND and output can be produced with the full amount of capital invested before period t, and with probability P there is a ND which destroys non-resilient public capital and private capital by a share δ^D_t. As labor is not predetermined, the share of labor employed domestically L^d_t takes different values depending on the occurrence of a ND, which adjusts with labor migration.

Inspection of the expected output equation indicates that marginal productivities of private capital and labor are decreasing in the share of non-resilient public capital. This is determined by the presence of the term$(1-\delta^D_t)$ affecting K^n_{t-1} in the second term. Therefore, private capital and employment are high when resilient public capital is also high. As resilient public capital is resistant to ND shocks, expected private output loss is smaller for given ND frequency $1/P$ and intensity distribution $f(\delta^D_t)$. As a result, expected private investment returns and thus private capital and output are higher with more resilient public investment, for given stock of total public investment.

Appendix II. Parameter Calibration

	ATG	DMA	GRD	LCA	KNA	VCT
Real Sector						
Annual probability of natural disaster	0.150	0.200	0.200	0.200	0.250	0.200
Semi-elasticity private capital	0.350	0.350	0.350	0.350	0.350	0.350
Semi-elasticity public capital	0.083	0.100	0.097	0.088	0.052	0.061
Labor force	53.082	45.064	76.467	72.401	42.420	46.625
Labor force, private sector	32.000	23.000	45.600	45.800	18.000	24.300
Labor force, working abroad (migration)	13.082	15.064	24.867	15.101	12.420	12.725
Foreign remittances / GDP	0.006	0.100	0.030	0.015	0.013	0.045
Share of labor migration wage transferred to domestic household	0.014	0.075	0.049	0.034	0.020	0.055
Labor force, public sector	8.000	7.000	6.000	11.500	12.000	9.600
Emigration rate, share of labor force abroad	0.327	0.502	0.482	0.264	0.414	0.375
Private capital depreciation rate	0.044	0.044	0.044	0.044	0.044	0.044
Non-resilient public capital depreciation rate	0.056	0.056	0.056	0.056	0.056	0.056
Resilient public capital depreciation rate	0.056	0.056	0.056	0.056	0.056	0.056
Capital depreciation in average natural disaster (disaster damage)	0.082	0.052	0.025	0.021	0.070	0.026
Government Sector						
Implicit interest rate public debt	0.040	0.035	0.048	0.048	0.027	0.043
Government revenues / GDP	0.208	0.305	0.252	0.223	0.256	0.294
Government Operations: taxes on goods and services + taxes on imports / GDP	0.074	0.175	0.078	0.156	0.147	0.180
Government Operations: taxes on property + corporate taxes / GDP	0.015	0.000	0.017	0.020	0.007	0.020
Government Operations: taxes on wages (taxes on income - corporate taxes) / GDP	0.010	0.050	0.112	0.023	0.052	0.070
Government Operations: non-tax revenues (grants, CBI, other) / GDP	0.109	0.080	0.044	0.026	0.050	0.024
Primary expenditures / GDP	0.227	0.295	0.205	0.245	0.281	0.287
Public sector employment, share of labor force	0.151	0.155	0.078	0.159	0.189	0.206
Government Operations: compensation employees	0.080	0.100	0.085	0.085	0.115	0.132
Total public investment expenditure share to GDP	0.030	0.075	0.060	0.047	0.048	0.039
Government Operations: public investment expenditure share to GDP, non resilient	0.030	0.075	0.060	0.047	0.048	0.039
Government Operations: public investment expenditure share to GDP, resilient	0.000	0.000	0.000	0.000	0.000	0.000
Share of resilient public capital in total public capital	0.000	0.000	0.000	0.000	0.000	0.000
Price resilient public capital relative to non resilient	1.250	1.250	1.250	1.250	1.250	1.250
Government Operations: Transfers and subsidies, including pensions	0.062	0.050	0.020	0.067	0.058	0.080
Government Operations: pensions and social transfers to HH	0.040	0.031	0.014	0.043	0.032	0.046
Government Operations: subsidies to productive sector	0.012	0.010	0.004	0.013	0.012	0.016
Government Operations: pensions and social transfers to public workers	0.010	0.009	0.002	0.011	0.014	0.018
From fiscal accounts: Government consumption (purchases of goods and services)	0.055	0.070	0.040	0.046	0.060	0.036
Public debt to GDP ratio	0.868	0.750	0.710	0.710	0.620	0.780
Target public debt to GDP ratio	0.600	0.600	0.600	0.600	0.600	0.600
Implicit tax rate: actual collection concumption tax / total consumption	0.066	0.150	0.098	0.150	0.150	0.150
Implicit tax rate: actual collection corporate tax / corporate net income	0.015	0.000	0.017	0.020	0.007	0.020
Implicit tax rate: actual collection payroll tax / wages paid	0.127	0.499	1.319	0.268	0.452	0.530
Ratio government non-resilient investment to total public investment	1.000	1.000	1.000	1.000	1.000	1.000
Ratio government resilient investment to total public investment	0.000	0.000	0.000	0.000	0.000	0.000
Depreciation rate non-resilient capital	0.056	0.056	0.056	0.056	0.056	0.056

Source: Fund staff calculations based on data from authorities' data.

Appendix III. Insurance Simulation Methodology

The starting point is to estimate an empirical model for each economy that captures the effect of ND on output and government finances. To this end, an unrestricted Vector Auto-regression Model (VAR) is estimated for each country including fiscal determinants of public debt dynamics, including vectors Y_t and X_t of endogenous and exogenous variables, respectively,

$$Y_t = \gamma_0 + \sum_{k=1}^{p} \gamma_k Y_{t-k} + \sum_{j=1}^{n} \beta_j X_j + \epsilon_t.$$

The endogenous variables in the VAR estimates include the cyclical components of GDP; government revenues excluding grants; grants; current primary expenditures; and capital expenditures. These are expressed as a share of each indicators' trend[1],

$$\hat{y}_{it} = y_{it}/y_{it}^{trend}; \hat{y}_{it} \in Y_t.$$

The exogenous control variables X_j account for non-ND sources of major shocks in ECCU countries, and thus estimated residuals $\epsilon_t \sim N(0, \Omega)$ are orthogonal to these. The vector of control variables X_j includes the U.S. real effective exchange (to capture competitiveness pressures given that the EC dollar is pegged to the U.S. dollar); the oil price (all countries are highly dependent on oil imports); the cyclical component of the U.S. output (the main source of tourist revenues); and a dummy for the September 11, 2001 terrorist attack in the United States that disrupted air travel and tourism exports. This allows the identification of ND shocks as the only potentially large shock remaining –ϵ_t thus includes ND and "small" shocks.[2] The variance-covariance matrix Ω characterizes the joint statistical properties of the contemporaneous disturbances of the endogenous variables. γ_k and β_j are vectors of coefficients.

The second step is to run a Monte-Carlo experiment. This involves generating many simulations using the estimated model above. Each simulation is shocked with a sequence of random vectors $\hat{\epsilon}_{t+1}, \ldots, \hat{\epsilon}_T$ such that $\forall\, \tau \in [t+1, T], \epsilon_\tau = W v_\tau$, where $v_\tau \sim N(0,1)$, and W is such that $\Omega = W'W$ where W is the Choleski factorization of Ω. The estimated VAR is then used to generate 2000 forecasts Y_t for each country with the randomly-generated shocks $\epsilon_\tau, \tau = t+1, \ldots, T$. In this way, the VAR produces joint dynamic responses of all variables in Y_t.[3] Each simulation is a projection consisting of a sequence of the five endogenous variables in the model, each affected by a sequence of simulated random shocks. In this way, the simulations mimic historical patterns in terms of the volatility, persistence, and co-movement of the endogenous series, as observed in the sample data. The results are then used to compute probability density functions for each of the five endogenous variables in each year projected, for the period 2017-2030.

[1] The cyclical components of GDP are estimated using the Hodrick-Prescott filter on 1990-2016 annual data. All variables expressed in real terms using the GDP deflator.

[2] The sample data used in the estimation spans 1990-2016.

[3] Notice that the results are not sensitive to the ordering of the variables in the VAR, as the stochastic simulation results are shaped per the variance-covariance matrix of reduced-form errors Ω, which is unique.

These simulations can then be used to calculate public debt dynamics for each random simulation with the debt accumulation identity

$$D_{t+l+1} = (1 + i_{t+l+1})D_{t+l} - PB_{t+l} + \left(I^{SF}_{t+l} - O^{SF}_{t+l}\right);\ \ D_{t+l} > 0;\ \ l = t+1, \dots, T\,;$$

where D_{t+l+l} is the stock of public debt in year $t+l+1$, and PB_t is the primary balance obtained from the revenue and primary expenditure endogenous variables in the simulations. The implicit interest rate i_t is calculated as the ratio of interest expenditures in year t divided by public debt stock in $t-1$. $I^{SF}_{t+l} - O^{SF}_{t+l}$ are the below-the-line inflows and outflows from the SF for NDs. Depending on the sequence of events (occurrence or non-occurrence of a ND in any given year in the simulations), different debt paths are thus possible, as these flows vis-à-vis the budget replace debt issuance. Notice that the debt stock projections are not affected in expected terms, provided savings into the fund are utilized in the long-term and across simulations in a given period.[4]

Given that these projections are obtained as deviations from trend, they are then calculated as a percent of GDP. To that end, a deterministic trend is projected for each variable, assuming each and all trends grow at the same constant rate starting from the end point of the estimated trend in the sample period, that is

$$y_{it+l} = \hat{y}_{it+l} y^{trend}_{it+l} \ \text{ with } \ y^{trend}_{it+l} = y_{yt}(1+g)^{l-t};\ l = t+1, \dots, T;$$

where g is the potential growth rate assumption. After all endogenous variables are expressed in real-term levels, they can be expressed in percent of GDP by dividing each of the fiscal indicator projections by the GDP projection in each of the vector simulations. In order to ensure revenue and expenditure indicators as a percent of GDP are consistent with the data, the starting points of the trend projections are set at constant prices of the last year of the sample.[5]

The third step is to identify the occurrence of NDs in each simulation, as needed to inform the triggering of financing flows vis-à-vis the SFs. To this end, the simulations include an algorithm that identifies as a ND the largest d percent fiscal deteriorations. The fiscal deteriorations are computed as the sum of the year-on-year changes of (i) non-grant revenue NG_t (with a negative sign as tax revenues decline along with output as affected by the ND); (ii) grant revenues Gr_t (which typically increase after ND as donor partners increase their supports) (iii) current primary expenditure G_t (as more social assistance and goods and services are needed after NDs); and (iv) capital expenditure K_t (on account of additional expenditures for rehabilitation and reconstruction). The fiscal aggregate random variable $z_t \epsilon\, Z$ used to identify simulated NDs, can be written as

$$z_t = \triangle\, Gr_t - \triangle\, NG_t + \triangle\, GCE_t + \triangle\, GKE_t$$

Simulated NDs are identified as the largest random draw realizations of the random variable z_t. The algorithm computes the distribution of this sum in every simulation year $t+l$, $l=t+1,\dots T$, across the

[4] Forward iteration on the debt accumulation identity shows that, in expected terms, $I^{SF}_{t+l} - O^{SF}_{t+l} = 0$ if SF's inflows and outflows are calibrated to be zero in expected terms, as set in the simulations by construction.

[5] It is therefore implicitly assumed that the deflators of GDP and the remaining fiscal variables change at the same rate in the projections.

2000 simulations, and identifies as a ND all the random realizations that fall in the highest d percent tail of the of the probability density function of this sum. In this way if, statistically in a given simulation, non-grant revenues decline significantly, and grant revenues, current primary expenditures, and capital expenditures increase significantly (a typical pattern after a ND), then that random simulation draw is labeled as a ND by the algorithm. As mentioned above, this identification rests on the assumption that all other major sources of large shocks have been controlled for in the VARs, and thus every remaining negative large shock is a ND.

The fourth step is to specify SFs financing flows vis-à-vis the budget. The simulations assume that in years with no ND (as identified by the algorithm explained above), the budget contributes savings to the SF.[6] These budget contributions to the SF are modeled as a fixed parameter θ as a percent of the previous' year GDP, with θ calibrated to achieve the financial sustainability of the Fund with a sufficiently low probability of depletion or, in other words, to ensure the SF stock is stable in expected terms[7].

In the event a ND occurs, as identified by the algorithm, a financing inflow to the budget from the SF takes place. This budget financing is computed as the sum of four components:

+ *Gap of non-grant revenues below trend.* Captures the decline in tax and non-tax revenues that typically take place after NDs as a result of a typical decline in economic activity and tax compliance.

- *Gap of grant revenues above trend.* Grants tend to be higher after NDs as a result of an increase in donor support, reducing the need for financing flows from the Fund.

+ *Gap of current primary expenditure above trend.* Captures higher expenditures in social support and rehabilitation of infrastructure after NDs. An additional fixed amount as a percent of GDP is deducted to capture below-trend spending reprioritization. The reprioritization below trend is denoted $\rho^G\ G_{t+l}^{trend}$; $\rho^G\ \in (-1,1)$.

+ *Gap of capital expenditure above trend.* Captures the higher public investment that typically follows NDs with the reconstruction spending. An additional fixed amount as a percent of GDP is deducted to capture below-trend spending reprioritization. The reprioritization below trend is denoted $\rho^K\ K_{t+l}^{trend}$; $\rho^K\ \in (-1,1)$.

Denote the random variable obtained from the sum of the four components above as

$$\sigma_t = -\left(NG_t - NG_t^{trend}\right) - \left(Gr_t - Gr_t^{trend}\right) + \left(G_t - G_t^{trend} - \rho^G\ G_t^{trend}\right) + \left(K_{t+l} - K_t^{trend} - \rho^K\ K_t^{trend}\right).$$

[6] If the simulations result in a fiscal deficit, then there would be a need to issue public debt to finance the required contribution to the Fund.

[7] This ensures that the saving rate is of an amount commensurate with the fiscal costs of ND. If saving inflows into the SF are set too high, then the size of the SF would tend to increase in expected terms, accumulating excess assets inefficiently. If, on the other hand, the saving flow is set too low, the SF would unsustainably decline in expected terms towards depletion.

The contributions to the budget continue until the year in which each indicator returns to a level that is below the value in the year prior to the ND –the SF therefore finances the "hump".

Allowing for expenditure re-prioritization in the simulations is key for a realistic assessment of SFs' size. In practice, a significant share of the fiscal space for social support and reconstruction after ND is obtained by way of reallocation and re-prioritization: some pre-ND allocations are postponed or cancelled. The text chart illustrates re-prioritization in the case of Dominica, after it was affected by Tropical storm Erika in August 2015. This implies that the reconstruction expenditures do not require an equivalent increase in public investment relative to the original investment levels without a ND. This is the reason for the reprioritization terms capturing expenditures that are postponed or cancelled, as explained above for current primary and capital spending.

The SF stock in each simulation evolves following the difference of saving inflows I_{t+l}^{SF} and outflows O_{t+l}^{SF} vis-à-vis the SF,

$$SF_{t+1} = SF_t\,(1 + r_t) + I_{t+1}^{SF} - O_{t+1}^{SF} = SF_t\,(1 + r_t) + (1 - ND_t)\,\theta\,GDP_{t-1} - ND_t\,\sigma_t,$$

with $\theta\,GDP_{t+l-1} = 0$ in years in which the algorithm identifies a ND ($ND_t = 1$), with probability P[d] = $P[\sigma_t \geq \bar{\sigma}] = p$, and $\sigma_{t+l} = 0$ in year with no ND as identified by the algorithm, with probability 1-P[d] ($ND_t = 0$) . As explained above, $\bar{\sigma}$ is a parameter specified in the calibration when setting the annual probability p of a ND, as per the frequency observed historically. For example, if a ND occurs every 5 years on average, then the calibration requires to set $p = 0.2$, which then informs the value of the threshold $\bar{\sigma}$ as per the estimated probability density function in the distribution of σ_t. r_t is the rate of return of assets in the SF. If in a simulation the SF is depleted, $SF_t = 0$, the simulations assume that the remaining financing is covered with public debt issuance.

The modeling of the SF also includes an assumption for the initial stock value, the start-up cost. This initial amount of assets $SF_0 > 0$ affects the probability of depletion over a time horizon. As the proposal assumes that the start-up cost of establishing a SF is funded with existing CBI assets, it has not been added to the debt stock at the beginning of the simulations.

Insurance Calibration

The simulation parameters are calibrated consistent with staff's macroeconomic frameworks for each ECCU country. The macroeconomic and fiscal parameters for calibration include potential GDP growth rate; the implicit interest rate on public debt; fiscal consolidation targets in percent of GDP. Appendix I shows the specific parametric calibrations used in the simulations for each country.

The parameters affecting the SF are calibrated to cover 95 percent of the fiscal deteriorations after NDs. The calibration ensures the SF long-term financial sustainability with a low probability of depletion. For example, in the case of Dominica, the probability of a ND was set at P[d]=0.2, broadly consistent with the historical frequency of ND occurring every 5 years on average. The initial size of the Fund stock is set at 10 percent of GDP, as needed to obtain a probability of depletion within the next ten years of 0.08. Notice this probability of depletion determines insurance coverage, and it is to be chosen also consistent with risk tolerance of the authorities, although a sufficiently low probability of depletion is preferable to

ensure the financial sustainability of the SF. In the simulations it is assumed that the probability of depletion is 5 percent –only in the most extreme 5 percent NDs' fiscal costs the SF savings are insufficient and is depleted. Budget saving flows into the SF in years without a ND of 1.5 percent of previous-year's GDP are needed to obtain a sustainable SF stock of assets in expected terms.

The remaining parameters for calibration specify the amount of SF financing to the budget after a ND, including for spending re-prioritization. To this end, **"**base" levels of capital expenditures and current primary expenditures are calibrated, with "base" defined as the level of spending that would prevail in a year in which there is no spending associated with the occurrence of a ND. This is captured by the parameters ρ^G and ρ^K, which need to be set carefully to ensure realistic expenditure reprioritization.

CCRIF and state-contingent debt are then calibrated to cover fiscal deteriorations post NDs to top up self-insurance coverage. These instruments are introduced as follows:

CCRIF. It is assumed the CCRIF insurance premium P^{CCRIF} is determined by the standard insurance formula

$$P^{CCRIF} = a\ AAL + b\ SD(AAL)$$

where a and b are fixed parameters calibrated to match observed premia, consistent with insurance multipliers in the range 1.5-2.0. AAL and $SD(AAL)$ are NDs average annual losses and standard deviation, respectively, set at values reported by CCRIF based on estimated loss functions' damages for tropical cyclones and earthquakes. In each country's simulation it is assumed that the *attachment point* and *maximum coverage* are set at the estimated damages along the expected loss function for 20 and 100 year estimated damages, respectively. Maximum coverage under CCRIF is thus the difference between maximum coverage and attachment point. CCRIF payouts are triggered according with the ND algorithm explained above. The payout amount is determined as a proportion of simulated losses. In addition, in light of imperfect correlation between parametric triggers under CCRIF and actual damages, it is assumed that CCRIF payouts are discounted by a factor of 0.5 for 1/20 year losses based on insurance multipliers of near 1 for low coverage (that is, payouts turn out to be ½ of losses on average for the smaller NDs for which CCRIF is triggered). For larger and less frequent NDs, it is assumed that the correlation increases at a constant rate until convergence to a value of 1 for 1/100 year loss (the payout is proportional to the loss covered). These assumptions result CCRIF disbursements that are increasing in the simulated intensity of NDs. The correlation between triggers and payouts of 0.5 is set according to CCRIF estimates of insurance multipliers of about 1 for relatively smaller and more frequent NDs (used for 1/20 year NDs), and about 2 for large NDs (1/100 year NDs).

State-contingent debt. Governments issue catastrophe (CAT) bonds for debt service relief in case of a ND. The proceeds are invested in safe asset, with returns equivalent to Libor, and held in a Special Purpose Vehicle (SPV). Governments hold a call option on the principal of the SPV with triggers specified in the bond contract. If ND occurs, governments can withdraw funds from SPV to pay claims, and interest and principal payments are forgiven. If ND does not occur, investors receive principal and interest. It is assumed CAT bonds are issued with 3-year maturity and interest rate equivalent to Libor plus 500 basis points. The amount of CAT bond issuance is assumed to be determined by the residual coverage needs to top up self-insurance and maximum CCRIF coverage. If in the simulations maximum insurance under

CCRIF remains insufficient to reach 99 percent overall coverage of NDs' fiscal costs, the simulations assume that countries issue US$ 10 to 100 million in CAT bonds to reach the 99 percent target.

The simulations with resilience repeat the exercise under no resilience adjusting the fiscal model parameters with the results in Section B. This is done by incorporating the results in Section B to the long-term benefits of resilient public investment on output, tax revenues, and fiscal costs of resilience to the Monte Carlo experiment. To ensure comparability, the experiment maintains the illustrative 80 percent resilience assumption of Section B, and also the coverage levels of 95 percent coverage of NDs fiscal costs with a SF and up to 99 percent with insurance. The adjustments to the Monte Carlo experiment are as follows:

- One-time increase in potential GDP (trend) by the growth rate in Section B for 80 percent resilience.
- One-time increase in tax revenue trend by the estimated amount in Section B for 80 percent resilience.
- Primary current expenditures remain unchanged in real terms, that is, at the same levels simulated without resilience.
- Capital expenditures are increased by multiplying the simulated levels without resilience by a factor 0.8 x 1.25 to capture the additional cost of resilience, at a price 25 percent more expensive than non-resilient investment, applied to 80 percent of spending.
- The algorithm used to identify NDs is the same as with no resilience. The simulated NDs frequency and intensity are therefore of exactly same distribution as in the simulations without resilience.
- Outflows of the SF to the budget in each simulated ND is adjusted by applying a factor of 0.2, which captures the fact that fiscal costs are 80 percent lower than without resilience. The SF initial stock and annual saving inflows are adjusted down as appropriate to obtain a probability of depletion of 95 percent with financial sustainability.
- CCRIF attachment point and coverage limit assumptions are same as with no resilience. CCRIF is purchased to achieve coverage of 99 percent of the NDs' fiscal costs –the disbursements from the SF plus the CCRIF payout cover the full increase of the NDs annual fiscal costs in 99 percent of the events, and in the remaining 1 percent are insufficient.
- CAT bonds are issued if CCRIF is not enough to cover 99 percent of NDs' fiscal costs if the coverage with the SFs and CCRIF are insufficient. Assumptions are the same as without resilience.

RESILIENT FISCAL FRAMEWORKS FOR THE ECCU: A ROADMAP[1]

A. Introduction

1. The ECCU countries have faced long-standing fiscal sustainability problems. At end- 2017, all six of the sovereign countries (ECCU-6) that form the bulk of the ECCU currency area had public debt of above the 60 percent long-term target adopted by the region.[2] While the region-wide public debt ratio declined recently, from 82 percent of GDP in 2010 to 72 percent of GDP in 2017, the fall largely reflected temporary or volatile factors, such as surging inflows from Citizenship-by-Investment (CBI) programs and periodic debt restructurings. Going forward, based on unchanged policies, and reflecting modest projected economic growth, the region's debt ratio is expected to resume growing. The high debt ratio is problematic for several reasons, not least because of its adverse impact on economic growth in the region.

2. The policy framework for reaching the agreed debt target has been evolving, but, despite some progress, it remains incomplete. In 2006, the ECCU abandoned the 3 percent of GDP deficit target for lack of compliance. A decade later, the target date for reaching the common 60 percent debt ratio was pushed back from 2020 to 2030. While, at national levels, the ECCU countries have been upgrading their medium-term fiscal frameworks and related institutions and procedures, this has had a limited effect on fiscal policy outcomes, which, in addition to the persistently high debt, have been characterized by strong policy pro-cyclicality. For now, there is no explicit operational framework that links short-term and long-term objectives across the ECCU (see IMF, 2017a).

3. A key complication is ECCU's susceptibility to large shocks, particularly natural disasters (NDs). ND' impact is especially large for the Caribbean, with total economic cost being assessed at 1¾ percent of GDP annually (see World Bank, 2018). The disasters also undermine fiscal positions through their effects on national wealth, output, and pressures on reconstruction spending. They also interfere with fiscal policies, inducing pro-cyclicality and offering repeated rationales (whether justified or not) for delaying policy action. The disasters have been considered a reason that makes fiscal responsibility frameworks (FRFs) particularly challenging to implement in smaller countries. In turn, the authorities' policy options to deal with the disasters are hampered by lack of fiscal space, which limits disaster-related spending and pushes resources toward emergency ex-post recovery rather than ex-ante disaster preparedness.

4. Recent advances have been made in understanding the workings of both the FRFs and options to address natural disasters. On the former, there is increasing evidence that: (i) well-designed frameworks can be effective in improving fiscal sustainability even with imperfect compliance (see IMF 2018a); (ii) there is an expanding menu of tools to tailor the

[1] Prepared by Bogdan Lissovolik (WHD).

[2] The two other, smaller, economies – Anguilla and Montserrat – are very particular cases, being British Overseas Territories, with Montserrat having very low public debt due to the lack of authorization to borrow. As such, these two economies are largely excluded from the analysis of this paper.

frameworks to country-specific conditions; and (iii) such frameworks are workable in small, shock-prone countries, including in the region (Grenada (the ECCU member), Jamaica, etc.). On natural disasters, recent research has fleshed out policies and requirements for implementing ex-ante mechanisms to enable (i) resilient investment and (ii) adequate insurance to cover the whole range of the risks that ECCU countries face (Chapter 1 in this SIP).

5. This paper analyses the case for FRFs in the ECCU based on these advances. It draws the following main conclusions. First, the ECCU countries are trapped in a vicious circle between NDs and weak fiscal positions, which needs a comprehensive solution. Second, the FRFs offer useful and workable policy options to policymakers. Third, the paper proposes to build these frameworks gradually, relying largely on country-specific elements with only a few ECCU-wide steps that would be primarily anchored by the agreed 60 percent of GDP debt target by 2030. Fourth, the FRFs are valuable tools for supporting ex-ante resilience building to ND. There is a wide array of technical tools available for analyzing the FRF options that best fit the region and the individual countries, including scenario analysis, counterfactual simulations, and stochastic simulations. The use of these tools is illustrated in this paper for some of the options.

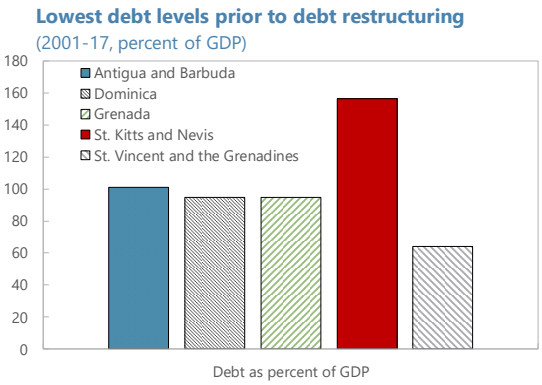
6. The paper is organized as follows. Section B offers a diagnostic of ECCU's current fiscal problems based on stylized facts, including by assessing heterogeneity among countries and the role of natural disasters. Section C briefly surveys relevant international experience with FRFs. Section D fleshes out elements of the proposed approach and describes how it would operate in ECCU countries, including how the framework would be made robust to natural disasters. Section E concludes. The Appendices give an overview of the diagnostic tools that could be available to the policymakers, an analysis of fiscal trends, and details about needed supporting institutions.

B. Diagnosing ECCU's Fiscal Problems

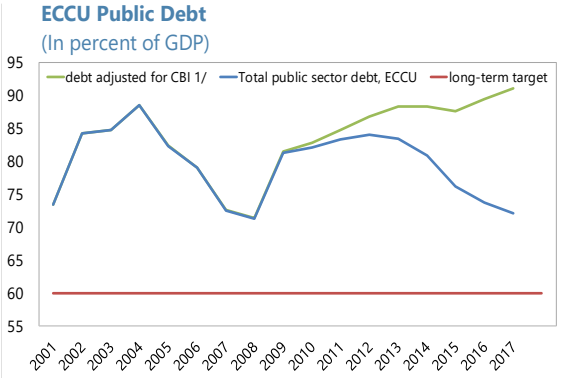
7. The ECCU countries are burdened with high public debt. Over the past two decades, the region's public debt ratio has hovered between 70 and 90 percent of GDP – well above the 60 percent of GDP target set in 1998. Furthermore, the debt dynamics over the past two decades could have been worse if not for (i) the substantial inflow of funds from the CBI programs, which through 2017 cumulatively amounted to around 15 percent of ECCU combined GDP; and (ii) frequent debt restructuring in most ECCU-6 countries (except St. Lucia).[3] The persistently high debt ratio has co-existed with low and declining growth in the region, with some research suggesting that the high debt was directly affecting economic growth.[4] Going forward, assuming unchanged policies, the ECCU region's debt ratio is projected to resume growing and exceed 83 percent of GDP by 2030.

[3] The total estimate of debt relief is difficult to measure precisely in the debt stocks given the insufficient data for some of the prior years and given that some of the debt restructurings (e.g., Grenada in 2006) provided debt relief that was not fully and quickly reflected in the debt stocks. The estimate of debt relief provided so far this century is in any case likely to exceed 10 percent of ECCU's combined GDP.

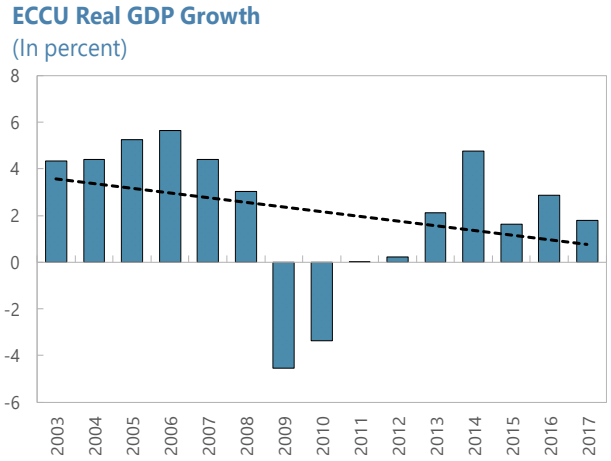
[4] Greenidge et al. (2012) estimate that gross debt beyond the threshold of 55-56 percent of GDP is associated with lower economic growth.



Sources: Country authorities and IMF staff estimates



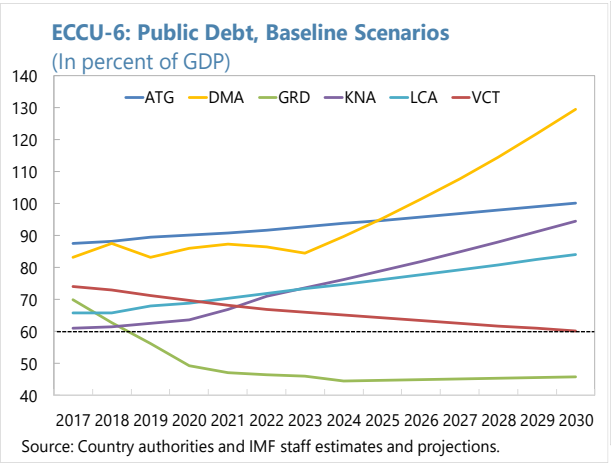
Sources: Country authorities and IMF staff estimates.
1/Counterfactual scenario assuming absence of historical CBI fiscal inflows that would have required debt issuance in the same amount.

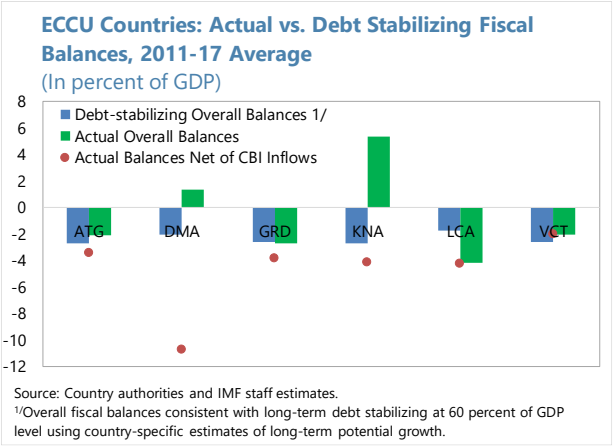


Sources: Country authorities and IMF staff estimates

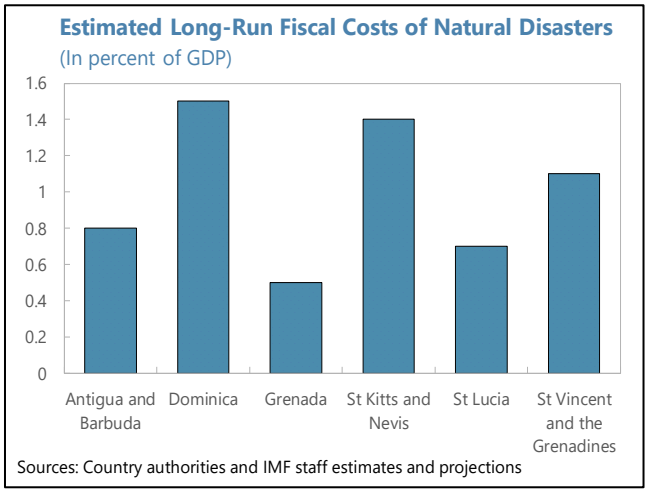
8. There is however substantial heterogeneity in ECCU-6 countries' debt sustainability trends. These differ across three basic patterns. First, Grenada and St. Vincent and the Grenadines have seen a substantial reduction in debt recently and have a favorable debt outlook that envisages convergence to the 60 percent of GDP target. Second, St. Kitts and Nevis and St. Lucia have been in an intermediate position, with their debt levels being so far only moderately above the 60 percent target; however, they are projected to diverge from the target going forward unless adjustments are made. Finally, Antigua and Barbuda and Dominica have the highest levels of public debt in the region and, without policy adjustments, could see their debt increase yet further to very high levels by 2030. These different debt sustainability outlooks essentially derive from the differences in the recently observed *underlying* fiscal deficits.[5] This country-specific heterogeneity is studied in more detail in Appendix II.

[5] "Underlying" deficits are defined as those of net of CBI inflows. As these inflows are expected to moderate from the high current levels, headline fiscal balances would not be a reliable gauge of the fiscal stance going forward.





9. Natural disasters were a significant factor in the deficit bias for most countries. Over the period, 2001-17 natural disasters affected most ECCU countries, (see Appendix II) and they were associated with higher underlying deficits in Dominica, where they became an overwhelming factor. At the same time, avoidance of large natural disasters by St. Kitts and Nevis did not by itself result in a sustainable fiscal position. In this context, while the timing of natural disasters is highly uncertain, approximate estimates of their average risk to fiscal accounts were made for ECCU countries based on the analysis of long-term historical data. These estimates suggest that natural disasters are an ever-present risk for all ECCU countries, and not just for those that experienced the disasters during 2001-2017. Risks from natural disasters are not explicitly accounted in most of ECCU countries' macroeconomic projections, and their underestimation for policy purposes may be an important contributor to the observed deficit bias.



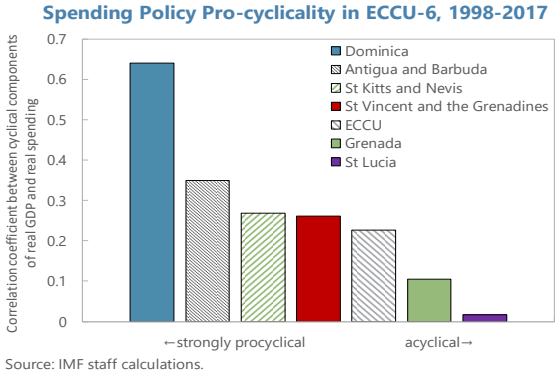
10. ECCU fiscal policies are not only subject to deficit bias, but also significant pro-cyclicality. The charts for individual ECCU countries indicate pro-cyclical policies, as the episodes of relative output strength have generally coincided with larger fiscal deficits, other things equal, in most countries. The issue of pro-cyclicality was studied more formally by calculating correlation of cyclical components of real GDP with real spending, following the methodology of (Bova et al., 2014). The analysis (see Appendix Table 1) confirms that all ECCU countries, including ECCU-6 aggregate, have been running pro-cyclical spending policies during 1998-2017.[6] The pro-cyclicality partly reflected that ECCU countries tended to tighten their fiscal deficits in bad

[6] Most of the estimates are significantly different from zero, except for St. Lucia and Grenada.

times due to low fiscal buffers and financing constraints, but also reflected the countries' expansionary policy choices in good times.

	1998-2017						
	Cyclical Component of Real Spending						
	Antigua and Barbuda	Dominica	Grenada	St Kitts and Nevis	St Lucia	St Vincent and the Grenadines	ECCU
Cyclical Component of real GDP	0.350***	0.641**	0.105	0.268**	0.0164	0.261*	0.227***
	(0.095)	*(0.231)*	*(0.110)*	*(0.096)*	*(0.136)*	*(0.126)*	*(0.067)*
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.020)	*(0.008)*	*(0.009)*	*(0.006)*	*(0.011)*	*(0.005)*	*(0.027)*
Observations	20	20	20	20	20	20	20
R-squared	0.432	0.299	0.049	0.301	0.001	0.192	0.392

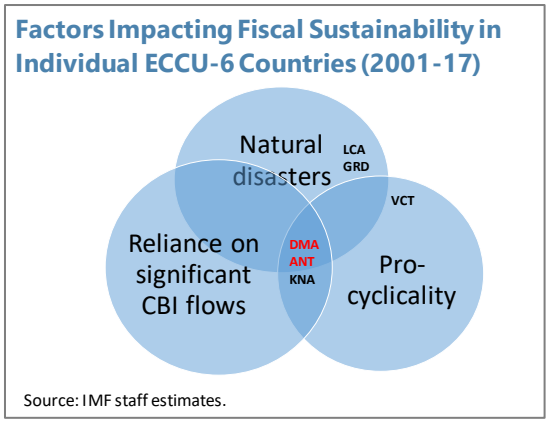
Note: The table shows regression coefficients between cyclical components of real spending and real GDP, estimated through the HP filter with a smoothing parameter lamda=100 (see Bova et al. 2014). Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Source: IMF staff estimates.



Source: IMF staff calculations.

11. CBI inflows have so far been a missed opportunity for achieving debt sustainability. Except for Grenada, the increase in the inflows coincided with a deterioraiton of the fiscal balances net of CBI flows (see Appendix II), which indicated that the extra income generated was not saved, but generally passed through to higher public spending. [7] Furthermore, while the headline fiscal deficits improved because of CBI inflows (as the latter were recorded as fiscal revenues), there was little progress in operationalizing the saving funds or other mechanisms that would create buffers and improve efficiency of contingency spending. (Grenada legislated such a mechanism, including by allocating a proportion of the CBI flows to be saved for addressing NDs, but it has not yet been made fully operational). [8]

12. In sum, the ECCU countries' experiences with debt sustainability positions were shaped in a multifaceted way. Each country's fiscal outcomes reflected the combined effect of natural disasters, economic procyclicality, the CBI inflow windfalls, as well as other determinants of the fiscal policy stance. [9] Each of those factors differed by country in terms of strength and interaction with other variables. While no single factor appears to have had an overwhelming importance, the two countries that were most subject to natural disaster shocks – Antigua and Barbuda and Dominica – ran strongly procyclical policies and have the most challenging fiscal sustainability outlook. This underscores the joint



Source: IMF staff estimates.

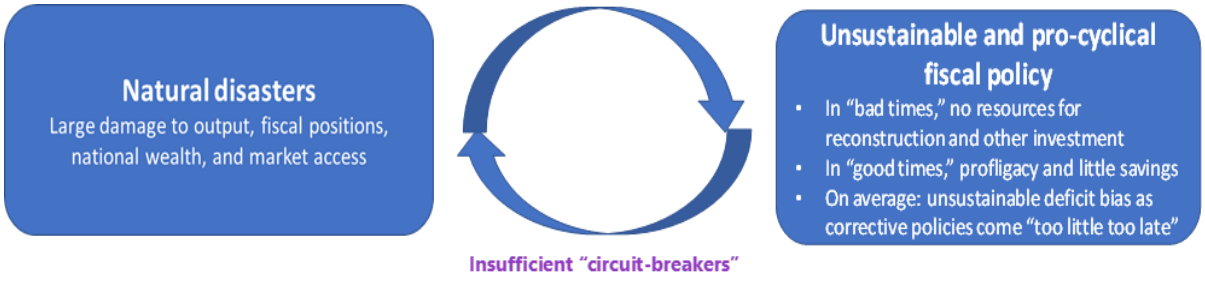
[7] The exact composition effect of the CBI inflows on the other items in the fiscal position differed by country and in some cases affected regular revenues rather than spending (see below).

[8] St. Vincent and the Grenadines (the only ECCU-6 country without a CBI program) is in the process of building a Savings fund.

[9] One such potential determinant would be "political procyclicality," whereby fiscal deficit positions are affected by the electoral cycle -- a feature common to many countries in the world, including the Caribbean.

importance of natural disaster shocks and countercyclical policies in steering the fiscal performance.

13. The joint effect of natural disasters and sub-optimal fiscal policies is indicative of negative spill-overs and a vicious circle. Natural disasters inflict damage on sovereign assets, cause public debt to ratchet up, and amplify a financing crunch. The resulting shock to fiscal solvency and liquidity forces a pro-cyclical tightening policy response, which limits possibilities for reconstruction, slowing the economic recovery. This, in turn, entrenches the country's vulnerability to natural disasters. "Circuit-breakers" such as insurance mechanisms and other buffers are limited, as the countries largely rely on external funding, which, while essential, is not sufficient. For now, this funding has been "reactive" rather than "proactive," with a prevalent focus on ex-post reconstruction as opposed to ex-ante resilience building. As a result, ECCU-6 countries relatively often resort to extreme steps such as debt restructurings to exit the circle. These however typically do not put the countries' public finances on a sustainable path, both because they tend to be highly disruptive to the economy and because they do not correct the policy pro-cyclicality and the deficit bias that accumulates both in good and bad times.



Source: IMF staff.

C. International Experience with Fiscal Responsibility Frameworks

Global Experience

14. The use of fiscal responsibility frameworks (FRFs) has proliferated in recent years. Over 100 countries now employ some version of a multi-year numerical fiscal target to guide their public finances (Lledó et al,. 2017).[10] A key motivation for such frameworks -- which operate by targeting deficits, expenditure, or other indicators – is to avoid truly costly ways to restore fiscal sustainability, such as sovereign defaults. The appeal of the frameworks is enhanced by (i) continued periodic debt sustainability crises, which are often a product of discretionary deficit biases, including due to electoral cycles; and (ii) greater flexibility options and country-specific granularity, which permit to effectively target not only debt sustainability but also a wide range of other fiscal policy objectives.

[10] Fiscal responsibility frameworks codified in a law and underpinned by multi-year numerical targets are often referred to as "fiscal rules." This paper eschews the term "fiscal rules" in favor of "fiscal responsibility frameworks" (FRF) to underscore the increased flexibility afforded by the "second-generation" features of these fiscal frameworks (see IMF 2018a).

15. Recent evidence suggests that well-designed fiscal responsibility frameworks can be effective in reducing deficits and debt. FRFs are associated with lower fiscal deficits than in countries that rely on policy discretion, although the results become insignificant if controlled for endogeneity (see IMF (2018a)). However, *well-designed* fiscal responsibility frameworks are more robustly associated with lower fiscal deficits, with the results remaining significant after endogeneity controls.[11] In addition, formal numerical fiscal responsibility frameworks have been associated with a so-called "magnet effect," whereby the gap between actual deficits and the rule's ceiling diminishes over time. This effect operates even with imperfect compliance and is particularly noticeable in the countries of the European Union with respect to their common supranational frameworks.

16. Initially, the FRFs were very rare in small states, but this is changing. This reflected a consideration that the high volatility observed in these countries would require very flexible policies (see IMF 2018b). However, the cost of discretion, including due to political economy pressures for public spending and exemptions and special treatments, is also very high. As a result, more and more small island states akin to the ECCU countries introduced the FRFs. Worldwide, these include countries such as Cabo Verde, Maldives, and Mauritius. In the Caribbean region, national fiscal responsibility laws have been adopted in Anguilla, Grenada, Jamaica, Suriname, and most recently Bahamas.

Grenada's and Jamaica's Examples in the Region

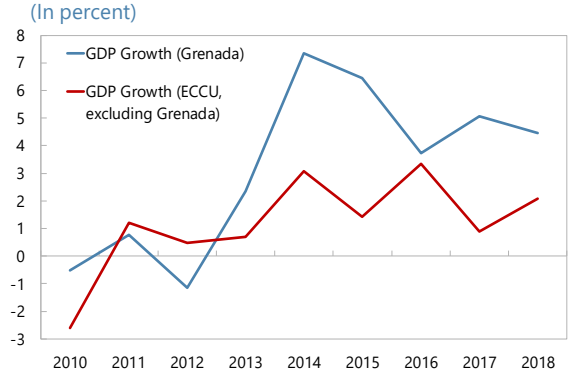
17. Grenada adopted its FRL in 2015 to address a difficult economic and fiscal situation. The FRF contains the following elements: (i) a medium-term debt target of 55 percent of GDP (with a ceiling of 60 percent of GDP that triggers corrective actions); (ii) a primary surplus floor set initially at 3½ percent of GDP for a rapid debt reduction; and (iii) caps on real growth in the central government's primary spending to 2 percent annually (in line with estimated potential growth) exempting grant financed capital spending and on the public wage bill of 9 percent of GDP. There is a phased transition process: after debt reaches the target of 55 percent of GDP, the primary surplus floor would be revised to a debt-stabilizing balance and the expenditure target may also be re-calibrated. The framework contains "escape clauses" to ensure flexibility in the face of natural disasters, recessions, financial crises, and other emergencies. It is also supported by extensive institutional provisions aimed at independent oversight and accountability.

18. Grenada's early experience with the FRF is reassuring. It underpinned large fiscal adjustment during the 2014-17 homegrown economic program (9½ percent of GDP), putting the public debt on a declining trajectory.[12] Despite prior concerns that such a large fiscal adjustment could hurt output performance, Grenada's growth has improved markedly and compares favorably to other ECCU countries. This also permitted a substantial reduction in unemployment. While the growth outcomes since 2015 included good performance of the agriculture sector, which is partly weather-related, they also reflected strong policy implementation that was

[11] Key elements associated with well-designed frameworks are listed in (IMF 2018a) and are discussed in the following section.

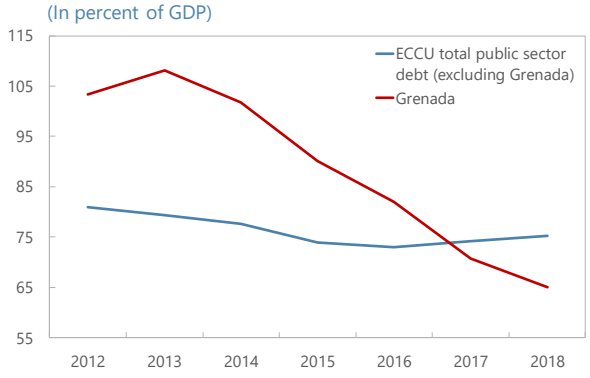
[12] The adjustment was accompanied by the collaborative debt restructuring, which reduced the debt stock by around 8 percent of GDP, which was less than a quarter of the cumulative debt reduction of 37 percentage points between 2013 and 2017.

enabled by the new framework (see IMF (2017c)). Further positive features of Grenada's performance included strong private investment, particularly FDI. The main concern with the FRF has so far been substantial under-performance of public investment, which has however also been impacted by factors not directly linked to the FRFs such as project execution capacity limitations (see IMF 2018d)).



Real GDP Growth in the Region
(In percent)

Sources: Country authorities and IMF staff estimates



ECCU Public Debt
(In percent of GDP)

Sources: Country authorities and IMF staff estimates

19. Jamaica's experience with its FRF contains some, but not all, of Grenada's elements. Its revised framework that was enacted in 2014 has been broadly similar to Grenada's, with some institutional differences.[13] Just like Grenada, Jamaica's 2014 framework enabled rapid public debt reduction, strong domestic private investment and FDI response, unemployment reduction (by 6 percentage points), and improved financial sector performance, with credit growth averaging 10 percent since the FRF was enacted. At the same time, unlike in Grenada, real GDP growth has remained around its long-term average of around 1 percent, although this was likely due to factors orthogonal to the FRF such as weather-related shocks to agriculture and long-term problems of high crime and poor infrastructure (see IMF 2018c).

20. Overall, the experiences of Grenada and Jamaica suggest a substantial positive potential of the FRFs, but also indicate that they are not a panacea. The adoption of the FRFs was associated with strongly positive fiscal outcomes in both countries. Also, the experiences suggest that FRF pre-conditions are not prohibitive and they could in principle be introduced relatively quickly.[14] While the link with economic performance was also positive, it was less so in Jamaica, possibly because of its still-high debt of around 100 percent of GDP in 2018 weakening

[13] The key difference is the absence of a cap on general expenditure growth in Jamaica (although the country has the same wage bill to GDP cap sub-target as Grenada). Additionally, the deficit target is that on the overall balance and not primary balance, while the medium debt target in Jamaica is to be achieved by a specific date (2025), being "undated" in Grenada.

[14] Both countries introduced their FRFs during concurrent IMF programs, which arguably helped strengthen the pre-conditions and policy implementation. Nevertheless, Grenada has continued to implement its FRF after the program expired, while Bahamas enacted its FRF in 2018 without an IMF program.

(continued)

the positive effects from debt reduction. The experience of Jamaica also indicates that a mere adoption of the FRF does not guarantee improvement: its original 2010 FRF saw slippages and had to be revamped before the positive effects materialized.

D. Designing Resilient Fiscal Frameworks for the ECCU

21. While FRFs are proving to be valuable for many countries, they need to be well-tailored to ECCU's characteristics to be effective. A typical FRF is focused on a debt objective and operational fiscal policy steps to achieve it. For the ECCU, such a design structure would be incomplete without internalizing the risks from, and policy requirements of, natural disasters.[15] A systematic internalization of natural disasters would be essential to address the ECCU's deficit bias through a realistic assessment of the cost of natural disasters for the debt path and the needed medium-term fiscal policy stance. Building resilience to ND would also help address procyclical policies since the ECCU's economic cycle is related to the "natural disaster" cycle.

22. A well-designed FRF also needs to maximize elements of simplicity, enforceability, and flexibility (see IMF 2018a). These objectives are not easily reconcilable, and the trade-offs need to be overcome by fitting the FRFs to specific circumstances and leaving reasonable scope for policy discretion. IMF (2018a) highlights several features of well-designed frameworks, which should include a clear public debt objective and parsimonious operational elements through which it can be achieved with maximum benefits to the economy.[16] Strong and broad-based political commitment would be essential to underpin the FRFs. In this respect, there remain substantial differences in the ECCU countries' attitudes toward the FRFs.[17]

23. For the ECCU, a significant FRF enforceability issue is whether it would apply at the regional or at national levels. On the one hand, given that the ECCU is a currency area, it offers scope for "supranational rules" that exist in other such unions, for example the EU. On the other hand, ECCU's institutions and practices place a strong emphasis on national sovereignty, its fiscal policies are fully conducted at individual country levels, and the legal framework for policy coordination and the supranational institutional capacity remain less extensive than in other unions such as the EU. Also, as the experience of other countries shows, political support for the FRF's is much more difficult to generate at the supra-national rather than national level.

[15] In this respect, it could be recognized that, despite encouraging experiences so far in Grenada and Jamaica, their new frameworks have not yet been tested by significant natural disasters. While Grenada's and Jamaica's FRFs include provisions to deal with natural disasters, these elements could be further enhanced through a more systematic approach.

[16] As per IMF (2018a), well-designed frameworks typically involve (i) calibrating targets based on economic principles; (ii) broad institutional and economic coverage of targets; (iii) incentivizing saving in good times; (iv) precise escape clauses in case of extreme events, and (v) ensuring institutional support that enhances accountability and transparency.

[17] As of 2018, some of the ECCU countries had already tabled medium-term fiscal frameworks in parliaments, while in others the process was ongoing. Most countries were weighing the merits of adopting formal fiscal responsibility legislation to solidify progress. For example, one country authority considered that, in the absence of extensive punitive sanctions for non-compliance in most existing FRLs, these were not suitable for codification in legal norms but rather could be adopted as government or parliamentary declarations of fiscal responsibility.

24. A bottom-up country-level approach appears to be the most promising for the ECCU at the current juncture, emphasizing the following principles:

- **Primacy of national over supra-national policy elements.** Given that the responsibility for fiscal policies remains with national governments and the substantial heterogeneity between the countries' fiscal policies, positions, and outlooks, it seems premature to anchor the process of building the FRFs at the supranational level. Instead, it is desirable for each country to proceed with country-specific frameworks (as Grenada started to do). Such an apporach would also help build on successful experiences and better assess what FRF elements are workable for the countries' conditions.

- **Flexibility in country choices over specific elements of FRFs.** Despite Grenada's encouraging experience to date, its own FRF should not necessarily be replicated by other ECCU countries in all aspects. Further experiences in Jamaica and, most recently, Bahamas, suggest that there can be substantial diversity of successful FRF elements in the Caribbean and institutions that support them, and scope for useful experimentation. Also, as elaborated below, there is an expanding menu of diagnostic tools that countries could use to calibrate medium-term fiscal policy choices.

- **Identification of desirable "common elements" of the FRFs as points of consensus emerge.** Already at this juncture, there are steps that can serve as region-wide "focal points" for the individual FRFs: (i) the 60 percent of GDP debt target to be achieved in 2030 and (ii) need for mechanisms to deal with natural disasters. Both points are uncontroversial in the ECCU and could provide a bridge from national to a region-wide fiscal responsibility. Tackling these two issues would also make a good start in addressing the core problems of unsustainability (by achieving the debt target) and pro-cyclicality (natural disaster). As discussed below, building on these two aspects consistently may entail additional implications for the common elements of the FRFs.

Key Suggested Common Elements

25. The 60 percent of GDP debt target for the ECCU would benefit from a credible strategy to achieve it by 2030 and maintain it well beyond this date. This argument alone entails several potential common steps that would need follow-up region-wide. The latter comprise: (i) commitment to the 60 percent of GDP target as a long-term debt ceiling; (ii) identification of credible operational targets for the governments to achieve this objective; (iii) internalization of ND risks as an integral part of fiscal policy planning; and (iv) institutional steps that are sufficient to verify that the target has been achieved in a durable manner. The rationales for and the content of these elements are elaborated below.

- **Acceptance of the debt objective as a long-term "ceiling."** Merely achieving the debt target by 2030 would be inadequate if there is a quick rebound in debt thereafter. To ensure durable progress, there needs to be a long-term commitment to this objective, which should be widely perceived as economically appropriate. While there is no consensus about the optimal level of public debt, several considerations indicate that 60 percent of GDP debt is a reasonable ceiling for ECCU countries: (i) it is close to the estimated threshold that triggers adverse effects of public debt on economic growth in

the Caribbean region (see Greenidge et al. (2012)); and (ii) it approximates a level at which debt restructuring can occur in the ECCU.[18] Additionally, if the 60 percent of GDP target is perceived as a ceiling, the probability of hitting this level should be sufficiently small. Thus, after the level of 60 percent of GDP is achieved, individual countries could target tighter "safe-debt" targets, based on specific characteristics (as explained below).

- **Operational target(s).** The debt objective does not provide guidance for fiscal policymaking, in terms of higher-frequency (e.g., annual) targets for the aggregates that the governments control. While individual ECCU countries could choose alternative ways to guide their fiscal policies, for most ECCU countries a *budget balance net of CBI inflows (underlying balance)* seems a reasonable operational target. Given the volatility of CBI inflows and high levels of public debt, this underlying budget balance is the best option to guide debt dynamics, which, until 2030, are expected to be the most pressing fiscal issue in the ECCU. To implement the budget balance target, countries would need to adopt specific fiscal adjustment plans. Expenditure targets could be additionally helpful to address pro-cyclicality in good times and could play greater role after 2030.

- **Supporting (common) institutional steps.** Continued work to improve fiscal institutions would be essential to underpin the FRFs. Given that the frameworks are national, priorities would be largely country-specific. Still, a few ECCU-wide steps are needed and could include: (i) a forum for discussing status of medium-term fiscal plans to reach the common debt ceiling; (ii) consultations on a potential adoption of national fiscal responsibility legislations and codification of fiscal targets and supporting measures in them; (iii) harmonized and robust classification and accounting procedures for the key fiscal aggregates (e.g., debt, fiscal deficits, and one-off measures) and (iv) a common strategy with respect to NDs and its financing. The ECCB is already involved in the work in all these areas. Further regional coordination, possibly involving the OECS Commission, would help accelerate the process by setting standards and facilitate peer review.

- **Accounting for natural disasters.** Given the importance of natural disasters for ECCU, all its countries need to step up progress in two areas:

    - **Create "real buffers"** (e.g., investment in resilient infrastructure and insurance mechanisms) to protect the economy from shocks. The minimum needs for the buffers were calculated in Chapter 1 in this SIP on a country-specific basis, including those needed for locking in critical progress by 2030 as a transition step. The key common ECCU issues are: (i) enforcing minimum **requirements for the buffers** within the FRFs and (ii) attracting **increased concessional financing**, given that the ECCU countries have limited fiscal space for these buffers, particularly before 2030. The support would help generate mutually reinforcing positive spillovers from reducing debt and increasing the buffers, as these processes should ideally proceed in parallel during the critical transition phase before 2030.

[18] As exemplified by the case of St. Vincent and the Grenadines, which restructured its public debt after it reached 64 percent of GDP in 2006.

- **Protect fiscal frameworks** from being derailed by shocks. Mechanisms should be included to provide flexibility while preserving credibility of the FRFs, such as: (i) **escape clauses** for truly large shocks; and (ii) **incorporation of the average historical fiscal cost** of the natural disasters in the projections to avoid understating the fiscal corrective efforts needed for sustainability.

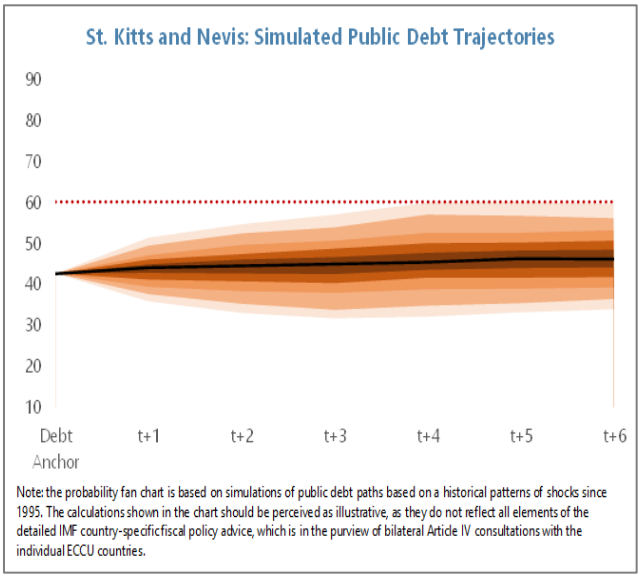
Scope for Country-Specific Choices

26. The individual countries' FRFs should envision an efficient selection of the fiscal parameters, targets, and institutions suitable for each country. Various examples focusing on the choices faced by the ECCU are studied below. The analysis uses some of the IMF's FAD department's tools that can help country authorities and researchers to select and calibrate options that best fit country circumstances (see IMF 2017b, 2017c, and Appendix I).

Calibrating the Debt Anchor: A Country-Specific Ceiling

27. Reaching the 60 percent of GDP common ceiling would be a major achievement, but by itself it may represent insufficient protection from the large shocks that ECCU countries face. Given that this debt ratio is close to the thresholds that trigger adverse economic consequences, it would be desirable to ensure that the debt stays below the ceiling under most circumstances. This in practice entails targeting a lower, "safe" level of debt, to help maintain debt dynamics under control even under various types of bad shocks.[19] Grenada's FRF effectively targets such a lower ceiling of 55 percent of GDP.

28. An estimate of the needed safety margin can be based on the history of shocks. The methodology for determining the safe level of debt (IMF, 2016) generates medium term simulations of the debt ratio, assuming that the pattern of historical macroeconomic and fiscal shocks faced by a given country were replicated going forward. The methodology yields illustrative scenarios based on history and plausible assumptions about fiscal policy choices. For ECCU countries, the simulations suggest that such a safe debt levels could range from 40 to 50 percent of GDP, depending on the country, and the desired probabilities of remaining below the ceiling (for example, 95 percent) within a certain horizon (for example, 6 years). It would be preferable, however, that



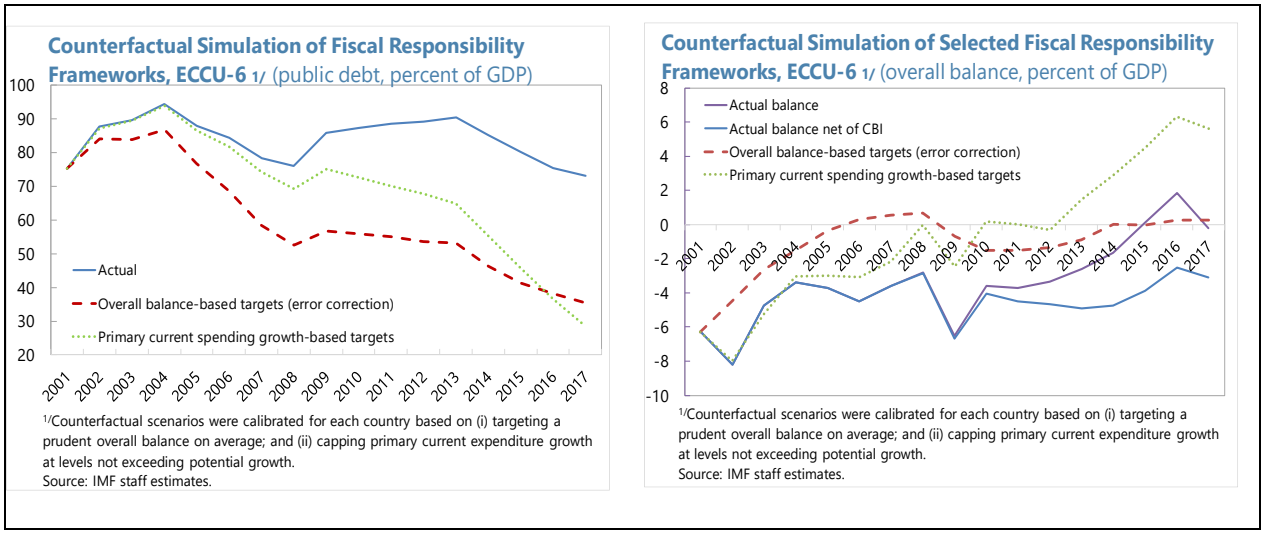
[19] In ECCU, in addition to the natural disasters, fiscal shocks can stem from external demand, off-budget operations, and "tail risks" such as bank bail-outs.

such a determination be made taking account of the expected fiscal buffers, which may imply different debt dynamics compared to the historically-observed levels.

Selecting Main Operational Target(s)

29. There is an extensive menu of main operational target options potentially available to the policymakers (IMF 2009). These include (i) public debt level (high-frequency) targets; (ii) revenue-based targets; (iii) cyclical adjustment; (iv) targets on nominal budget balances; and (v) expenditure targets. For the ECCU, the first 3 options have limited appeal. Debt-based operational targets are rare and are hampered by the volatile debt outturns, which also stem from GDP volatility. Revenue-based targets are also rarely used in practice since they lack comprehensiveness and would reduce emphasis on expenditure control (a key problem in most ECCU countries). Finally, cyclically adjusted targets rely on uncertain estimates of the output gap and fiscal elasticities, which are not reliable, with much larger errors in small economies.

30. In practice, the choice of the main operational mechanisms in the ECCU countries is likely to be between budget balance-based and expenditure-based targets. These two operational targets, on deficits and expenditure, have several major advantages. They are based on simple data, represent key outcomes of the budget process, and can be tracked both during the budget preparation and execution phases. Counterfactual simulations were used to assess the merits of the two operational targets for the ECCU, assuming both would have been implemented in the region starting from 2002. As can be seen from the charts, compliance with any of the two frameworks would have resulted in substantially lower average fiscal deficits than was observed for the period. Over a 15-year horizon, this would have resulted in a lower public debt ratio, by about 40 percent of GDP under both frameworks.

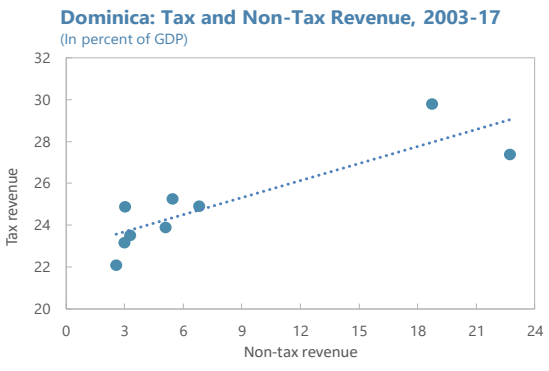


31. There are pros and cons of budget balance- versus expenditure-based operational targets. A balance-based framework target is generally more effective in correcting a public debt trajectory that results from excessive deficits, reflecting a closer link to debt dynamics. In practice, this link reflects a wider scope that this mechanism offers in improving the fiscal position through both revenue and expenditure measures. On the other hand, nominal budget

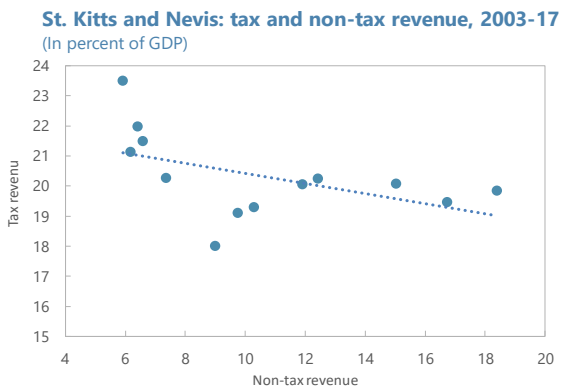
balance targets tend to cause procyclical polices and would be relatively less desirable in a situation when debt sustainability considerations are less dominant. Conversely, an expenditure- based framework would have a looser link to debt on average and would be less effective as a mere corrective mechanism. However, expenditure-based frameworks would be generally more counter-cyclical and, in some circumstances, it could underpin a more sustained and higher quality fiscal adjustment that incentivizes savings "in good times."

32. Budget balance-based frameworks would be particularly suitable for ECCU countries in the period through 2030. Their relative merits are illustrated in the charts, whereby the budget balance-based targets are more effective in reducing debt from the initial, high-debt-and-deficit situation but the spending-based framework is more impactful on debt toward the end of the horizon, which is characterized by substantial revenue windfalls.

33. Revenue mobilization is another consideration impacting the choice between budget balance and expenditure targets, generally favoring the former. Under most circumstances, a budget-balance-based FRF will internalize the policy needs of revenue mobilization more than an expenditure-based framework.[20] This would however depend on the importance of revenue mobilization, which may vary by country. Specific considerations would be needed to determine policy choices that best suit country circumstances. Key factors here would be the desired size of government and understanding revenue and expenditure structure, trends, and pressures. For example, a surge in windfall (non-tax) revenues in recent years appears to have been associated with a fall in tax revenues in St. Kitts and Nevis (where the spending ratio was relatively stable) but not in Dominica (where the spending ratio increased). In this context, the same (e.g., expenditure-based) FRF could well have very different impact on the key fiscal variables. Thus, a detailed analysis of technical factors (revenue and expenditure structure and trends) against policy goals would help determine the choice of the operational target.



Sources: Country authorities and IMF staff estimates



Sources: Country authorities and IMF staff estimates

34. Should a budget-balance-based framework be selected, a further choice between primary and overall balance-based targets is of limited importance for the ECCU FRFs. Policymakers may choose to exclude interest payments from the deficit target to put compliance

[20] To be sure, discretionary revenue measures could also be implemented under an expenditure-based targets, but in practice spending-based measures are likely to dominate over time in this framework.

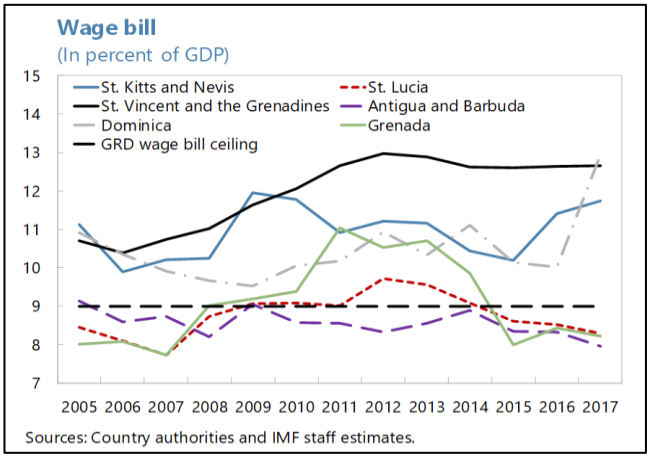
with the target more directly under their control. However, this exclusion slightly weakens the link to debt and budget financing needs, which drives a wedge between the annual budget process and medium-term fiscal frameworks. In ECCU countries, the difference between these two approaches would be generally small, given the limited volatility of the interest bill. For now, individual countries in the Caribbean, including Grenada, have mostly targeted primary balances, with the main exception being Jamaica, which has focused on the overall valance due to the more pressing need to reduce public debt.

35. A broad coverage of the operational target at the non-financial public sector (NFPS) level is desirable, but it may not be immediately feasible for the ECCU. The choice of coverage presents a similar dilemma: central government outcomes are better controlled by the policymakers, but more comprehensive aggregates that are inclusive of the operations of public enterprises matter for public debt dynamics. For ECCU countries, there is a need for institutional improvements in measuring NFPS deficit outcomes before these could be targeted. During the transition period, it would be reasonable to target CG balances while measuring NPFS dynamics and, if needed, applying corrective mechanisms to the operational targets should the stock-flow discrepancy be a significant factor.

Scope for Operational Sub-targets

36. Individual countries could complement the main operational target with sub-targets to address spending composition and quality issues. For ECCU, critical spending priorities involve containing the public wage bill and incentivizing public investment. In thinking of whether to add the sub-targets, it would be however highly desirable that the countries avoid complexity and limit themselves to a narrow subset of options.

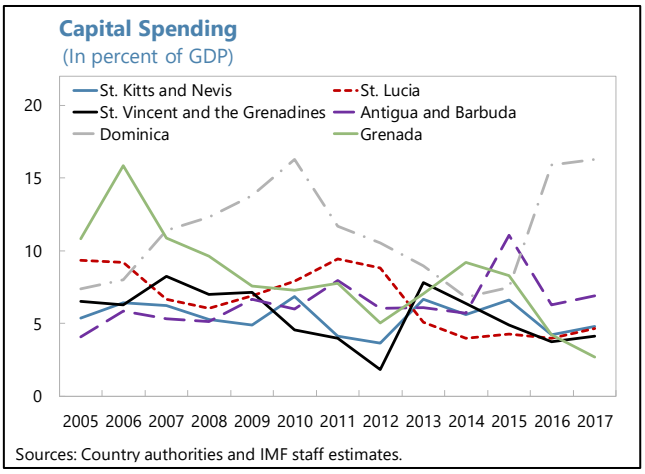
37. There is a case for a public wage bill cap sub-target in some ECCU countries. In the ECCU and broader Caribbean, public wage bills are typically a key current spending aggregate that would benefit from fiscal and efficiency gains to be achieved through rationalization and containment (see Mitchell et al., 2018). Additionally, wage bills tend to become a source of political pressures, including in the context of election-related expenditure expansions. As a result, all Caribbean countries that have so far introduced the FRFs – Jamaica, Grenada and Bahamas – have imposed a limit on the wage bill of 9 percent of GDP. In this context, three of the ECCU countries would need a substantial effort in wage bill containment if such a target were to be adopted.



38. The FRFs should not unduly constrain public investment given the ECCU's substantial development and capital resilience needs. This issue is important in ECCU countries given the observed volatility in capital spending, which may be a result of fiscal financing constraints and capacity shortcomings, but also fiscal policy choices that prioritize

current over capital spending. In many countries including the ECCU, public investment compression tends to be a first-resort option for achieving broader fiscal targets. Several steps could be considered as medium-term policy options for the ECCU to relieve potential framework constraints on public investment.

- **Exemption for grant-financed spending.** Grenada incentivizes investment by excluding grant-financed public capital spending from its spending growth operational target. This approach has yet to produce a visible change in public investment dynamics. However, the public investment outturns in Grenada reflect deeper institutional problems related to capacity to execute investment projects and meet conditions required for grant financing, as well as an exogenous decline in grant financing.[21] A consideration is currently being given to exempt Grenada's grant-related counterpart financing from the expenditure rule, which is small and would not impact debt sustainability outcomes.



Sources: Country authorities and IMF staff estimates.

- **Applying an expenditure (growth) cap only on current spending.** This approach would exempt public investment from the expenditure targets. The impact on debt sustainability could be controlled if the FRF also includes the main operational targets on the fiscal balance that do not contain this exemption. An application of this approach could usefully incentivize re-balancing the structure of public spending toward investment while achieving other key goals if the core problem is indeed the structure of spending as is often the case in ECCU countries.

- **Exempting public investment from the main operational target(s).** This approach could encompass several options, including the so-called golden rule. In this set-up, public investment may be favored even if debt sustainability targets are not fully achieved in the short-to-medium term, as it is implicitly assumed that additional investment would not hurt long-term debt sustainability. This approach however carries substantial fiscal risks, particularly if public investment turns out to be costly and inefficient. There are several methods to limit, but not eliminate, those risks, including capping the public investment levels that would qualify for such exemptions.[22] Robust statistical classification between current and capital spending would be crucial to a judicious implementation of these steps.

[21] Additionally, Grenada's stopped overstating public investment due to improvements in fiscal statistics starting from 2016, as some of the current spending transactions can no longer be misclassified as capital spending.

[22] For example, Serbia's fiscal responsibility law of 2011 envisions exempting public investment that exceeds 3 percent of GDP by up to 2 percentage points.

Internalizing Building Ex-Ante Resilience to NDs in the FRFs

39. As argued, a key policy priority for each ECCU country is to weaken the vicious circle between natural disasters and fiscal positions. Addressing it requires action on three interrelated dimensions (i) revamping fiscal policymaking to make it more resilient in achieving all its key objectives;[14] (ii) reducing damage from natural disasters, and (iii) creating "circuit-breakers" through pre-determined contingency plans and flexibility provisions to reasonably insulate fiscal policy from natural disasters. In this context, the emergency response should not derail non-disaster-related policy priorities such as fiscal and social sustainability and development objectives. Staff analysis suggests that determined action along these dimensions over the next decade could significantly improve ECCU's economic and fiscal performance.

40. Resilient fiscal policy can be achieved through implementation of robust FRFs. With respect to natural disasters, the key FRF steps already described above include: (i) calibration of a long-term country-specific debt anchor with a buffer that would ensure a low probability of being exceeded even with significant natural disasters; (ii) an operational (budget balance) target that would be robust to incorporate average historical cost of NDs and withstand a possibility of a decline in one-off or volatile revenue components; and (iii) institutional steps that are sufficient to verify and explain that the targets are being pursued in a consistent manner, even in case natural disaster shocks interfere with achieving pre-determined "headline" objectives.

41. The damage from natural disasters could be reduced through "real buffers" such as resilient public investment and insurance. The requirements for and effects of the buffers have been calculated in Chapter 1 in this SIP on a country-specific basis. First, resilient public infrastructure would reduce losses from natural disasters. Simulations indicate that gradually phasing in such investment could achieve that 80 percent of the public capital stock is resilient by 2030 and raise potential output by 0.1-0.4 percent per year in ECCU countries, with a knock-on positive spillover effect on fiscal balances. Second, staff analysis suggests that, for ECCU countries, it is feasible to adopt a layered insurance strategy incorporating saving funds, increased CCRIF coverage, and state-contingent sovereign debt to cover the risks stemming from 99 percent of disasters. Further contingency plans could be made to address the cost of 1 percent of disaster episodes, which could potentially be very large, including (i) hurricane clauses to alleviate debt-service problems (already in place in Grenada); (ii) rapid mobilization of grant funding, and (iii) potentially pooling ECCU's contingency reserves to diversify risks.

42. Further enhancing "circuit-breakers" involves making the FRFs both more robust and flexible. First, the buffers would by themselves serve as circuit-breakers by supporting fiscal sustainability through better growth and revenues and reduced costs of natural disasters and debt issuance in their aftermath. Second, the FRFs need to be additionally protected through **escape clauses** in the event of exceptionally large shocks, with corrective measures to revert to the headline parameters of the framework within a reasonable horizon. The escape clauses should be tailored to the size of the buffers and shocks, be precisely defined, and have verifiable

[14] See IMF (2018e) for broader fiscal policy steps that are recommended to deal with natural disasters.

criteria for greater credibility (see Box 1). Incorporation of the buffers could help the escape clauses to be used relatively infrequently.

43. The FRFs should be integrated with the needs of resilience-building and insurance buffers. The FRF's targets need to create the necessary fiscal space to ensure a credible overall strategy and fill financing gaps, consistent with the plans to build buffers and upscale resilient investment. Steps for this could include: (i) adequate allocations to support technical plans to deal with natural disasters and replenishment of the buffers to be included in annual budgets; (ii) costing of investment projects and financing needs, with plans and outcomes to be reported in the medium-term fiscal frameworks; (iii) legislating minimum public financial management (PFM) requirements for standards of resilient infrastructure and public insurance against natural disasters; (iv) contingency plans for dealing with truly large natural disasters, including attracting emergency donor support and potential provisions for debt or debt service relief (e.g., "hurricane clauses"); and (v) provisions for allocating volatile revenues, particularly from CBI programs, to the financing of the real buffers.

Fiscal Institutions to Underpin Country-Specific FRFs

44. The FRFs should rely on institutions, including legal frameworks and PFM procedures, to help comply with the targets and do so in an effective way. This would permit, for each country, to strike a right balance between the binding medium-term elements of the FRFs and scope for policy discretion that is needed to respond to shocks and other unforeseen events. In the ECCU, the key areas of institutional support for the FRFs concern: (i) level of legislation; (ii) statistics and data; (iii) fiscal projections; (iv) budget, cash, and debt management; (v) government transparency; (vi) independent monitoring; (vii) sanctions; and (vii) public investment management procedures. A more detailed analysis of the specific institutional requirements in contained in Appendix III.

45. While the scope for institutional improvements is extensive, they generally should not be a reason for delaying the introduction of the FRFs. Experience of Grenada and Jamaica suggests that the institutional improvements can proceed in parallel with the implementation of the FRFs[15] (except for a very limited number of large gaps that may require urgent action). In many cases, the FRFs may usefully increase incentives to accelerate PFM-type reforms.

[15] For example, unlike Jamaica sequencing with implementing PFM-type reforms with respect to the FRL substantially differed from Grenada's, including for example, the introduction of a fiscal council.

Box 1. Options for Escape Clauses for Natural Disasters in the FRFs

To facilitate continued compliance with the FRF targets, these need to be viewed as reasonable over a long-term horizon. To that effect, the targets should accommodate unusual, exogenous circumstances that fundamentally affect the countries' capacity to comply with targets. The nature of the unusual events can be generally anticipated, but their precise effects and timing are inherently unpredictable.

Escape clauses provide scope to suspend or amend the FRF, temporarily, to avoid amplifying the impact of large adverse shocks, notably natural disasters, but also other shocks. However, an escape clause is not a substitute for disaster management preparations and would best work in an integrated system of policy actions. International experience suggests that well-designed escape clauses have the following features:

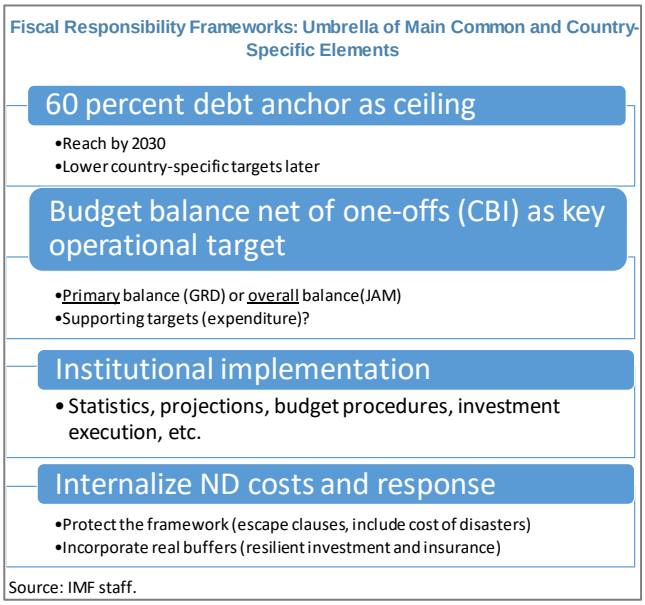
- **Ex-ante precision over discretion.** Countries are moving away from escape clauses that give substantial discretion to the policymakers. Instead, the most recent clauses, including in Jamaica and Grenada, contain numerical triggers.
- **Significant size of shocks.** Size of the natural disaster and other shocks that qualify for escape clauses should be relatively large to ensure they are used in truly exceptional cases. For instance, Jamaica requires that only natural disasters with economic damages of above the historical median qualify.
- **Independent verification.** The triggering of escape clauses is linked to actions of institutions that have specialized expertise and credibility to verify the occurrence of escape clauses. Currently in the Caribbean, institutions like the Planning Institute (Jamaica), central banks and parliaments are involved in the confirmation of escape clauses.
- **Follow-up actions.** Following activation of an escape clause, the government could be required to bring forward (i) an updated fiscal strategy that would explain the nature and magnitude of the shock and response to it, (ii) the timeframe for suspending operation of the fiscal framework, and (iii) the publication a new set of fiscal projections with the intended correction. These should remain consistent with the principles of fiscal sustainability and convergence to the fiscal targets.

For the **ECCU countries**, the following specificities could be incorporated in designing escape clauses:

- **Link of the escape clause and buffers.** The triggers could be calibrated to truly large events. In case the ECCU countries achieve insurance coverage levels recommended in Chapter 1 in this SIP, the threshold could be derived by parametrizing characteristics of the 1 percent of disasters for which the coverage is incomplete.
- **Using parametric triggers.** Thresholds related to parametric characteristics of NDs (e.g., strength of hurricane winds) would be more objective than linking them to an assessment of ex-post costs of natural disasters. The problem that the parametric are not always strongly correlated with actual economic damage, but the disconnect would likely less pronounced for truly large NDs.
- **Involving CCRIF in the verification process.** The region has an advantage of relying on CCRIF's expertise. Hurricane clauses in Grenada (and more recently in Barbados) have been linked to CCRIF payouts, which can also serve as escape clause triggers. ECCU countries could also choose to supplement the triggers through assessments of their National Emergency Management Agencies.
- **Recalibration.** Escape clauses could be adjusted over time in a transparent manner, including based on updated assessments of climate change and of insurance buffers, as well as the changing availability of the buffers.

Implementing the FRFs in the ECCU

46. Implementation of both common and country-specific elements of the FRFs requires a comprehensive strategy and cooperation on the part of the ECCU countries. Advancing in the process entails combining country-level progress with region-wide actions across many levels, within the four blocks of issues highlighted in this paper, thereby creating an umbrella structure common umbrella. As discussed, individual countries would have substantial leeway in shaping choices in all areas, given their different debt sustainability outlooks, economic structures, and even positions of the individual ECCU countries within the natural disaster cycles. It is however necessary to accommodate this complexity to build broad and sustained support for the principles of fiscal responsibility across the entire ECCU.



Source: IMF staff.

47. A successful implementation of the FRF promises major payoffs for the ECCU countries. Resilience and natural disaster-related measures discussed in Chapter 1 in this SIP will have growth and fiscal benefits that – while not very large initially – are likely to generate significant permanent effects. These measures would help entrench fiscal sustainability and reduce the likelihood of disruptive debt restructurings. Also, the measures would reduce the costs of natural disasters as well as social dislocation. A solid progress of the FRFs would give confidence to the international community that the ECCU countries are seriously revamping their fiscal management practices and are building more viable economies. Even in a scenario of intensifying natural disasters, ECCU's efforts would play an important signaling role that would help preserve and perhaps upscale their support as it would be used more efficiently.

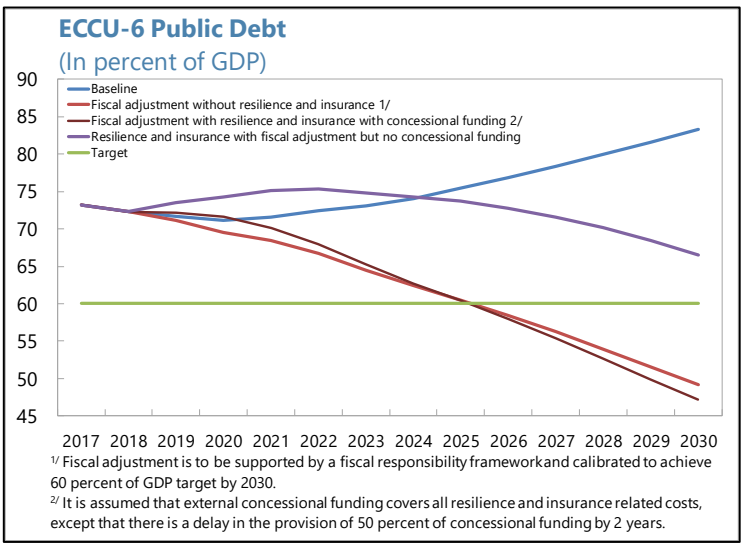
48. However, building the fiscal responsibility framework entails both substantial fiscal consolidation and costs in the short run to phase in ex-ante resilience building. First, given the upward debt dynamics in most ECCU countries on current policies, large fiscal consolidation efforts are needed. Such an effort could amount up to 7 percent of GDP cumulatively in some countries with larger debt sustainability problems.[16] Second, the minimum cost of phasing in resilient investment and layered insurance mechanisms for the ECCU would amount to around US$100 million or 1½ percent of the region's combined GDP annually, but could be substantially higher (up to US$350 million annually). With less resources to address

[16] While the fiscal multipliers and hence the growth effects of adjustment are estimated to be very small in the ECCU, such a large adjustment could be challenging to implement for political and social reasons.

(continued)

these issues, the ECCU countries would likely be forced to slow down progress that could be achieved by 2030 (in terms of a public capital stock that is about 80 percent resilient[17] and insurance that would cover 99 percent of disaster events (though it would be a significantly smaller portion of the total potential cost given that the largest disasters would be covered to a smaller extent).

49. A scenario analysis illustrates the effects and trade-offs of implementing a resilient fiscal framework. The following are the main scenarios to consider for the policymakers.



- **Baseline.** In the absence of any action to undertake fiscal consolidation the region's debt ratio would be steadily rising, exceeding 83 percent of GDP in 2030. In this case, debt sustainability considerations would likely dominate all others, and undertaking systematic measures to build buffers to natural disasters would likely be infeasible.

- **Fiscal responsibility without ND resilient investment and buffers.** Aggressive and frontloaded fiscal consolidation starting from 2019, which is designed to fully incorporate average expected costs of natural disasters, would result in a steady decline in the public debt ratio. It would be projected to dip below the 60 percent of GDP before 2030.[18] However, the ECCU economies would remain as vulnerable to natural disaster shocks as they are now, and if the NDs' intensity is above historical averages, the plans would face major implementation challenges.

- **Fiscal responsibility with ND resilient investment and buffers but no concessional financing.** Should the authorities proceed with the same fiscal consolidation plans (in terms of the amount adjustment assumed in the previous scenario) but additionally

[17] This conclusion hinges on an assumption that resilient investment is 25 percent more costly than normal investment.

[18] The scenario assumes implementation of fiscal consolidation strategies broadly in line with advice of recent IMF Article IV consultations for each ECCU country, which can be approximated by a budget-balance-based operational target in a fiscal framework. Staff analysis suggests that these strategies are compatible with a prudent target on a fiscal balance net of CBI inflows.

decide to build the recommended ND resilient investment and buffers, the public debt ratio would decline only moderately and stay well above 60 percent of GDP by 2030. In other words, the additional costs involved in building the buffers would stand in the way of substantial debt reduction, even if the ECCU countries make substantial fiscal consolidation efforts.

- **Fiscal responsibility with ND resilient investment and buffers with external support.** In a scenario where the ECCU countries undertake fiscal adjustment and phase in ND resilient investment and buffers without incurring substantial additional fiscal cost,[19] the ECCU countries both reap the benefits of adjustment for fiscal sustainability and achieve significant progress in building resilience. These latter benefits would show in a public debt ratio trajectory declining at a faster pace than in a pure fiscal consolidation scenario.[20] The benefits would be further amplified beyond 2030, as the growth and fiscal benefits would continue while the cost of maintaining the buffers would decline after the transition period is completed. [21]

50. There is currently a window of opportunity for the ECCU to step up efforts to implement resilient fiscal frameworks. On the one hand, with a little more than a decade remaining until 2030, determined action needs to be initiated very soon to credibly achieve the target by then, as another delay in reaching the target would be perceived as a significant setback. On the other hand, the intensification of hurricanes in recent years has catalyzed the international community's awareness of the cost of hurricanes for small island countries, potentially unlocking resources that may become available through climate funds and other channels. Commitment to fiscal responsibility frameworks can help make progress in both these areas: it would anchor fiscal adjustment and the supporting institutional improvements, while giving confidence to the donors that progress in achieving the fiscal goals remains on track.[22]

51. Developing robust financing strategies, which require coordinated action from both the international community and ECCU countries, is key to unlocking the benefits from the FRFs. Realistically, most of the ECCU economies by themselves are unlikely to generate significant fiscal space that would be sufficient for building the recommended resilient public investment and insurance buffers, given the already significant adjustment efforts that are assumed in the scenarios. Enhancing access to concessional financing will therefore be a key option for making resilience building sustainable. The ECCU countries should however explore all possibilities to do their share, including undertaking further fiscal adjustment in those countries where it is feasible, channeling of the bulk of the CBI revenues to the building of resilient

[19] It is assumed, for illustration, that the bulk of the extra cost is covered by concessional financing with a significant grant element, with some delay in the provision of such financing.

[20] Specifically, the more ND-resilient economy in this scenario would enjoy the advantages of (i) higher long-term growth; (ii) better revenues; (iii) lower interest cost due to the need to issue less debt; and (iv) reduced cost of natural disasters as it is offset by insurance payouts.

[21] For insurance alone, the cost of maintaining the same coverage after 2030 would be only one-fourth of the annual cost of scaling up the insurance until then.

[22] The confidence effects from the FRFs would remain in effect even if headline fiscal indicators are thrown off course in the event of a large natural disaster.

investment and insurance buffers, and credibly meeting the donors' conditionality on PFM advancement.

E. Concluding Remarks

52. The ECCU countries are trapped in a vicious circle between natural disasters, weak fiscal frameworks, and low economic growth. Exiting this circle requires forceful measures to address all its elements, including (i) resilient physical investment in preventing damages from natural disasters; (ii) enhancing "circuit-breakers" such as saving funds, insurance and other contingency-based financing and effective operational plans; and crucially (iii) strengthening fiscal frameworks and policies to achieve debt sustainability and overall fiscal policy countercyclicality that supports the shift towards building ex-ante resilience.

53. Fiscal responsibility frameworks offer tangible benefits for the ECCU countries, in terms of fiscal sustainability and resilience building. Well-designed frameworks have a fair record in addressing problems of debt unsustainability and pro-cyclicality. The experience of other countries, including in the region, suggests that substantial fiscal and growth benefits could derive from the frameworks that are well-tailored to country circumstances and are broadly shared societally. The frameworks should aim to create fiscal space for resilient investment and insurance coverage, which will address the key portion of the ECCU's deficit and pro-cyclicality biases that are due to natural disaster cycle.

54. The proposed "umbrella structure" for the FRFs in the ECCU seeks to give substantial leeway to individual countries. The bottom-up approach derives from the primacy of national sovereignty, but also from substantial heterogeneity in the individual countries' positions. The countries can build broad societal ownership by selecting and calibrating the many features of well-designed frameworks within a reasonably parsimonious system of targets and institutional elements. The main common elements derive from the need to credibly achieve the shared 60 percent of GDP debt target, and in this context budget balance-based frameworks would be particularly suitable for ECCU countries in the period through 2030. Finally, mechanisms to deal with natural disasters should be accommodated by the FRFs as integral elements. This step currently presents an opportunity for critical progress, but enhanced support from the international community would be a key option for realizing those benefits.

55. While adopting the FRFs is an essential step, it is only part of the agenda to make the ECCU's economies more prosperous and resilient. This paper has focused on the resilience of the public balance sheet and infrastructure, but, additionally, major efforts are also needed to bolster private sector resilience and growth. The public sector needs to take the lead in underpinning economy-wide resilience by serving as example, pro-actively enacting standards, and implementing effective economy-wide growth strategies that are compatible with the reality of intensifying natural disasters.

References

Bova E., Carcenac N., and M. Guerguil (2014) "Fiscal Rules and Pro-cyclicality of Fiscal Policy in the Developing World," IMF Working paper, 14/122.

CDB (2014) Public-Private Partnerships in the Caribbean: Building on Early Lessons, Caribbean Development Bank

Greenidge K., Roland C., Thomas C., and L. Drakes (2012) "Threshold Effects of Sovereign Debt: Evidence from the Caribbean," IMF Working Paper, 12/157.

IMF (2009) "Fiscal Rules—Anchoring Expectations for Sustainable Public Finances," *IMF Policy Paper* (Washington, DC: International Monetary Fund)

IMF (2012) Fiscal Rules in Response to the Crisis—Toward the "Next-Generation" Rules. A New Dataset Schaechter A., Kinda T., Budina N. and A. Weber

IMF (2016) "Analyzing and Managing Fiscal Risks: Best Practices," *IMF Policy Paper* (Washington, DC: International Monetary Fund)

IMF (2017a) "Fiscal Rules for the ECCU," *IMF Country Report* 17/151 (Washington, DC: International Monetary Fund)

(IMF 2017b) Lledo V., Dudine P., Eyraud L., and Peralta, 2017 "How to Select Fiscal Rules? A Primer," IMF How-To Note, December.

IMF (2017c) Baum, Eyraud, Hodge, Jarmuzek, Kim, Mbaye, and Ture, 2017, "How to Calibrate Fiscal Rules? A Primer," IMF How-to Note, December.

IMF (2017d) "Sixth Review under the Extended Credit Facility (ECF) Arrangement and Financing Assurances Review" IMF Country report No 17/131.

IMF (2018a) SDN 18/04 "Second-Generation Fiscal Rules: Balancing Credibility, Flexibility, and Simplicity."

IMF (2018b) "Staff Guidance Note on the Fund's Engagement with Small Developing States," January.

IMF (2018c) "Jamaica: Staff Report for the 2018 Article IV Consultation Third Review Under the Stand-By Arrangement and Request for Modification of Performance Criteria," IMF Country report No 18/103.

IMF (2018d) "Grenada: Staff Report for the 2018 Article IV Consultation," IMF Country report No 18/236.

IMF (2018e) "How to Manage the Fiscal Costs of Natural Disasters," IMF How to Note, 18/03.

Lledó, V.D., S. Yoon, X. Fang, S. Mbaye, & Y. Kim (2017) *Fiscal Rules at a Glance* (Washington, DC: International Monetary Fund)

Mitchell W., James R., and A.M. Wickham (2018) "Managing the Government Wage Bill and Civil Service Reform in ECCU Member Countries," IMF Working paper, forthcoming.

World Bank (2018) "FROM KNOWN UNKNOWNS TO BLACK SWANS" How to Manage Risk in Latin America and the Caribbean" Semiannual Report – Office of the Regional Chief Economist, October 2018

Appendix Table: Analysis of ECCU-6 Fiscal Policies over the Cycle

	1998-2017						
	Cyclical Component of Real Spending						
	Antigua and Barbuda	Dominica	Grenada	St Kitts and Nevis	St Lucia	St Vincent and the	ECCU
Cyclical Component of real GDP	0.350***	0.641**	0.105	0.268**	0.0164	0.261*	0.227***
	(0.095)	*(0.231)*	*(0.110)*	*(0.096)*	*(0.136)*	*(0.126)*	*(0.067)*
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.020)	*(0.008)*	*(0.009)*	*(0.006)*	*(0.011)*	*(0.005)*	*(0.027)*
Observations	20	20	20	20	20	20	20
R-squared	0.432	0.299	0.049	0.301	0.001	0.192	0.392

	1998-2007						
	Cyclical Component of Real Spending						
	Antigua and Barbuda	Dominica	Grenada	St Kitts and Nevis	St Lucia	St Vincent and the	ECCU
Cyclical Component of real GDP	0.280**	1.000***	0.039	0.479**	0.038	0.264**	0.174
	(0.087)	*(0.267)*	*(0.247)*	*(0.153)*	*(0.185)*	*(0.093)*	*(0.100)*
Constant	-0.003	0.003	0.005	-0.003	-0.004	-0.004	-0.012
	(0.018)	*(0.008)*	*(0.018)*	*(0.008)*	*(0.015)*	*(0.004)*	*(0.036)*
Observations	10	10	10	10	10	10	10
R-squared	0.566	0.636	0.003	0.552	0.005	0.502	0.276

	2008-2017						
	Cyclical Component of Real Spending						
	Antigua and Barbuda	Dominica	Grenada	St Kitts and Nevis	St Lucia	St Vincent and the	ECCU
Cyclical Component of real GDP	0.420**	0.417	0.128	0.153	-0.0348	0.342	0.267**
	-0.176	-0.397	-0.088	-0.122	-0.230	-0.327	-0.097
Constant	0.006	0.003	-0.004	0.001	0.005	0.005	0.015
	(0.038)	(0.014)	(0.008)	(0.008)	(0.017)	(0.009)	(0.043)
Observations	10	10	10	10	10	10	10
R-squared	0.415	0.121	0.209	0.164	0.003	0.120	0.485

Note: The table shows regression coefficients between cyclical components of real spending and real GDP, estimated through the HP filter with a smoolthing parameter lamda=100 (see Bova et al. 2014). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Appendix I. Tools Used to Evaluate the Fiscal Framework Design

IMF staff uses a range of tools to inform the revision of existing fiscal responsibility frameworks and assess the performance of alternative designs.[1]

- *Counterfactual analysis*. This approach amounts to "rewriting history" through a retrospective scenario whereby a multi-year numerical target is assumed to be introduced at some point in the past. The method analyzes how the government behavior and the economic indicators would have changed under different targets and what would be today's outcomes. For instance, Andrle and others (2015) compare the performance of the FRFs based on the expenditure and structural balance rules (or targets) if they had been adopted in Italy and France since the early 2000s. For the **ECCU countries**, a counterfactual analysis was used to assess and compare the effects of the operational budget balance-based target and expenditure-based targets (see charts in paragraph 30), assuming that such frameworks would have been introduced in 2002 in all ECCU countries. For tractability, various simplifying assumptions needed to be used.[2]

- *Scenario analysis*. This approach is forward-looking and simulates the effect of rules over the forecasting horizon. It was initially developed by Debrun and others (2008) for Israel and further expanded in IMF (2009). The effects of rules are simulated under various scenarios, including a baseline (which could be the IMF World Economic Outlook projections) and shock scenarios. For the **ECCU countries**, this type of scenario analysis was used to assess different public debt trajectories that include key recommended elements of fiscal frameworks such as fiscal adjustment and incorporation of resilient investment and insurance buffers (see chart in paragraph 49).

- *Stochastic simulations*. The forward-looking performance of fiscal frameworks or rules can also be assessed in response to stochastic shocks. Instead of simulating ad hoc deterministic scenarios (like in the previous approach), the shocks are drawn from a distribution representing the past behavior of the data. This approach builds on the framework developed in Celasun and others (2007) and was applied to the United Kingdom (IMF, 2010a). Based on repeated simulations of random macroeconomic shocks, fan charts are derived representing the frequency distribution of the budgetary aggregates for each fiscal rule and year of projection. In the **ECCU countries,** an element of stochastic simulations was used in this paper to assess the needed buffer for a safe level of debt (see paragraph 28), as a partial exercise that is useful for informing the design of the fiscal frameworks.

- *Model-based selection*. The most elaborate approach to assess the design of fiscal frameworks is to use a multi-country macroeconomic model (for instance, a medium-scale DSGE), which incorporates the intertemporal decisions of households and firms as well as the general

[1] This Appendix draws heavily on IMF, 2017b with respect to the examples of the non-ECCU countries, whose references are cited therein.

[2] For example, in this exercise, it was assumed, for illustrative purposes, that past debt restructurings in the ECCU would have occurred even at lower levels of debt.

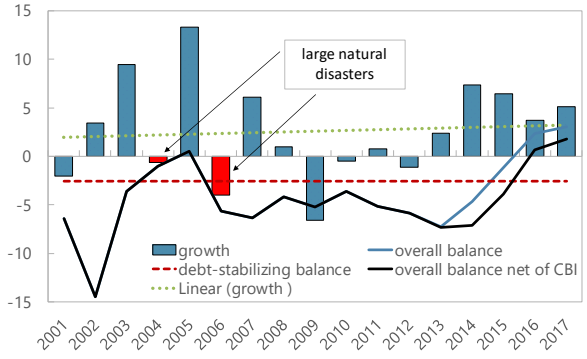
equilibrium effects of fiscal frameworks, including on expectations. The general idea is to apply shocks to the model and analyze how the economy responds in the presence of alternative frameworks. Simulations can be conducted around the steady state of the model (as in IMF, 2009; and Andrle and others, 2015) or around a baseline forecast (as in IMF, 2012). Shocks are calibrated in an ad-hoc way or, preferably, on past data. For instance, IMF (2009) presents GIMF simulations performed for three stylized economies representing a small open advanced economy, a large open advanced economy, and a small open commodity-exporting economy. The shocks considered are a domestic demand shock, an exogenous fall in supply (productivity shock), and, for the commodity-exporting economy, an exogenous change in external demand for the commodity. Various rules are assessed by plotting the path of GDP, inflation, debt, deficit, tax revenues and interest expenditure in deviations from the steady state over a 15-year horizon. For **ECCU countries**, Chapter 1 in this SIP is an example of such model-based approach for some aspects that can inform the design of the fiscal framework.

Appendix II. Analysis of ECCU-6 Fiscal Performance

The ECCU countries' heterogeneity can be tracked through an evolution of key measurable factors impacting debt sustainability in each country. These factors include (i) fiscal deficit positions (gross and net of CBI inflows) relative to those consistent with long-term debt-stabilizing levels (these show as lines in the respective country-specific charts below); (ii) economic growth performance both in terms of long-term trends and short-term fluctuations (with the latter shown as bars in the respective charts) and (iii) large natural disasters (shown in red color among the growth bars for the years in which the disasters occurred). These indicators are discussed as part of a holistic narrative for country-level achievements and shortcomings in regaining debt sustainability.[1]

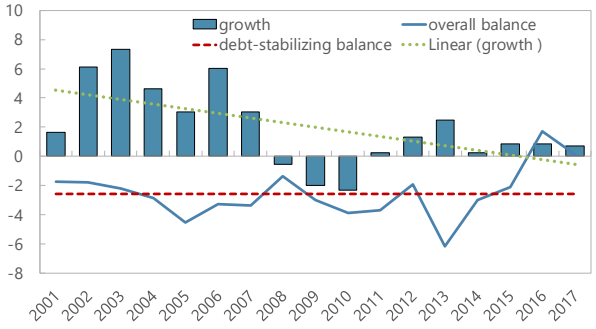
- **Countries on track to reach debt sustainability.** Over the past two decades, both Grenada and St. Vincent and the Grenadines largely avoided an *average* fiscal deficit bias relative to debt-stabilizing levels, with periods of "underperformance" periodically alternating with those of "overperformance." Additionally, both countries saw their fiscal position improve recently, with fiscal balances currently being above debt-stabilizing levels. Historically, however, both countries had to deal with fiscal pressures and shocks. There was a significant and protracted deterioration of Grenada's fiscal position in the aftermath of 2004-06 natural disasters, ultimately necessitating a correction implemented during 2014-17 and supported by the new FRF. St. Vincent and the Grenadines had the good luck of avoiding large natural disasters so far this century while maintaining a prudent fiscal position on average despite a down-trend in economic growth.

Grenada: Fiscal Balance, Growth, and Natural Disasters
(In percent of GDP or percent for growth)



Sources: Country authorities and IMF staff estimates.

St.Vincent and the Grenadines : Fiscal Balance, Growth and Natural Disasters
(In percent of GDP or percent for growth)

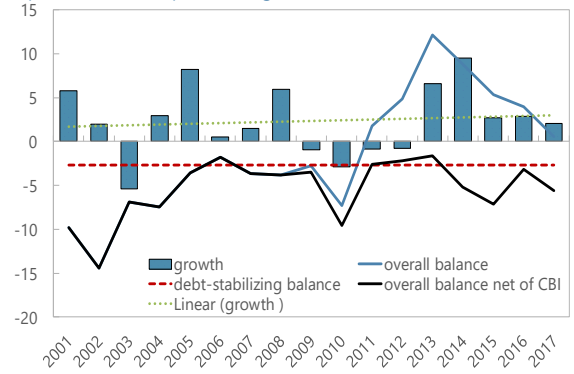


Sources: Country authorities and IMF staff estimates.

[1] The evolution of public debt could be an additional characteristic. However, it is not very informative because of the frequent debt restructurings in the ECCU. In this context, most of the debt drivers are already captured by the discussion of the fiscal deficits relative to debt-stabilizing levels.

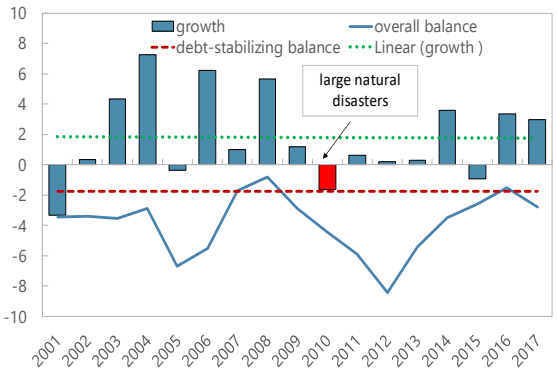
- **Countries with "moderate" debt sustainability problems.** Unlike the above two countries, both St. Lucia and St. Kitts and Nevis exhibited a noticeable deficit bias, as debt-stabilizing balances were only (and barely) achieved in their best fiscal years, but not on average (in the case of St. Kitts and Nevis, this refers to the fiscal balance net of CBI inflows). The deficit bias owes to different reasons in the two countries. In St. Lucia, the 2010 natural disaster coincided with a sustained deterioration of the country's fiscal position, but, unlike in Grenada, the subsequent deficit correction that started in 2013 has been insufficient. St. Kitts and Nevis avoided large natural disasters this century, but has not strengthened underlying fiscal position in the face of surging CBI inflows. Still, in both countries as of 2017 the underlying fiscal positions were close to debt-stabilizing levels, pointing to relatively moderate adjustment need for achieving fiscal sustainability.[2]

St. Kitts and Nevis: Fiscal Balance, Growth and Natural Disasters
(In percent of GDP or percent for growth)



Sources: Country authorities and IMF staff estimates.

St. Lucia : Fiscal Balance, Growth and Natural Disasters
(In percent of GDP or percent for growth)

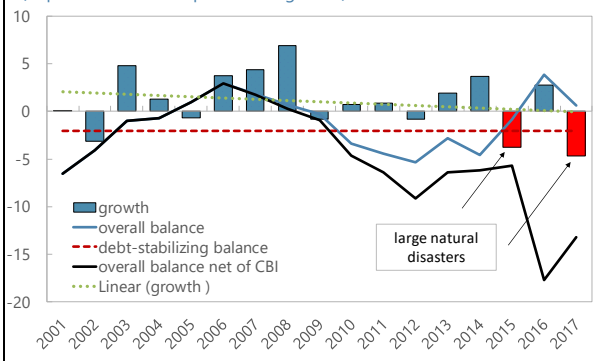


Sources: Country authorities and IMF staff estimates.

- **Countries with large debt sustainability problems.** Both Antigua and Barbuda and Dominica exhibited a pronounced average underlying deficit bias over 2001-17, and both countries were hit by multiple natural disasters recently that added to the fiscal imbalances. These factors played out differently by country. In Dominica, the fiscal position was close to the debt-stabilizing balance through 2008, but the global financial crisis and, subsequently, truly devastating disasters of 2015 and 2017 triggered a major deterioration in fiscal sustainability. By contrast, Antigua and Barbuda's deficits were substantially and persistently higher than those ensuring debt-stabilizing levels in the earlier part of the period. The imbalances moderated in the second part of the period, despite the natural disasters. Still, the underlying fiscal balances were not sufficient to reach debt stabilizing levels, let alone exceed them to correct the previous imbalances.

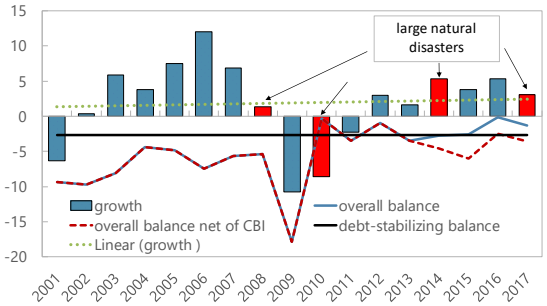
[2] St. Lucia's CBI program has been relatively small and started relatively recently, so its impact on the underlying fiscal deficit position is not considered in this analysis as it is not yet macroeconomically relevant.

Dominica : Fiscal Balances, Growth, and Natural Disasters
(In percent of GDP or percent for growth)



Sources: Country authorities and IMF staff estimates.

Antigua and Barbuda: Fiscal Balances, Growth, and Natural Disasters
(In percent of GDP or percent for growth)



Sources: Country authorities and IMF staff estimates.

Appendix III. Institutional Factors to Underpin the ECCU FRFs

The FRFs should rely on institutions, including legal frameworks and PFM procedures, to help comply with the targets and do so in an effective way. This would permit, for each country, to strike a right balance between the binding medium-term elements of the FRFs and scope for policy discretion that is needed to respond to shocks and other unforeseen events. In the ECCU, the key areas of institutional support for the FRFs concern:

- **Level of legislation.** A formal legal architecture can make policy commitments more binding over a longer-term horizon and increase the costs of non-compliance. Thus, most countries enshrine fiscal responsibility in laws or statutory norms, and a few in their Constitutions (see IMF 2012).[1] A higher level of legislation would, other things equal, signal a longer-lived and more broad-based commitment to fiscal responsibility while constraining passage of legislation that is inconsistent with this goal.[2] For example, Grenada passed a stand-alone FRL while aligning with it elements of other fiscal legislation. However, the higher legal level by itself is not a magic bullet and would not work if enforcement and accountability procedures are weak.

- **Statistics, data, and accounting.** There is a critical mass of indicators essential to monitor the fiscal targets. In this regard, priorities are reliable data on: (i) NFPS public debt for tracking the FRF's anchor; (ii) fiscal deficits and their key components (e.g., interest bill) at different government levels, as well as CBI inflows for tracking the operational targets(s); (iii) fiscal risks such as contingent obligations, including from public private partnerships; (iv) any other fiscal and economic indicators that are essential for country-specific FRFs, including any supplementary targets such as the wage bill or public investment.[3] ECCU countries have substantial data gaps, including on debt and deficits, that need to be fixed by improving data and harmonizing methodologies.

- **Fiscal projections.** Reliable budget forecasts help implement the targets as they would minimize unwarranted deviations from the framework that could hurt its credibility. The ECCU countries' own budget forecasts in recent years have been generally characterized by expenditure overruns on current spending and under-execution of capital spending. For ECCU countries, the key ingredients to solid forecasting would include: (i) macroeconomic and fiscal projections that are exclusively based on technicians' inputs; and (ii) inclusion of the average long-term fiscal and real-sector impact of natural disasters (which are yet to be incorporated in most ECCU countries).

[1] For example, in Europe countries that included fiscal responsibility in the Constitution include Germany, Poland, Slovakia, Slovenia, and Spain.

2 Acts with lesser legal power such as political or coalition agreements are relatively rare (involving about 15 percent of FRFs worldwide). One risk is that they may be considered as more short-term-oriented political or electoral moves and thus not effective in limiting the politicians' bias toward excessive deficits.

[3] In 2016, Grenada improved its accounting of public investment by removing from it recurrent spending.

- **Budget, cash, and debt management.** The budget management processes should be synchronized with the FRFs and further upgraded to support policy counter-cyclicality. This would include updating medium term fiscal frameworks in the leadup to each annual budget with planned trajectories for the key fiscal targets for rolling multi-year periods. Additional documents could be produced alongside the budget, including a medium-term debt strategy and a fiscal risk statement. The procedures of budget execution, in the absence of large adverse shocks, should favor stability of budget appropriations. This would allow the operation of automatic stabilizers on the revenue side and could be facilitated by improved cash management and pre-agreed procedures for saving revenue overperformance. Accordingly, debt management procedures should also be upgraded with a view to reducing the interest cost and financing risks.

- **Government transparency.** The governments' fiscal objectives need to be supported by fostering public debate and engaging civil society and the media. Its medium-term fiscal strategy documents would help frame such a public debate and evaluate progress. To this effect, the government could develop a framework for ex-ante and ex-post verification of compliance with fiscal targets, explaining deviations and corrections and setting out a credible plan for dealing with deviations. Another pillar of transparency is a comprehensive and timely publication of all budget and medium-term fiscal documents, typically during the budget process.

- **Independent monitoring.** Institutions such as fiscal councils can assess compliance with targets, evaluate projections and risks, improve public awareness, and promote transparency and accountability. The challenges of establishing such institutions in small countries with limited resources may imply that creating a fiscal council could take some time. However, the example of Grenada's Fiscal Responsibility Oversight Committee (FROC) suggests that a fiscal council can become operational relatively quickly. The councils could initially concentrate on a narrower range of tasks, such as ex-post compliance, while gradually building capacity in other areas. Operationalizing the councils involves establishing a trusted, but also arm's-length, relationship with the government. This would enable the flow of essential information in both directions, while creating space for the councils' public outreach and accountability.[4]

- **Sanctions and accountability.** It is not uncommon for the FRLs to contain sanctions for non-compliance. These may take the form of (i) personal sanctions of government officials (involving dismissals or fines); and (ii) large financial penalties for institutions or even countries (e.g., in the supranational frameworks, as is the case for the EU). Experience suggests, however, that "punitive" sanctions have limited effectiveness (see IMF 2018a). A key reason is that self-imposed sanctions are unlikely to be implemented at the national level. A more promising avenue to incentivize compliance would be through reputational

[4] In Grenada's case, the FROC is unconnected to the government and reports directly to parliament.

costs and increasing awareness of the benefits of compliance, including access to financing and other benefits for compliers.

- **Public investment management.** Public investment is a key bottleneck for the ECCU, reflecting the region's large investment needs and limited capacity to implement complex, multi-year projects. Assessments of the region generally highlight low quality of infrastructure and the need for it to be more resilient to natural disasters (CDB, 2014). The PIMA-based analysis of ECCU countries documents weaknesses in project management, which needs to be significantly upgraded. Findings from a survey of officials using the PIMA methodology show an overall score of 3.9 for the ECCU average, compared to a top score of 10 and 5.4 for Jamaica (see IMF (2018d)). This suggests that there is considerable potential for improving public investment management.