INTERNATIONAL MONETARY FUND

DOMINICA

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CONTENTS

A SAVINGS FUND FOR NATURAL DISASTERS: AN APPLICATION TO DOMINICA[1]

This paper presents a proposal for the creation of savings funds (SF) for rehabilitation and reconstruction after natural disasters (ND) in Dominica. A Monte-Carlo experiment is used to calibrate the size of the SF, based on the distribution of ND fiscal shocks estimated from an empirical fiscal model. ND shocks are identified by controlling for other major sources of shock affecting the cyclical fluctuations of output, and government revenue and expenditure, and by calibrating the probability of ND consistent with their historical frequency. The simulations provide estimates of the amount of savings needed to ensure the financial sustainability of the SF with a low probability of depletion. The simulation framework also allows for the specification of fiscal consolidation measures, and generates probabilistic public debt projections after accounting for the financing flows of the SF vis-à-vis the government budget.

A. Introduction

1.   Recurrent tropical storms and other forms of natural disasters (ND) have affected Dominica in the past years, resulting in human loss, destruction of infrastructure, and fiscal costs. Natural disasters have put pressure to government's finances both in the near and long term. In the near term, as a result of the unanticipated needs for immediate social protection and rehabilitation expenditures, at a time when revenues in general tend to decline. In the long term, the costs of reconstruction have contributed to the ratcheting up of public debt. Barro (2006, 2009) shows that the occurrence of large economic disasters in advanced economies (wars, economic depressions, financial crises) implies large welfare costs equivalent to about 20 percent of annual GDP, which he estimates to be much larger than the costs of economic fluctuations of less amplitude of about 1.5 percent of GDP. For developing small states such as Dominica, which are subject to larger and more frequent disasters than advanced economies, these events should have an even greater effect on the welfare of the average citizen.

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[1] This paper was prepared by Alejandro Guerson.

2.   This paper proposes the creation of a SF with revenues from the Economic Citizenship Program (ECP). In recent years, there was a substantial surge in budget revenues from the Economic Citizenship Program (ECP). These revenues have shown an increasing trajectory in recent years, and have become relevant also from a macroeconomic perspective. If spent without regard to the general macroeconomic conditions, they can pose challenges to macroeconomic management and affect sector activities, including on financial stability, fiscal discipline, external competitiveness and growth (see Rasmussen 2004; Noy 2009; Cavallo and Noy 2011; Cavallo, Galiani Noy and Pantano 2013; and Xin Xu, El-Ashram and Gold 2015). The possible instability of ECP revenues adds uncertainty and makes macroeconomic management more challenging. ECP revenues are difficult to predict and could be subject to a sudden stop, given the increasing scrutiny from advanced economies and growing competition, especially within the ECCU. On the latter, it should be noticed that there is a possible externality in the provision of passports and citizenship that affects the stability of the revenues if there are reputational spillovers to the ECP of other countries in the region.[2]
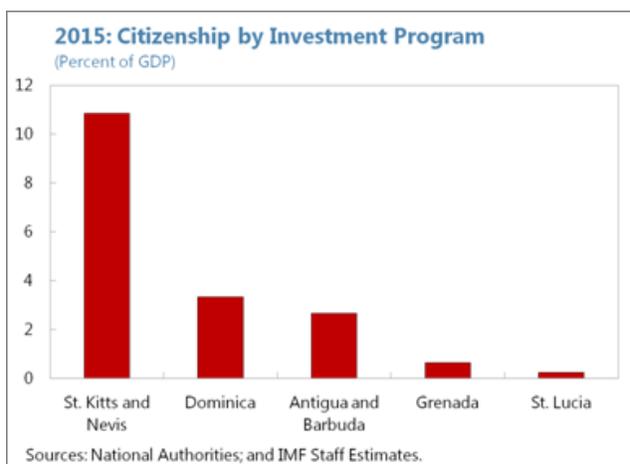
3.   In addition, Dominica is affected by high public debt and fiscal sustainability challenges. Public debt is high at over 85 percent of GDP, imposing a constraint on the ability to borrow in the face of NDs. This fact reinforces the case for the use of ECP financing for the start-up and the subsequent funding of the SFs. If so, the saved ECP flows would be allocated to reconstruction after NDs, effectively preventing the need to issue additional debt in the face of a shock. Also, this allocation would reduce the scope of increasing recurrent expenditures from this unreliable source of revenue, further reinforcing fiscal sustainability.

4.   The paper is organized in four sections. Section B presents some reasons why government of countries affected by large and recurrent ND should consider self-insurance, setting aside fiscal savings commensurate to the frequency, size, and anticipated fiscal costs of NDs. Section

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[2] This is because the benefits of a program are fully internalized by the country issuing a passport but the potential costs in the case of the granting of a passport to problematic beneficiaries could affect the reputation of the ECP programs of the region as a whole, therefore undermining the prospective revenues of other countries. This situation can distort the incentives towards reducing the efforts on due-diligence checks and therefore exacerbates the risks of revenue erosion or outright loss.

C presents the methodology used in the simulation exercise. Section D includes the calibration of the case of Dominica. Section E presents the results, and section F concludes.

B.   Why a SF for Self-Insurance against ND?

5.   Theoretically, countries could purchase insurance against ND, but in reality insurance markets and the existing regional schemes offer insufficient and costly options. The private sector is in general uninsured or underinsured for ND, especially in the most vulnerable segments of the population, which is also the vast majority. Also, ND could affect a significant share of the population and wealth in a single ND event, especially in a case of Dominica given its small size (low probability and high damage episodes), complicating the assessment of risk and the need for capital and liquidity by the insurers.[3] In addition, the difficulties in calculating the probability of occurrence of a ND and the variety of possible types of ND (hurricanes with high wind; tropical storms with abnormally abundant rainfall; earthquakes) also complicates the actuarial assessment of expected losses and the specification of insurance contracts. These factors result in high cost of insuring against NDs. General equilibrium calibration analysis indicates that ensuring against ND by issuing catastrophe (CAT) bonds would be beneficial only if the cost of issuing these bonds was significantly smaller than in the data (Borensztein, Cavallo and Jeanne 2015)[4]. Moreover, CAT bonds' triggers for payment are imperfectly correlated with the actual losses.[5]

6.   Given insufficient market-based insurance, governments become the de-facto ultimate insurer. 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 and to provide social support. All ECCU members have access to the Caribbean Regional Insurance Fund (CRIF), but the costs are high and the coverage purchased is typically limited. Moreover, the CRIF also faces similar complications than those mentioned for the insufficient development of market insurance.

7.   As a result, a SF could provide public self-insurance for immediate expenditure needs, rehabilitation and reconstruction, while supporting fiscal sustainability. In principle, if access to financing was granted and immediate, a saving Fund would not be necessary. A government could allocate the fiscal savings to debt reduction (of an amount commensurate to the expected cost of reconstruction) and save on interest expenditures, and then borrow when hit by a ND to cover the costs. However, there are several reasons why this strategy is difficult to implement in practice. First,

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[3] Although the largest insurance companies in the region have access to reliable re-insurance, typically from major European companies, but this is not the case for in the majority of cases of relatively smaller insurance companies operating in the region.

[4] CAT bonds are inherently risky, typically pay coupons of Libor plus a spread in the range of 3-20 percent, and have maturities of less than 3 years. See also Froot 2001; Cummins 2008 and 2012; and Cummins and Mahul 2009.

[5] CAT bonds are structured in four types of triggers for payment: (i) Indemnity (trigger by the actual losses in excess of a specific threshold0; (ii) modeled loss (based on catastrophe modeling run with the event parameters to measure if the modeled losses are above a specified threshold); (iii) indexed to industry loss (triggered when the insurance industry loss reached a specified threshold, as determined by a specified agency); (iv) parametric (trigger is indexed to the natural hazard caused by nature, such as wind speed in a specific location for a hurricane); and (v) parametric index (models used to compute an approximated loss, de-facto it is a hybrid parametric/modeled loss).

access to financing is typically not sufficiently rapid, especially for a small country like Dominica with no access to international financial markets. Obtaining an increase in official loans, and changing the scope of exciting official loans towards reconstruction, would typically involve a lengthy process. Furthermore, the disbursement of grants from bilateral donor countries also requires lengthy application and approval processes, and can also take time to materialize. Access to rapid domestic financing could also be limited, especially if the ND shock affects financial institutions' asset quality, and if deposits decline as the population copes with the shock. As the fiscal savings for reconstruction are saved in a dedicated SF, this would facilitate long-term fiscal sustainability by imposing a recurrent saving discipline of an amount that is commensurate to the expected reconstruction costs.

8.   Creating a SF does not imply the crowding-out of other spending priorities nor higher debt servicing costs, as it substitutes for future debt issuance after NDs. Given the developmental and infrastructure needs in Dominica, governments typically face competing expenditure needs that also have high social returns. SF would therefore have high opportunity costs, either in the form of investments foregone or otherwise as higher interest expenditures if the resources in the SF were used for debt reduction. However, the fact that ND are recurrent implies that the resources saved would be fully used at some point, and therefore public debts would have a similar level over the long-term as without a SF. Specifically, public debt would not decline as much when savings are allocated into the Fund, but then countries would need less debt issuance after ND. In this way, the SFs could facilitate fiscal discipline by setting aside the savings to cover the expected costs of reconstruction.

9.   Some countries in the region already have similar SFs, but none is specifically targeting the financing of ND fiscal costs. The Sugar Industry Diversification Fund in St. Kitts and Nevis is a national development fund that is also financed with ECP inflows, set up as a public fund. It was established in 2006 with the objective to support the financing of economic diversification away from the sugar industry through training and research. In 2011, its focus was expanded to maintain stability and the financing of industries. It provides budgetary support, undertakes direct social spending, and supports subsidized credit by banks. In 2014 Grenada launched a National Transformation Fund funded by ECP revenues. Set up as a Sovereign Wealth Fund (SWF), it is owned by the government but governed by an independent Board of Directors including both public and private representatives. It is regulated to make transfers to the government for the repayment of arrears and investment projects. Trinidad and Tobago has a SWF dedicated to the savings of oil revenues, which serves the purposes of cyclical stabilization and inter-generational equity. Turks and Caicos also has separate funds that serve different objectives, including a Development Fund, a Sinking Fund, and a Contingencies Fund. The experience with these funds in the region, however, has been mixed, in part due to political influence and capture affecting the allocation of resources. This underscores the importance of a strong institutional design and oversight.

C.   Methodology

10.   The starting point is to estimate an empirical model of the Dominica economy that captures the dynamics of output and the main fiscal variables in response to ND. To this end, a

Vector Auto-regression Model (VAR) is estimated. The vector of endogenous variables in the VAR includes the cyclical components of GDP; government revenues excluding grants; grants; current primary expenditures; and capital expenditures.[6]

11.   ND shocks are identified by including control variables that account for other major sources of shocks. The historical data includes information about the impact of ND as these affect output and fiscal indicators. However, the variability in the historical data would typically also reflect other shocks. Because of this possibility, control variables are necessary to account for the variability of the estimated residuals that could be the result of the other type of shocks. This is important because the estimated distribution of the residuals is later used to draw random ND shocks, as needed to generate the simulated time series. The vector of control variables 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 2001 shock that significantly disrupted tourism exports. The underlying assumption is that the control variables "remove" the main alternative sources of fiscal shocks from the estimated vector residuals, resulting in a streamlined distribution that includes natural disasters as the most significant shock remaining.[7]

12.   The second step is to generate a large number of simulations using the estimated model for 2016-2030. Each simulation is a projection consisting of a sequence of the five endogenous variables in the model. 1000 simulations are run, each affected by a sequence of simulated random shocks. The shock simulations are drawn from the normally-distributed probability density function estimated from the model residuals. The simulations generate data that mimic historical patterns in terms of the volatility, persistence, and co-movement of the endogenous series in each simulation in response to shocks that are orthogonal to the controls (and therefore include NDs as the main shock and other smaller shocks).

13.   The results are then used to compute probability density functions for each of the five endogenous variables for each year projected. Values for each projected variables in percent of GDP are obtained after assuming a deterministic trend for each, which are assumed to grow at the same constant rate –starting from the end point of the estimated trend in the sample period. The calculation of the overall balance and the stock of public debt require also a projection of interest expenditures. To this end, the debt stock at the end of the previous year is multiplied by an implicit interest rate path (the ratio of interest expenditures to public debt stock), which is treated as a parameter for calibration. The calculation of interest expenditures is then added to revenues and

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[6] The cyclical components used in the empirical model are calculated as the ratio of the variable with respect to its estimated trend. The cyclical components of GDP are estimated using the Hodrick-Prescott filter on 1990-2015 annual data. All variables are transformed into real terms using the GDP deflator and expressed in logarithms. The identification of shocks is performed according to the Choleski decomposition, according to the ordering presented.

[7] The sample data used in the estimation spans 1990-2015.

primary expenditures to compute the public debt stock dynamics using the debt accumulation identity, which is expanded to also include the budget financing flows vis-à-vis the SF.

14.   The third step is to identify the occurrence of natural disasters 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 X percent fiscal deteriorations –and therefore the remaining 1-X percent is interpreted as other smaller shocks that are different from ND. The assumption is therefore that all other "large" sources of shocks have been accounted for by the control variables. The fiscal deteriorations are computed as the sum of the year-on-year changes of (i) non-grant revenue (with a negative sign as tax revenues would tend to decline along with output during ND); (ii) grant revenues (which would presumably increase after ND as donor partners increase their supports) (iii) current primary expenditure (as more social assistance and goods and services are needed); and (iv) capital expenditure (on account of additional expenditures for rehabilitation and reconstruction). The algorithm then looks at the distribution of this sum, and identifies as a ND all the random realizations that fall in the highest X percent tail of the of the probability density function of the distribution 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 the random simulation is identified as a ND.

15.   The calibration of the probability threshold is important, as it determines the annual frequency of NDs in the simulations. For example, if recent episodes indicate that a ND occurs every 5 years, then a parameter of 0.2 would be appropriate, or Probability[$x(t) < X$]=0.2, where $x(t)$ is a random realization of the fiscal deterioration sum in year t, as explained above. In this way, on average 200 out of the 1000 simulations in each year through 2016-2035 would be identified as a ND –and the rest are identified as other smaller shocks that are different from ND and the controls. The distribution of the intensity or size of each ND is captured by the simulated fluctuations of government revenues and expenditures: if the negative impact on revenues and expenditures is severe, then a large ND has occurred.

16.   The use of the SFs is modeled by specifying financing flows vis-à-vis the budget. The simulations assume that in years with no ND, the budget generates an additional overall balance surplus as a percent of GDP that is deposited in the SF[8]. These budget contributions to the SF are modeled as a fixed parameter as a percent of the previous' year GDP. The amount of this annual saving is calibrated to achieve the financial sustainability of the Fund with a sufficiently low probability of depletion, and ensuring the SF stock is stable in expected terms[9]. 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:

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[8] 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.

[9] In other words, if inflows into the Fund are too high (low), then the size of the Fund would tend to increase (decrease) in expected terms.

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

- *Gap of grant revenues above trend.* Grants tend to be higher after natural disasters 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 natural disasters. An additional fixed amount as a percent of GDP is added that captures below-trend reprioritization of spending.

+ *Gap of capital expenditure above trend.* Captures the higher public investment that typically follows NDs. An additional fixed amount as a percent of GDP is added that captures below-trend reprioritization of spending.

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 natural disaster –the SF therefore finances the "hump".

17.   The simulation strategy also accounts for expenditure re-prioritization, resulting in a realistic assessment of the need for fiscal savings. On first impression, the simulation assumption that the SF finances only the *increase* of fiscal needs above trends may appear insufficient when considering the large amount of the estimated fiscal cost. For example, in an extreme case in which a ND results in a destruction of public infrastructure of 50 percent of GDP, one could expect an increase in public investment of 5 percent of GDP over a ten-year period. However, this is not what is observed in practice: a significant share of the fiscal resources used for social support and reconstruction are obtained by way of reallocation and re-prioritization: some pre-ND allocations are postponed or cancelled. As a result, the reconstruction expenditures do not require an equivalent increase in public investment. This is the reason for the additional savings explained above relative to the estimated trends allowed for the current primary and capital expenditures.

18.   The modeling of the SF also includes an assumption for the initial stock value, the start-up cost. This initial amount of assets affects the probability of depletion over a time horizon. For example, if the initial size of the Fund is set too low, then the probability of depletion (say, within the next 10 years) would be high for a given set of inflow and outflow financing assumptions vis-à-vis the budget, undermining the sustainability prospects of the Fund. In the opposite case, if the initial stock size is set too high, the opportunity cost as measured in terms of interest costs (i.e. if the funds were used for debt repayment) or the returns of public investment would outweigh the welfare benefits of the precautionary reserve in the SF. As the proposal assumes that the start-up cost of establishing a SF is funded with existing ECP assets, it has not been added to the debt stock at the beginning of the projection horizon (end-2015).

19.   The simulations are then used to compute probabilistic public debt projections, taking into account the government budget financing flows vis-à-vis the SF. The simulated series of

revenues and primary expenditures allow the calculation of primary balances and public debt dynamics using the debt accumulation identity. In years with no ND, the budget contributes the specified savings to the Fund –as opposed to reducing debt in that amount. If a ND occurs, the Fund is used to finance the additional fiscal needs as specified in the SF disbursement rules –as opposed to issuing public debt.

D. Calibration

20.   The simulation parameters are calibrated consistent with staff's macroeconomic framework. Potential GDP growth is set at 1.7 percent of GDP. The potential output growth rate calibrated assumption is also applied to the trend growth of the remaining endogenous fiscal indicators in the simulations. In this way, the simulated projections are stable in the long-term as a percent of GDP. The implicit interest rate (interest payments / debt stock) is set consistent with measured implicit interest rates in recent years. The calibration also includes fiscal consolidation amounts in percent of GDP per year, allocated across the four simulated fiscal variables, also consistent with the macroeconomic framework. Table 1 shows the specific parametric calibrations used in the simulations.

Table 1. Parameter Calibration for Dominica

	2016	2017	2018	2019	2020	2021	2022-35
GDP potential growth, percent	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Implicit interest rate on public debt, percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Fiscal consolidation measures							
Primary Balance, percent of GDP	-0.4	0.1	1.6	1.6	1.6	0.5	0.0
Non-grant revenue	1.0	1.0	1.0	1.0	1.0	0.0	0.0
Grant revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current primary expenditure	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Capital expenditure	1.5	1.0	-0.5	-0.5	-0.5	-0.5	0.0
Cumulative fiscal consolidation, percent of GDP	-0.4	-0.3	1.3	2.9	4.5	5.0	5.5
Government Fund							
Initial Fund stock / GDP	10.00						
Inflows into the Fund from the budget, percent of GDP							
Non-grant revenue t-1	1.500						
Grant revenue t-1	0.000						
Outflows of the Fund to the budget parameters							
Storm probability threshold	0.200						
Base capital expenditure level / GDP	0.064						
Capital expenditure trend / GDP trend	0.084						
Year average capital expenditure on reconstruction / GDP	0.020						
Base current primary expenditure / GDP	0.190						
Current primary expenditure trend / GDP trend	0.230						
Year average current expenditure social support and rehabilitation / GDP	0.040						

21.   The parameters affecting the SF are calibrated to achieve its long-term financial sustainability with a low probability of depletion. A key parameter is the ND probability threshold. This parameter was set at 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. [10] The budget saving flows into the SF in years without a ND were set at 1.5 percent of previous-year's GDP. For consistency, if in a given simulation the Fund is depleted it is assumed that the deficit is covered with debt issuance.

22.   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. The "base" capital expenditure is set at 6.4 percent of GDP by specifying a gap from the estimated capital expenditure trend in 2015 of 2 percent of GDP. The "base" current primary expenditure is set at 19 percent of GDP, obtained after specifying 4 percent of trend current primary expenditures associated with ND. As explained above, the SF is assumed to disburse financing to the budget after a ND of an amount equivalent to the gap between the simulated amounts of current primary expenditures and capital expenditures and the calibrated base levels, respectively (net of the simulated increase in grants). These financing flows to the budget continue during the years after a ND for as long as the simulated level of spending is higher than the level registered before the ND.

23.   The fiscal consolidation is also calibrated in line with the policies in the macroeconomic framework. It includes cumulative fiscal consolidation measures of 5.5 percent of GDP, largely from revenue measures that are introduced smoothly through 2016-2021. Capital expenditures are also calibrated to map the expected increase in capital expenditures in the near term out of the tropical storm Erika in 2015, which the subsequent unwinding towards 2021.

E.   Results

24.   Under the parameter calibrations proposed, the SF would be financially sustainable with a low probability of depletion. The text figure shows one random simulation out of the 1000 draws to illustrate how the SF would operate in practice. The SF stock of assets would fluctuate around the start-up level depending on the random realization and size of the simulated NDs through 2016-2030. In the particular simulation used in the figure, three ND take place between 2016 and 2030. The SF stock of assets increases up to 2020, as 1.5 percent of GDP in assets are saved every year, to more than 15 percent of GDP. In 2021 a ND hits Dominica, and SF

Off-sample Simulated Dynamics of a Fund for Natural Disasters
(In percent of GDP)

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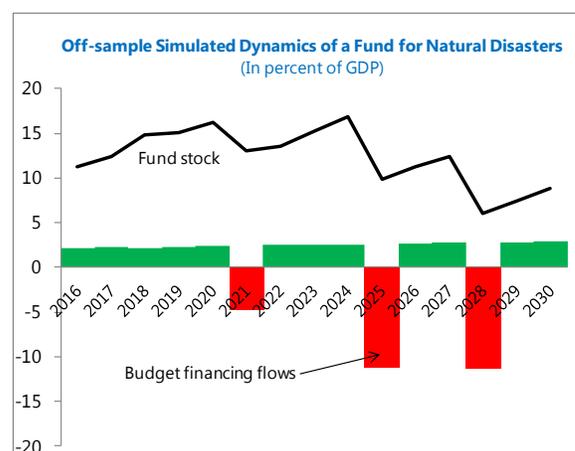
[10] This probability of depletion is similar to insurance coverage, and it is to be chosen also consistent with risk tolerance of the authorities, although a sufficiently low probability of depletion is preferable to ensure the financial sustainability of the SF.

disbursements to the budget of about 5 percent of GDP take place. The figure also shows two additional simulated ND in 2025 and 2028.

25.   **A Fund stock of at least 10 percent of GDP and annual savings of 1.5 percent of GDP are needed to achieve the Fund's financial sustainability with a low probability of depletion.**

Annual Budget Contributions to the Fund for Natural Disasters (ND)
(percent of GDP)

Probability thresholds used to calibrate the frequency of simulated natural disasters
The blue oval indicates the calibration value in the baseline simulation

Probability of Depletion of the Saving Fund
(Average probability through 2016-25)

Assumption: annual probability of a ND = 0.20

Size of saving fund (percent of GDP)
The red oval indicate the size of SF recommended for its financial

26.   The text charts illustrate alternative assumptions and the rationale for the size and amount of annual saving proposed. The left chart shows the sensitivity of the results to changes in the calibrated frequency of natural disasters, as determined by the probability threshold (Probability[$x(t)$ < X]). As explained, with a probability of ND in any given year set at 0.2, and given the specified parameters for the rules for budget financing in the case of a ND, annual budget savings of 1.5 percent of GDP are needed to achieve financial sustainability of the SF over time (no gradual depletion and no unnecessary perpetual accumulation of savings). However, if the probability of ND is set at 0.25 (a ND occurring every 4 years on average), budget savings of 2 percent of GDP per year would be needed for the SF financial sustainability. Other calibrations are also displayed in the left chart. The right chart shows the probability of depletion of the SF when the ND probability is set at 0.2 for different initial sizes of SF stock of assets. For example, if the SF starts up with assets of 2 percent of GDP, the SF would be depleted at some year during 2016-2030 with a probability of more than 30 percent, implying that there would be no sufficient savings to cover the ND costs. In order to reduce this probability to less than 10 percent, a more prudent level, a SF of at least 8 percent of GDP is required.

27. **With this calibration, public debt would decline to near 60 percent of GDP by 2030 in expected terms, but with significant dispersion depending on the realization of shocks.** This is

obtained after accounting for the financing flows between the government budget and the SF depending on the occurrence of the ND in the simulations. Also, this result is broadly in line with the government regional commitments to reach a public debt ratio of 60 percent of GDP or lower by 2030.[11] However, the results indicate that even with this significant fiscal consolidation effort there is still a significant probability that the target will not be met in under the more extreme conditions of ND hitting Dominica more frequently and/or harder than

Public Debt Dynamics with a Fund for Natural Disasters 1/
(In percent of GDP)

1/ Assumes a probability threshold of natural disasters of 25 percent, which requires annual budget contributions of 1.2 percent of GDP for the sustainability of the Fund.

expected. This is illustrated in the text chart, which shows a fan chart with probabilistic ranges public debt projections depending on the distribution of frequency, intensity and severity of ND as identified in the simulations.
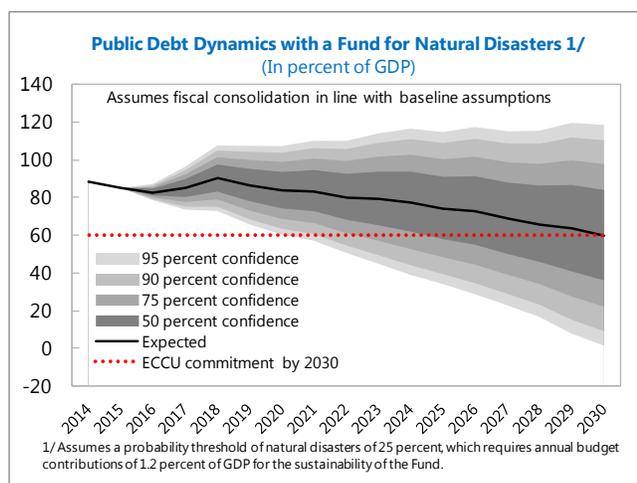
F. Conclusion

28. **A saving Fund for ND can be important to support immediate needs after ND and to provide financing for reconstruction within fiscally sustainable bounds.** Probabilistic simulations in this paper indicate that a saving Fund stock of about 10 percent of GDP and annual budget savings of 1.5 percent of GDP in years with no ND are needed in order to have sufficient savings commensurate to the expected fiscal costs and observed frequency of NDs. A SF of this size would finance the increase in current primary expenditures and capital expenditures after a ND with a low probability of depletion (except in the most extreme events), and would therefore be consistent with its financial sustainability. These calculations take into account the expenditure reprioritization that typically takes place in the aftermath of ND. The results indicate that, conditional on a fiscal consolidation in line with the commitments in the RCF program approved in November 2015, a SF for ND would set public debt on a downward trajectory and would also be consistent with a decline of public debt towards the regional target of 60 percent of GDP by 2030, although with significant risk bands.

29. **Supporting the SF with a strong institutional setup is critical to protect it from political pressures for spending or opportunistic appropriations.** A strong institutional design should include unambiguous budget contribution and disbursement rules, with triggers based on verifiable

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[11] This result is below the level projected in the macroeconomic framework of 67 percent of GDP, but still the range with high probability. This is an important result confirming the realism of the macroeconomic framework, as the model equations from which the simulations are generated reflect historical patterns.

criteria, a clearly-stated objective, and strict information disclosure requirements to ensure the transparency of its operations.

30.   The start-up costs and subsequent saving flows could be financed with ECP resources. ECP revenues could be used as the funding source, and also for the subsequent annual savings with clear savings rules established in legislation. This would ultimately also support fiscal sustainability, for various reasons. First, it would avoid the need to issue public debt to finance the starting cost. Second, it would provide the discipline to save for future ND by explicitly treating ND as recurrent events, which could otherwise result in the ratcheting up of public debt. Third, it would reduce the scope of allocation of ECP revenues for recurrent spending, which could be problematic in a context of fiscal consolidation as these are typically more difficult to adjust. The later is especially important given the uncertain nature of ECP revenues as a result of increasing regional competition and scrutiny from advanced countries.[12]

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[12] Other sources of revenues could be considered as funding sources in addition to the ECP, including from donor partners' contributions for budget support and from international loans for investment projects to be financed with resources from the Fund.

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CREDIT UNIONS IN DOMINICA: FINANCIAL IMPORTANCE AND POLICY CHALLENGES[1]

A. Introduction

1.   **Credit Unions play a prominent role in the Dominican financial system**. They provide an important financial intermediation role, particularly for middle and lower income groups and other key segments of the population that might otherwise find it difficult to access credit through the commercial banking system. However, the objectives of credit unions are somewhat different from those of commercial banks. For the latter the main premise is profit maximization, while for credit unions the prime objective is to serve its members with a greater focus on thrift and less so on risk taking. Thus, there is often a trade-off between offering the best financial services and products to the membership and the need make a reasonable return. Nonetheless, credit unions provide services similar to banks and are therefore subject to the same macro-economic shocks and stresses. Some of the larger credit unions are comparable in size to the indigenous bank in Dominica. Consequently, there is a pressing need to strengthen the sector through more timely data disclosure and improved regulation and supervision.

2.   **The increasing importance of the credit union sector in Dominica is reflected in the steady growth of its assets and deposits**. During the period 2009–14, the total assets size of the credit union sector increased from US$172 million (35 percent of GDP) to US$233 million (45 percent of GDP), with an average annual growth rate of 7 percent. This represent a faster expansion than that of commercial banks' assets, which increased to US$ 462 million (88 percent of GDP), during the same period, with an average annual growth of about 5.5 percent. Similar upward trends are also reflected in the growth of credit unions' deposits and loans. Credit unions have also extended proportionally more loans, as the loans-to-GDP ratio increased by about 7 percentage points to 31 percent, during 2009–14, while the banking system saw a decline in credit.

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[1] Prepared by Saji Thomas.

Dominica: Total Assets of Credit Unions, 2009-14

- Assets (US$millions, LHS)
- Assets (% of GDP, RHS)

Dominica: Total Deposits of Credit Unions, 2009-14

- Deposits (US$millions, LHS)
- Deposits (% of GDP, RHS)
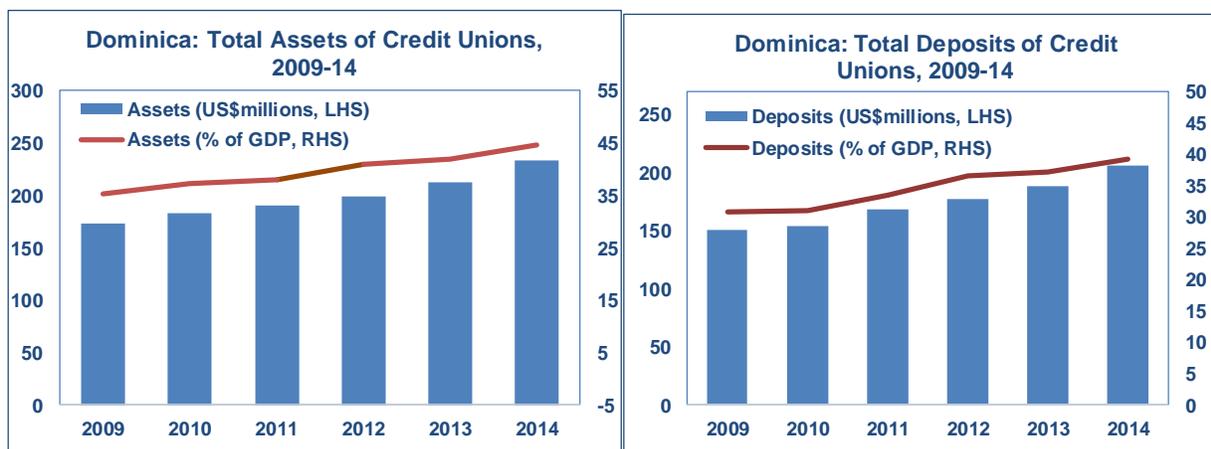
3. **Credit union membership in Dominica is very high when compared to other ECCU countries**. Among the ECCU countries, Montserrat and Dominica had the highest ratios of credit union members to total population, compared to the ECCU average of 61 percent, as of end-2014. This high degree of penetration in Dominica suggest that the credit unions have been able to develop their niche in markets of different income levels and financial structures despite the low level of development and shallow financial markets. In general, a higher penetration of credit unions is observed in rural communities and for small and micro businesses with limited access to commercial banks.

Share of credit union members to total population, 2014 (in percent)

MSR 104, DMA 95, VCT 63, BRB 59, GRD 50, TTO 44, LCA 43, JAM 36, KNA 35, ATG 35, ECCU Average 61
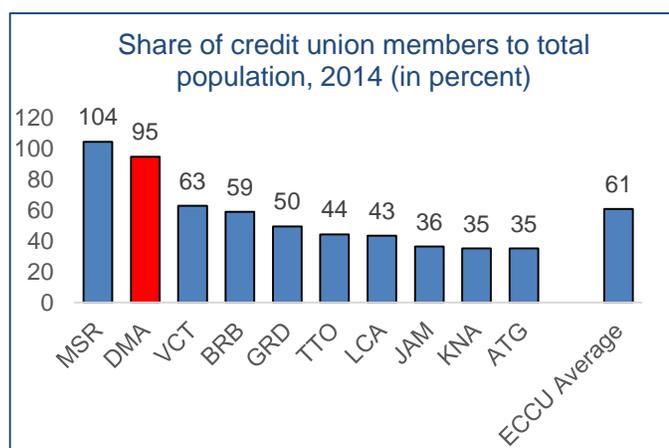
4. **The credit union sector is heavily concentrated**. Out of 10 credit unions, the largest credit union accounts for about 71 percent of the credit union's total assets, making them one of the most prominent financial institutions in the country. However, a large majority of the credit unions are small and some are likely to be too small to be viable. As of end-2014, the sector was a major provider of credit to households, including mortgages, with total loans to members amounting to 31 percent of GDP.

**Dominica: Concentraion of Credit Unions, 2014
(Share of assets to total, in percent)**
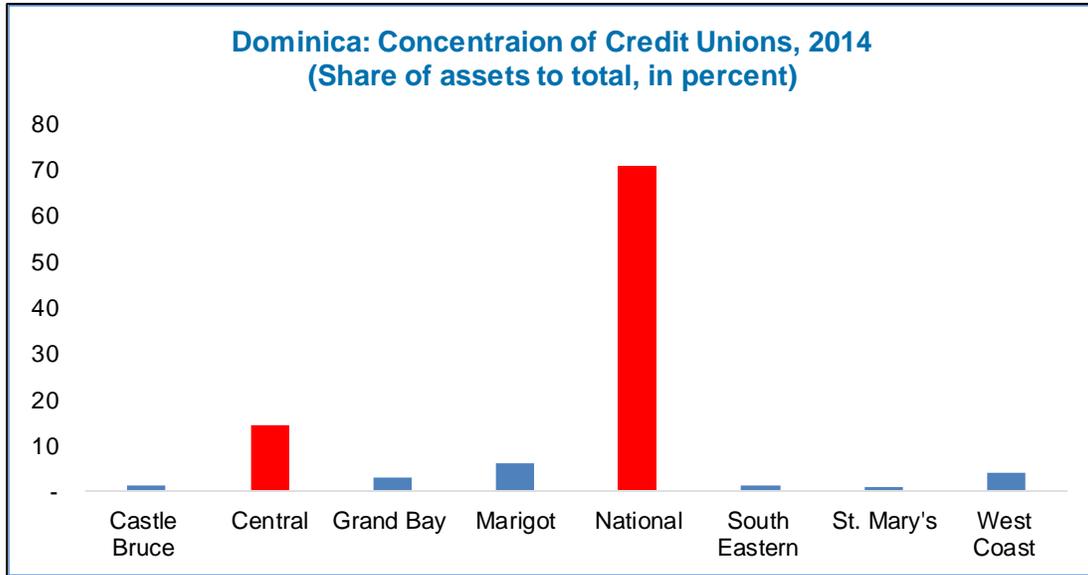
5.   **Credit union loans accounts for almost one-third of the total private sector credit in Dominica.** In Dominica credit union loans amount to almost 32 percent of the total private sector credit, suggesting some competition between credit unions and commercial banks. In the period 2009-14, while the credit unions lending to private sector has increased steadily, the commercial bank's lending to the private sector has been declining. In terms of sectoral lending, most of the CU loans are targeted towards mortgage and personal consumer loans.

NCCU: Composition of the Loans Portfolio, 2014

Sources: NCCU annual report, 2014. Fund staff calculations.

Dominica: Private sector credit by Banks and Credit unions, 2009-14 (in percent)
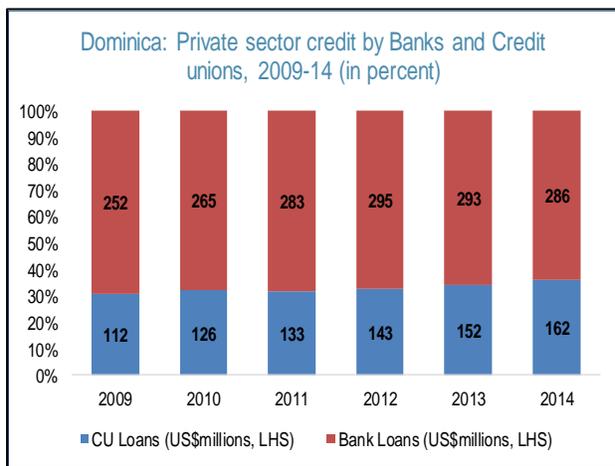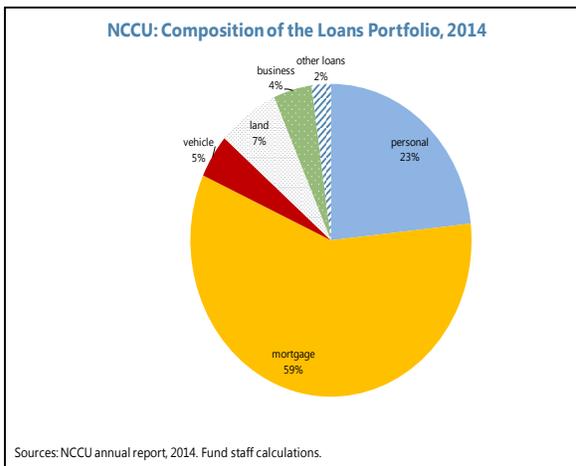
6.   Credit unions make substantial deposits in the commercial banks which creates a potential risk for deposit withdrawals and financial contagion. The credit unions account for about one-third of the total Bank deposits. The credit unions make substantial deposits in the commercial banks. During 2009-14, the credit union deposits accounted for about 32 percent of the commercial bank deposits and about 41 percent of the commercial bank's liquid deposits. The cross deposits between the two financial institutions creates a potential risk for financial contagion arising from the exposure of commercial banks to deposit withdrawals from the credit union.

Credit Union deposits in commercial Banks, 2009-14 (in percent)

Credit union deposits/Total Bank Deposits

Credit union deposits/Bank liquid Deposits
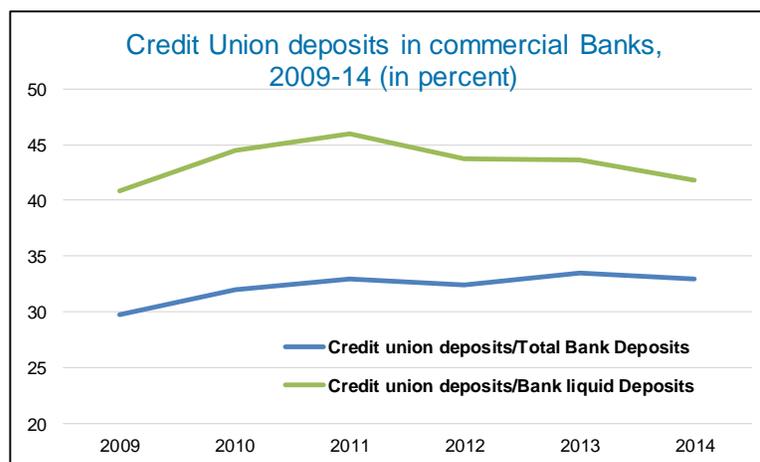
7.   The financial performance of the sector has improved in 2014, but challenges from the failure of two regional insurance companies remain. Many credit unions held large exposures to the units of the CL Financial Group, Colonial Life Insurance Company (CLICO) and British American Insurance Company (BAICO), which failed in 2009, entailing large provisioning expenses over the past five years. These provisioning expenses have depleted the capital buffers of some of these institutions. For the credit unions as a whole, the non-performing loans stood 6.4 percent, while the capital adequacy ratios stood around 8.7 percent as of end-2014—well short of the minimum required by law. Still, total equity grew by 6.6 percent over the year; reflecting both improved earnings and concerted efforts among some credit unions to boost capital, including by requiring potential borrowers to purchase additional shares in order to obtain credit.

8.   Overall, the system-wide capital adequacy ratio (CAR) remains below the minimum regulatory requirement of 10 percent at end December 2014. Financial soundness indicators point to the credit union sector as a whole, as being undercapitalized, but profitable and liquid. Deposit liabilities are the main funding source for CUs—at end-2014, deposits represented 90 percent of the sector's balance sheet. The ratio of interest income to total income, approximately 90 percent, provides an indication of the importance of lending in generating income, as opposed to fees and commissions. However, the aggregate CAR masks wide disparities among credit unions. Asset quality has not shown much improvement lately. Although the ratio of gross NPLs to total loans has dropped for the entire CU sector, this decline masks significant variations at individual CUs. The macroeconomic outlook exposes this sector to credit risks, and exposures need to be monitored closely and warrants a strengthening of crisis prevention and management capabilities.

9.   High, although declining, NPLs have been a persisting problem. The recent reductions in the ratio of NPLs to total loans reflect in part the sector's rapid credit expansion. Credit quality is broadly an issue, with an NPL ratio of 7 percent of gross loans at end-2014 (the regulatory

requirement is 5 percent). Provision for NPLs stood at 60 percent and thus was deemed insufficient. The provisions-to-loans ratio shows the importance of credit growth in reducing NPLs. It would be important to monitor NPLs by business activity to detect vulnerabilities in particular sectors (e.g., the public enterprise sector).

10.   Liquid assets represent 10 percent of credit unions' assets. The liquidity level of credit is lower relative to those of the commercial banks (40 percent). This reflects significant exposure to non-tourism sector, which provides increased lending opportunities. However, the high cost of credit stemming, in part, from limited competition among banks and unfavorable legal and judiciary procedures, make it hard for CUs to recover delinquent loans and foreclose on collateral.

11.   The credit union sector is regulated and is monitored by government agencies and industry organizations. The regulatory and supervisory powers reside with the national Financial Services Unit (FSU), unlike the commercial banks, whose regulator is the regional central bank. The FSU has the authority to perform on-site inspections of institutions and can advise the credit unions on actions they might take to improve their strength. The FSU does not have the power to issue financial penalties to financial institutions that fail to comply with its directives, including the credit unions. Outside the government, the credit unions are members of the Dominica Co-Operative Societies League, a private-sector organization that monitors the credit unions, advises its members on best practices, and provides other services, but does not have legal enforcement powers. In the absence of stronger powers for either the FSU or the League, the regulatory response to the credit unions with needs for additional capital has thus far been confined to advisories and moral suasion. As a consequence, the credit unions have been slow to take corrective action, entailing higher risks in the financial system. The authorities' efforts to clarify the law, including the responsibilities and powers of the FSU, are welcome and should be continued. The supervision of the credit unions would benefit from the introduction of a prompt corrective action framework. Stronger supervision and regulation of the credit unions would entail greater human resource needs for the FSU, and Dominica could pursue efforts to satisfy these demands in a cost effective manner by pooling resources at the regional level.

B.   Stress Testing of Credit Unions

12.   To gauge the resilience of credit unions to adverse events arising from the concentration of exposures, stress testing is applied to various types of risks. The stress tests covered all CUs in Dominica. Solvency and liquidity tests followed a bottom-up approach using end-2014 balance sheet data. CU' capital needs were assessed against the regulatory requirement of 10 percent of risk-weighted assets. The tests also examined the impact of shocks due to a sudden drop in confidence and a deposit run on the banking system (liquidity risks) and also the impact of higher interest rates on the net interest margin of the CUs. Although the stress test results call for caution given data quality concerns, they show that system-wide capitalization is vulnerable to credit shocks. The sector is also vulnerable to liquidity shocks, and to a certain extent interest rate risks. The stress tests are aimed at understanding the potential short- and medium-term vulnerabilities in the system, rather than estimating recapitalization needs (and potential liquidity shortages) for specific credit unions.

C. Credit Risks

13.   Credit risk is the risk that a counter-party or obligor will default on their contractual obligations. It refers to the risk that the cash flows of an asset may not be paid in full, according to contractual agreements. Credit risks are the major source of solvency risk. Measuring the credit risk exposure involves measuring the likelihood of default on each instrument and the extent of losses in the event of default. Credit has been increasing rapidly over the last four years and Credit unions rely on member deposits as wholesale funding source. The main features of this framework are the definition of credit losses, and the relationship between credit risk and capital. Credit risk capital is the amount of economic capital that an institution must hold in order to cover its unexpected losses.

Dominica: Capital Adequacy Ratios under credit risk stress scenarios, end-2014 (in percent)

Higher NPLs and full provisioning	3.3
Full provisioning of NPLs	5.9
Baseline	8.7
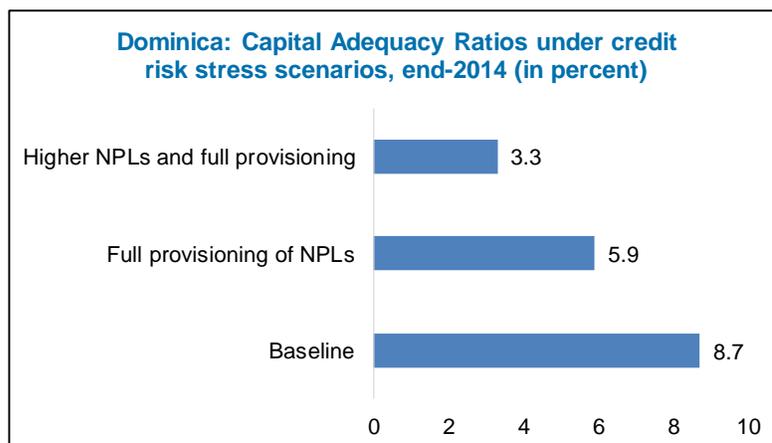
Typically expected losses are covered through appropriate provisioning and pricing of their credit instruments. The evaluation of capital adequacy is carried out through the assessment of expected losses and the commensurate loan loss provisions. Unexpected losses are accounted for by assuming a probability density function of the loan portfolio and are typically measured using the standard deviation of losses or a predefined percentile level. Two credit risk stress scenarios are carried out. In the first scenario, we assume that all expected loses are covered by the credit unions through full provisioning. The capital adequacy ratio (CAR) decreases from 8.7 percent in the baseline to 5.9 percent well below the stipulated level of 10 percent. In the second scenario, we assume further unexpected losses by increasing the NPLs by one standard deviation (about 50 percent higher) and assume these losses to be covered fully. The CAR ratio fall further to 3.3 percent in that scenario, as shown in the figure.

D. Liquidity Risks

**14.   Liquidity risk refers to the inability to access sufficient funds to meet payment obligations in a timely manner. Illiquidity occurs after a financial institution becomes insolvent. Thus, the lack of adequate liquid funding is considered to be a key sign that a CU is facing financial difficulties. The Funding liquidity risk tests assess the CUs resilience against a bank-run type shocks. It is assumed that a loss of confidence would result in higher than-expected withdrawals of retail deposits. The tests uses annual credit union balance sheet data to simulate two liquidity ratios (liquid assets to total assets and liquid assets to short-term liabilities) in the event of a run.

Dominica: Liquid Assets to Total assets under liquidity risk scenarios, end-2014 (in percent)

Draw down of deposits by 5%

Baseline

0   5   10   15

Dominica: Liquid Assets to Short-term Liabilities under liquidity risk scenarios, end-2014 (in percent)

Draw down of deposits by 5%

Baseline

0.0   5.0   10.0   15.0
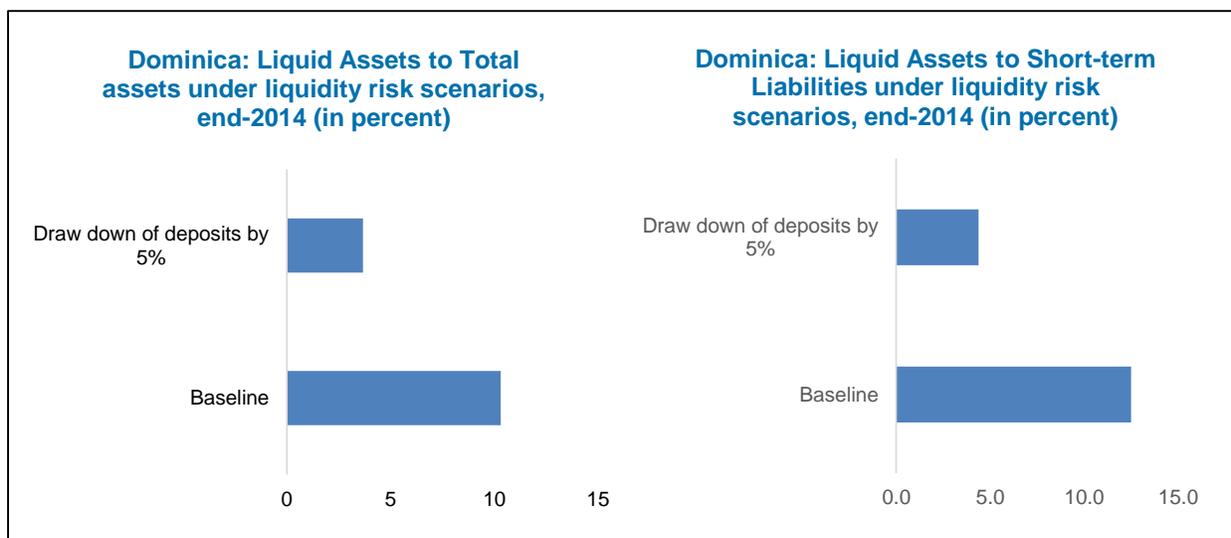
E. Interest Rate Risks

15.   Interest rate risk is the risk incurred by a financial institution when the interest rate sensitivity of its assets and liabilities are mismatched. Changes in interest rates can affect the market value of assets and liabilities of the institution, since the present value of future cash flows is sensitive to changes in interest rates. Interest rate risk can be analyzed using the difference in the flow of earnings on the holdings of assets and liabilities. Two interest rate risk stress scenarios are carried out. In this scenario, we assume that with the possibility of rate hikes in the US the funding costs of the Credit unions will increase since the EC$ dollar is pegged to the US dollar. The higher interest rates are assumed lower the net interest margin of the CUs and thereby decrease their reserves and capital slightly. The capital adequacy ratio (CAR) decreases slightly from 8.7 percent in the baseline to 8.5 percent with a 2 ppt. increase in interest rates, as shown in the figure. The interest rate risk does not appear to be a big factor in affecting the profitability or CAR ratios of CUs.

Dominica: Capital Adequacy Ratios under interest risk stress scenarios, end-2014 (in percent)

Interest rate increases by 4 ppt.   8.5

Interest rate increases by 2 ppt.   8.6

Baseline   8.7

8   8.5   9
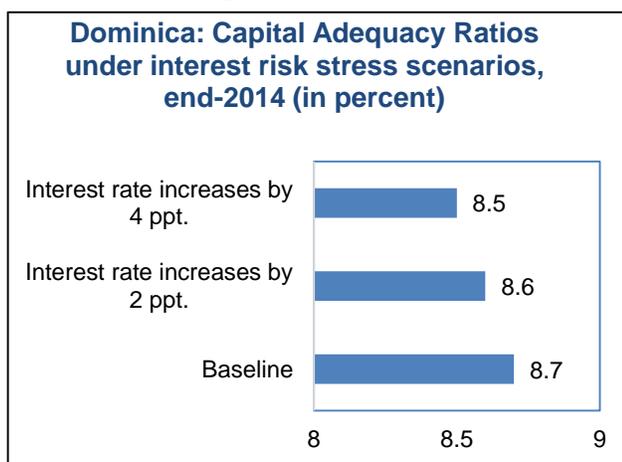
F.   Consolidated Monetary Accounts of Banks and Credit Unions

16.   In Dominica, the monetary survey includes the central bank and commercial bank account transactions but does not include the credit unions. However, as described in Section I, credit unions play a dominant role in the domestic economy in terms of total assets and deposits and lending to the non-tourism sector. Thus, to better understand the growth of credit and its role in the domestic economy, we construct a consolidated monetary account using the information from the balance sheets of the credit unions. The deposits of credit unions at the commercial banks are excluded from Bank's assets to avoid double counting. The chart shows that even though bank lending to the private sector has declined since 2012, the financial intermediation activity of the credit unions has been increasing steadily and they have been compensating for the declining private sector lending from Banks, especially to the non-tourism sector. This increases the overall risk to the financial stability given the weaker regulation and supervision of this sector, including the lack of a lender of last resort arrangement. Furthermore, given the large deposits of credit unions at commercial banks, there is a stronger need to monitor and manage the macro-financial spillover risks from the credit union to the Banks and the broader economy.
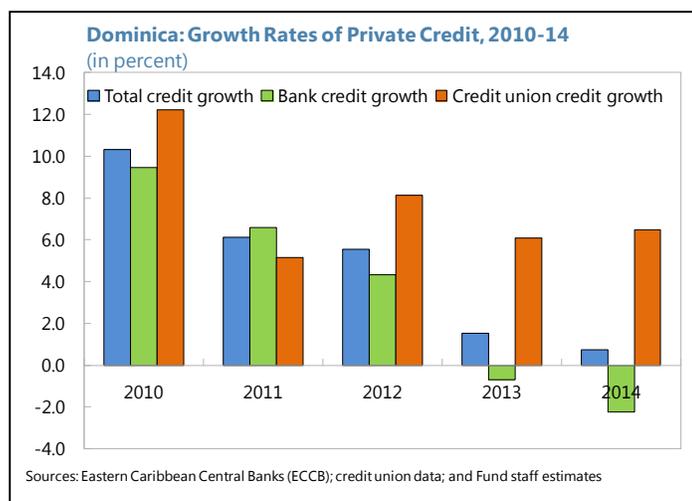
Dominica: Growth Rates of Private Credit, 2010-14 (in percent)

Sources: Eastern Caribbean Central Banks (ECCB); credit union data; and Fund staff estimates

G.   Policy Recommendations and Conclusions

17.   Given the growing importance of the credit union sector in the Dominican economy, regulation and supervision of the credit unions needs to be stepped up by strengthening the information exchange and collaboration between the ECCB, SRUs, and local regulators. A more efficient role by the credit unions could be reached through an improvement of their institutional framework, in particular the strengthening of their supervision to a level equivalent to commercial banks.

18.   Special attention and supervision is required especially for the big credit unions in Dominica. The National credit union which accounts for about 71 percent of the total credit union assets in Dominica and could have spillover risks to the rest of the financial system. In light of the fact that credit union lending has been increasing steadily, while banks are deleveraging, the credit union loan portfolio should be supervised closely. The ongoing efforts to boost capital are very welcome and should be sustained until every credit union is in compliance with capital requirements. While capital needs vary with each credit union, and some report adequate capitalization already, at the end of 2014, a majority of the credit unions in Dominica did not meet this requirement. Recent actions taken by several institutions, including advanced consolidation

plans among three credit unions and ongoing merger talks among another three cooperatives, can enhance capitalization, stability, and efficiency of the sector as a whole.

19.   Collection and compilation of data from credit unions need to be strengthened. Enhance data collection to improve the accuracy and greater effectiveness in the regulation and supervision of credit unions is key. The lack of data makes difficult to assess and monitor the performance and exposure of the credit unions in the region.

Table 1. Dominica: Consolidated Accounts of the Monetary Sector[1]

	2009	2010	2011	2012	2013	2014
	in millions of Eastern Caribbean dollars, end of period					
Net foreign assets	557.3	536.2	456.7	545.0	527.9	611.9
Net domestic assets	715.6	832.8	932.9	974.1	1,039.4	1,072.3
Public sector credit, net	-140.6	-139.1	-96.6	-133.2	4.7	21.4
Private sector credit	957.9	1,056.8	1,121.6	1,183.8	1,201.9	1,210.8
credit from banks	654.3	716.2	763.4	796.5	790.9	773.2
credit from credit unions [2]	303.6	340.7	358.3	387.3	411.0	437.6
Other items (net)	-101.7	-85.0	-92.1	-76.5	-167.2	-159.9
Cross deposits	-30.9	-32.8	-34.0	-35.6	-38.1	-41.8
Broad Money	1,242.1	1,336.1	1,355.6	1,483.6	1,529.2	1,642.4
Money	198.4	205.3	187.2	221.3	210.6	232.4
Quasi-money	771.0	822.9	844.2	910.5	945.7	1,014.2
Credit union currency and deposits (net)	272.7	307.9	324.2	351.8	372.9	395.8
	(12-month percentage change)					
Net foreign assets		-3.8	-14.8	19.3	-3.1	15.9
Net domestic assets, *of which:*		16.4	12.0	4.4	6.7	3.2
Public sector credit, net		-1.1	-30.6	37.9	-103.5	361.0
Private sector credit		10.3	6.1	5.5	1.5	0.7
credit from banks		9.5	6.6	4.3	-0.7	-2.2
credit from credit unions		12.2	5.2	8.1	6.1	6.5
Broad money		7.6	1.5	9.4	3.1	7.4
NFA contribution		-1.7	-5.9	6.5	-1.2	5.5
NDA contribution		9.4	7.5	3.0	4.4	2.2
Money		3.5	-8.8	18.2	-4.8	10.4
Credit union currency and deposits (net)		12.9	5.3	8.5	6.0	6.1

Sources: Eastern Caribbean Central Banks (ECCB); and Fund staff estimates and projections.
1/ This table includes estimations on Credit Unions.
2/ Credit union data are from the survey and by Fund staff estimates

20.   Stress testing indicates that credit unions are vulnerable to credit and liquidity risks. The stress tests were aimed at understanding the potential short and medium-term vulnerabilities in the system, rather than estimating recapitalization needs (and potential liquidity shortages) for specific credit unions. The stress tests indicate that the system is vulnerable to credit and liquidity risks. Since this sector has an important role in the financial system of the country the sector needs to be more carefully supervised.

References

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ECONOMIC IMPACT OF TROPICAL STORMS[1]

1.   The Caribbean region is one of the most disaster-prone regions in the world. The location of the Caribbean countries, their small size and narrow production and export base makes them vulnerable to natural disasters and other real shocks. 15 Caribbean islands are among the top 25 countries affected by tropical cyclone disasters. And, the probability of a hurricane hitting seven of them, including Dominica, in any given year is above 10 percent.

Probability of a Hurricane Striking on a Given Year
(In percent)

Jamaica	23.6
Bahamas	20.2
St. Lucia	17.2
Belize	17.2
Dominica	15.1
Antigua and Barbuda	15.1
St. Vincent	12.7
St. Kitts and Nevis	10.2
Barbados	10.2
Trinidad and Tobago	8.9
Grenada	8.9
Anguilla	7.6
Montserrat	4.7

Source: IMF, Caribbean Small States: Challenges of High Debt, 2013.
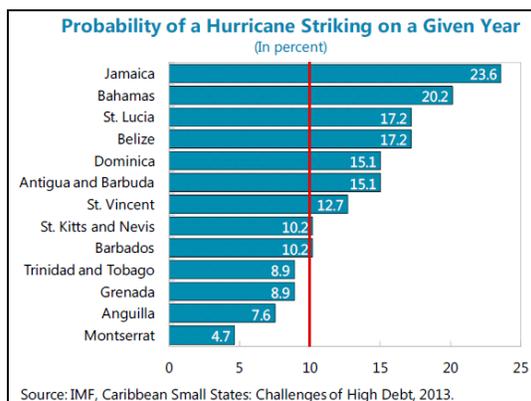
2.   The estimated cost of damage by natural disasters is relatively large in Dominica compared to other Caribbean countries. There are different ways to assess the damage caused by natural disasters. Acevedo (forthcoming) estimates the wind-related economic costs of tropical cyclones[2] – the elasticity of damage to wind speed ranges between 2 and 3 depending on whether the storm makes landfall – that have hit the Caribbean from the 1950s. We estimate – using Acevedo's work and the World Bank (2015) "Rapid Damage and Impact Assessment" report on Tropical Storm Erika in 2015 – the average annualized actual cost of a tropical cyclone is 7.4 percent of GDP during the period of 1970-2015, and the estimated cost is 10.8 percent of GDP. Using the

Dominica: Estimated Tropical Cyclone Damages[1]
(Average annual cost, in percent of GDP, 1970-2015)

	Value
Actual	~7.4
Estimated	~10.8
Combined	~9.4

Sources: Data for 1950-2014 from Acevedo (forthcoming) ; Data for 2015 from the World Bank Assessment report; Fund staff calculations.
Note: 1 Estimated tropical cyclone damages for disasters recorded in EM-DAT, and for storms with hurricane strength winds and passed within 60 miles of the country

Dominica: Estimated Tropical Cyclone Damages[1]
(in percent of GDP, 1950-2015, ranked by estimated damage)

	Value
Cleo, 1964	217
Betsy, 1956	201
Inez, 1966	149
Erika, 2015	96
David, 1979	85
Edith, 1963	74
Lenny, 1999	68
Marilyn, 1995	67
Allen, 1980	60
Dorothy, 1970	29
Hugo, 1989	11
Luis, 1995	8
Dean, 2007	5
Klaus, 1984	2
Iris, 2001	1
Ophelia, 2011	0

Sources: Data for 1950-2014 from Acevedo (forthcoming). Data for 2015 from the 2015 World Bank assessment report; Fund staff calculations.
Note: 1 Estimated tropical cyclone damages for disasters recorded in EM-DAT, and for storms with hurricane strength winds and passed within 60 miles of the country

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[1] Prepared by Wayne Mitchell and Ke Wang.

[2] In Acevedo's paper, a tropical cyclone is defined to include tropical storm and hurricane. The estimated tropical cyclone damages are estimated with regressions mainly based on the wind speed and distance of the weather station. Half the largest disasters were created by tropical cyclones that did not make landfall. The study acknowledges that significant damage is caused by heavy rainfall and sea surges but does not estimate the economic costs.

estimated cost, more than half of the tropical cyclones affecting Dominica caused damages of over 50 percent of the country's national output in the given year.

3. **Climate change could imply higher risk of natural disasters in the future.** The

average intensity of tropical cyclones is expected to increase as the climate and sea surface temperatures warm. Acevedo estimates the increase in damages from tropical cyclones from the climate change impact of higher temperatures. His findings suggest that if all the disasters affecting Dominica over the last 65 years had happened in warmer temperatures with more intense storms, damages would have been between 4 percent of GDP larger in the low temperature scenario (3°C higher than normal) and 8 percent of GDP larger in the high temperature scenario (5.6°C higher than normal).

Dominica: Estimated Damages if Temperatures Were as in 2100
(1950-2014, In percent of GDP)

Sources: Data from Acevedo (forthcoming).
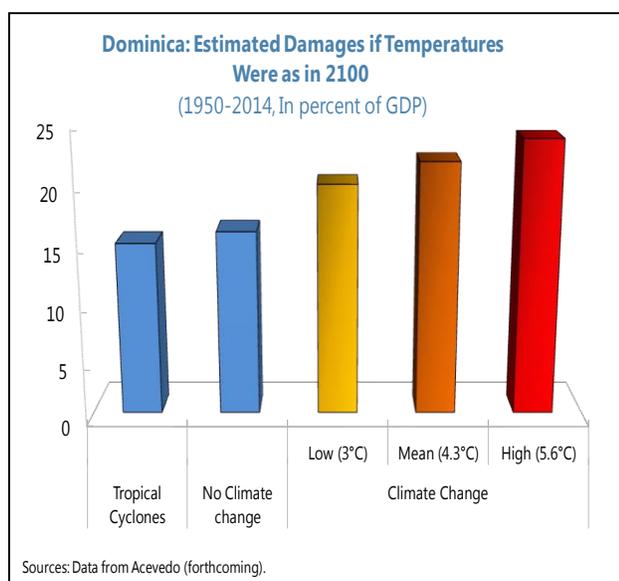
4. **Natural disasters have both short-term and long-term economic effects on countries.** A joint report (IDB, IMF, OAS and the World Bank - 2005) on the economics of disaster mitigation in the Caribbean summarizes the transmission channels of natural disasters on economies in both the short-term and long-term.

- In the short term countries usually experience declines in national production and export receipts because of damage to infrastructure (roads, bridges, air and sea ports), agriculture, tourism, utilities and service sectors while imports increase because of reconstruction needs and disruptions to domestic supplies.3 The deterioration in external trade is partially offset by foreign grants, remittances and insurance payments. Some empirical studies have confirmed such negative impacts on growth and the balance of payments in Caribbean countries. There are

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[3] There are methodological and data challenges in analyzing the size and duration of the economic impacts of natural disasters. Consequently, eclectic analyses using a mixture of partial, quantitative and qualitative techniques are commonly applied to distinguish between primary effects – direct and indirect damages to tangible assets and flows of goods and services – and secondary macroeconomic effects without incorporating feedback from policy responses.

Volatility of Caribbean Small States

Volatility of Real per-capita GDP Growth, 2000-11

Volatility of the CA-to-GDP Ratio, 2000-11

Note: The blue box shows the 25th percentile and 75th percentile of the country groups; the black bar shows the median of the country groups.
Source: Jahan and Wang, 2013; IMF Policy Paper 2013. Fund staff calculations.
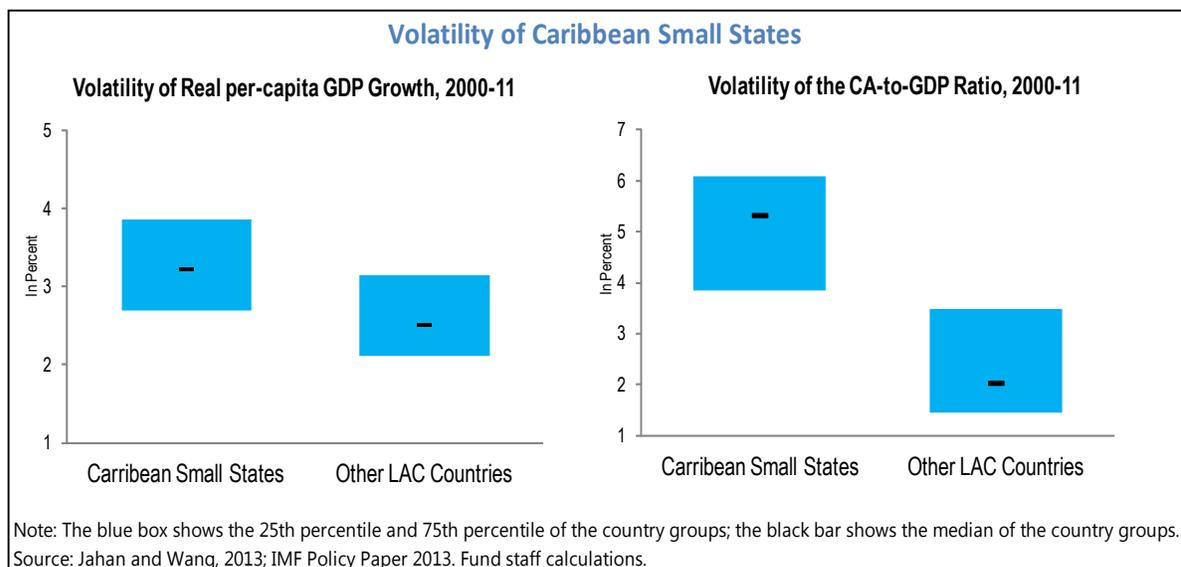
also adverse impacts on the fiscal sector as the tax base contracts and expenditures for rehabilitation and reconstruction increases. Reduced production and income coupled with concerns about the future earning losses of local companies puts the exchange rate under depreciating pressure while increasing inflationary pressure. Lastly, there could be spillovers to other countries not directly hit by the tropical cyclones through damage to regional input/output networks – damage to shared ports and disruption of cross-border supply chains – and financial linkages.

- The long-term economic costs reflect the severity and frequency of natural disasters as well as the adequacy of policy responses. The transmission channels are similar to those identified in the short term but are more severe or longer. Consequently, they pose greater risks to public debt sustainability, worsen the external sector, cause high inflation, increase the risk of capital flight and lead to banking and or balance of payments crises. Policy responses are important to mitigate those short-term and long-term impacts.

5.   The impact of past storms on Dominica's economic performance have been significant – lowering real GDP, worsening current account balances and putting pressure on the fiscal sector. The economic impacts of selected storms are summarized in panel Figure 1. The sizes of the economic impacts and recovery periods depend on the severity of the storm. Policy responses and support from the international community in the form of development assistance aid the recovery and help to mitigate the effects of disasters.

Figure 1. Dominica: Economic Impacts of Selected Storms

Real GDP is expected to fall in large disaster events...

Real GDP
(index, year prior to disaster=100)
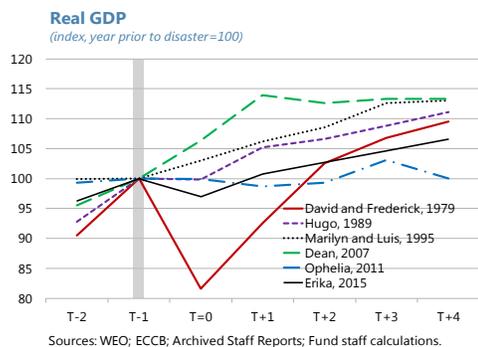
...and the current account widens reflecting rebuilding needs

Current Account Balance
(percent of GDP)

Sources: WEO; ECCB; Archived Staff Reports; Fund staff calculations.
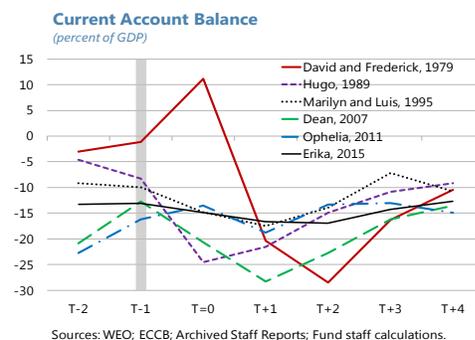
Revenues may decline but are sometimes offset by an increase in grants.

Government Revenues
(percent of GDP, fiscal years beginning July)
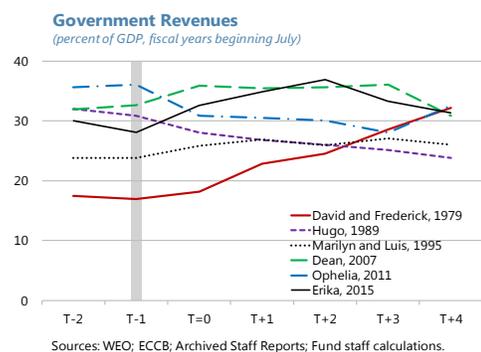
Expenditures will jump as repairs to infrastructure fuel public capital expenditures,

Government Expenditures
(percent of GDP, fiscal years beginning July)

Sources: WEO; ECCB; Archived Staff Reports; Fund staff calculations.
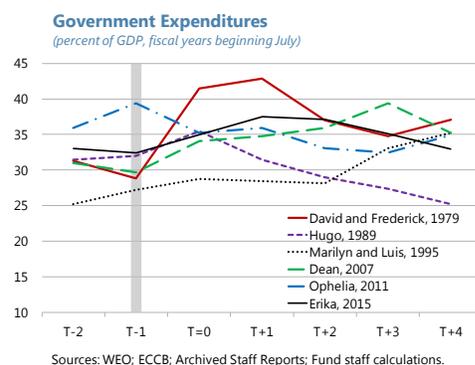
...which may boost external debt.

Public External Debt
(percent of GDP, fiscal years beginning July)
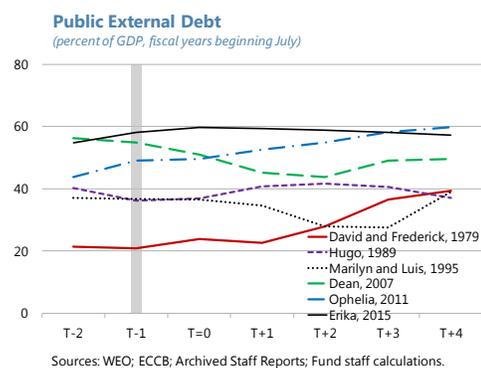
Inflation pressures increase.

Consumer Price Index
(index, year prior to disaster=100)

Sources: WEO; ECCB; Archived Staff Reports; Fund staff calculations.
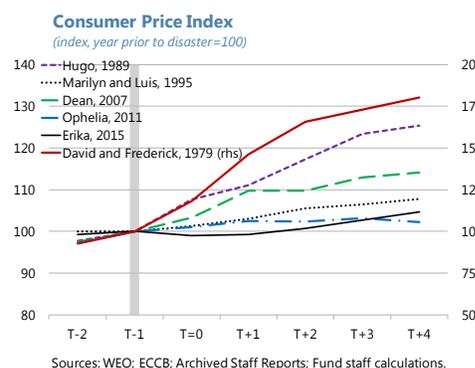
Source: IMF staff report, 2015.

6.   In conclusion, Dominica needs policy strategies to be better prepared for natural disasters. The assessment of damages show that damages can be extensive and costly and are likely to increase in magnitude as temperatures rise with climate change. Disaster adaptation and mitigating measures should include the implementation of improved early warning systems as well as the enforcement of better building standards and zoning laws that protect or reduce the size of losses. Precautionary policy measures that provide financing buffers such as contingency funds together with improved market insurance and regional insurance pools should facilitate the internalization of the shocks and fast track disaster relief and reconstruction. More prudent fiscal policies over the medium term will improve Dominica's fiscal position, debt sustainability and financing options, and will provide it with the flexibility to absorb adverse shocks through timely countercyclical fiscal policy. Further, the undertaking of precautionary measures could be supported by the donor community and IFI's in a bid to assist the country in promoting self-protection.

7.   The strategies should incorporate actions to better prepare for climate change. The recent Paris Agreement by the Parties to the United Nations Framework Convention on Climate Change provides an opportunity for the government to pursue a regional approach to adaptation and mitigation of climate change. This can be done through a regional focus (i) to expedite the ratification of the Paris Climate Agreement and strengthen commitments to slow global warming and reduce emissions by 2030 and (ii) on the preparation of regional systems to enable countries access to climate finance that can be used for adaptation and resilience to climate shocks. Increasing the share of renewable energy and improving energy efficiency would help to achieve such targets.

Table 1. Estimated Tropical Cyclone Damages, 1950-2014

| Country | Year | Month | Storm | Damages | | | | | | Safir-Simpson Scale | cpoa[2] | Landfall | EM-DAT | | |
| | | | | Percent of GDP | | | Million US$ (current) | | | | | | | | |
				Actual	Estimated	Combined	Actual	Estimated	Combined				EM-DAT	Deaths	Affected
Dominica	1956	8	Betsy		201.1	201.1				Hurricane category 2	15				
Dominica	1963	9	Edith		73.9	73.9	2.6		2.6	Hurricane category 1	63		Yes		
Dominica	1964	8	Cleo		217.1	217.1				Hurricane category 3	26				
Dominica	1966	9	Inez		149.0	149.0				Hurricane category 3	44				
Dominica	1970	8	Dorothy		28.6	28.6		6.6	6.6	Tropical storm	67		Yes		
Dominica	1979	8	David	85.1	178.1	85.1	44.7	93.5	44.7	Hurricane category 4	22	Yes	Yes	40	72,100
Dominica	1980	8	Allen		60.1	60.1		42.1	42.1	Hurricane category 4	111		Yes		
Dominica	1984	11	Klaus	1.9	0.7	1.9	2.0	0.8	2.0	Tropical storm	348		Yes	2	10,000
Dominica	1989	9	Hugo	10.8	57.5	10.8	20.0	106.6	20.0	Hurricane category 4	54		Yes		710
Dominica	1995	9	Luis	7.7	20.7	7.7	20.0	53.9	20.0	Hurricane category 4	139		Yes	2	5,001
Dominica	1995	9	Marilyn	67.4	32.2	67.4	175.0	83.6	175.0	Hurricane category 1	4	Yes	Yes		
Dominica	1999	11	Lenny	67.8	8.0	67.8	215.0	25.3	215.0	Hurricane category 4	228		Yes		715
Dominica	2001	10	Iris		1.1	1.1		3.7	3.7	Tropical storm	130		Yes	3	175
Dominica	2007	8	Dean	4.8	12.4	4.8	20.0	51.4	20.0	Hurricane category 2	64		Yes	2	7,530
Dominica	2011	9	Ophelia	0.3	0.3	0.3		1.6	1.6	Tropical storm	253		Yes		240
Average 1950-2014				**3.8**	**16.0**	**15.0**									
Average 1970-2014				**5.5**	**8.9**	**7.5**									
Average 1980-2014				**4.6**	**5.5**	**6.3**									

Source: Acevedo (forthcoming). "Gone with the Wind: Estimating Hurricane and Climate Change Costs in the Caribbean", Table 7.
[1] Estimated tropical cyclone damages for disasters recorded in EM-DAT, and for storms with hurricane strength winds and passed within 60 miles of the country.
[2] Closest point of approach (cpoa) measures the distance from the country's weather station (usually at the airport) in miles.

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