

An Analysis of Puerto Rico's Debt Relief Needs to Restore Debt Sustainability

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ABSTRACT

This paper makes two contributions. First, we examine the macroeconomic implications of Puerto Rico's Fiscal Plan certified in March 2017 for fiscal years 2017–18 to 2026–27. Second, we perform a Debt Sustainability Analysis (DSA) that incorporates the expected macroeconomic dynamics implied by the Fiscal Plan in order to compute Puerto Rico's debt restructuring needs. We detect a number of flawed assumptions in the Fiscal Plan that lead to an underestimation of its contractionary effects on the island's economic activity. We conduct a sensitivity analysis of the expected macroeconomic dynamics implied by the plan that allows us to construct more realistic scenarios of Puerto Rico's debt restructuring needs. We show that the island's current debt position is unsustainable, and compute the necessary debt relief to restore sustainability under different sets of assumptions. The paper offers insights for designing a plan of action for resolving Puerto Rico's current debt crisis that will remain valid after the certification of a new fiscal plan. [Key words: Puerto Rico's debt, debt restructuring, Debt Sustainability Analysis, sensitivity analysis, macroeconomics, debt relief]

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1. INTRODUCTION

Puerto Rico's economy has been suffering a recession for more than a decade. The recession has led to a debt and economic crisis. The ultimate goal of this paper is to offer insights for designing a plan of action for resolving Puerto Rico's current debt crisis.

Our contribution is thus twofold. First, we examine the macroeconomic implications of Puerto Rico's Fiscal Plan that has been approved for fiscal years 2017-18 to 2026-27, as it is a crucial element for a computation of Puerto Rico's debt restructuring needs. Second, we perform a Debt Sustainability Analysis (DSA) that incorporates the expected macroeconomic dynamics implied by the Fiscal Plan in order to compute the island's restructuring needs.

We stress two important caveats. First, we note that the computations included in this paper were performed before the hurricanes Irma and Maria hit Puerto Rico. We claim that the methodological and empirical analysis offered in this paper will serve as the basis to update the computations when more precise information on the costs of the hurricanes becomes available.

Second, this paper does not study the causes that led to the debt crisis. The reader interested in an analysis of the factors that contributed to the unsustainable growth of Puerto Rico's debt is referred to Caraballo-Cueto and Lara (2017), and the references therein. Caraballo-Cueto and Lara (2017) offer a thorough analysis that connects the evolution of Puerto Rico's debt to deindustrialization. The study points to the fragility of an economic model focused on tax-incentivized industrialization as a major determinant of the unsustainable debt dynamics experienced by the island. The authors provide evidence that supports the hypothesis that a deindustrializa-

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tion process, triggered by a change in US tax and trade policies and the subsequent failure of the island's government and private sector to adapt, led to a secular decline of the economic activity that was followed by a reduction in government revenues and increasing levels of debt.¹

Besides this introduction, this paper includes five other sections. Section 2 introduces the conceptual framework that serves as the basis of our analysis of the Fiscal Plan and the computation of the debt restructuring needs. The conceptual analysis notes that the design of a restructuring proposal must take into account that the relationship between debt restructuring and fiscal policies exhibits bi-directional causality. On one hand, absent macroeconomic policies that expand the aggregate demand, Puerto Rico will not recover; and if the economy does not recover, Puerto Rico will not be able to pay its creditors without imposing severe damages on its nearly 3.5 million residents. On the opposite direction of causality, a larger debt reduction would imply that the territory would have more resources for expansionary macroeconomic policies, making the recovery more feasible and full repayment of the restructured debt more likely.

Section 3 examines the Fiscal Plan certified in March 2017 for the period 2017–2026. It first discusses its assumptions. We claim that some of its critical assumptions are unsound and analyze their implications. We identify a number of core flaws in its design and perform a sensitivity analysis, with respect to the assumptions, for the fiscal multipliers and the effects of the structural reforms. This analysis suggests that the fall in real GNP over the next decade was likely to be significantly larger than what the plan had predicted.

Section 4 presents a computation of Puerto Rico's debt restructuring needs. We first demonstrate that the island's current debt position is unsustainable. Assuming the fiscal plan will be respected, absent a debt restructuring, the territory would be forced to sustain primary fiscal surpluses between 3.5 percent and 7.4 percent of GNP from 2027 onwards, forever. But pursuing such a fiscal surplus would lead to a contraction that would make the collection of the necessary tax revenues to achieve it simply untenable, rendering the fiscal surplus unfeasible. We compute the necessary debt reduction to restore debt sustainability for different combinations of assumptions. We report the following main conclusions:

- (i) When we maintain the assumptions of the Fiscal Plan, we find that the necessary reduction of Puerto Rico's debt to restore debt sustainability should include a full cancellation of the interest payments that are scheduled not to be repaid in the Fiscal Plan, plus a face value reduction that should lie roughly between 45 and 65 percent of the current debt stock of \$51.9 billions included in the Fiscal Plan.
- (ii) However, the relevant universe of the public sector's debt obligations may go beyond the debts included in the Fiscal Plan, as the sustainability of the public sector's debt may also depend on the sustainability of a large part of debt issued by other public entities that is not included in the Fiscal Plan.

- When we compute the necessary relief assuming that the relevant stock of debt corresponds to the total debt of the public sector,² which increases the relevant stock to \$72.2 billions, we obtain that the necessary reduction includes full cancellation of unpaid interest plus a face value reduction of between 60 and 73 percent of this alternative relevant stock of public debt.
- (iii) Under a more comprehensive range of assumptions for fiscal multipliers that includes both the assumption of the Fiscal Plan and other more realistic scenarios, and dismissing the unjustifiably optimistic positive assumed effects of the structural reforms on GNP growth for the period 2017–2026, we conclude that if the fiscal plan is implemented, the territory would need full cancellation of interest payments not scheduled for payment in the Fiscal Plan plus a face value reduction that lies between roughly 50 and 80 percent to restore debt sustainability – and again, the necessary reduction is larger if we take \$72.2 billions instead of the just \$51.9 billions included in the Fiscal Plan as the relevant universe of debt obligations.

Our computations are conservative, as we are not addressing how migration flows will be affected by the deeper depression that the fiscal plan is projected to generate, and more importantly, we are maintaining the fiscal plan's controversial assumption that the territory will somehow manage to achieve a steady state annual nominal GNP growth rate of 2.6 percent without having implemented any expansionary aggregate demand policies. Thus, the range of the values of necessary debt relief that we obtain must be considered as a lower-bound.

The structure of seniority will imply that not all bondholders will get the same discount. Our analysis does not study how the debt write-off will be distributed among bondholders, but simply provides a perspective on the macroeconomic needs. The distribution of losses will be determined by legal considerations that go beyond the object of this study.

We argue that in order to deal with the uncertainty that will underlie the implementation of the fiscal plan and the debt restructuring, the restructuring process could be improved with the inclusion of GNP linked bonds that align debt payments with Puerto Rico's capacity to pay. By definition, these bonds improve the sustainability of the restructured debt and align the incentives of the debtor and the creditors such that the creditors would also benefit from a stronger recovery.

Finally, section 5 concludes with a summary of the policy implications of the analyses and findings of the paper for resolving Puerto Rico's social, economic, and debt crisis.

2. CONCEPTUAL FRAMEWORK

2.a. PUBLIC DEBT SUSTAINABILITY AND MACROECONOMIC DYNAMICS

A public debt sustainability analysis must be able to answer the two following questions:

Q1. Is public debt sustainable with high probability?

Q2. If it isn't, what are the restructuring needs in order to restore debt sustainability?

Answering Q1 and Q2 requires a definition of the concept of debt sustainability.

The economic definition of public debt sustainability refers to the capacity of the government to satisfy its intertemporal budget constraint (IBC) without resorting to a debt default. The IBC states that the present discounted value of primary fiscal surpluses has to be equal to the value of outstanding debt. Each trajectory of states is associated with an IBC. Formally, in an infinite time setup we can describe the IBC in one trajectory of states as:

$$d_t^* = \sum_{j=0}^{\infty} (1+r)^{-j} s_{t+j} \quad (\text{IBC})$$

$$\lim_{j \rightarrow \infty} \frac{1}{(1+r)^j} d_{t+j} = 0 \quad (\text{TC})$$

where the condition (TC) is known as the government's transversality condition, $d_t^* = (1+r)d_{t-1,t}$ denotes debt to output ratio at the start of period t , s_t is the primary fiscal surplus to output ratio in period t , and $1+r = \frac{1+R}{1+g}$, where R is the nominal interest rate and g is the growth rate of output (for simplicity we denote them as constant). In the context of Puerto Rico, we will use GNP as the measure of output.

More generally, the definition of debt sustainability may also refer to other economic or non-economic principles that are meant to ensure an efficient functioning of debt markets and the respect human rights. For instance, debt could be considered unsustainable if full payment would entail the need to cut on essential public services.³ Therefore, the satisfaction of the government's solvency condition is a necessary but not a sufficient condition for debt sustainability, as the territory's development needs have to be taken into account. Relatedly, defining debt sustainability also requires a definition of the relevant universe of creditors. Defining the universe of creditors in a public debt restructuring is different than in a corporate debt restructuring, as the creditors of a country need not be only the formal creditors but also the informal ones—as pensioners and workers.

Public Debt and Macroeconomic Dynamics

The objects of each side of the IBC are not independent. The capacity to collect revenues depends on the level of economic activity. In turn, the level of economic activity depends on fiscal policies. But the space of feasible fiscal policies depends on the debt burden. Formally, the primary fiscal surpluses that enter the IBC must be consistent objects that respect the functional relationship between fiscal policies, economic activity, and fiscal revenues. The consideration of these endogenous feedback effects in a system in which fiscal outcomes, the level of economic activity, and the borrowing costs are endogenous variables is central in any analysis of debt sustainability, and missing it leads to flawed estimates of the implications of debt policies.

Puerto Rico's deep and long-lasting downturn has put the economy into a demand-constrained regime. Such a situation calls for the application of macroeconomic policies that expand the aggregate demand—a basic principle of macroeconomic theory. Implementing expansionary macroeconomic policies requires the capacity for financing them. But a country that is in a demand-constrained regime and faces a debt burden that is unsustainable lacks the capacity for expansionary policies. Instead, the unsustainable debt position becomes a drag for economic growth. The logic is simple: when the debt position is perceived as unsustainable with a high probability, the cost of refinancing debt increases; this in turn increases the burden of interest payments, and decreases the available resources net of interest payments for financing public policies. Attempting to force full repayment under those conditions creates a destabilizing dynamic. The induced fiscal austerity decreases aggregate demand, which in the demand-constrained regime leads to a deeper recession, which in turn leads to a debt position perceived as even more unsustainable, and so on. Indeed, the idea that fiscal austerity could somehow restore debt sustainability in an already depressed economy, in times in which the private sector is also contracting, without contemplating the possibility of destabilizing contractionary spirals, is ill conceived and not aligned with sound macroeconomic theory or evidence.⁴ The uncertainty created by an unresolved debt problem also deters new investment in the economy, so that in addition to the negative impact on aggregate demand there is an adverse effect on aggregate supply.^{5,6}

Thus, in these circumstances—those prevailing today in Puerto Rico—the recovery of debt sustainability is a necessary condition for economic recovery: There is no possibility of implementing the policies needed for macroeconomic recovery when debt is unsustainable. To restore debt sustainability, debt must be restructured—a restructuring that goes beyond just “reprofiling,” e.g. changing the maturity of the obligations. Even creditors as a group may benefit from a restructuring, because the expansionary effects that it allows increases the size of the pie that is distributed among the claimants.⁷

We have just described the ex-ante effects of unsustainable debt—costs that are borne well before a default actually occurs. In addition, there may be large costs which occur when the default actually occurs, and the anticipation of these costs themselves can have adverse effects in the present. The theoretical literature suggests various channels through which debt defaults are associated with output losses as the result of, for example, reputational damage and international trade exclusion costs (e.g., Eaton and Gersovitz 1981; Bulow and Rogoff 1989; Cole and Kehoe 1998; Aguiar and Gopinath 2006; Arellano 2008).⁸ However, the empirical literature suggests that the major costs have been those associated with the impact of defaults on domestic bondholders (Sandleris, 2016).^{9, 10}

Relationships between Fiscal Policies, Revenues, and GNP Growth: The Fiscal Multipliers

The effects of the fiscal policies that are included in a macroeconomic plan depend on the size of fiscal multipliers, i.e. the parameters that describe the impact of fiscal

policies on the level of economic activity. Thus, any fiscal plan must aim at making realistic assessments on the values of the fiscal multipliers.

There are different types of multipliers. The “spending to output multiplier” refers to the effect of changes in public spending on output. The “tax rate to output multipliers” refer to the effects of changes of different tax rates on output; from the tax multipliers, we can infer the values of the “revenues to output multipliers,” which indicate how a variation in fiscal revenues will affect output. Finally, the ‘spending to revenues multipliers’ indicates how a change in public spending will affect tax revenues through the effects that it will have on the endogenous tax bases.

There is a sizable empirical literature that estimates different types of fiscal multipliers for different regions or countries, in different stages of the cycle, and with different methodologies. Although to our knowledge there are no precise estimates for Puerto Rico, the literature offers valuable insights for assessing what assumptions are sensible at the moment of studying the consequences of a fiscal plan for the island. This section offers a brief review of the main findings from that literature. Some of the finds of the empirical literature are that (i) fiscal multipliers are state-dependent;¹¹ (ii) there are negative endogenous feedback effects from fiscal contractions;¹² and (iii) fiscal multipliers depend on the exchange rate regime: Consistent with the predictions from economic theory, the empirical literature finds that they are larger in economies operating under predetermined exchange rates than under flexible exchange rates.¹³

A simple corollary of the multipliers’ state-dependence is that there is uncertainty about the values of multipliers in a particular economy at a particular time. Certainly, there is no precise knowledge about the correct distributions for the values of multipliers for Puerto Rico. Extrapolating values found for US regions or other economies may be of help, but an analysis for Puerto Rico must take into account that the territory is currently in a deep recession and faces the possibility of large out-migration, so that multipliers are likely to be larger than what is obtained for US regions in more “normal” recessions.

The uncertainty about the values of the multipliers has practical implications for an analysis of debt sustainability and for the study of the consequences of a fiscal plan. It makes sensitivity analysis with respect to the baseline assumptions an especially necessary part of the exercise. Our analysis will include a sensitivity analysis that refers to the ranges of estimates that we report in this section.

The stochastic nature of the DSA

Given that any analysis is made under uncertainty, the implication is that the assessment of debt sustainability must be stochastic (see IMF 2013; Celasun, Debrun and Ostry 2006; Consiglio and Zenios 2015, 2017; Guzman and Heymann 2015; Guzman and Lombardi 2017). There may be multiple states of nature, and each state of nature will have a different associated intertemporal budget constraint. This is why we assess debt sustainability from a stochastic perspective, requiring only that there the condition of debt sustainability holds *with a high probability*.

2.b. EMPIRICAL EVIDENCE ON DEBT REDUCTION AND MACROECONOMIC PERFORMANCE

The empirical evidence is consistent with our earlier analysis suggesting that debt relief has beneficial economic effects for debtor countries. Reinhart and Trebesch (2016) examine the economic performance of debtor countries during and after sovereign debt relief operations, for samples that cover the periods 1920–1939 for defaults on official (government to government) debt and 1978–2010 for emerging markets defaults with private creditors. They find that per capita GDP increases 11 percent for emerging markets and 20 percent for advanced economies during the five years following a restructuring that results in exiting from the state of default. They also find a strong increase in average ratings for emerging markets—a result predicted by economic theory, as the market perceptions of debt sustainability should improve if the debt restructuring is effective in resolving the debt crisis. Besides, debt levels decline strongly following the exit of crises. Within five years, total government debt/GDP falls by 27 percentage points across emerging market episodes and by 22 percentage points in the sample of defaults with official creditors. However, they find that not every type of restructuring is associated with improvements in economic performance and ratings: the effects are significant only in deals that involve face value reductions. Reprofitting deals, such as operations with maturity extensions and interest reductions, were not associated with improvements in economic performance.

Recent commentaries and research have made the mistake of looking at what has been the average in past restructurings as a guide for appropriate future debt policies (Edwards 2015a, 2015b). But what has been the norm in recent practice should instead be taken as representative of what is unacceptable. The amount of relief that distressed countries have obtained has generally been insufficient to resolve debt crises. Indeed, restructurings are coming in the form of “too little and too late” (cf. Guzman, Ocampo, and Stiglitz 2016). From 1970 to 2010, between 49.9 percent and 60 percent of sovereign debt restructurings with private creditors were followed by another restructuring or default within 3 to 7 years, respectively (Guzman and Lombardi 2017, based on data from Cruces and Trebesch 2013), the figures suggest that restructuring processes have too often been ineffective at providing enough relief to restore debt sustainability with high probability.

Among the successful cases, two stand out—at least in terms of their magnitude and the attention they have received in the literature. One of them is the case of West Germany following World War II. West Germany obtained significant debt relief through the London Debt Agreement (LDA). The case is studied by Galofré-Vilà et al. (2016), who conclude that West Germany's spectacular recovery would have not been possible without the LDA. The significant debt write-down released resources for fiscal policies that allowed the pursuing of the public policies that the recovery required. Absent such a relief, West Germany would have been forced to obtain sizable fiscal surpluses that would not only have undermined the recovery, but would also have fostered political instability, potentially renewed geopolitical conflict, and ultimately be economically self-defeating.

The other case was Argentina's debt restructuring following the default of 2001—the largest recorded sovereign default in history at the time. The country followed a strategy that resulted in significant debt relief (see Basualdo et al. (2015); Guzman (2016); Chodos (2016); and Cruces and Samples (2016) for details), which created space for fiscal policies that played a crucial role in the fast and large recovery that the country experienced following the default.³⁴ However, the country also got immersed in a complex legal dispute with holdout bondholders—bondholders who decide to not cooperate in restructuring negotiations even when a large majority accepts the proposal of the debtor—including the so-called vulture funds who bought debt at a low fraction of its face value when it was already in default, sued the country in US courts seeking full payment and won, blocking the finalization of the restructuring process and also the country's access to international credit markets for more than a decade. The case is also telling of the complexities of resolving debt crisis under severe gaps in the legal frameworks.

Among the recent unsuccessful cases, Greece stands out. The case is extensively analyzed by Varoufakis (2016). The management of Greece's ongoing debt crisis is an example of *too little* and *too late*. After a few years of recession and of an unsustainable debt position, the country restructured its debt in 2012. But the restructuring was not effective to restore debt sustainability. It came with conditions of fiscal austerity imposed by the Troika that undermined the possibility of escaping the recession. The draconian demands have continued since then. The Troika later imposed a program for reducing Greece's public debt to GDP ratio that included a target of primary surplus of 3.5 percent of GDP for 2015, and 4.5 percent of GDP from 2015 onwards, forever. Predictably, such a program has not restored Greece to prosperity. The country continues to struggle, and throughout this period, opportunities have vanished for many Greeks. The unemployment rate was 7 percent in 2008 and skyrocketed since then, growing higher than 25 percent; it was 23 percent in 2016. Youth unemployment statistics are even more alarming. The youth unemployment rate peaked at 60 percent in 2013, then declined to 47 percent at the time of this study after many migrated or stopped looking for jobs.

2.c. PROJECTIONS

The model we employ for projecting the debt repayment capacity respects the functional relationships assumed by the Fiscal Plan. The growth rate of real GNP, g_t^y , is defined as

$$g_t^y = g_t^b + g_t^d + g_t^s$$

where g_t^y is the real GNP growth, g_t^b is the baseline real GNP growth rate, g_t^d is the growth rate of real GNP that comes from fiscal policy measures, and g_t^s is the growth rate in real GNP that comes from structural reforms, in all cases between years $t - 1$ and t . The growth rate of real GNP that comes from fiscal policy measures is given by

$$g_t^d = \frac{\Delta RGNP_t^d}{RGNP_{t-1}}$$

where $RGNP_t$ is the real GNP in year t , and

$$\Delta RGNP_t^d = \alpha_{Y,G} \Delta G_t + \alpha_{Y,T} \Delta T_t^C + \alpha_{Y,T} \Delta T_t$$

where $\alpha_{Y,G}$ is the public spending to real GNP multiplier and $\alpha_{Y,T}$ is the fiscal revenues to real GNP multiplier.

The ΔT_t^C component denotes the necessary change in tax revenues to compensate the initial variation due to the change in public spending in year t :

$$\Delta T_t^C = -\alpha_{T,G;t} \Delta G_t$$

where $\alpha_{T,G;t}$ is the public spending to fiscal revenues multiplier that denotes the endogenous feedback effect that a contraction of public spending creates on fiscal revenues through the fall in economic activity.¹⁵

Informed by the literature (see section 2.A above), we project the real and nominal GNP for each possible combination of the following parameters: $\alpha_{Y,G} = \{1, 1.34, 1.5, 2, 2.5, 3, 3.5\}$, $\alpha_{Y,T} = \{0, 0.5, 1, 1.34\}$, and $\epsilon_{T,G} = \{0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7\}$ where $\epsilon_{T,G}$ is the elasticity of fiscal revenues to public spending,

$$\epsilon_{T,G} = -\alpha_{T,G;t} \frac{G_t}{T_t}$$

We are making a conservative assumption for the tax revenues to real GNP multiplier, under the premise that part of the increases in tax revenues will fall on agents with low marginal propensities to consume. Our projections would be more pessimistic if we chose the same range for $\alpha_{Y,T}$ as for $\alpha_{Y,G}$.¹⁶

The nominal GNP growth rate is denoted by g^y , where

$$g_t^y = g_t^y + \pi_t + g_t^y \pi_t$$

and where π_t is the rate of inflation between years $t - 1$ and t .

The real GNP in period t is given by

$$RGNP_t = RGNP_{t-1} (1 + g_t^y)$$

and the nominal GNP in period t is given by

$$NGNP_t = NGNP_{t-1} (1 + g_t^y)$$

Our choice of parameters for the multipliers $\alpha_{Y,G}$, $\alpha_{Y,T}$ and the elasticity $\epsilon_{T,G}$ results

in 192 combinations of parameters that can be defined as “scenarios”. We project real and nominal GNP for each of those 192 scenarios.

3. AN ANALYSIS OF THE FISCAL PLAN 2017-2026¹⁷

In this section, we examine the macroeconomic implications of Puerto Rico’s Fiscal Plan that had been approved for fiscal years 2017–18 to 2026–27, as it is a crucial element for a computation of Puerto Rico’s debt restructuring needs. The Fiscal Plan presented by the Government of Puerto Rico had been certified by the Oversight Board on March 13, 2017.

The plan includes a detailed path of policies, including spending and tax policies as well as structural reforms. It offers a projection of the effects of those policies on Puerto Rico’s GNP for the ten-year period under a set of assumptions regarding

Table 1

Fiscal year ending June 30 (\$ in millions)	2017	2018	2019
PR Nominal GNP Growth	(2.2%)	(2.8%)	(2.4%)
Revenue before Measure	\$18,952	\$17,511	\$16,407
Nointerest Exp. before Measures	(\$17,872)	(\$18,981)	(\$19,233)
Cash flows pre-Measures	\$1,000	(\$1,470)	(\$2,826)
Measures			
Revenue Measures	-	924	1,361
Expense Measures	-	951	2,012
Net impact of measures	-	1,875	3,393
Cash flows post-Measures, before Debt Service	\$1,000	\$404	\$567
Fiscal year ending June 30 (\$ in millions)	2020	2021	2022
PR Nominal GNP Growth	(0.5%)	(0.4%)	0.3%
Revenue before Measure	\$18,434	\$16,494	\$16,590
Nointerest Exp. before Measures	(\$19,512)	(\$20,477)	(\$20,477)
Cash flows pre-Measures	(\$3,077)	(\$3,456)	(\$3,886)
Measures			
Revenue Measures	1,384	1,531	1,633
Expense Measures	2,415	2,983	3,156
Net impact of measures	3,799	4,515	4,789
Cash flows post-Measures, before Debt Service	\$722	\$1,059	\$903

Source: Fiscal Plan 2017-2026.

the macroeconomic effects of fiscal policies, the effects of the structural reforms, the migration flows, the baseline growth rate of GNP (that describes the scenario that would prevail in absence of new policy measures), and the inflation rate.

On the demand side, the program is characterized by fiscal contraction over the entire decade but mainly concentrated in years 2018 and 2019. Regarding the structural reforms, the plan features four packages that are classified as (i) improve the ease of business activity, (ii) improving capital efficiency, (iii) energy reform, and (iv) promoting economic development. The concrete measures include (textually reproduced from the approved Fiscal Plan, p. 23):

- Institute public policy measures aimed to attract new businesses, create new employment opportunities, and foster private sector employment growth to increase labor demand.

Table 1 (continued)

Fiscal year ending June 30 (\$ in millions)	2023	2024	2025
PR Nominal GNP Growth	1.0%	1.6%	2.1%
Revenue before Measure	\$16,746	\$16,953	\$17,204
Nointerest Exp. before Measures	(\$20,884)	(\$21,310)	(\$21,973)
Cash flows pre-Measures	(\$4,139)	(\$4,357)	(\$4,769)
Measures			
Revenue Measures	1,740	1,752	1,766
Expense Measures	3,255	3,357	3,724
Net impact of measures	4,995	5,108	5,491
Cash flows post-Measures, before Debt Service	\$857	\$751	\$722
Fiscal year ending June 30 (\$ in millions)	2026	'17 - '26 total	
PR Nominal GNP Growth	(0.5%)	(0.4%)	
Revenue before Measure	\$18,434	\$16,494	
Nointerest Exp. before Measures	(\$19,512)	(\$20,477)	
Cash flows pre-Measures	(\$3,077)	(\$3,456)	
Measures			
Revenue Measures	1,384	1,531	
Expense Measures	2,415	2,983	
Net impact of measures	3,799	4,515	
Cash flows post-Measures, before Debt Service	\$722	\$1,059	

Source: Fiscal Plan 2017–2026.

- Change welfare and labor incentives to encourage greater sector participation, thus increasing labor supply.
- Centralize, streamline, and modernize and expedite permitting processes; increase business friendly environmental and economic growth.
- Lower marginal tax rates and broaden the tax base; simplify and optimize the existing tax code to achieve gains in efficiency, ease of doing business and reducing tax evasion.
- Reduce unnecessary regulatory burdens to reduce the drag of government on the private sector.
- Augmenting competitiveness by investing in critical infrastructure and quality of public services in roads, ports, telecommunications, water and waste, knowledge services, and other strategically important sectors.*

Table 2

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
PR Annual Inflation Rate %	-0.2	1.2	1.0	1.0	1.1	1.3	1.5	1.5	1.6	1.6

Source: Fiscal Plan 2017–2026.

Table 3

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Baseline Real GNP Growth (%)	-2.4	-1.31	-1.39	-1.44	-1.47	-1.49	-1.50	-1.51	-1.52	-1.53

Source: Fiscal Plan 2017–2026.

Table 4

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Impact of structural reforms on real GNP growth (%)	0	0	0	0	0	0.5	1	1.5	2	2.5

Source: Fiscal Plan 2017–2026.

- Leverage key public assets through long-term concessions to optimize quality of public infrastructure, services to public and sustainable operations and maintenance.
- Implement management system to boost development of critical projects through expedited processes.
- Leverage and facilitate expedited private sector investments in modern, cost-efficient, and environmentally compliant energy infrastructure; reform PREPA operations and services to clients; and allow for greater competition in energy generation.
- Promote productivity growth, attract FDI & incentivize investments in technology through collaboration with the private sector.
- Externalize the overseeing of marketing efforts and continuity under a single brand and as a unified front representing all of Puerto Rico's tourism components.

Table 1, reproduced from the Fiscal Plan (p.10), summarizes the fiscal measures and the projections for the growth rate of nominal GNP.

The plan assumes a constant annual population growth rate of -0.2 percent for the entire period and an evolution of the inflation rate as described in Table 2.

As publicly reported, the plan assumes that the multiplier associated with fiscal contractions will be 1.34, which means that every dollar of contraction in the primary surplus will be associated with a fall in GNP of 1.34 dollars. The Fiscal Plan assumes baseline real GNP growth rates for the decade as described in Table 3 (i.e. these are the growth rates that would have occurred, in the absence of the Plan's changes in policy).¹⁹

The plan also assumes that the effects of the structural reforms will kick in by 2022 and will make a contribution to real GNP growth as described in Table 4.

Critiques

Our analysis of the fiscal plan detects a number of core flaws in its design:

- (I) The plan is based on assumptions that are not sensible: thus it fails to appropriately recognize the magnitude of the destabilizing dynamics that it would create.
- (II) The plan falls short on presenting a debt restructuring and sustainability analysis, and as we have already explained, such an analysis is essential for making reasonable growth forecasts. Instead, it simply specifies what is the amount that must be repaid to creditors during the next decade, without being explicit about the longer-term obligations that the island will face and their sustainability.

We discuss each of these in turn. Specifically:

1. The values of fiscal multipliers used for the GNP projections are overoptimistic.

The value for the multiplier associated with the fiscal contraction of 1.34 is close to the lower-bound of the estimates corresponding to times of recession, as described in the review of the literature in section 3. That value corresponds to estimates for US regions in recessions,²⁰ but Puerto Rico is suffering a depression that is deeper than a "normal" recession. Multipliers are likely to be larger for deep recessions. This is especially so in the case of Puerto Rico, given the likely effect of a deep recession on migration.²¹ And even if the assumption is considered sensible, a robust plan

should consider the consequences of deviations from it. It is not only the point estimate what matters, but also the distribution.

2. The endogenous feedback effects that the fall in economic activity would have on fiscal revenues are not taken into account.

While the assumption on the fiscal multiplier cannot be classified as a wrong assumption—but simply as an overoptimistic one—ignoring the effects that the fall in economic activity would have on tax revenues is a plain mistake, one that leads to an underestimation of the contractionary impact of the proposed fiscal policies. Implicitly, the projections assume that the elasticity of public spending on tax revenues is zero—as tax revenues fall as the economy contracts, to meet the fiscal targets, public expenditures have to fall. But this induced contraction of expenditures then has a further contractionary effect. The Board's analysis seems to have ignored these feedback effects.²²

3. The plan assumes that the territory will begin to experience a recovery starting in 2022 entirely because of structural reforms that mostly affect the supply side. This assumption goes against sound macroeconomic theory, because Puerto Rico's economy is a demand-constrained regime.

In a supply-constrained regime, structural reforms that remove obstacles to supply formation will likely have expansionary effects. But Puerto Rico's economy is in a demand-constrained regime. Thus, the assumption that supply-side reforms will be the driver of economic recovery is not well-founded. On the contrary, any spending-reducing reform as cuts in pensions will more likely deepen the recession in the short-term.

In summary, the entire reasoning of the fiscal plan for how Puerto Rico will recover relies on an assumption that is not aligned with sound economic theory. Puerto Rico will not manage to recover if it does not implement policies that push aggregate demand while the economy is in a demand-constrained regime. And the Plan provides no argument for how in the foreseeable future Puerto Rico will shift away from a demand constrained economy.

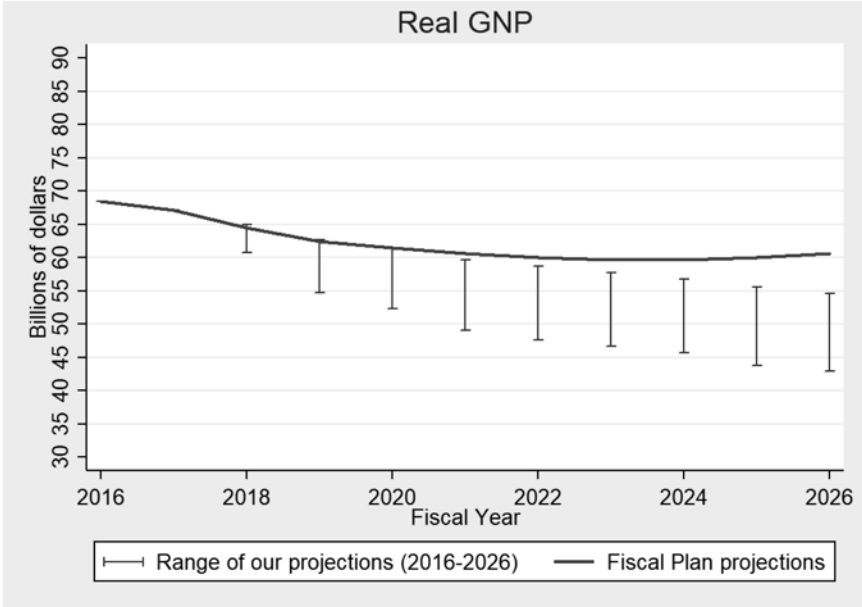
4. The assumption on migration flows assume that migration pressures will not intensity with the projected contraction in economic activity.

Puerto Rico's population has declined from approximately 3.8 million in 2000 to a little more than 3.4 million in 2016. Between 2010 and 2016, the annual rate of population contraction exceeded 1 percent, and reached 1.8 percent in 2016. A deeper recession—as anticipated by the Board's plan—will further decrease opportunities in the island, fueling more migration to the mainland. And yet the plan assumes that the migration flows will taper off, with the population declining by only 0.2 percent per year over the 2017–2026 period. This is an unrealistic assumption.²³

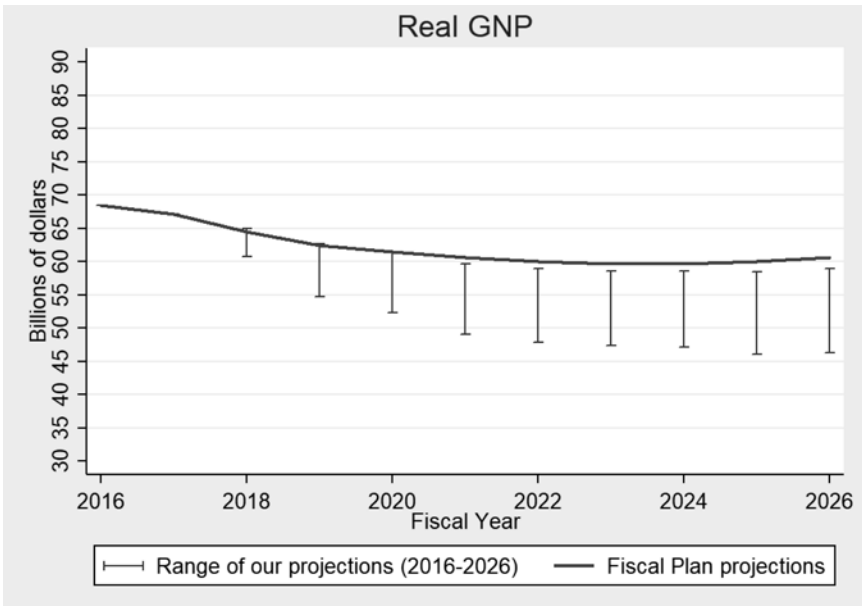
An intensification of migration outflows as a result of the contractionary effects of the Plan would accelerate the fall in fiscal revenues. Then, to achieve the revenue targets stated in the Fiscal Plan, the adjustments would need to be larger—but that would trigger further contractions in economic activity and would increase the per capita burden for those remaining in the island, leading to a destabilizing dynamic that the Fiscal Plan fails to recognize.

Figure 1

Assuming the Fiscal Plan's assumption on structural reforms hold



Assuming structural reforms have no effect on GNP



5. The plan does not present a proposal for debt restructuring.

The plan simply states what is the amount that must be repaid to creditors during the next decade, but it falls short on the specifics of a restructuring plan as, for instance, on the amount of relief that the territory should obtain to restore debt sustainability. This is a mistake, because the possibilities that the territory will face in terms of fiscal policies are contingent on the restructuring it achieves; and those fiscal policies in turn will affect output, employment, migration, and tax revenues.

There is a sixth issue that deserves attention. The annual growth rates of nominal and real GNP are assumed to reach 2.6 percent and 1 percent respectively in 2026. It is not specified whether these assumptions correspond to a steady state.²⁴ Assumptions about future growth obviously affect the sustainability of the debt after 2026; market perceptions about debt sustainability obviously affect the interest rates the territory will have to pay; and this in turn affects (for reasons already explained) the territory's macroeconomics.

Finally, the exercise of projecting the effects of public policies must take into account that there is uncertainty about the values that the relevant parameters and the magnitude of the shocks that the island will experience. The sensitivity analysis, where changes in the assumptions are analyzed, must be part of the projection analysis. We next engage into such an exercise.

Projections: Sensitivity analysis

In order to address the limitations of the Fiscal Plan's forecasts, we conduct a sensitivity analysis of the expected implied macroeconomic dynamics. This allows us to construct more realistic scenarios of Puerto Rico's debt restructuring needs. We project the trajectories under alternative assumptions for fiscal multipliers described in Section 2.A above, maintaining the same assumptions of the Fiscal Plan for the trajectory of baseline real GNP growth and the annual inflation rates until 2026. We maintain those assumptions because our initial goal is to assess how the GNP projections react to changes in the values of the fiscal multipliers. We assume that the component of the fiscal primary balance that corresponds to the line "Measures" in Table 1 is the "unanticipated" component of the fiscal policy, to which the multipliers apply—the Fiscal Plan assumes the same.

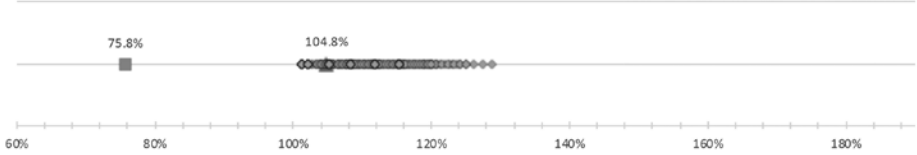
Our choice of parameters for the multipliers μ , ν , and the elasticity η results in 192 combinations of parameters that can be defined as "scenarios." We project real and nominal GNP for each of those 192 scenarios. Figure 1 shows the ranges of our projections, as well as and the Fiscal Plan's projections, for the real GDP, for two scenarios: in panel A, the Fiscal Plan's assumptions on the effects of structural reforms on GNP are maintained, while in panel B the comparison is made under the assumption that the Fiscal Plan's structural reforms have no effect on GNP.

Our projections strongly suggest that the Fiscal Plan's projections are overoptimistic. They lie on the most optimistic bound within the range of assumptions on the values of multipliers that are aligned with the empirical evidence. The magnitude of

Figure 2

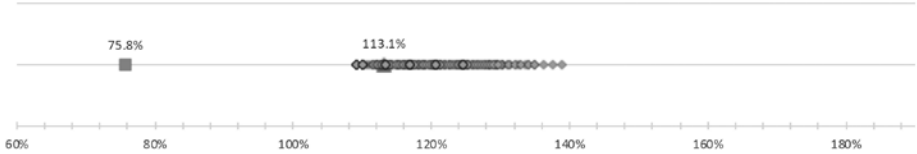
PANEL A: Debt included in Fiscal Plan to GNP

Assuming the Fiscal Plan's assumptions on structural reforms hold



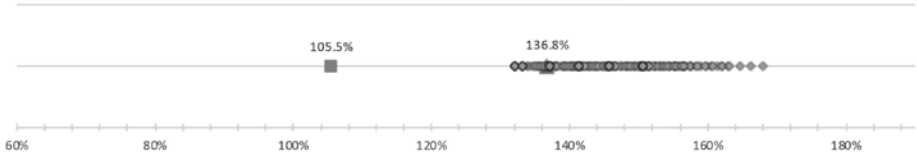
PANEL B: Debt included in Fiscal Plan to GNP

Assuming structural reforms have no effect on GNP



PANEL C: Total Public Debt to GNP (net of Children's Trust and HFO)

Assuming the Fiscal Plan's assumptions on structural reforms hold



PANEL D: Total Public Debt to GNP (net of Children's Trust and HFO)

Assuming structural reforms have no effect on GNP



the differences between our range of projections and the projections of the Fiscal Plan is noticeably larger if we dismiss the positive effects that the structural reforms are assumed to have on GNP by the Plan.

And even under those optimistic assumptions, the plan falls into an “austerity trap”: the magnitude of the targets for primary surpluses leads to a decrease in GNP over a decade that is larger than the reduction in the stock of debt, thus leading to an increase in the debt to GNP ratio by 2026. If there was no reduction in the debt principal, and if missed payments either of interest or principal were capitalized at zero interest rate, the total public debt to GNP ratio would rise from 1.09 in 2016 to 1.41 in 2026 in the scenario projected by the Fiscal Plan. (It is this “austerity trap” which has led to the dire outcomes in Greece, where, after its austerity program and after successive debt restructurings, the debt GDP ratio is higher than it was in the beginning of the crisis.)

And as figure 2 shows, the magnitude of the austerity trap will likely be larger, as the projected debt to GNP ratio for 2026 is even larger in the large majority of the postulated scenarios.

True, the lower-bound of our projections corresponds to projections that may be too pessimistic. Prospects should be certainly better if there is a restructuring that restores sustainability, as the baseline growth rate of GNP would probably be larger if the debt position of the territory is perceived as sustainable by market participants. But our projections call the attention on the deeply negative consequences that the implementation of the Fiscal Plan could have for Puerto Rico's economy. And our projections still ignore the larger effects that the fall of economic activity could have on migration outflows.²⁵

4. A COMPUTATION OF PUERTO RICO'S DEBT RELIEF NEEDS

In this section, we perform a Debt Sustainability Analysis (DSA) that incorporates the expected macroeconomic dynamics implied by the Fiscal Plan in order to compute Puerto Rico's restructuring needs. The analysis includes a computation of the amount of debt relief that is required in order to restore Puerto Rico's public debt sustainability. More specifically, we compute the reduction in the value of Puerto Rico's public debt that would make full repayment of the restructured debt feasible, being consistent with the Fiscal Plan assumptions that the country will achieve a real GNP growth rate of 1 percent in 2026, and that will settle on that rate as a steady state.

Our DSA takes the premise that the Fiscal Plan will be respected. We assume that any discrepancy between the Fiscal Plan's GNP projections and realizations will be addressed in a way that respects the schedule of debt payments—or equivalently, the schedule of cash after measures available for debt service—established in the Fiscal Plan. Therefore, each projection will lead to the same face value of debt in 2026, because by construction we force the economy to do whatever it takes to reach the targets of fiscal revenues included in the Fiscal Plan. But each scenario will be associated with different GNP trajectories, as shown in figures 1 to 4. Thus, for each of the 192 scenarios that are defined by the assumed range of fiscal multipliers, we obtain a different value of the debt to GNP ratio for 2026, as depicted in figure 2.

For each of those 192 projected debt to GDP ratios, we need to respond the following questions:

- a.) What path of primary fiscal surpluses would the economy require after 2027 to satisfy the government's IBC?
- b.) Is that path economically feasible?
- c.) If it is not, what is the size of the debt write-down that would make the satisfaction of the government's IBC feasible with high probability?

Answering these questions requires taking a stance on the relationship between fiscal policies and GNP growth. We use exactly the same functional form that is used for the projections of the Fiscal Plan, but as explained previously, we run the projections under a set of assumptions that include those of the Fiscal Plan as well as others, informed by the empirical literature.

To perform the computations required to answer questions (a) to (c), we make the following additional assumptions:

Assumption i. We take the value of the fiscal surplus to GNP ratio of 2026 as the new structural fiscal balance for year 2027—the first year for which there is no information from the Fiscal Plan. This is an optimistic assumption—one that assumes that the reforms and policies included in the plan will be as effective as assumed and will remain in place after 2026. If anything, this assumption leads to an underestimation of Puerto Rico's debt relief needs—consistently with our strategy of making assumptions in each step of the analysis that imply that our computations of the debt relief needs must be interpreted as lower bounds.

Assumption ii. With the same goal of making our computations a representation of lower-bounds, we assume that the interest payments that are missed during the period 2017-2026 are capitalized after being rolled-over to 2027 at zero interest rate.

Assumption iii. We assume that by 2027 the economy will have already settled on a trend of real GNP growth rate of 1 percent, as predicted by the fiscal plan. We also assume that the inflation rate will settle on a trend of 1.6 percent per year after 2026—which is the inflation rate the Fiscal Plan assumes for 2026. As discussed above, these are controversial assumptions. If the country does not implement policies that push aggregate demand, the real and nominal growth targets will likely not be met. Again, the goal is to err on the underestimation side of relief needs rather than on the overestimation side.

Assumption iv. Finally, we assume that the nominal interest rate stabilizes at 6 percent after the restructuring, which corresponds to a scenario of a risk free nominal interest rate of 3 percent, recovery of sustainability with probability 95 percent, and recovery rate of 46 percent in case of default. The online appendix presents the sensitivity analysis regarding this assumption.²⁶

The debt stabilizing primary fiscal surplus to gnp ratio

We search for the value of the debt stabilizing primary fiscal surplus to GNP ratio in a steady state situation. We denote this variable in scenario i as s^i , and it is defined as

$$s^i = d^i \frac{(R - g^B)}{1 + g^B}$$

where g^B is the steady state nominal GNP growth, and, as defined before, d^i is the debt to GNP ratio in scenario i , and R is the nominal interest rate that corresponds to the situation where debt has been stabilized. The debt stabilizing primary fiscal surplus denotes the value of the primary fiscal surplus as a ratio of GNP that must be achieved to satisfy the government's intertemporal budget constraint. But that value may or may not be feasible, i.e. it may or may not be achievable once we take into account the endogenous feedback effects between fiscal policies and economic performance.

Let s_{2026}^i be the structural primary fiscal balance by the end of 2026 in scenario i , i.e. the new primary fiscal balance in absence of measures by the time the Fiscal Plan ends. From 2027 onwards, we do not take a stance on what component of the primary

Table 5: Debt-stabilizing primary fiscal surplus, R=0.06, g =0.026

Scenarios	Measure of debt	Fiscal Plan assumptions on structural reform	Mean	Minimum	Maximum
192	Total public debt net of Children’s Trust and HFO	No	5.8%	4.9%	7.4%
192	Debt included in Fiscal Plan	No	4.3%	3.7%	5.2%
192	Total public debt net of Children’s Trust and HFO	Yes	5.3%	4.6%	6.7%
192	Debt included in Fiscal Plan	Yes	3.9%	3.5%	4.7%

balance (revenues or spending) will have to be adjusted in order to achieve the target of primary surplus defined for each scenario. Therefore, we assume the same multipliers for tax revenues and public spending for each combination i : $\alpha_{G,Y}^i = \alpha_{T,Y}^i = \beta^i$. We redefine the function that determines the effects of fiscal contractions on real GNP growth as

$$\alpha_{G,Y}^i = \alpha_{T,Y}^i = \beta^i \quad (1)$$

which, as stated, is the same function used for the Fiscal Plan projections.²⁷

Computing s^i requires a series of iterations until the economy stabilizes on a path of constant nominal GNP growth and stable debt-to-GNP ratio.

The iteration process works as follows:

Step 1: Under the *Assumption ii*, we compute d^i for each i for 2026.

Step 2: For each d_{2026}^i , we compute s^i . If $s^i \neq S_{2026}$, the economy will not be in a steady state situation, and then we need to compute g_{2027}^{iY} , where g_{2027}^{iY} is the nominal growth rate of GNP in scenario i . This will result in a new d_{2027}^{iY} that will differ from d_{2026}^i .

Step 3: For the new value of d_{2027}^{iY} , we compute again the new s^i . If $s^i \neq S_{2027}$, then $g_{2027}^{iY} \neq g_{2027}^{iB}$, and we need to compute d_{2028}^i .

Step 4 to N: This iteration will continue until $s_t^i = s_{t-1}^i$, with $g_t^{iY} = g_{t-1}^{iY} = g^{iB}$. At that moment (step N), we get a constant s^i that satisfies the government’s IBC.²⁸

Results: The debt stabilizing primary fiscal surpluses to GNP and the evolution of debt to GNP ratios

In the absence of restructuring, the debt included in the Fiscal Plan to GNP ratio would have to stabilize at values from 1.04 (when $\alpha_{GY} = 1.34$, $\alpha_{GT} = 0$, $\alpha_{TY} = 0$) to 1.45 (when $\alpha_{GY} = 3.5$, $\alpha_{GT} = 0.7$, $\alpha_{TY} = -1.34$), and the total public debt (net of Children's Trust and HFO) to GNP ratio would have to stabilize at values from 1.38 to 2.04. The lower bound of 1.04 corresponds to $s = 0.035$, and the upper bound corresponds to $s = 0.074$. Under the Fiscal Plan assumptions, those ratios take values of 1.08 and 1.43 respectively, and in 2026 they take values of 1.04 and 1.36 respectively.

Therefore, in absence of any relief, Puerto Rico should achieve primary fiscal surpluses between 3.5% and 7.4% of GNP after the end of the Fiscal Plan, forever. Under the Fiscal Plan's assumptions, the primary surpluses after 2028 would have to be 3.5% or 4.7% of GNP, forever, depending on whether the relevant debt stock is the one included in the Fiscal Plan or the total public debt net of Children's Trust and HFO. Table 5 summarizes these findings.

On the feasible primary fiscal balance paths

The functional form (1) used for the Fiscal Plan projections relates the growth rate of GNP to the change in the primary surplus, but it does not relate it to the level of the primary surplus. Thus, according to their model, even if the government is forced to sustain primary surpluses of 7 percent of GNP forever, that would not affect the (growth) performance of the economy in the long term. The only period in which economic activity would be affected would be the one in which the large contraction to achieve the target of 7 percent occurs.

But such premise is, of course, not valid over the entire range of primary surplus levels. The need to maintain massive primary surpluses for a long time would have significant effects on the possibilities of the government to make investments in infrastructure, health, or human capital, or to implement other development policies. A draconian plan as requiring constant primary surpluses between 3.5 to 7.4 percent of GNP would entail drastic permanent cuts to spending in these areas, and that would have long term effects. The targets would likely be inconsistent with the baseline assumption of convergence to a real GNP growth rate of 1 percent. (Moreover, such draconian measures would further encourage migration, making the growth targets even more unrealistic.)

The IMF DSA framework and its fan charts approach provide a helpful basis for complementing our analysis. IMF (2011) recognizes that sustained large surpluses are not common, and incorporates this constraint in its debt sustainability analyses; it reports that out of a sample of 87 countries, only 16 countries (less than 20 percent) sustained primary surpluses exceeding 5 percent of GDP for five years or longer. Some of these episodes of sustained large surpluses were related to specific conditions that are not easily applicable to most countries. Out of the 16 countries that recorded episodes of sustained surpluses, five had this performance in connection to exogenous factors—large increases in revenues related to natural resources

(Botswana, Chile, Egypt, and Uzbekistan) or transfers arising from customs union membership (Lesotho). Episodes of sustained large surpluses in the absence of facilitating exogenous factors have been limited to 11 countries (13 percent of the sample). And a few of these countries ran large primary surpluses in the absence of a large debt burden (Denmark, New Zealand, Turkey). The ones that sustained surpluses exceeding 5 percent of GDP for five years or longer at times where debt levels were above 60 percent of GDP were Belgium, Canada, Dominica, Israel, Jamaica, Panama, Seychelles, and Singapore. And no country targeted those values forever.

Besides, there is no evidence that supports the premise that targeting those high primary fiscal surpluses has been associated with recoveries in situations of distress. Indeed, four of those eight economies faced situations that are significantly different from that of the debt distress Puerto Rico is facing (Belgium, Canada, Israel, and Singapore were in situations where austerity could ensure the sustainability of the public sector without triggering a self-defeating macroeconomic process. For instance, Canada had the good fortune of having a flexible exchange rate regime and having its major trading partner, the US, experience a boom.). While Dominica combined a debt restructuring in 2004 with an average primary fiscal surplus of 3.9 percent of GDP for the period 2004–2008, it had only an average fiscal surplus of 1.19 during the decade that followed the restructuring; Jamaica has been keeping sizable primary fiscal surpluses since its last debt restructuring in 1990, on average of 748 of GDP, and the economy has suffered the consequences: the unemployment rate has kept at two digits for almost the entire period, and the government's debt to GDP ratio is at about the same levels now as in 1990, above 120 per cent; Panama combined two debt restructuring episodes in 1994 and 1996 with an average primary fiscal surplus of 1.08 percent of GDP in the decade that followed the latter restructuring; and Seychelles combined a debt restructuring in 2010 with an average primary fiscal surplus of 5.98 percent of GDP during the period 2010–2015—in a context of significant increases in the prices of its exports.

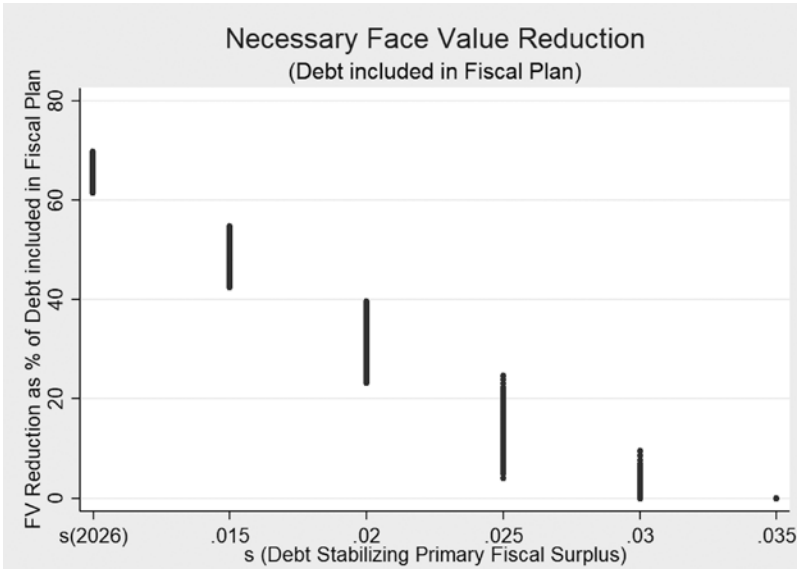
Most important, the primary surplus is an endogenous outcome; if a country recovers due to the implementation of an appropriate mix of policies that include a debt restructuring, obtaining primary surpluses becomes a more likely outcome.

In summary, while there is no evidence that suggests that a country in a situation of debt distress, in a demand-constrained regime, can do well by avoiding a restructuring through the achievement of very large primary fiscal surpluses, there is evidence that long periods of large primary fiscal surpluses are very rare, and that a restructuring has been almost always ultimately unavoidable under those circumstances.

We conclude that if Puerto Rico's government needs to collect primary surpluses in the order of 3.5 percent to 7.4 percent of GNP after 2027 forever, this means that Puerto Rico's debt is almost surely unsustainable, and that it needs to be restructured to a level where the required path of primary fiscal surpluses becomes feasible.

Figure 3: Necessary face value reduction under the Fiscal Plan assumption on the effects of structural reforms on GNP growth – Relevant debt: Debt included in Fiscal Plan

Panel A: As % of total relevant debt



Panel B: In billions of \$

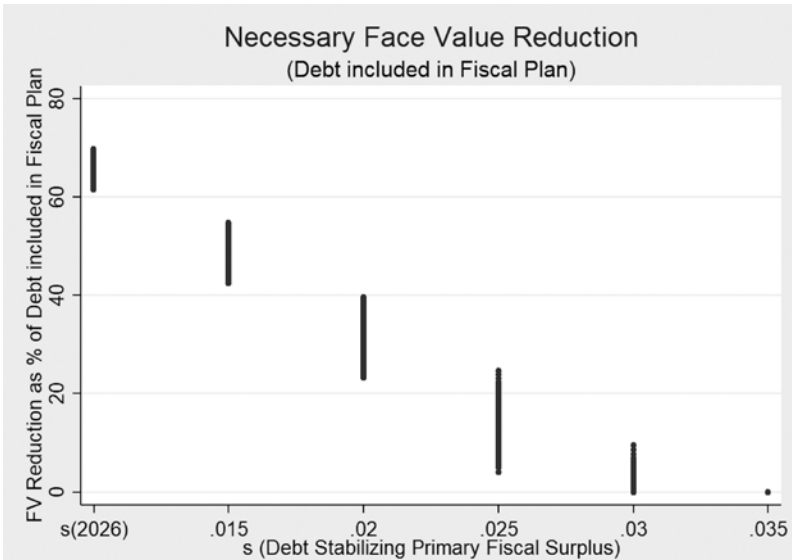


Table 6: Necessary face value reduction under the Fiscal Plan assumption on the effects of structural reforms on GNP growth, as percent of total relevant debt – Relevant debt: Debt included in Fiscal Plan

Debt stabilizing primary surplus scenarios to GNP since 2027	No. of scenarios	Min Face Value Reduction (% of total current public debt)	Max Face Value Reduction (% of total current public debt)	Face value reduction under Fiscal Plan multiplier assumptions
s2026	192	61.6	69.8	63.0
0.015	192	42.4	54.7	44.4
0.02	192	23.2	39.7	25.9
0.025	192	4.0	24.6	7.4
0.03	192	0.0	9.5	0.0
0.035	192	0.0	0.0	0.0

Figure 4: Necessary face value reduction under the Fiscal Plan assumption on the effects of structural reforms on GNP growth – Relevant debt: Total Public Debt Net of Children’s Trust and HFO

Panel A: As % of total relevant debt

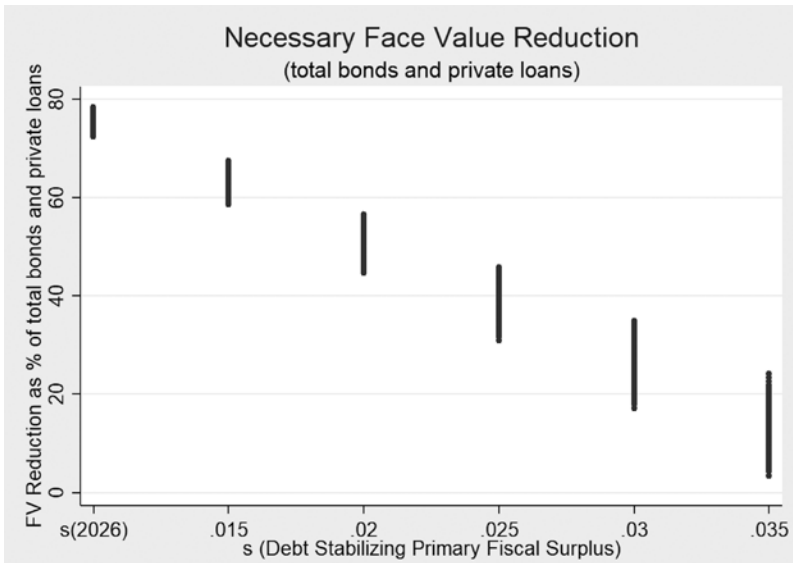


Figure 4 (continued)

Panel B: In billions of \$

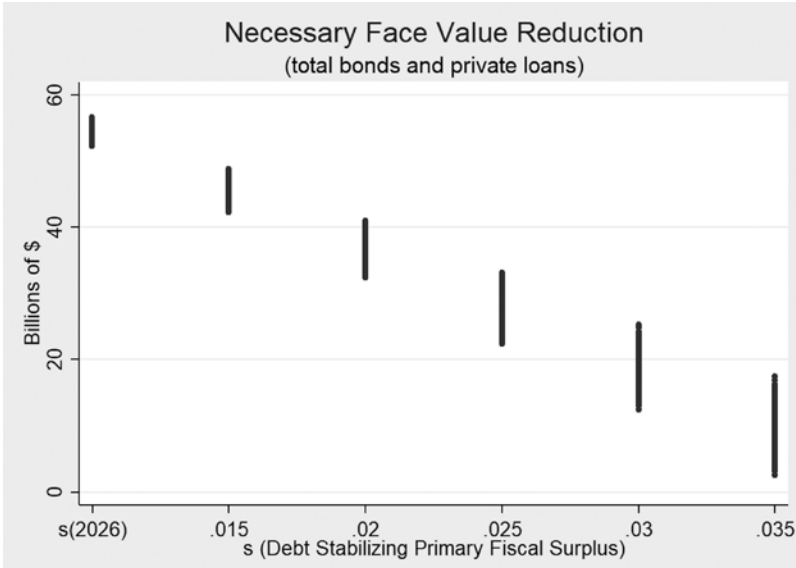
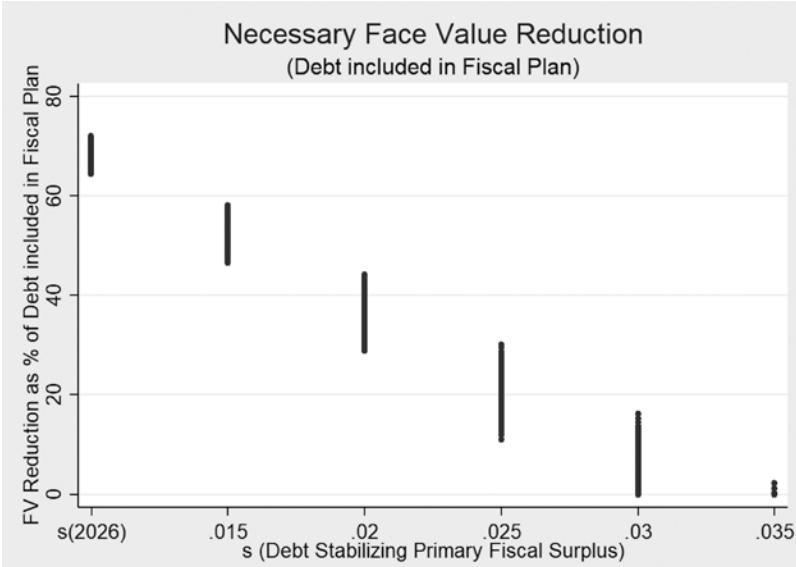


Table 7: Necessary face value reduction under the Fiscal Plan assumption on the effects of structural reforms on GNP growth, as % of total relevant debt – Relevant debt: Total Public Debt Net of Children’s Trust and HFO

Debt stabilizing primary surplus to GNP since 2027	No. of scenarios	Min Face Value Reduction (% of total current public debt)	Max Face Value Reduction (% of total current public debt)	Face value reduction under Fiscal Plan multiplier assumptions
s2026	192	72.4	78.3	73.4
0.015	192	58.6	67.5	60.1
0.02	192	44.8	56.6	46.8
0.025	192	31.1	45.8	33.5
0.03	192	17.3	35.0	20.2
0.035	192	3.5	24.1	6.9

Figure 5: Necessary face value reduction under the assumption that structural reforms have no effects on GNP growth – Relevant debt: Debt included in Fiscal Plan

Panel A: As % of total relevant debt



Panel B: In billions of \$

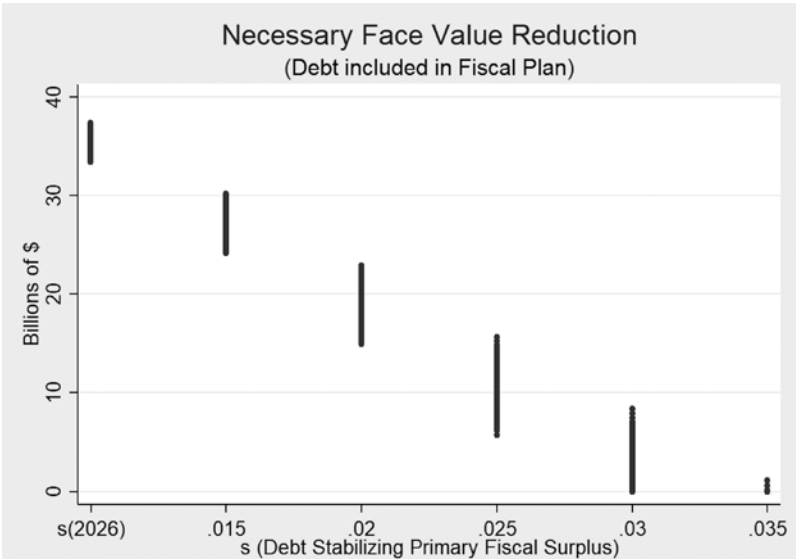


Table 8: Necessary face value reduction under the assumption that structural reforms have no effects on GNP growth, as % of total relevant debt – Relevant debt: Debt included in Fiscal Plan

Debt stabilizing primary surplus to GNP since 2027	No. of scenarios	Min Face Value Reduction (% of total current public debt)	Max Face Value Reduction (% of total current public debt)	Face value reduction under Fiscal Plan multiplier assumptions
s2026	192	64.4	72.0	65.7
0.015	192	46.6	58.1	48.5
0.02	192	28.8	44.1	31.3
0.025	192	11.0	30.1	14.1
0.03	192	0.0	16.1	0.0
0.035	192	0.0	2.2	0.0

Figure 6: Necessary face value reduction under the assumption that structural reforms have no effects on GNP growth, as percent of total relevant debt – Relevant debt: Total Public Debt Net of Children’s Trust and HFO

Panel A: As % of total relevant debt

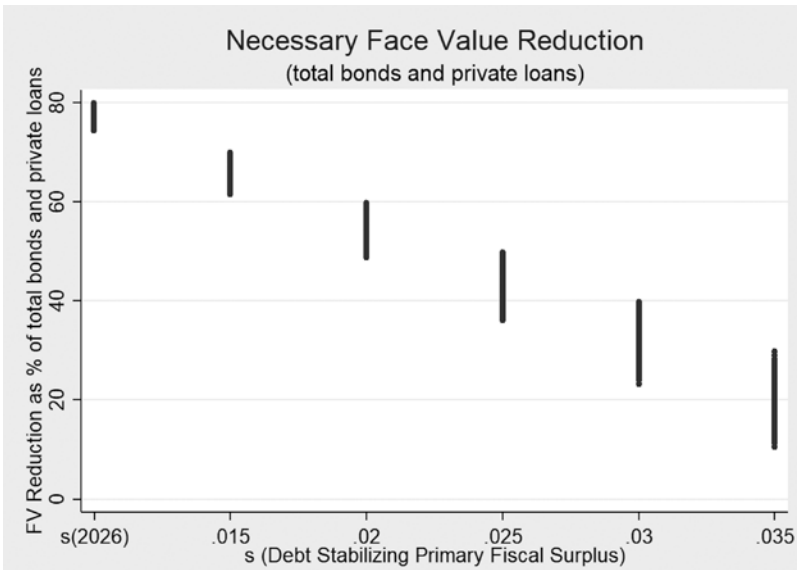


Figure 6 (continued)

Panel B: In billions of \$

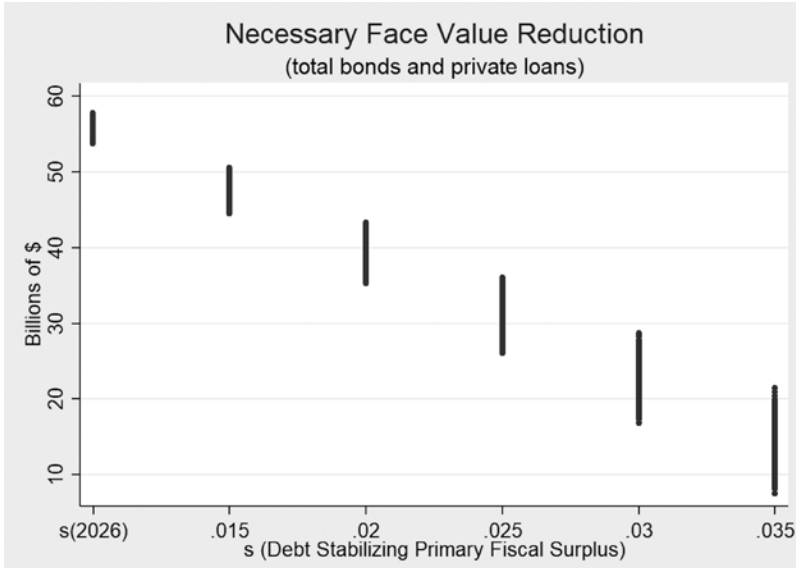


Table 9: Necessary face value reduction under the assumption that structural reforms have no effects on GNP growth, as percent of total relevant debt—Relevant debt: Total Public Debt Net of Children’s Trust and HFO

Debt stabilizing primary surplus to GNP since 2027	No. of scenarios	Min Face Value Reduction (% of total current public debt)	Max Face Value Reduction (% of total current public debt)	Face value reduction under Fiscal Plan multiplier assumptions
s2026	192	74.4	79.9	75.3
0.015	192	61.6	69.9	63.0
0.02	192	48.9	59.8	50.7
0.025	192	36.1	49.8	38.3
0.03	192	23.3	39.8	26.0
0.035	192	10.5	29.7	13.6

Figure 7: Sustainable debt under the Fiscal Plan assumption on the effects of structural reforms on GNP growth, in billions of \$

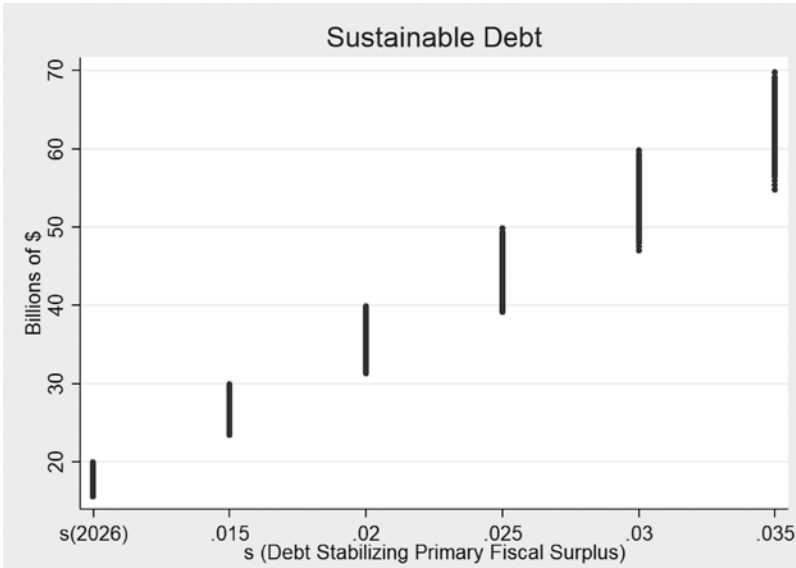


Table 10: Sustainable debt under the Fiscal Plan assumption on the effects of structural reforms on GNP growth, in billions of \$

Debt stabilizing primary surplus to GNP since 2027	No. of scenarios	Sustainable Debt (Billions of USD)		Under government multiplier assumptions
		Minimun	Maximun	
s2026	192	15.7	19.9	19.2
0.015	192	23.5	29.9	28.8
0.02	192	31.3	39.9	38.5
0.025	192	39.2	49.8	48.1
0.03	192	47.0	59.8	57.7
0.035	192	54.8	69.8	67.3

Figure 8: Sustainable debt under the assumption that structural reforms have no effects on GNP growth, in billions of \$

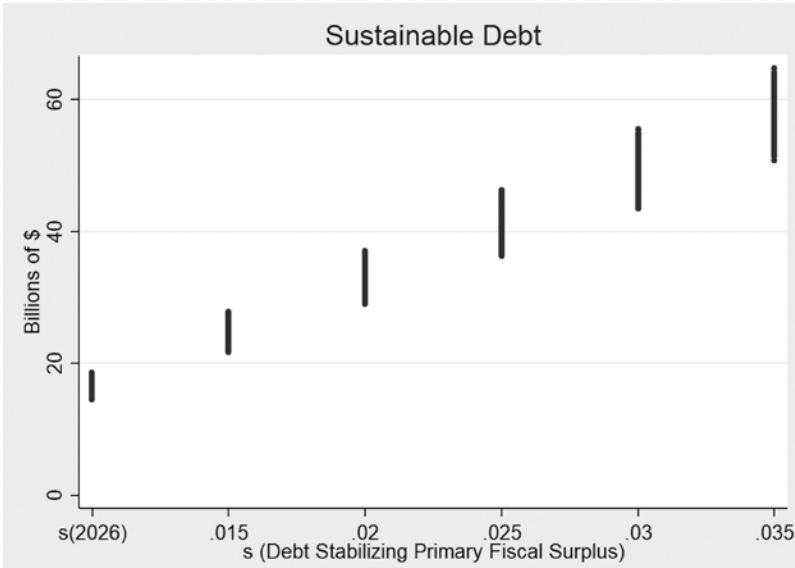


Table 11: Sustainable debt under the assumption that structural reforms have no effects on GNP growth, in billions of \$

Debt stabilizing primary surplus to GNP since 2027	No. of scenarios	Sustainable Debt (Billions of USD)		Under government multiplier assumptions
		Minimum	Maximum	
s2026	192	14.5	18.5	17.8
0.015	192	21.8	27.7	26.7
0.02	192	29.0	37.0	35.7
0.025	192	36.3	46.2	44.6
0.03	192	43.5	55.4	53.5
0.035	192	50.8	64.7	62.4

Table 12: Fiscal Plan projections of primary fiscal surpluses to GNP ratio, 2017-2026

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
5	0.0161	0.0107	0.0089	0.0114	0.017	0.0145	0.0137	0.0118	0.0112	0.0122

Source: Fiscal Plan 2017-2026.

Computing the necessary debt relief to restore debt sustainability

The debt position that can be deemed as sustainable with high probability depends on the path of fiscal policies that are considered feasible.

To compute the necessary relief to restore sustainability, we first compute the stabilizing debt to GNP ratio for values of s from the value that corresponds to each of our projections for 2026, s_{2026} (the range of these values goes from 0.012 to 0.016) to a maximum of 0.035. Next, we calculate the necessary relief for restoring sustainability as the difference between the debt to GNP ratio in scenario i in 2026 and the stabilizing debt to GNP ratio for $s = \{s_{2026}, 0.015, 0.02, 0.025, 0.03, 0.035\}$.

We perform these computations for two groups of scenarios:

- (i) First, we assume that the Fiscal Plan’s assumptions on the effects of the structural reforms on GNP hold.
- (ii) Second, we assume that the structural reforms stated in the Fiscal Plan have no effects on GNP growth during the period 2017-2026.

The results are summarized in figures 3 to 8 and in tables 6 to 11. The results show the necessary face value reduction in the different scenarios under analysis for restoring debt sustainability, assuming the debt service scheduled in the Fiscal Plan will be respected, and not taking into account the devastating effects of the hurricanes Maria and Irma as well as the effects of the Federal aid as a response to those natural disasters.

To reach a conclusion on the necessary relief needs for Puerto Rico, we need to take a stance on the set of feasible values of s . Even under the most optimistic projections the economy is projected to have a lower GNP in 2026 than in 2016, and as was described above, the projected debt to GNP ratio absent a restructuring is projected to be larger. The Fiscal Plan projects the evolution of primary fiscal surplus to GNP ratios that is described in Table 12. Requiring a larger s after 2027 than the values of s_{2026} would not be a sensible stance; the economy is projected to be in worse shape 2027 than at the moment we perform this analysis, hence being even more ambitious in terms of the fiscal targets would not lead to better outcomes than the ones projected for the next decade. Instead, being overly ambitious with the primary fiscal surplus targets would most likely lead to another lost decade after 2027.

For a stable primary fiscal surplus after 2027 that takes values between s_{2026} and 1.5 percent of GNP, the necessary debt reduction includes the full cancellation of interest payments not scheduled for repayment in the Fiscal Plan plus a

face value reduction that under the Fiscal Plan assumptions should be between 44.4 percent and 63 percent if the relevant debt stock is \$51.9 billions (table 6, column “Face value reduction under Fiscal Plan multiplier assumptions”), and between 60.1 percent and 73.4 percent if the relevant debt stock is \$72.2 billions (table 7, column “Face value reduction under Fiscal Plan multiplier assumptions”). Under a broader range of assumptions that include different values for the fiscal multipliers and under the assumption of no effects of structural reforms on GNP growth, the debt reduction should include the full cancellation of interest payments not included in the Fiscal Plan plus a face value reduction of between 46.6 and 72 percent if the relevant debt stock is the one included in the Fiscal Plan of \$51.9 billions (Table 8, column “Min Face Value Reduction” for $s = 0.015$ and column “Max Face Value Reduction” for $s = s_{2026}$, respectively), or between 61.6 and 79.9 percent if the relevant debt stock is the figure of \$72.2 billions that we achieve once we take into account other debts not included in the Fiscal Plan (Table 9, column “Min Face Value Reduction” for and column “Max Face Value Reduction” for $s = s_{2026}$, respectively). Clearly, Puerto Rico needs substantial relief. But the interpretation of these results must take into account important caveats, to which we next turn our attention.

Interpretation of our results

Our computations show that in order to restore debt sustainability with high probability the restructuring should deliver a substantial reduction of Puerto Rico’s debt. The figures we presented are “macroeconomic” figures that do not establish how the debt write-off should be distributed across the different bond series. And these are conservative estimates due to a number of reasons.

First, throughout we have kept all the computations the Fiscal Plan’s assumption that annual real GNP growth will reach 1 percent in 2027, and we assume that this will correspond to a new steady state. But if the Fiscal Plan 2017–2026 is respected, for the reasons discussed in this study, getting to that state will be an unlikely outcome. If no expansionary aggregate demand policies are implemented to escape out of the current depression, the necessary relief to restore sustainability will have to be even larger. Puerto Rico has no debt service capacity today, and if it does not recover, it will not improve its payment capacity in the future either.

Second, as we described above, in every step of our analysis we made conservative assumptions as to err on the “too little” side of debt relief.

A final caveat is that we do not study how the write-off will be distributed, and this is an issue that will have macroeconomic effects. The expansionary effects of the restructuring will be increasing in the fraction of the write-off that falls on external bondholders, rather than on domestic bondholders, as the marginal propensity to spend in Puerto Rico’s economy is lower for external than for domestic bondholders. The evidence supports this basic theoretical insight, as it shows that the macroeconomic costs of a default are increasing in the proportion of debt held by domestic residents (see Alessandro 2011;

Guembel and Sussman 2014) and are highly related to the transmission through the balance sheets of domestic banks (cf. Gennaioli, Martin, and Rossi 2014).²⁹

GNP linked bonds

A non-contingent debt relief is always exposed to the risk that ex-post the relief ends being “too little”—harming the recovery—or “too much”—implying that creditors could have got more without undermining sustainability. To deal with the uncertainty that is present at the time of the restructuring, the debt restructuring could include GNP growth linked bonds, which relate the debt payments to the evolution of the territory's GNP. These instruments would improve sustainability, as the payments would be related to the payment capacity of the debtor; and they would also align the interests of creditors and the debtor, as both would benefit from a larger recovery. The economic rationale has been largely developed in the literature.³⁰

Despite their virtues, the implementation of this type of contingent debt has not been straightforward. In practice, securities with a return linked to economic growth have been issued only in the context of a few debt restructurings, including those in Bulgaria (1994), Argentina (2005),³¹ Greece (2012), and Ukraine (2015). To date, no advanced economy has issued growth-indexed bonds in normal times. But the support in policy spheres has been increasing (Blanchard, Mauro, and Acalin, 2016).

5. CONCLUSIONS

The most urgent policy that Puerto Rico needs is a debt restructuring that provides substantial debt relief. This paper made two main contributions that intend to shed light on the island's debt restructuring needs. First, we examined the consequences of the Fiscal Plan for the period 2017–2026 and identified a number of problems with its assumptions. Second, our analysis informs what are the actual restructuring needs of the country.

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NOTES

¹ For a non-technical account of the evolution of events that preceded the debt crisis, see Guzman (2018).

² Net of Children's Trust's and HFA's debts, the reason for excluding the debts of those two entities being that their payment is not the responsibility of residents of Puerto Rico.

³ The literature on the principles that should be respected in a restructuring process significantly grown over the last few years. For instance, see Blankenburg and Kozul-Wright (2016), Bohoslavsky and Goldmann (2016), Goldmann (2016), Guzman and Stiglitz (2016a, 2016b), Kolb (2006), Raffer (2016), and Li (2015).

⁴ See, for example, Jayadev and Konczal (2010, 2015), Auerbach and Gorodnichenko (2012a, 2012b, 2012c, 2012d); Eggertsson and Krugman (2012); Herndon, Ash, and Polish (2014), Jorda and Taylor (2013); see also the commentaries by Krugman (2010, 2013, 2015) and Stiglitz (2010a).

⁵ See Krugman (1988a). The destabilizing dynamics at play in the context of a financial crisis has been thoroughly analyzed in the macroeconomics literature by seminal authors as Fisher (1933), Keynes (1936), Minsky (1977, 1992), Kindleberger (1978), Leijonhufvud (1981), Stiglitz and Heymann (2014), Koo (2003), and Eggertsson and Krugman (2014), among many others.

⁶ In Puerto Rico, the sub-utilization of factors can rapidly turn into migration, a phenomenon that would not be captured by measures of intensity of use of the available factors of production.

⁷ This claim has been demonstrated by Krugman (1988b), who demonstrates that the expected present discounted value of payments for creditors takes the shape of a Laffer curve as a function of the value of the debtor's total liabilities. The reason is that the probability of default, and thus the interest rate, is an increasing function of the debt burden. Sachs (1989) also emphasizes the potential welfare benefits of forgiving debt in a situation of debt overhang, in a model where both creditors and debtors can gain from a partial debt write-down, since an excessive debt stock and the prospect of large future debt repayments act as a tax on domestic investment and depress the present value of claims held by investors. Under those conditions, debt relief should be followed by a period of higher growth.

⁸ The theoretical literature suggests, however, that the costs arising from the exclusion from financial markets may be less than is often feared, because capital markets are forward looking. Indeed, by reducing existing debt obligations, a default may make lending to the country more attractive. See Stiglitz (2010b).

⁹ Debt restructuring renegotiations under insufficient legal frameworks for dealing with col-

lective action problems also result in inefficient delays that reduce output (Benjamin and Wright 2009; Pitchford and Wright 2012).

¹⁰ The literature also suggests that defaults have dire political consequences for incumbent governments and finance ministers (Borensztein and Panizza 2009).

¹¹ Auerbach and Gorodnichenko (2012b, 2012c), using regime-switching models, estimate the effects of fiscal policies over the business cycle and find that fiscal policy is considerably more effective in recessions than expansions. They provide estimates for multipliers for disaggregate spending variables for US regions. Military spending has the largest multiplier: estimates range from 3.69, with standard error of 0.83 (Auerbach and Gorodnichenko, 2012c) to 1.67, with standard error of 0.72 (Auerbach and Gorodnichenko, 2012b). The estimates for non-defense spending multipliers range from 1.34, with standard error of 0.31, to 1.09, with the same standard error. These values demonstrate the effect of \$1 of additional spending on output; for example, according to Auerbach and Gorodnichenko (2012c) an additional dollar of public spending in the non-defense sector increases output by \$1.34. In the expansion, the defense spending multiplier changes sign: it ranges from -1.03, with standard error of 0.25 (Auerbach and Gorodnichenko, 2012c), to -0.43, with standard error of 0.24 (Auerbach and Gorodnichenko, 2012b). And the non-defense spending multiplier keeps the positive sign but the magnitudes are smaller: it ranges from 1.17, with standard error of 0.15 (Auerbach and Gorodnichenko, 2012c), to 1.03, with the same standard error (Auerbach and Gorodnichenko, 2012b). Auerbach and Gorodnichenko (2012a) also estimate fiscal multipliers for OECD economies. The effects in recessions are stronger for this group of economies: Their point estimate is that an increase of government purchases of \$1 results in about \$3.50 of added GDP when the economy is weak, with a 90 percent confidence interval running from 0.6 to 6.3. On the other hand, in times of a strong economy, added government purchases reduce GDP, according to the point estimate. The confidence interval for that estimate includes moderate positive values. In all those estimates, the effects of fiscal policies are not necessarily concentrated in one year, but can be accumulated over time. The IMF has also recognized the importance of considering the non-linear nature of multipliers (Blanchard and Leigh, 2013). This recognition received special attention as the calls for a reconsideration of the methodology for assessing debt sustainability and the assumptions on multipliers had intensified after the dramatic consequences that the underestimation of the impact of fiscal austerity had for Greece, and also for other European economies in distress (see Guzman and Heymann, 2015). Another estimate is provided by Nakamura and Steinsson (2014), who using historical data on military procurement to estimate the effects of government spending, obtain a so-called “open economy relative multiplier” of approximately 1.5—the “open economy relative multiplier” estimates the effects on output that an increase in government spending in one region of the union relative to another, and differs from the “closed economy aggregate multiplier” that is estimated using aggregate US data. More recently, Chodorow-Reich (2017), based on an analysis of the American Recovery Reinvestment Act and of a survey of empirical studies, suggests that his “preferred” point estimate of the cross-sectional fiscal spending to output multiplier lies around 1.8.

¹² Auerbach and Gorodnichenko (2012b, 2012c) also offer evidence on the impulse-responses regarding the effects of an increase in public spending on tax revenues. For non-defense

spending, the tax revenues response to an increase in $\$1$ ranges from $\$0$ to $\$1$. See the Figure A.3 in the appendix of Auerbach and Gorodnichenko (2012c) and the Figure A.3 in the appendix of Auerbach and Gorodnichenko (2012b).

¹³ See Ilzетки, Mendoza, and Végh (2012).

¹⁴ In a context of favorable international conditions and under the implementation of a policy of competitive and effectively multiple real exchange rates, GDP grew more than 8 percent on average from 2003 until the eruption of the global financial crisis in 2008 (see also Damill, Frenkel, and Rapetti (2015) for a more comprehensive description of the post-default dynamics, and Guzman, Ocampo, and Stiglitz (2018) for a description of the rationale of those policies and their importance in the Argentine post-default recovery). These conditions are markedly different than the ones Puerto Rico will face after its debt restructuring.

¹⁵ The latter multiplier includes the time sub-index, because we assume constant values for the elasticities of fiscal revenues to public spending, hence the multiplier will vary over time with the variations in the fiscal revenues to public spending ratio.

¹⁶ Not all the measures on the fiscal revenues side will lead to a reduction of Puerto Ricans' spending. For instance, while the Fiscal Plan plans to replace Act 154 by taxes that would achieve the current revenues over the next decade, if Act 154 was replaced with a tax that is paid by multinationals there would be no associated depressing effect on Puerto Rico's economy. Our conservative range of assumptions for the multiplier of tax revenues on output accounts for the possibility of a less depressing effect of revenues measures relative to public spending measures. It must be noted, however, that there is uncertainty about Act 154 being replaced by a scheme that has no cost on Puerto Ricans. This will depend on Federal policies that are beyond Puerto Rico's reach, which adds a layer of uncertainty to the projections of the effects of the Fiscal Plan. This uncertainty is indeed a matter of major concern. Makoff and Setser explain that "how Puerto Rico will do so [Act 154 will eventually be replaced by a set of taxes that maintain current levels of revenue over the next 10 years] is a great mystery: nobody has explained how Puerto Rico will continue to collect the same amount of revenue from the tax-allergic multinational corporations if federal forbearance on credibility lapses" (2017, 23).

¹⁷ For a non-technical summary of the findings presented in this section, see Guzman and Stiglitz (2017).

¹⁸ Public investments do not only affect supply formation but also have demand multiplier effects.

¹⁹ These assumptions were made by the Fiscal Board and accepted by Puerto Rico's government.

²⁰ The definition of a recession comes from a calibration that is consistent with the duration of recessions according to the NBER business cycle dates since 1946.

²¹ While migration is likely to reduce the need for certain categories of government expenditures, these effects are likely to be overwhelmed by the effects on the territory's income and tax revenues.

²² If it did take those endogenous feedback effects into account, this would mean that the multiplier associated with the contraction in spending assumed by the plan is not 1.34 but lower.

²³ Makoff and Setser provide a detailed analysis of Puerto Rico's migration dynamics in its recent history and argue that the Fiscal Plan's assumptions on migration over the next decade are off. In their words: "Something is off here. How does the economy drop by 12 percent over

10 years and the population by only two percent? How does the rate of net migration improve from its current run rate of -2 percent a year to only -0.2 percent a year at the same time that the island is being hit by a significant cut in jobs and services? Absent a miraculous shift in household sentiment, Puerto Rico's population will certainly fall by more than the plan projects" (2017, 16). They also observe that the Puerto Rico Institute of Statistics reported that the new Census Bureau outmigration projection for the next 10 years is 1.4 percent annually.

²⁴ An additional concern, not analyzed in this study but in Makoff and Setser (2017), is that the baseline trend of Puerto Rico's economy may be worse than projected by the Fiscal Plan. They point out that while the Fiscal Plan takes a continued fall of the economy on its historic trend (about 1.5 percent a year since 2005) as the baseline scenario, this is a controversial assumption, "because the territory's historic downward trajectory likely would have been much worse if it were not for the billions of dollars injected into the economy through emergency federal transfers (Obamacare, the American Recovery Act stimulus and the backdoor transfer provided by the federal tax treatment of Act 154), the commonwealth's aggressive debt financings (primarily general obligation, "GO," and sales tax backed, "COFINA," bonds), and the depletion of Puerto Rico's public pension plan assets to pay benefits (Makoff and Setser 2017, 16).

²⁵ The fiscal plan does not specify whether the output growth baseline assumptions already incorporate the effects of a planned debt restructuring. If they do, the projections would be including the effects of a debt restructuring through the baseline assumptions instead of doing it through the macroeconomic multipliers that would be associated with the need for lower primary fiscal surpluses. If the baseline assumptions already incorporate the effects of an eventual restructuring, incorporating those effects in the macroeconomic multipliers would lead to an overestimation of the beneficial effects of a restructuring—they would be counted twice. It is possible though to replicate the analysis under alternative (less optimistic) baseline assumptions to deal with this possibility. All the codes for the projections are publicly available at <<http://espaciosabiertos.org/analisis-de-alivio-de-deuda-para-sostenibilidad-del-pais/>>.

²⁶ <<http://espaciosabiertos.org/wp-content/uploads/2018/01/Online-Appendix-DSA-2018.01.pdf>

²⁷ For each public spending to real GNP multiplier, once we take into account the endogenous feedback effects from public spending contractions on tax revenues, we can find a lower associated value of .

²⁸ In essence, this procedure computes the fixed point that satisfies both equation (1) and the intertemporal budget constraint associated with each scenario.

²⁹ There are important binding constraints for designing a selective default strategy that requires targeting the bondholdings of foreigners, as these bonds are actively traded in secondary markets (see Broner, Martin, and Ventura 2010; Broner and Ventura 2011). However, the transfer from domestic bondholders to the territory that the restructuring would entail will still be expansionary in the short run if the government uses the funds for policies that have a larger macroeconomic expansionary effect. And the larger space for public policies can also have positive long-term consequences.

³⁰ See Borensztein and Mauro (2004) for a review, and Barr, Bush, and Pienkowski (2014) for a more recent contribution, as well as Robert Shiller's related proposal to create "macro mar-

kets” for GDP-linked securities (Shiller 1993, 2003).

³¹ Argentina implemented a variant of known as GDP warrants. But the results of the experiment were ambiguous. On the one hand, the warrants paid off extremely well, benefitting the creditors who kept them in their portfolios. But on the other hand, they were not well received by markets at the time of issuance. This may have had to do with their complex design, that made pricing difficult: the trigger for the payment was a threshold growth rate of GDP, but the formula for the amount of payments depended on the difference between the actual level of GDP and a threshold level (see Cruces and Samples (2016), Guzman (2016), and Benford, Best, and Joy (2016) for details).

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