



**Lisbon School
of Economics
& Management**
Universidade de Lisboa

**MASTER
MASTER'S IN ECONOMICS**

MASTER'S FINAL WORK

DISSERTATION

Debt-for-nature swaps: Belize's 2021 exchange and the future of climate finance

Tiago da Costa Abreu

May – 2025



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"In real life, big gestures aren't enough. You need to be consistent. You need to be dependably good. You need to do it every day."

- BoJack Horseman

For the past two years, I was alienated from a big part of my life to maintain a solid job and finish this degree simultaneously.

It was the hardest, grittiest thing I have ever done in my life.

I am proud of my work and have but my friends to thank for, for carrying me through the finish line. You have my eternal gratitude.

Alas, no matter how interesting the work, life itself needs a window to shine through. It's important to be consistent, but it's also important to have a drink, pet a dog, climb a mountain - to remind ourselves why we do what we do.

Now I am tired, worn out, covered in allegoric sweat. I had at it every day, and it paid off.

Now, it is time to live a little.

Glossary

\$ United States Dollar. 2, 18–23, 31

BBIC Belize Blue Investment Company, LLC. 2, 18, 19, 21, 32

CAC Collective Action Clause(s). 2, 12

CBB Central Bank of Belize. 2, 16

CFA Conservation Funding Agreement. 2, 20

Conservation Fund Marine Conservation Fund. 2, 19, 20

CRI Climate Risk Index. 2, 5, 23

DFC U.S. International Development Finance Corporation. 2, 19, 20, 22

DFNS Debt-for-nature or debt-for-conservation swap(s). 2, 4, 8–10, 12, 18, 20–22, 25, 26, 31–33

DSRA Debt Service Reserve Account. 2, 19

ESG Environmental, social or governance themed. 2, 4, 5, 9, 12, 13, 31–33

FDI Foreign direct investment. 2, 25, 30

GDP Gross Domestic Product. 2, 7, 14, 16, 20, 21, 23, 25, 30

IDB Inter-American Development Bank. 2, 22

IMF International Monetary Fund. 2, 23, 29, 32

IRR Internal Rate of Return. 2, 19

KPI Key Performance Indicator(s). 2, 12

LAC Latin america and the caribbean. 2, 9, 15, 16

M, B, T Million, Billion, Trillion. 2

ND-GAIN Notre Dame Global Adaptation Initiative Index. 2, 5, 23, 29

NIIIP Net International Investment Position. 2, 5, 23

PCI Parametric Catastrophe Insurance. 2, 20–22

SCM Synthetic Control Method. 2, 7, 24, 26, 30

TNC The Nature Conservancy. 2, 18–20, 22, 27, 28, 31, 32

Abstract

KEYWORDS: Debt-for-nature or debt-for-conservation swap(s) (DFNS), Blue Bonds, macroeconomics.

This work explores the role of debt-for-nature swaps (DFNS) in tackling the critical interplay between sovereign debt fragility and climate change vulnerabilities, particularly in developing nations. The core problem addressed is the limited fiscal capacity for climate action in highly indebted countries, compounded by the historical shortcomings of traditional DFNS in delivering substantial, legally binding environmental commitments.

To investigate this, this work analyses Belize's 2021 debt-for-nature exchange, highlighting its pioneering financial and legal advancements. A key focus is placed on how Belize's agreement uniquely tied conservation payment obligations directly to its Blue Loan. This is contextualised by comparing Belize's deal with preceding and subsequent Blue Bond-based restructurings to assess its replicability and broader implications for climate finance. Furthermore, it empirically examines the impact on Belize's economy and climate resilience through macroeconomic and environmental indicators, ultimately employing a Synthetic Control Method (SCM) analysis.

Belize's 2021 DFNS established a robust and archetypical model for future transactions by legally integrating conservation and debt payment obligations. Despite its modest immediate debt relief, the swap significantly contributed to both Belize's debt sustainability and marine conservation efforts, setting a precedent for enhanced accountability in Environmental, social or governance themed (ESG) instruments. The findings suggest that while scalability challenges exist, such operations offer a viable pathway for providing combined debt relief and environmental funding to vulnerable nations in the right context, in a landscape where current demand for these is stronger than the supply.

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1 Introduction

Climate change is here and there is no denying it. Around the world, ecosystems and natural resources are threatened by a myriad of hazardous human endeavours. Marine biodiversity has declined by roughly 36% in the past 50 years as a consequence. (Fund 2022b)

Furthermore, climate and debt problems are closely linked.

Climate change can exacerbate debt vulnerabilities, as it catalyses extreme weather events (such as floods and hurricanes). These not only damage a country's production capability, but also hinder its debt position by forcing the state to incur in more debt in order to fund reparations.

Debt problems, in turn, reduce fiscal space for climate action (Chamon et al. 2022). Countries with fragile debt positions, fighting to stay afloat in international capital markets, have little wiggle room to undertake climate investments without compromising their debt sustainability further. This is made worse for developing countries with precarious credit ratings, especially in light of recent global challenges such as the COVID-19 pandemic.

It seems likely that the upward trend of climate demands will continue incentivizing sovereigns to explore methods of dealing with both debt issues and environmental challenges (Cheng et al. 2022).

Although DFNS have been around since the 1980s, the amount of debt relief they provided since then is dwarfed by more traditional sovereign debt restructurings, and their number has been in decline (Thomas & Theokritoff 2021). Furthermore, ESG instruments commonly used to raise capital, such as "use of proceeds" and KPI bonds, often lack real economic, financial and legal consequences for defaulting borrowers, fostering fears of greenwashing (Grund & Fontana 2023).

In recent years however, there has been a surge of cases wherein countries issue ESG bonds, including Blue Bonds, to raise capital and finance environment conservation projects. (Initiative 2016) (of Budget Financing & Risk Management 2024) (BBC 2010) (on Financing Water 2023).

Following its history, the Latin America and the Caribbean (LAC) region, continues to yield fertile ground for innovation on this type of operations, and exchange after exchange, there is an upwards trend in the magnitudes of debt relieved, strength of environmental commitments and impact on debt sustainability. Belize's 2021 DFNS, which will be the cornerstone of this body of work for its disruptive nature, serves as a blueprint

for the Blue Bond-based debt swaps that succeeded it, such as those that took place in Barbados in 2022 and Ecuador in 2023. Together with their relatively simpler predecessor, the 2015 Seychelles' DFNS, these 4 transactions have generated more savings toward conservation than the +/- 20 DFNSs that preceded them over a 25-year period. (on Financing Water 2023).

This work describes Belize's groundbreaking DFNS, analyses its impact in the country's debt and climate positions through representative indicators and empirical analysis, and sheds light on how its innovations pave the way of the future for climate finance.

Section 2 defines sovereign debt restructurings and elaborates on why they are needed; it describes traditional instances of these as well as the debt-for-nature swaps discussed in this dissertation.

Section 3 provides an overview of Belize, some economic insights into the country and a peak into its history of defaults. It aims to show why Belize was a good candidate for the innovative debt exchange that took place.

Section 4 describes Belize's 2021 multilateral debt-for-conservation exchange in some detail, highlighting the key innovations and disruptive aspects it brought to the table. It puts Belize's case in perspective, comparing it with a similar preceding exchange and two posterior ones modelled after it. It then explores the evolution of representative macroeconomic and climate progress indicators in the aftermath of the DFNS, and realizes an empirical analysis on its effects in the country.

Section 5 extrapolates on the future of Blue Bonds, DFNS and other operations based on the advancements discussed.

2 Sovereign debt restructurings

2.1 Classic approaches

Virtually all sovereign states borrow money (Wikipedia 2024b), promising to repay it according to the terms of some agreement. A debt restructuring is a change in those terms, negotiated between all the lenders and borrowers, that reduces or postpones the debt servicing obligations for the borrower and / or the present value of the claim for the lender (Gelpern & Powell 2023).

These restructurings can be pre-emptive, enacted so that a sovereign can avoid missing debt repayments ("distressed restructuring"), or reactive, when sovereign states effectively do miss these. Credit rating agencies tend to assign "default" status to sovereign states in either situation.

In this scenario, lenders still want their money back, but alas have limited judicial power over borrower sovereign states, and are deterred from accessing their assets by international law, often choosing to disrupt their financial and trade flows instead (Gelpern & Powell 2023). It is said to be easier to obtain court judgement against a sovereign that has defaulted than to extract payment from them (Gelpern & Powell 2023).

Successful restructurings, characterized by a reduction in debt ratio and display of economic growth, make it easier for borrowers to repay what they owe. Additionally, a more sustainable debt position minimizes the chances of a default recurrence and consequent need for a new restructuring.

Countries primarily borrow money by issuing bonds, which can be purchased by both private and public institutions. When a default takes place and the state cannot repay borrowed money, conditions of bond contracts are renegotiated primarily in 3 fronts in order to facilitate repayment:

- **Maturity:** Debt maturity extensions allow the debtor more time to fulfil their obligations;
- **Interest rate:** Coupon rate reductions mean less interest paid to the creditor, and a reduced fiscal burden over time on the debtor;
- **Face value reductions:** Also called haircuts, are reductions in the total value of debt the debtor originally had to pay; the creditor simply takes a loss on their investment.

The renegotiation processes are often cumbersome, and for some instrument structures may require all bondholders to vote favourably, leading to issues like the holdout problem - wherein certain bondholders opt to vote against the restructuring in hopes of recovering the full value of their investments (Fang et al. 2021). Since the 2000s, Collective Action Clause(s) (CAC)s have become the norm in bond contracts, allowing a supermajority of bondholders to vote on restructuring decisions (Fang et al. 2021).

These classic exchanges, in contrast with debt-for-nature-flavoured ones, focus on improving the debt position and liquidity of the debtor country, and do not legally codify any other objectives, ESG or otherwise, into the bond contract.

2.2 Debt-for-nature twist

Debt-for-nature swaps codify concrete nature and climate conservation commitments into renegotiated bond contracts. This is particularly relevant for sovereign states with both debt and climate vulnerabilities. Latin America and Caribbean countries fit this profile and have been at the forefront of innovations in the field.

For many of these, Belize included, sea and land are important sources of revenue. Natural disasters potentiated by climate change have adverse impacts on the country's production capacity and touristic attractiveness, and thus its ability to fulfil debt obligations, rendering nature and climate conservation components of the debt restructuring all the more relevant to its effectiveness.

Historically, most of these restructurings made use of two types of ESG debt instruments:

- *Use of proceeds bonds*, the most common type, a type of bond where the borrower promises to apply the proceeds to a given ESG finality. The only consequences for failing to achieve the proposed goals or even formally earmarking the proceedings for that end are mostly reputational. There is no default and there are no legal bindings enforcing these commitments.
- *Key Performance Indicator(s) (KPI) bonds*, which alter their financial or structural characteristics, such as maturity or coupon value, depending on whether the borrower meets their ESG targets.

Belize enacted its 2021 DFNS by resorting to a Blue Bond, defined by the World Bank as a "debt instrument that national governments, development banks and corporations is-

sue to raise finance for marine and ocean-based projects that have long-term sustainability objectives and benefits" (Group 2018).

This type of bond is often considered a subset of green bonds, used more broadly for climate and environmental endeavours, and itself a subset of ESG bonds.

3 Belize



FIGURE 1: Map of Belize

Source:

https://commons.wikimedia.org/wiki/File:Belize_map.png,
accessed 2024-09-14.

Belize is an English-speaking country located in Central America.

It has an area of 22,966 km^2 - about $\frac{1}{4}$ th the area of Portugal - and boasts a population of around 400,000 people. About half of the population lives in rural areas, and roughly 15% resides in the old capital, Belize City (SIB 2010).

The country has a tropical climate - making it very hot and humid - and is plagued by natural disasters, namely hurricanes, tropical storms and coastal floods. (CIA 2024)

The Belize Barrier reef runs along its coastline, making up for 30% of the Mesoamerican Barrier Reef system, one of the largest coral reef systems in the world - second in size only to Australia's Great Barrier Reef. It is a major tourist attraction in the country.

Agriculture and tourism are big sources of revenue for Belize, rendering the country's economy vulnerable to natural disasters and other external economic shocks, such as the COVID-19 crisis.

Tourism alone accounts for 40 percent of Belize's GDP and nearly 60 percent of its foreign exchange earnings (Grund & Fontana 2023). In the aftermath of the pandemic, Belize experienced a 14% GDP contraction, shown in Figure 3 around 2020, highlighting the country's dependency on it.



FIGURE 2: Portion of the Belize Barrier Reef

Source: https://commons.wikimedia.org/wiki/File:Coral_Reef,_Belize.jpg, accessed 2024-09-10.

The Barrier Reef is one of the country's most sought after attractions for divers, snorkellers and biologists (Board 2024) for its pristine condition and its lifeform variety, and its health and preservation is threatened by several anthropogenic activities such as pollution and overfishing.

3.1 Natural disasters

Akin to other nations in the LAC region, Belize's geographical location and developing nation status make the country particularly vulnerable to natural disasters and climate change.

The nation experiences frequent extreme weather events that leave deep economic dents due to its poor infrastructure, high population density in coastal areas and overreliance on primary industries and tourism.

The UN registered 32 natural disasters in Belize since the beginning of the millennium (for the Coordination of Humanitarian Affairs 2024), 31 being hurricanes, tropical storms, coastal floods or a combination of these. Some disasters occurred around the times of its many restructurings, compounding on other factors to complicate its sovereign debt position.

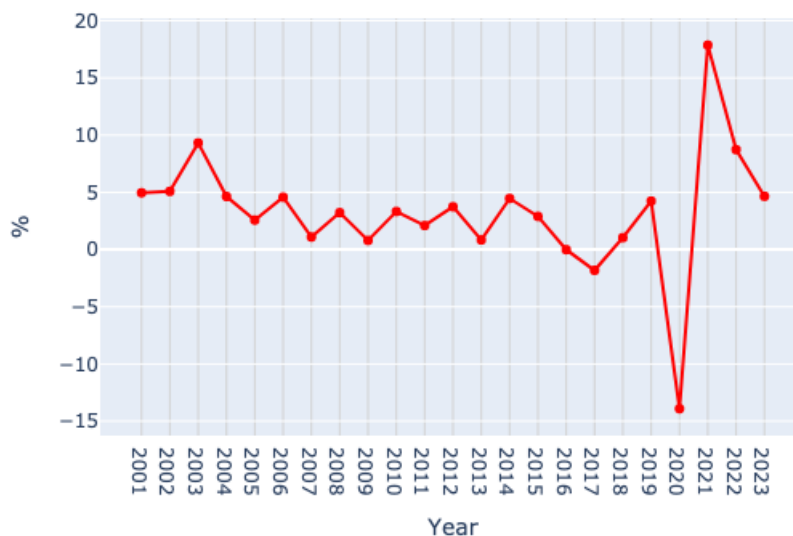


FIGURE 3: Real GDP Growth

Source: Data from Central Bank of Belize (CBB), graph by author.

3.2 Serial default chronology

Belize became known as a serial defaulter following its 4 debt renegotiations in a span of 20 years.

The first one was triggered in 2006-07, due to "acute external liquidity shortage" following expansionary policies enacted in the 90s and into the 2000s (Asonuma et al. 2017). These constituted aggressive attempts to stimulate economic growth in the aftermath of several natural disasters, including hurricane Dean. (Asonuma et al. 2017) claim debt ratio reached as high as 100% of GDP in this period. The renegotiation only provided temporary liquidity relief, leaving room for improvement in debt sustainability.

The second restructuring was triggered in 2012-13. Although in part fomented by the shortcomings of 2006-07, debt sustainability remained unaddressed and only a cash-flow relief was provided (Asonuma et al. 2017) Several disasters occurred around this period as well, notably Hurricane Richard in 2010.

Later in 2016, Hurricane Earl caused around 3-4% GDP worth of damages and pushed growth into negative territory, shown in Figure 3. This preceded the third debt restructuring in 2017, which again focused primarily on addressing immediate liquidity pressures.

As with many restructurings that happened in the LAC region, neglecting longer-term

sustainability problems led to this need for repeated debt restructurings. (Asonuma et al. 2017) notes that in order to obtain lasting gains, "restructurings need to be underpinned by a credible and sustained program of ambitious fiscal consolidation, combined with structural reforms to boost growth."

The section that follows will shed a light on how Belize codified some of these important reforms into its fourth and latest restructuring in 2021.

4 Belize's 2021 debt-for-nature swap

Debt-for-nature swaps are not new - they have been around since the 1980s (Grund & Fontana 2023). Past swaps have provided little debt relief and featured weak conservation commitments, fostering fears of greenwashing.

Belize's deal brought together multiple entities to renegotiate the largest debt-for-nature swap at the time, while introducing innovative mechanisms for credit enhancement, described below, and strongly linking its debt obligations to conservation efforts.

The following section outlines how this was achieved.

4.1 Prelude

4.1.1 External debt position

In 2021, 25% of Belize's total debt and 100% of its external commercial debt consisted of a single, United States dollar bond with multiple creditors - referred to as "Superbond" - that resulted from the consolidation of its debt instruments throughout previous exchanges (Gelpert & Powell 2023), thus flagging it as potentially unsustainable to investors.

The bond was trading at a deep discount, given bondholder concerns over Belize's ability to repay it due to "economic slowdown and high debt burden" (Conservancy 2022). These fears also meant Belize would have a hard time borrowing funds to repay it while producing meaningful savings, since the interest rates of the loan would be steep.

Faced with a potential default, the country requested The Nature Conservancy (TNC) set up the exchange structure discussed herein, and buy back this bond for cash at 55% of its original value, around 300M United States Dollar (\$).

The proposal was approved with an 87% majority vote.

4.1.2 Key parties

Several institutions played key roles in the success of this deal. This section provides a quick overview into who they are and the role they played in the DFNS

- TNC a global environmental organization with decades of conservation and climate investment experience.
- TNC's subsidiary, Belize Blue Investment Company, LLC (BBIC), established to

mediate the cash flow between this deal's creditors and the government of Belize.

- U.S. International Development Finance Corporation (DFC), an American agency investing in development projects in middle and low-income countries, which provided loan insurance and credit enhancement, vital to the success of the deal.
- Credit Suisse via its subsidiary Platinum, which issued the Blue Bond and lent the capital for the Superbond repurchase.

4.2 Design of the exchange

In order to finance the swap, an investment banking institution - Platinum - issued a Blue Bond valued at 364M\$. This bond features a 6.1% Internal Rate of Return (IRR) and a 20-year maturity, effectively surpassing the Superbond's original maturity by 6 years.

The proceedings were forwarded to a subsidiary of TNC - BBIC - which, in turn, lends money to Belize in a so-called "Blue Loan".

The loan was used to

- Buy back the entirety of the outstanding Superbond debt;
- Fund the foundation of the Marine Conservation Fund (Conservation Fund), an organization jointly run by Belizeans and TNC members, responsible for coordinating the country's marine conservation efforts;
- Accrue other debt management and transaction costs such as opening the Debt Service Reserve Account (DSRA), which covers payments to holders for up to 2 years in case of default.

Figure 4 outlines the resulting changes in Belize's external debt structure.

The DFC provided "arbitral award default and denial of justice" insurance to BBIC and in turn, bondholders. This type of political risk insurance was used for the first time in this exchange and is backed by the full faith and credit of the US government. Should Belize default, it would cover Blue Bond value and interest payments in full. The insurance elevated the country's credit rating well into "investment grade" range for the first time since the past century, attracting a broader area of the market comprised of institutional investors seeking low-risk assets, such as global insurance companies or pension funds (Conservancy 2022).

The transaction also introduces a commercial Parametric Catastrophe Insurance (PCI), covering the Blue Loan in case Belize defaults due to environmental or natural disasters.

Figure 5 illustrates the cashflow and insurance policies between all parties involved

4.3 Conservation innovations

Arguably the most notable innovation in Belize's 2021 debt restructuring lies in the way conservation commitments were codified.

In a Conservation Funding Agreement (CFA) signed with TNC, Belize agreed on quarterly payments to be made to the Conservation Fund for conservation efforts, as well as several sustainability milestones.

These conservation efforts involve increasing ocean protection, fostering biodiversity and expanding Belize's biodiversity protection zones.

The payments average 4M\$ and will total at least 100M\$; they are to be made in local currency, relieving pressure on the country's external currency reserves. Combined with the initial endowment, this triples Belize's current conservation budget over the Blue Bond's lifetime, and leads to a conservation effort totalling 3.6% of the country's 2022 GDP and covering 30% of its maritime area.

Payments under the CFA are tied to the Blue Loan, meaning failed Conservation Fund payments by Belize can trigger a default both under the CFA and the Blue Loan.

As is the case with KPI bonds, for which non-fulfilment of sustainability targets affects the coupon rate of the bond, Belize's DFNS Blue Bond ties missed sustainability milestones to increases in payments to the conservation fund. For reference, in other cases of sustainability-linked bonds such as Chile's or Uruguay's 2022 bond emissions, this increase is between 5-6% of the annual interest rate expense, while for Belize it is 30% (Grund & Fontana 2023).

4.4 Other innovations

The exchange marks the first-ever debt conversion based on credit enhancement, premiering both the use of the DFC's political risk insurance in a debt swap and a commercial sovereign PCI.

The DFC's "arbitral award default and denial of justice" insurance, a type of its political risk insurance, played a crucial part in the viability of the deal. This insurance covers

BBIC and thus ultimately bondholders for up to 610M\$, encompassing the initial amount of the loan plus all interest payments, making the Blue Loan fully backed by the United States government in case Belize defaults on its debt obligations, and effectively changing the credit rating of Belize's external debt obligations from non-investment grade to investment grade, as assessed by several credit rating agencies.

Additionally, in the event of a qualifying tropical storm or hurricane, the PCI provides coverage for Belize's next principal and interest debt repayments. It also defers its next two conservation repayments by three and six months respectively, and makes the state avoid default under the Blue Loan.

4.5 In perspective

In this section, we look at a predecessor and two successors of the Belize DFNS: Seychelles 2015, Barbados 2022 and Ecuador 2023, the latter being the biggest DFNS to date.

Although Seychelles laid the foundation for marine debt-for-nature swaps by pioneering the use of Blue Bonds, the conditions on its debt renegotiation were mostly unenforceable 2.1. Aside from reputational cost and undermining its own conservation efforts, the state has no financial consequences for defaulting on its debt obligations or missing conservation payments, since none were coded into law within the bond contract.

Belize's 2021 deal increased the stakes by tying its conservation efforts to the Blue Loan deal, rendering conservation obligations *pari passu*¹ with debt obligations.

Barbados followed suit with a DFNS similar to Belize's, and Ecuador upped the ante further in 2023 by signing a swap one order of magnitude larger than its predecessors in debt volume.

Table I compares these 4 exchanges side by side.

4.6 Limitations

Some authors claim the size of the haircut was too small in comparison with other classical exchanges, and profit cuts along the way further reduced the debt relief Belize obtained (Padín-Dujon 2023) (Grund & Fontana 2023). Positive haircuts seem to be associated with positive GDP growth and lower debt ratios in the periods following restructurings, as opposed to null haircuts for which GDP growth is negative (Gelpern &

¹Meaning "on equal footing"

TABLE I: COMPARISON BETWEEN SEYCHELLES 2015, BELIZE 2021, BARBADOS 2022 AND ECUADOR 2023 DFNS

	Seychelles	Belize	Barbados	Ecuador
Volume of renegotiated debt	21.6M\$	553M\$	150M\$	1.63B\$
Size of haircut	1.4M\$	252M\$	None	1,121B\$
% of GDP committed to conservation	0.8	3.6	0.9	0.12
Missed conservation goals consequences	Conservation ^(a)	Conservation and legal	Conservation and legal	Conservation and legal
Total ocean area to be protected (km ²)	410,000	10,800	56,000	198,000
% of country's ocean area	30%	30%	30%	18%
Loan default protection	None	DFC + PCI	Inter-American Development Bank (IDB)	IDB + DFC

^(a) Less capital being used to finance climate conservation efforts

Sources: Data from TNC (Conservancy 2023) (Conservancy 2022), IDB (Bank 2023), Commonwealth Secretariat (Secretariat 2020); table by author.

Powell 2023).

They also note other affected sovereigns' debt structures might not be so favourable, making the already complicated web of entities and legal structures harder to weave, which can lead to longer negotiation times for these deals. This may pressure sovereigns to accept fast reprofiling that provide temporary relief but do not contribute to long term debt sustainability.

Belize's renegotiated debt volume was relatively small - credit enhancement for bigger volumes is hard to come by and poses threats to the sovereignty of debtor nations in cases of default (Wikipedia 2024a).

4.7 Aftermath of the exchange

In a single stroke, Belize managed to address debt sustainability and marine conservation efforts, in a debt exchange that moved an order of magnitude more funds than any other in history at the time of its implementation (Conservancy 2022).

Its impact on Belize's economy is, however, hard to access empirically, given how recent its implementation is, and other strong economic shocks that happened temporally close to it, such as the COVID-19 pandemic and the category 1 hurricane Lisa, that struck the country in November 2022.

Nevertheless, within this section, we look at the evolution of several indicators that are likely to have been affected, as well as provide a baseline synthetic control analysis with limited results.

4.7.1 NIIP

The NIIP is the difference between the external financial assets and liabilities of a country (Bivens 2004). "It can be interpreted as a "nation's balance sheet with the rest of the world at a specific point in time." (Investopedia 2024) The International Monetary Fund (IMF) notes Belize's NIIP, improved from -167 to -111 % of GDP between 2020 and 2023, citing a reduction in external debt due to fiscal consolidation and this exchange specifically as some of the causes (Fund 2024).

The entity also projects a decrease in public external debt in the next 5 years, displayed in Figure 6.

4.7.2 CRI

The CRI is an index updated yearly by the Germanwatch since 2006, that "analyses climate-related extreme weather events' degree of effect on countries.". (e.V. 2025) In 2025 Belize ranked second most affected among the 180 countries analysed. Germanwatch attributes this result to hurricane Lisa's estimated 104M\$ in damages and the high number of people affected. (Adil 2025)

4.7.3 ND-GAIN

The ND-GAIN is an annual composite index developed by the eponymous organization. Ranging from 0 to 100, it measures a country's vulnerability and readiness to adapt

to negative effects of climate change (Initiative n.d.)

From 2021 to 2022, Belize saw a 0.43 points jump in its score. Only 6% of the 192 countries analysed experienced a better improvement in their scores in the same period; this is shown in Figure 7

4.7.4 Empirical analysis

A SCM was employed to test the hypothesis that this exchange contributed toward improving the economic position of Belize.

The rationale behind the hypothesis is that the improvement in the country's external debt position, as well as the increased preservation efforts aimed at one of its main sources of touristic revenue - the ocean and the barrier reef - would lead to an overall bigger improvement (or smaller degradation) in economic performance, as well as a bigger increase in inbound foreign direct investment, when compared to a scenario where this treatment did not take place.

SCM The SCM is a tool for investigating the causal effects of a treatment on a specific unit, by comparing the trajectory of a representative target indicator against that of a synthetic control group, comprised of multiple weighted control units.

Given the heterogeneity of sovereigns across the world, this weighted combination of control units is expected to yield a better model of Belize than any one other singular sovereign would.

Initially, a series of predictors that influence the target indicator are picked.

The method then assigns weights to each control unit and predictor, and an optimization process ensues, aiming to find the weight values that minimize the difference between the pre-intervention trajectories of predictors of the treated unit and the synthetic control's.

The resulting synthetic control model is evaluated according to its ability to track the treated unit's target output in the pre-intervention period. Closer fits imply more reliable counterfactual estimates produced in the post-treatment period.

The mathematical formulation of the model can be found in the original paper by (Abadie & Gardeazabal 2003).

Data In this specific analysis, units are countries, the treated unit being Belize, and the treatment is the DFNS discussed herein.

Ideal candidates for the synthetic control pool are countries in a similar macroeconomic context to Belize's: small, open economies, with high dependence on tourism and agriculture and little resilience to external economic shocks, namely extreme weather events.

Ideal predictors should be representative of the health and stability of the economic position of these sovereigns.

In practice, data was sourced from the World Bank, and several countries and indicators had swathes of missing observations. A small analysis was conducted to determine which countries and indicators had a maximum of around 10% of observations missing, in order to minimize interpolation of the data (itself bound to pre-treatment period).

As a result, the countries picked to integrate the synthetic control pool were Dominican Republic, Trinidad and Tobago, Dominica, Fiji, Cabo Verde, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Mauritius, and the Bahamas. Barbados and Jamaica, two additional strong candidates, were left out due to having undergone similar debt exchanges in a recent past.

The indicators used in the analysis were GDP growth, (%), Foreign direct investment (FDI) (net inflows, growth, %), current account balance growth (%), real interest rate (%), inflation (from consumer prices, %) and population growth (%).

1990 was selected as the lower cut-off point for the pre-treatment period for the same practical reason.

Results The analysis was run for two different targets, GDP growth and FDI growth. In both cases, the synthetic control's fit in the pre-treatment period was coarse, as shown in figures 8a and 8b. Treatment is marked with a vertical blue dashed line, corresponding to the 2021 DFNS.

In the post-treatment period, the control predicts an acceleration of FDI growth, which real data shows to have slowed down in the 2 years that succeeded the DFNS. Conversely, the analysis targeting GDP growth predicts a steep deceleration in economic growth, which in reality was not as pronounced.

Both results yield a counterintuitive effect of the DFNS on Belize's economic position, implying the operation actually worsened the country's macroeconomic position.

However, several factors dramatically affect the statistical significance of this analysis,

rendering it inconclusive. These are explored in the next subsection.

Limitations and future work Pre-treatment fit of the synthetic control group is subpar, leading to poor trajectories of indicator counterfactuals in the post-treatment period.

Belize's recent macroeconomic shocks, notably the COVID-19 pandemic and category 1 hurricane Lisa, which befell the country in years before and after the DFNS respectively, contributed to the high unpredictability of the target indicators used in the analysis, hindering the pre-treatment fit.

The effect is exacerbated by the very macroeconomic heterogeneity and data gaps that characterize small, tourism-based economies of sovereigns similar to Belize.

Time constraints on the author's end further limited the quality of the data processing, indicator and sovereign selection and model fine-tuning.

In future works, combining World Bank data with data from other sources can reduce the amount of gaps in the predictors used, minimizing the need for interpolation and effectively enhancing the pre-treatment fit. Simply waiting a few years will also elongate the post-treatment period with ground truth data for the targeted indicators, facilitating the comparison with the results yielded by the control and improving the significance of the analysis.

Using the augmented version of the SCM is also likely to lead to better results in scenarios where the pre-treatment fit is not reliable, as is the case. As stated by the authors, it "uses an outcome model to estimate the bias due to imperfect pre-treatment fit and then de-biases the original SCM estimate [in the post-treatment period]" (Ben-Michael et al. 2021).

Code The code for extracting and processing the data, as well as fitting the model was written in Python, and leveraged the 'pysyncon' package, which implements the original SCM as modelled by (Abadie & Gardeazabal 2003).

It is available for consultation in its entirety at (Abreu 2025)

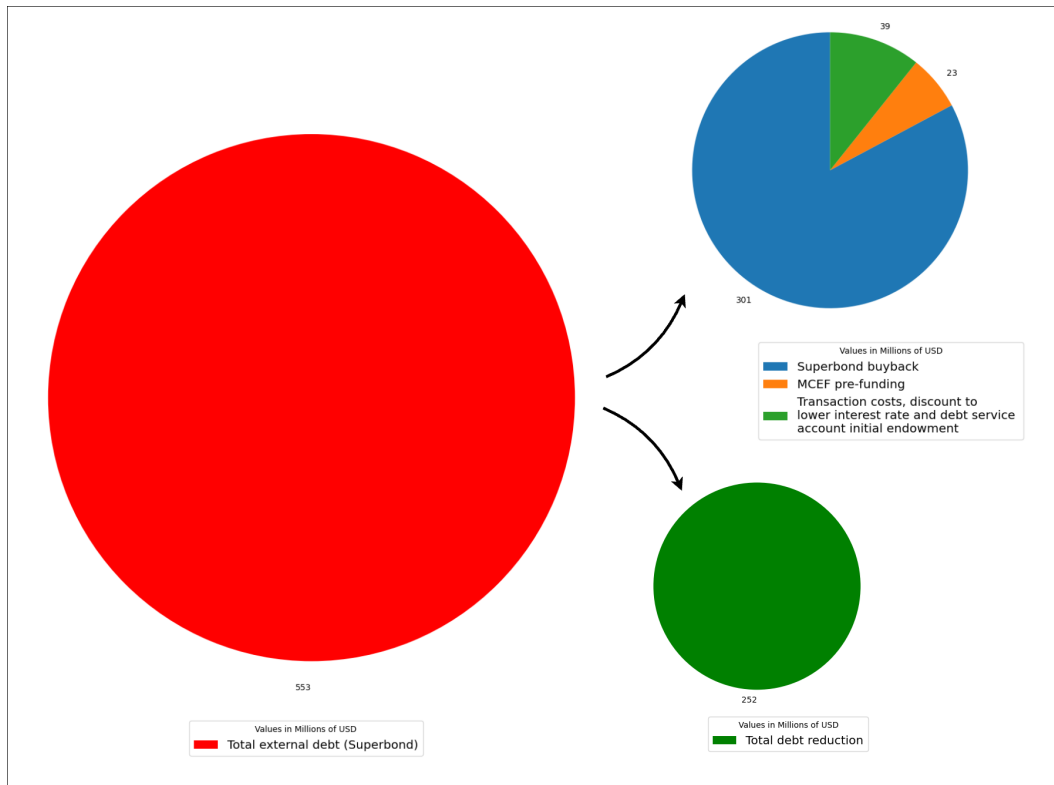


FIGURE 4: Change in Belize’s external debt structure following the exchange

Source: Data from TNC (Conservancy 2022), diagram by author.

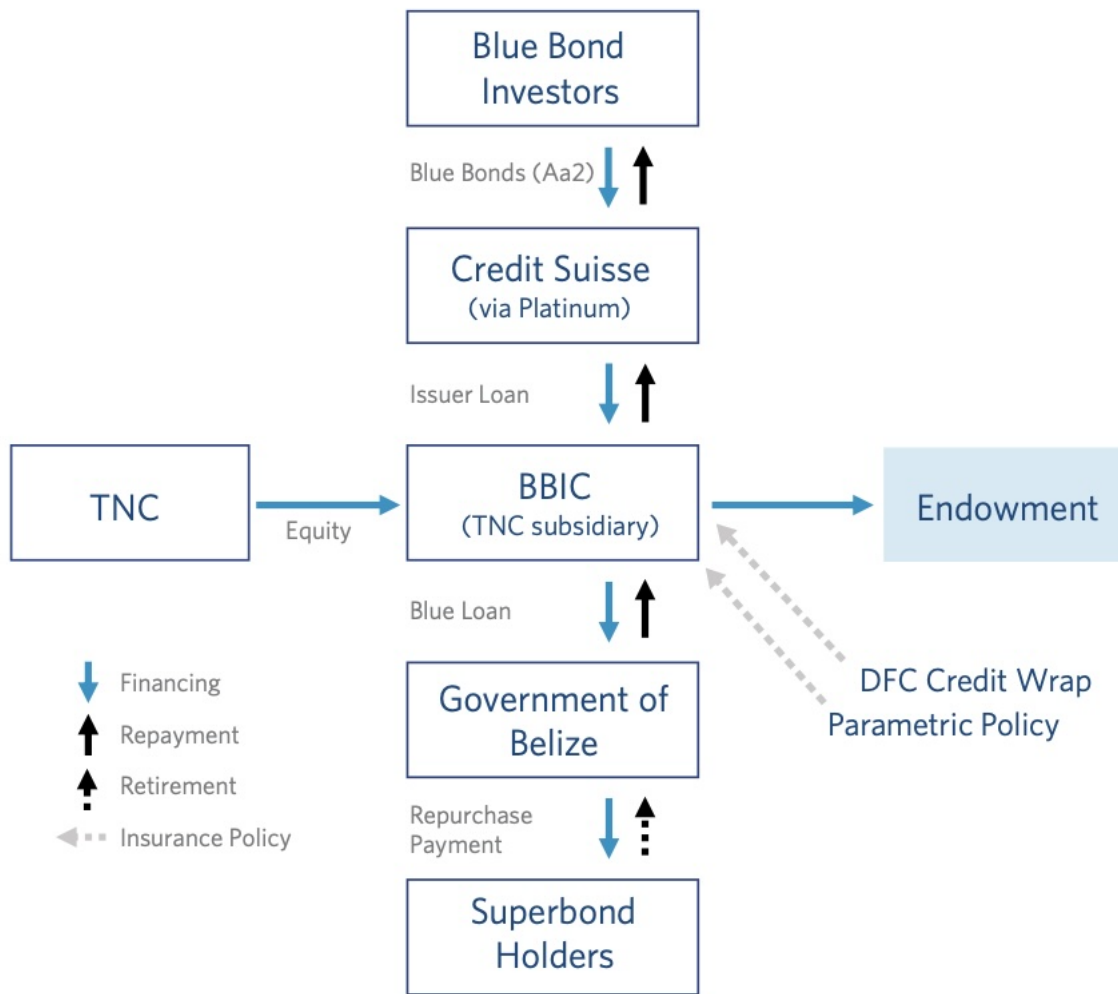


FIGURE 5: Exchange agreement structure

Source: TNC (Conservancy 2022).

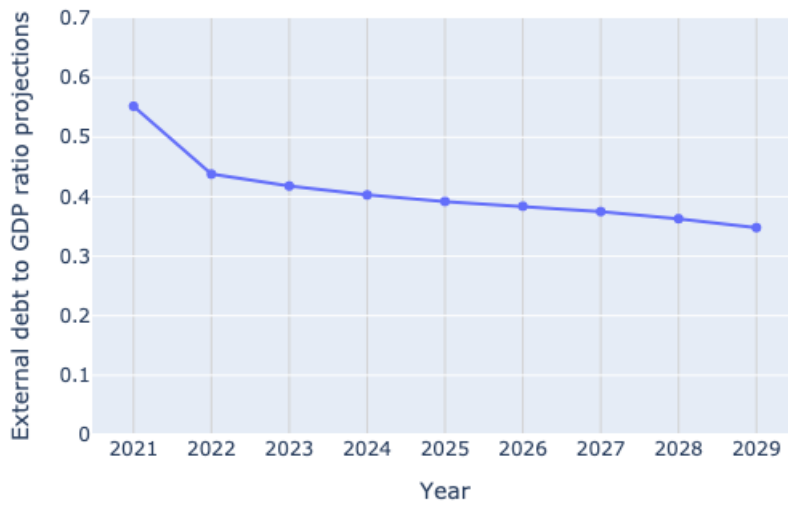


FIGURE 6: Belize’s public external debt projections

Source: Data from IMF (Fund 2024), graph by author.

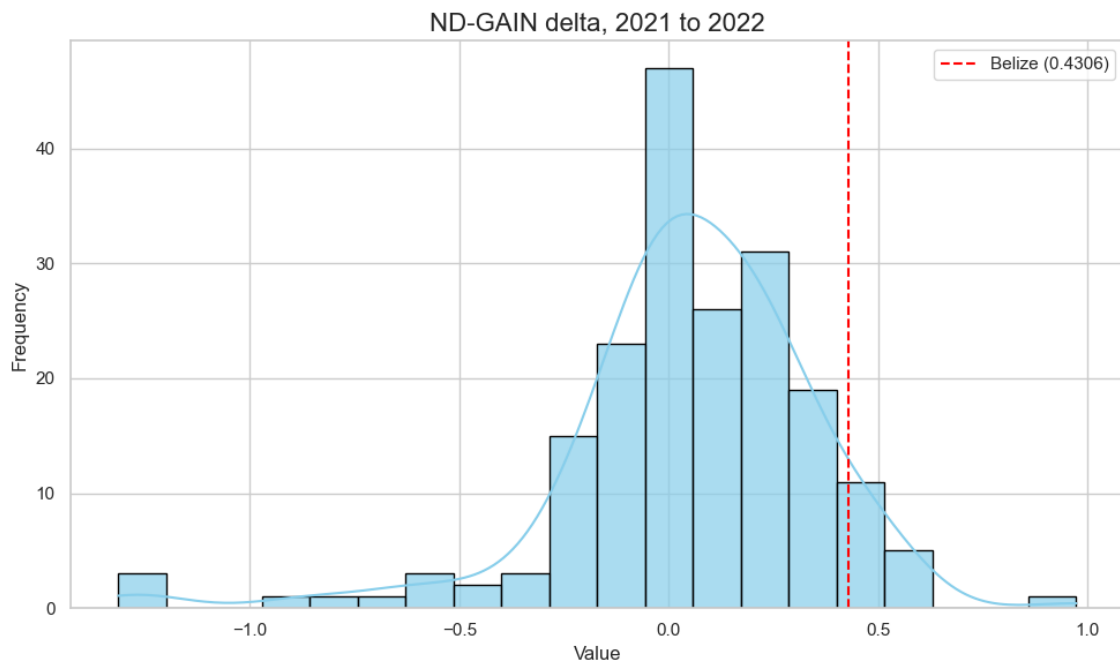
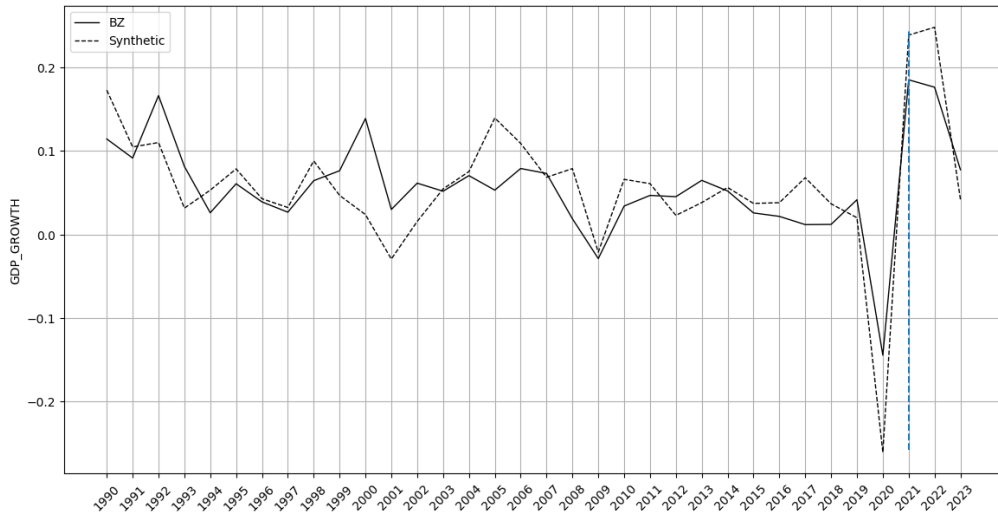


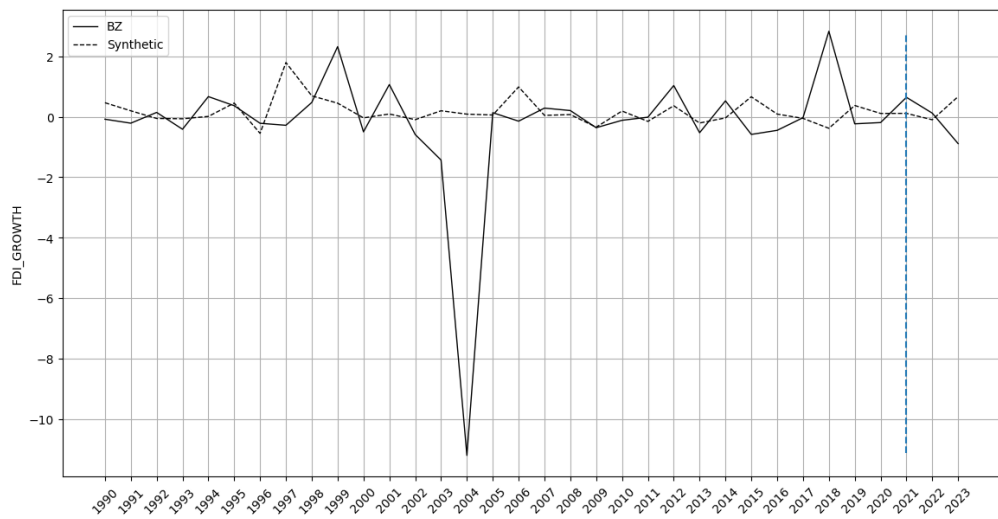
FIGURE 7: Distribution of ND-GAIN change for all countries in index

Source: Data from ND-GAIN (Initiative n.d.), graph by author.



(a) Synthetic control method targeting GDP growth

Source: Data from World Bank, graph by author.



(b) Synthetic control method targeting FDI growth

Source: Data from World Bank, graph by author.

FIGURE 8: SCM results

5 Future of climate finance

5.1 Supply and demand

Bound by treaties such as the Paris Agreement and the Kyoto Protocol, countries are ramping up their environmental commitments. In light of these, total climate finance has grown rapidly in the past decade. The global sustainable bond market has increased fourfold in the 2019-2021 period alone, totalling around 3T\$ (Cheng et al. 2022).

As staggering as that number might seem, an estimated 590% increase in climate investment is still needed to achieve objectives by 2030 (Cheng et al. 2022).

Sovereign ESG bonds, category under which Blue Bonds fall, shone through in this growth period, experiencing a dramatic increase in issuance since the COVID-19 pandemic (Cheng et al. 2022).

Given this increase in demand for sustainable financial instruments, the supply might follow: an increasing number of countries are experiencing the inexorable effects of climate change, leaving room for a potential increase in DFNS.

5.2 Replicability

The Belize transaction was unique for a variety of reasons. The country's relatively simple external debt structure at the time combined with TNC's decades of experience with conservation in Belize specifically facilitated its implementation, while its sheer complexity hindered it.

There is however a case to be made for the replicability of this type of DFNS (Chamon et al. 2022) (on Financing Water 2023). Provided there are

- Some achievable conservation outcomes that affect long-term debt sustainability;
- Debt to refinance;
- Availability and affordability of credit enhancement;
- Conservation NGOs with the power and willingness to mediate the operations;
- Means to codify conservation commitments *pari passu* with debt obligations

then this type of deal makes sense from the financial and economical point of view.

When it comes to tackling both debt sustainability and environmental conservation simultaneously, the IMF specifically notes debt-for-nature swaps only supersede any combination of conventional instruments if the conservation expenditure commitments are considered "senior" to the remaining debt service and conservation efforts have an impact on sovereign risk. (Chamon et al. 2022)

In the case of Belize, missed conservation fund payments as well as interest payments allow BBIC to declare a default on the Blue Loan, fulfilling the first condition. The second condition is also fulfilled, given Belize's production capacity is imperilled by climate related adversities.

This exchange is thus positively archetypical for future implementations, provided the conditions outlined above are met.

5.3 ESG bonds breadth

Although served hand-in-hand in this particular case, not all issuances of sustainable bonds are tied to DFNS.

Indonesia recently issued the first publicly offered standalone sovereign Blue Bond, showing countries' increasing willingness to carve new paths toward climate investment.

The private sector seems to be picking up on the advantages of Blue Bonds as well, with Ørsted issuing the first corporate Blue Bond in 2023.

Lastly, it is worth mentioning TNC is considering expanding Blue Bonds to the conservation of freshwater bodies (on Financing Water 2023), which provide much of the drinkable water us humans consume today.

6 Conclusion

Belize's 2021 DFNS laid down a solid model for the future of this type of transaction, as it legally tied both missed conservation and debt payments to its Blue Loan, a big change toward tackling fears of greenwashing surrounding ESG instruments.

Despite the modest debt relief, its contributions to both debt sustainability and conservation combined pave the road toward better public debt management for the country.

The hardships agents face in putting together a deal like this may compromise its scalability, but don't necessarily doom it, and although difficult, it is possible to find credit enhancement for bigger volumes of debt being restructured, as was shown in Ecuador in 2023.

Parties involved in this and other deals, some modelled after Belize's, proved it is possible to come to an agreement within a reasonable timeframe, and that there are organizations around the world willing and eager to bring them to fruition.

In some cases, a DFNS can be a country's sole option toward a greener and more sustainable future, and the framework erected in 2021 and polished in later years is likely to keep evolving, providing easier, deeper and wider combined debt relief and conservation funding to nations in need.

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