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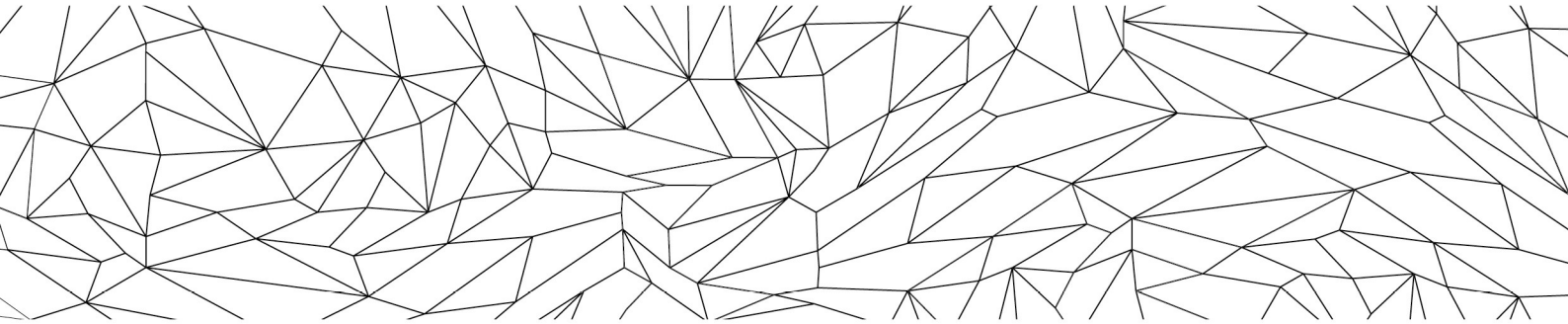

Threading the Needle: The Delicate Art of Designing Debt-for-Nature Swaps

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Threading the Needle: The Delicate Art of Designing Debt-for-Nature Swaps

Alexander Dryden

Abstract

Debt-for-nature swaps (D4NS) have re-emerged as a popular financial tool, with a dozen transactions completed since 2021 alone. Yet despite their appeal as a triple-win for creditors, debtors, and the environment, their effectiveness remains poorly understood. This paper presents the first comprehensive database of 169 D4NS transactions across 45 countries from 1987 to 2025, covering their structure, scale, and environmental outcomes. A new financial framework is proposed to evaluate these deals based on three core criteria: debt volume, discount achieved, and environmental proceeds. The results reveal that while early-generation D4NS were environmentally robust but small in scale, recent deals, although larger, often deliver limited debt relief and are environmentally 'leaky'. Furthermore, the most effective transactions from a debt reduction standpoint typically occur amidst an economic crisis. The study concludes with policy recommendations for a more agile and impactful fourth generation of D4NS, involving the creation of a pro-active D4NS distressed debt fund.

Keywords: Sovereign Debt, Climate Finance, Debt-for-Nature Swaps

JEL classification: F34, H63, Q56.

1. Introduction

Debt-for-nature swaps (D4NS) are often described as a triple win for debtor governments seeking fiscal relief, creditors aiming to exit distressed positions, and conservationists pursuing environmental gains (Mengdi and Wang, 2021). These transactions reduce the fiscal burden on governments, allow creditors to offload potentially impaired debt, and redirect freed-up financial resources toward environmental and social projects.

Following a long period of dormancy, D4NS have experienced a modest resurgence. Since 2021, a dozen new transactions have been completed, compared to just nine in the preceding decade. Yet this new wave of deals differs significantly from the earlier generations, raising important questions about their design and impact. Despite growing interest, D4NS remain an under-researched field, with the academic discourse still dominated by case studies and anecdotal evidence rather than comprehensive, systematic analysis.

This paper addresses that gap by presenting the first comprehensive database of 169 D4NS transactions conducted by 45 countries between 1987 and January 2025, significantly higher than previous estimates (Quentin et al., 2023). It also introduces a new framework for assessing and comparing swaps across different generations, focusing on three dimensions: environmental efficacy, the scale of debt involved, and the degree of actual debt relief achieved.

The findings suggest that while early-generation swaps were small in scale, they tended to deliver strong environmental outcomes. In contrast, recent deals, though larger, have often been environmentally ‘leaky’ and have delivered limited net debt relief. Crucially, the most fiscally effective D4NS tend to occur during periods of economic distress: 91 percent of first-generation and 51 percent of second-generation swaps were executed during domestic crises. These patterns highlight how difficult it is to align all three objectives simultaneously - suggesting that constructing a truly effective D4NS often requires threading the needle between fiscal needs, environmental goals, and market conditions.

The paper concludes with a proposal for a more agile and impactful fourth generation of D4NS. It argues for the creation of a pre-funded distressed debt facility - capitalized by NGOs, philanthropies, or development institutions - which could purchase sovereign bonds from pre-approved countries during short-lived windows of market dislocation. By acting quickly, such a fund could secure deeper discounts and free up more fiscal space for environmental investment, better threading the needle between scale, debt reduction, and sustainability.

The paper is structured as follows. Section 2 defines the three generations of D4NS, tracing their evolution from NGO-driven transactions to more recent privately intermediated structures. Section 3 outlines the proposed financial framework. Section 4 discusses the methodology and sources used in constructing the database. Section 5 presents stylized facts from the novel dataset. Finally, Section 6 concludes with a

discussion of policy implications and the potential design of a fourth generation of D4NS.

2. Debt-for-nature Swaps: An evolutionary tale

D4NS is a financial transaction where a proportion of a countries debt is conditionally reduced in exchange for the debtor agreeing to invest the freed-up resources in domestic environmental initiatives (Fresnillo, 2023). Whilst the objective of D4NS has not materially changed since the inception in 1987, the underlying structure for facilitating the transaction has evolved considerably over time.

This paper builds on the generational framework first introduced by (von Moltke, 1990), which distinguished between the first and second waves of D4NS. Expanding on that taxonomy, this study introduces and formalizes a third generation of D4NS, characterized by the growing use of private intermediation and debt buybacks. The remainder of this section traces the evolution of D4NS through these three generations.

2.1 First Generation

D4NS were first conceptualized by Dr. Thomas Lovejoy in 1984, who observed that many highly indebted countries - whose external debt was trading at a steep discount - were also among the most environmentally vulnerable economies (Lovejoy, 1984; Buckley and Freeland, 2011).

The first wave of D4NS required external third-party capital to facilitate transactions. Environmental NGOs would use donations or grants to purchase the sovereign debt of environmentally vulnerable economies on the secondary market at significant discounts. The acquired debt would then be cancelled or converted, with debtor governments committing to fund conservation projects in local currency (Visser and Mendoza, 1994). This approach helped alleviate exchange rate risk for debtor nations, as it replaced foreign-denominated obligations with local currency commitments.

Key organisations in these transactions included the World Wildlife Fund (WWF), The Nature Conservancy (TNC), and Conservation International (CI), which coordinated the swaps and ensured that the funds were directed to approved environmental projects (Buckley and Freeland, 2011; Fresnillo, 2023). These projects ranged from establishing protected reserves to supporting environmental education and reforestation initiatives. Early activity was concentrated in Latin America, with countries such as Costa Rica, Ecuador, and Bolivia among the first to adopt D4NS as a means of protecting biodiversity while managing debt burdens (von Moltke, 1990; Visser and Mendoza, 1994). Not all governments in the region embraced the approach. Brazil initially rejected such transactions, arguing that they represented foreign interference in domestic affairs (Visser and Mendoza, 1994).

Over time, criticisms emerged around the complexity, transparency, and modest scale of debt relief delivered by these swaps (Visser and Mendoza, 1994). The process often involved multiple intermediaries and high transaction costs, and skeptics questioned whether the deals could meaningfully address the structural debt challenges faced by developing nations (Fresnillo, 2023).

2.2 Second Generation

In 1990, President George H.W. Bush launched the Enterprise for the Americas Initiative (EAI), ushering in the second generation of D4NS (von Moltke, 1990; Clark, 1991; Sheikh, 2010). Unlike the first-generation swaps, which relied on non-governmental intermediaries, these transactions were bilateral, government-to-government agreements that allowed debtor nations to redirect official debt service payments into local environmental and sustainable development funds (von Moltke, 1990).

Under the EAI framework, countries meeting specific economic and policy criteria were granted the ability to swap their debt servicing obligations into local currency commitments, which were then deposited into national conservation funds (Clark, 1991). This streamlined approach reduced the involvement of external charities and NGOs, increasing government control over fund allocation. By the early 1990s, Argentina, Bolivia, Chile, Colombia, El Salvador, Jamaica, and Uruguay had all entered into agreements under this model, allowing them to finance large-scale conservation programs while restructuring bilateral debt (Sheikh, 2010).

Despite the increased efficiency, second-generation swaps faced their own criticisms. They were still limited in scale, with only 10-15 percent of a country's official bilateral debt eligible for conversion (Clark, 1991). Moreover, conditionalities imposed by creditor governments often restricted debtor nations' sovereignty over environmental policymaking (Fresnillo, 2023).

2.3 Third Generation

The popularity of D4NS dwindled in the post-2000 era as the success of the Highly Indebted Poor Country Initiative (HIPC) provided material fiscal capacity to developing economies, reducing the pressure on governments to embark on protracted D4NS negotiations (Caliari, 2020). However, rising and expensive debt levels, particularly in the wake of the COVID-19 pandemic alongside the growing damage of climate change, has seen D4NS stage a comeback, albeit in a different form (Clifford Chance, 2023}.

The third generation of D4NS represents a significant evolution in transaction structure, shifting from government-driven agreements to privately intermediated debt buy-backs (Fresnillo,2023). Unlike the first-generation D4NS, which relied on NGO donations, or the second-generation bilateral government agreements, these newer

transactions leverage private financial markets, involving commercial banks, development finance institutions (DFIs), and institutional investors (Fresnillo, 2023).

A key component of third-generation D4NS is the sovereign debt buy-back, where a debtor country repurchases its outstanding commercial debt at a discounted rate, typically through a market tender offer. Theoretically, this process allows countries to retire costly sovereign bonds and replace them with lower-cost debt, reducing their overall debt burden (Clifford Chance, 2023).

To finance the buy-back, a Special Purpose Vehicle (SPV) is established in a favourable tax and regulatory jurisdiction (Clifford Chance, 2023). The SPV will then issue a green bond that attracts a lower borrowing cost given that the proceeds will be directed towards environmental efforts. The proceeds from the new bond are used to extend a loan to the debtor government, which then uses the fund to buy-back older more expensive debt (Fresnillo, 2025).

These savings arise from purchasing the debt at a discount from bondholders, issuing a new bond under more favourable conditions, such as lower interest rates and extended maturity, or a combination of both (Fresnillo, 2025). To further reduce borrowing costs and enhance creditworthiness, this newly issued debt often receives credit enhancements in the form of political risk insurance, partial guarantees, or liquidity support from development finance institutions (DFIs) (Fresnillo, 2025). These risk-mitigation measures make the newly issued bonds more attractive to investors by improving their credit rating helping lower borrowing costs and increase the impact of any debt repurchase (Clifford Chance, 2023}.

As a condition for receiving debt relief, sovereign governments commit to legally binding conservation targets, which are managed through Conservation Trust Funds (CTFs). CTFs disburse financial resources gradually rather than in a single lump sum, ensuring the long-term sustainability of conservation projects while minimizing the risk of misallocation. To reinforce accountability, monitoring, compliance, and enforcement mechanisms are embedded within these transactions (Clifford Chance, 2023). External impact assessments track conservation progress, and an independent verification agent is often appointed to oversee implementation.

Failure to comply with the environmental criteria outlined in the transaction can lead to financial penalties being inflicted on the domestic government including higher interest rates or a change in the distribution of funds (Clifford Chance, 2023). Furthermore, these latest contracts are concerning for their lack of disclosure with legal and consultative fees rarely publicly disclosed (Kaiser, 2023). Where disclosure has been available, the associated costs have been strikingly high. In Ecuador’s 2023 deal, the government is effectively paying an interest rate of 11 percent - around 560 basis points above the 5.4 percent coupon on the newly issued debt (Das, 2025). Similarly, in Belize’s 2021 transaction, administrative expenses reached US$85 million, consuming roughly 25 percent of the new capital raised (Das, 2025).

Despite the high fees and tough enforcement mechanisms, the new structure has sparked a resurgence in D4NS, with the Seychelles (2015), Belize (2021), Ecuador (2023), and Gabon (2023) all employing similar approaches to support their recent D4NS. However, the terminology surrounding this latest generation of D4NS remains contested. As Kaiser (2023) notes, creditors selling debt on secondary markets are motivated purely by financial interests. Given this lack of environmental intent on the part of debt holder, the most recent D4NS transactions may be better characterized as debt buybacks rather than true swaps (Kaiser, 2023; Fresnillo, 2025).

Despite D4NS having a long and evolving history as a financial market instrument there remains no coherent framework via which to assess their effectiveness from either an environmental, fiscal or debt relief perspective. The following section outlines an initial framework to rectify this.

3. A framework for assessing the impact of debt-for-nature swaps

Due to their evolving nature and the absence of a formal database documenting key financial details, assessments of D4NS have largely relied on individual case studies and anecdotal evidence. This lack of standardisation has made it difficult to evaluate their financial and environmental efficacy across cases.

From a financial perspective, D4NS are multi-purpose instruments. In an ideal scenario, a D4NS would involve the repurchase of a substantial amount of debt at a steep discount to face value, with the majority of the resulting fiscal space redirected to environmental projects. However, this diverse array of objectives can complicate traditional financial analysis of these instruments.

To help evaluate D4NS transactions more consistently, three core financial metrics are proposed:

- The nominal value of the debt involved, typically expressed as a percentage of total debt volumes.
- The repurchase price of the debt, reflected as average cents on the dollar.
- The proportion of funds diverted into environmental projects, measured as environmental proceeds as a percentage of the nominal debt value.

These metrics form the basis of a financial framework for analysing D4NS, illustrated in Figure 1. By positioning transactions along these three dimensions, scale, discount, and environmental allocation, the framework offers a consistent method for identifying both exemplary and underwhelming deals.

At the centre of the framework is the ideal D4NS, which combines a significant debt volume, a steep discount, and a high share of funds directed toward environmental goals. However, many real-world D4NS fall short in one or more of these areas. Figure

1 labels three such cases to illustrate the kinds of trade-offs that often emerge in practice.

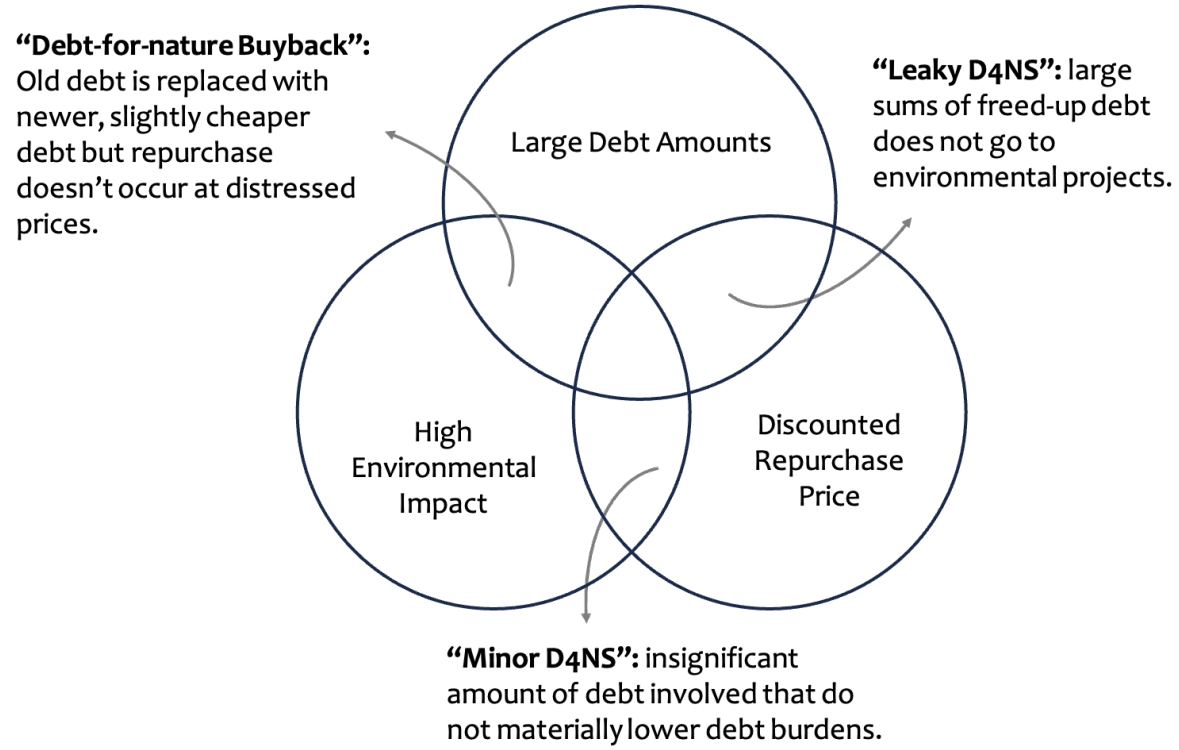
The term `Leaky D4NS' applies to cases where a significant amount of public debt is involved and repurchased at a deep discount to face value. However, instead of allocating most of the freed-up capital to environmental projects, the creditor absorbs a large portion into its own budget.

`Minor D4NS' refers to agreements where a significant share of the proceeds is directed toward environmental projects and the debt is acquired at a discounted price, but the overall amount of debt involved is relatively small.

While any increase in environmental spending is beneficial, D4NS transactions demand considerable time, fees, and international political capital from debtor governments (Fresnillo, 2025). Thus, while pursuing a minor D4NS is not inherently problematic, it raises the question of whether the time and resources devoted to negotiations could be better spent advocating for a more extensive D4NS agreement.

In a `Debt-for-nature buyback' old debt is replaced with newer, cheaper debt, but the repurchase occurs in secondary markets. As initially observed by Kaiser (2023), creditors in these transactions prioritize financial metrics over environmental outcomes. As a result, the debt is typically purchased at levels close to par, offering minimal debt relief for the debtor government.

Figure 1: A framework for assessing the impact of debt-for-nature swaps



Source: Developed by the author

4. Methodology and Data

This section introduces the D4NS database, which systematically records the total face value of the debt involved in each transaction, the repurchase price, and the fiscal funds allocated to environmental projects. In the absence of a formal database, previous research has struggled to establish consistent financial metrics for evaluating D4NS performance, leaving gaps in both comparative analysis and policy assessment.

Section 4.1 draws on this dataset to present three primary series - face value, repurchase details, and environmental proceeds - and defines key measures for evaluating environmental, fiscal, and debt relief outcomes: the environmental efficiency ratio, the fiscal debt measure, and the repurchase amount (see Figure 4.1). Section 4.2 then outlines the case selection criteria and data sources used in the study.

4.1 D4NS Metrics

Face Value of Debt

In compiling the D4NS database, this study records the total face value of debt included in each transaction, categorizing it by transaction type - first generation, second generation, or third generation (see Section 2 for more details). The face value of debt represents the nominal or contractual amount of outstanding obligations involved in a D4NS transaction and is recorded in U.S. dollars. This figure serves as the baseline for assessing the scale of debt relief provided under the agreement.

Historical case studies have often assessed fiscal efficacy based on gross debt levels and on foreign-denominated debt terms (Fresnillo, 2023). While this approach is valid for first and second-generation swaps, third-generation swaps frequently involve governments raising additional debt to finance an effective debt buyback. Consequently, assessing fiscal efficacy requires considering debt levels as a percentage of the overall debt stock.

For the purposes of fiscal efficacy, this study evaluates the face value of debt on a net debt basis using the following formula:

Repurchase Amount

The repurchase amount denotes the price paid to repurchase the debt in a D4NS agreement. This is typically negotiated at a discount to the face value, with the level of discount reflecting creditor willingness, market conditions, and the financial distress of the debtor nation. The repurchase amount is a critical metric in assessing the fiscal implications of D4NS transactions, as it determines the extent of debt relief and the resources available for environmental funding.

In constructing the D4NS database, this study records repurchase amounts for each transaction and calculates the implied discount rate to face value using the following equation:

A lower repurchase price relative to face value suggests a greater degree of debt forgiveness, while a higher price may indicate a more conservative restructuring approach with limited fiscal space for environmental investments.

Moreover, the repurchase amount plays a key role in determining the cost-effectiveness of D4NS transactions. A highly concessional repurchase arrangement enhances the environmental efficiency of the swap by maximizing the proportion of funds channelled into conservation projects. Conversely, a high repurchase price relative to the face value may limit the fiscal and environmental benefits of the transaction. By analyzing repurchase terms across different agreements, this study aims to establish benchmarks for assessing the financial viability and effectiveness of D4NS as a policy tool.

Environmental Projects and Proceeds

For an environmental project to be included in the database, there must be a clearly defined financial commitment earmarked for its implementation. The recorded amounts are expressed in U.S. dollars. For agreements denominated in other currencies, the data set has converted the figures using the average exchange rate for the year in which the transaction occurred. This standardization allows for more accurate comparisons of funding allocations across different D4NS.

To compare the environmental proceeds across different generations of D4NS this study proposes an environmental efficacy ratio using the following formula:

Theoretically, a high-quality D4NS should result in a high environmental efficacy ratio whereby a large proportion of fiscal flexibility freed up by the transaction is diverted into the environmental project. Low efficacy ratios imply that the debt relief has been absorbed into the wider government budget, undermining the environmental impact of the transaction.

The database also tracks the environmental projects funded by the proceeds of D4NS. Table one provides an overview of the five major types of initiatives identified, along with their definitions and practical examples drawn from transaction documents or public announcements. Additionally, a broader 'Other' category captures projects that do not fit neatly into these main classifications.

Table 1: Definition of environmental initiatives

Environmental Initiatives	Definition	Examples
Marine Conservation	This category focuses on the protection and sustainable management of marine and coastal ecosystems. It includes the establishment of Marine Protected Areas (MPAs), sustainable fisheries management, pollution control, coastal ecosystem restoration, and the promotion of sustainable livelihoods linked to the blue economy. The goal is to safeguard marine biodiversity, enhance the resilience of coastal communities, and ensure the long-term sustainability of river and ocean resources.	Establishing marine protected areas (MPAs); sustainable fisheries initiatives; mangrove restoration projects; reducing marine pollution; blue economy development
Forest Conservation	Forest conservation initiatives aim to protect and sustainably manage forests, including tropical, temperate, and boreal ecosystems. Programs may involve preventing deforestation, promoting reforestation and afforestation, encouraging sustainable forestry practices, and supporting community-based forest management. These efforts contribute to biodiversity preservation, climate change mitigation through carbon sequestration, and the protection of ecosystem services critical for local and global well-being.	Reforestation programs; community-based forest management; sustainable timber harvesting; fire management initiatives; carbon sequestration projects; development of sustainable community farming practises
National Parks and Terrestrial Protected Areas	This category covers the creation, expansion, and management of national parks and other protected terrestrial areas. It includes wildlife conservation efforts, the development of ecotourism, community engagement in buffer zones, and the establishment of conservation infrastructure. The aim is to safeguard terrestrial biodiversity, promote sustainable economic opportunities, and ensure the long-term integrity of protected landscapes.	Protected area expansion; wildlife corridors; anti-poaching programs; ecotourism infrastructure development; community engagement in buffer zones
Conservation and Biodiversity Protection	Broad in scope, this category addresses the protection of biodiversity across various ecosystems. It includes programs focused on endangered species, habitat restoration beyond forests and coasts, the creation of biodiversity corridors, invasive species management, and community-led conservation initiatives. The objective is to preserve ecological diversity, maintain ecosystem health, and support the sustainable coexistence of human and natural systems.	Endangered species recovery plans; habitat restoration projects; invasive species management; biodiversity corridors development; community-led conservation programs
Research & Development	This category emphasizes scientific research and innovation to support effective conservation strategies. It involves biodiversity studies, environmental monitoring, the development of sustainable practices, and the dissemination of knowledge. Strengthening local research capacity is also a key focus. These efforts ensure that conservation initiatives are informed by the latest scientific evidence and contribute to long-term environmental and socio-economic outcomes.	Biodiversity surveys; environmental monitoring systems; innovation in sustainable practises; data sharing platforms; capacity building; training programs
Other	See notes section of specific swap for more details	Energy transitions; climate resiliency; water & sanitation improvements

Source: Author's calculations

4.2 Data Sources

At the onset of this project there was no single standardized source providing a consistent set of details of D4NS transactions. To try and construct a detailed and reliable database, this study embarked on an extensive data collection exercise where information was gathered and cross-checked from 55 publicly available lists and additional sources including congressional reports, individual NGOs documents, environmental charities, legal firms, financial consultants, regional development bank releases as well as articles in the financial press.

First, in defining D4NS this database only considers debt transactions that are swapped for measurable nature objectives. There is a plethora of other types of debt-for-development swaps, such as debt-for-health swap (see Genberg, 1992), debt-for-climate swaps (Green Climate Fund, 2024) or debt-for-education swaps (World Bank, 2024) that are outside of the scope of this initial database. Secondly, each included transaction had to specify an agreed and clearly articulated environmental objective. This includes objectives such as biodiversity conservation, forest preservation, or ecosystem restoration. Finally, the parameters of the D4NS must be clearly defined with clear documentation and financial flows. Ambiguous cases were therefore removed from consideration. The majority of D4NS are consistent in disclosures and details however, some second generation bilateral D4NS do have limited information. For example, in 1992, Kenya agreed to a bilateral debt-for-nature swap with Japan; however, the total value of the debt was not disclosed, nor were the funds clearly directed toward environmental projects. As a result, this transaction has been excluded from the database.

Based on these selection criteria, this database identifies 169 D4NS transactions conducted by 45 countries since 1987. The total face value of the debt involved in these transactions amounts to over US$8 billion, with over US$3 billion being utilised for environmental projects. The database considers the face value of the debt involved, the environmental proceeds as well as the repurchase amounts. For second-generations swaps, the database uses an implied repurchase amount using discount rates, concessional borrowing rates and maturities consistent with government accounting standards (see appendix for further details).

5. Debt-for-nature Swaps: Results and Stylized Facts

The dataset and estimates of the 169 reveal a series of observations on D4NS that are best presented as a series of stylized facts:

5.1 Stylized Fact 1: More Prevalent Than Previously Understood

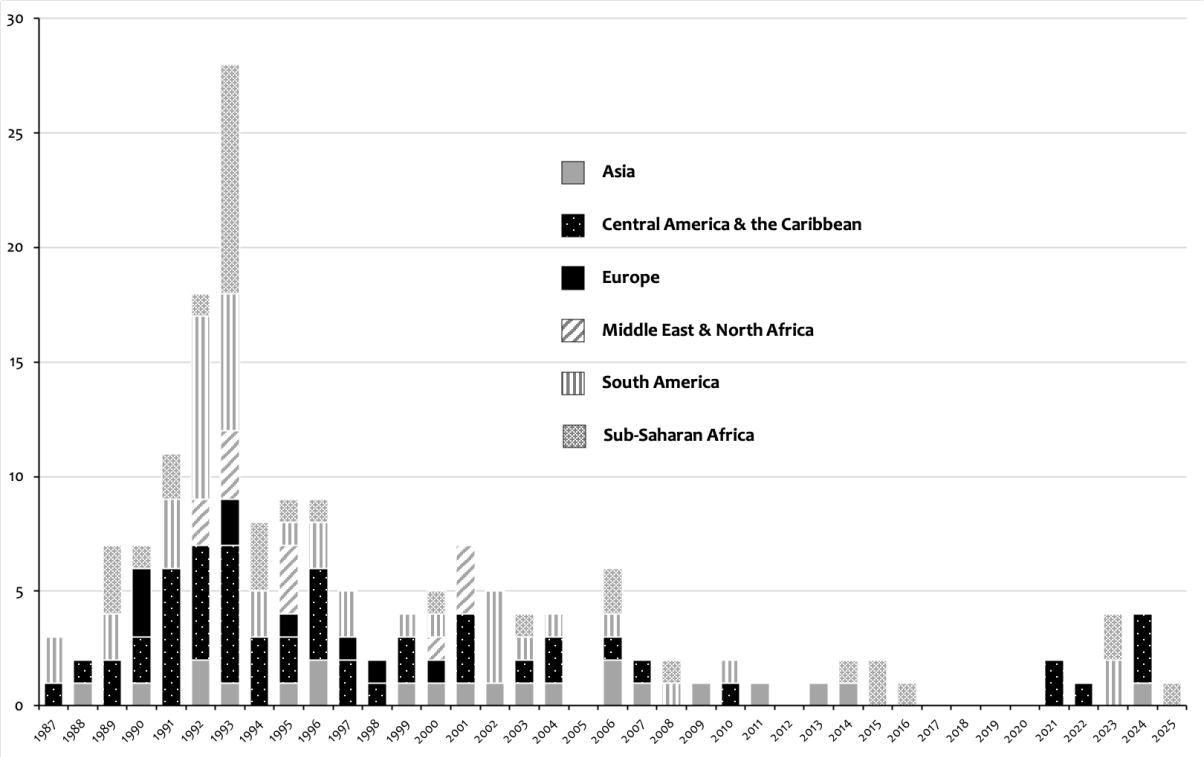
A first insight from the dataset is that D4NS are significantly more prevalent than commonly portrayed in the academic literature or financial media. From their inception

in 1988 to January 2025, this study identifies 169 distinct D4NS transactions across 45 countries - materially exceeding the often-cited figure of 140 swaps.

Consistent with the observations of Chamon et al. (2022) and Mengdi and Wang (2021), the data also capture a sharp decline in D4NS activity following the launch of the Heavily Indebted Poor Country (HIPC) Initiative in 1996. Prior to HIPC, D4NS were relatively frequent, averaging 11 transactions per year between 1987 and 1995. In the decade after HIPC, this dropped to just five transactions annually, and fell further to two per year between 2006 and 2016. From 2017 to 2020, the D4NS market effectively went dormant with no recorded transactions until 2021. Since 2021, D4NS have underwent a small renaissance with 12 transactions recorded, primairly in the third-generation structured discussed in section 2.3.

As shown in Figure Two, geographically, Central America and the Caribbean account for the highest share of D4NS activity, with 52 agreements, representing 31 percent of the total. South America (24 percent) and Africa (20 percent) have also participated regularly. In contrast, Asia remains a notable outlier, comprising just 13 percent of total D4NS transactions. This underrepresentation may reflect both the relative absence of acute debt distress and a political aversion to perceived external influence over domestic environmental policy (Dryden, 2025). Meanwhile, small island nations (SINs) have been frequent adopters of D4NS, responsible for over 12 percent of all transactions since 1987.

Figure 2: Debt-for-nature swaps by region (1987-2025)



Source: Author's calculations.

5.2 Stylized Fact 2: High Fiscal Gains from D4NS Typically Require a Debt Crisis

Repurchasing debt at deep discounts to face value is a theoretically critical ingredient in achieving a highly effective D4NS (Fresnillo, 2023). However, such discounts are rarely available in sovereign debt markets under normal conditions. Substantial price declines typically occur only during periods of economic distress. Indeed, the original D4NS concept emerged in the context of the Latin American debt crisis of the 1980s, when distressed debt traded far below par (Lovejoy, 1984).

Historical patterns suggest that a domestic crisis is often a precondition for executing an impactful D4NS. Crises tend to suppress the market value of foreign-denominated debt, thereby making deep repurchase discounts more feasible. In practice, 91 percent of first-generation and 51 percent of second-generation D4NS have taken place during episodes of economic or financial crisis. These crises, defined broadly to include sovereign defaults, banking failures, currency crashes, inflation spikes, and prolonged downturns, create windows in which debt relief becomes both politically and financially viable.[*] The link between crisis conditions and discount depth is also reflected in transaction-level data. Among first-generation D4NS conducted during a crisis, the average discount was 54 percent. For those negotiated outside a crisis, the average discount fell to just 32 percent. This difference highlights how crisis periods can significantly amplify the financial leverage of a D4NS and, by extension, its potential fiscal impact.

5.3 Stylized Fact 3: D4NS Cover a Limited Share of the Total External Debt Stock

Across first and second-generation D4NS, the face value of debt serviced has averaged just 0.44 percent of countries' total external debt - highlighting their limited scale. Only twelve transactions have involved more than 1 percent of total external obligations, all of which have been bilateral, second-generation swaps.

In contrast, third-generation D4NS have involved far larger headline figures. However, because these transactions rely heavily on debt refinancing and replacement mechanisms, a more accurate financial appraisal requires assessing the net reduction in debt, rather than the gross amount treated. On this basis, the fiscal outcomes of third-generation D4NS appear far more mixed.

The overall scale of the D4NS landscape also remains modest. Between 2000 and 2015, only 44 D4NS were completed, down from 113 deals agreed between 1987 and 1999. That said, the 2016 Seychelles transaction marked a turning point. Though small in size (just US$21.6 million), it introduced a new template involving a special purpose vehicle (SPV) and external concessional finance, paving the way for the larger third-generation deals that emerged after 2020.

Since 2021, seven privately intermediated or `third-generation' D4NS have been executed, involving Belize (2021), Barbados (2022 & 2024), Gabon (2023), Ecuador (2023), El Salvador (2024), and The Bahamas (2024). These deals are significantly

[*] See Reinhart and Rogoff (2009) and Cruces (2013) for for typologies and historical data on crises and debt restructurings.

larger than earlier generations, averaging US$636 million in face value, with Ecuador's 2023 swap treating US$1.6 billion - a record. By comparison, second-generation bilateral swaps averaged US$40 million, while first-generation transactions were smaller still, averaging just US$3.5 million.

Despite this increase in scale, third-generation D4NS may still be justified primarily as a debt management tool, allowing countries to replace expensive, short-term debt with longer-dated, concessional obligations (see Section 2.3). Yet, as noted by Fresnillo (2023), even these larger deals remain far from a “silver bullet” for addressing the interlinked debt and climate challenges facing the Global South.

5.4 Stylized Fact 4: Second-Generation D4NS Have Lower Environmental Impact

First-generation D4NS have historically represented a less 'environmentally leaky' transaction type compared to second-generation swaps. Indeed, 77 percent of first-generation swaps have an environmental efficacy ratio greater than 75 percent. In contrast, only 47 percent of second-generation D4NS have the same level of proceeds being diverted to environmental projects and 27 percent having an environmental efficacy ratio of below 25 percent.

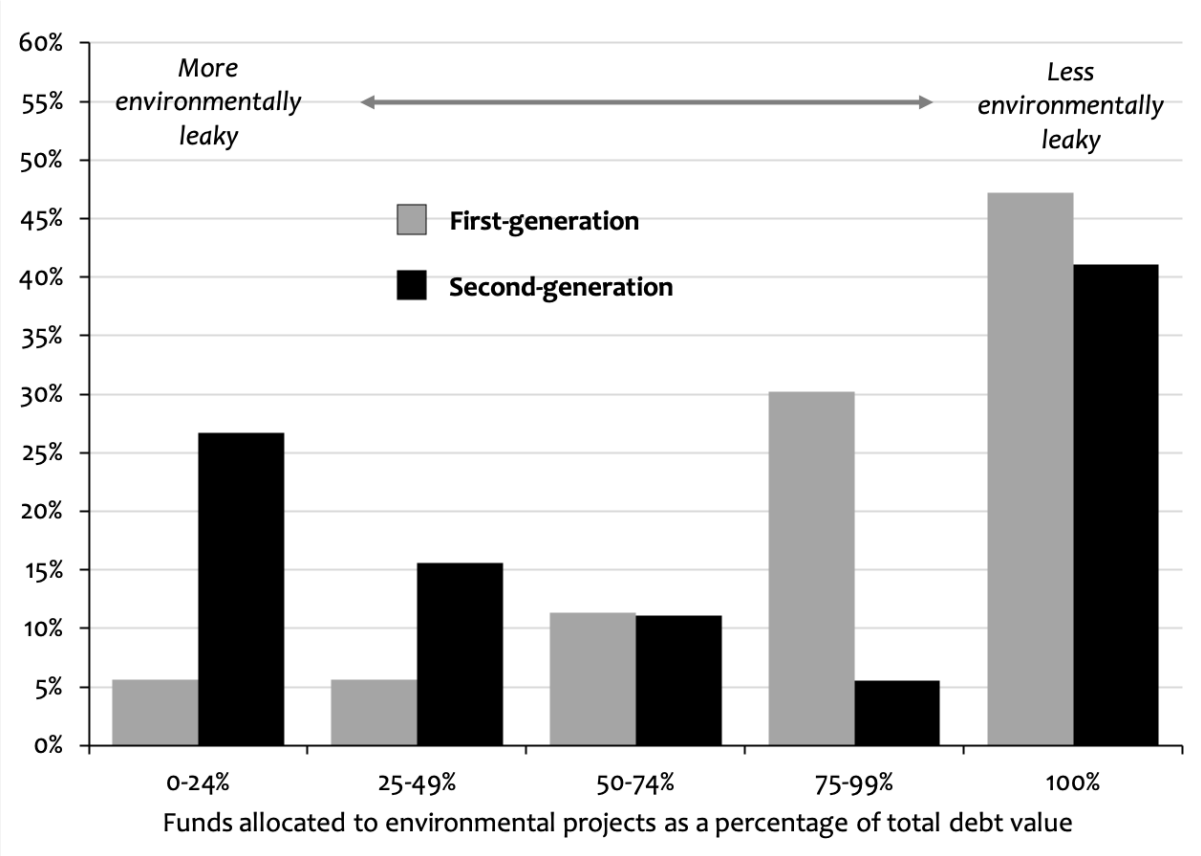
The potentially 'leaky' nature of second-generation swaps compared to the more robust setup of first-generation swaps may reflect the demands of creditors. The direct ownership of debt by environmental charities and NGOs in the earlier generation may have placed greater emphasis on ring-fencing funds for environmental purposes. By contrast, the government-to-government nature of second-generation swaps may reflect the broader political scope of bilateral debt negotiations, whereby debtor governments appeal for greater fiscal flexibility, and creditor governments pursue a mix of strategic, diplomatic, and reputational objectives. In some cases, the environmental framing of second-generation swaps masks their role as a softer form of debt relief - one that allows creditor countries to maintain influence while permitting debtor governments to absorb proceeds into the general budget. This blurring of boundaries between environmental finance and sovereign restructuring suggests that second-generation D4NS are not only less environmentally effective but also politically entangled instruments shaped by creditor-debtor dynamics rather than purely conservation logic.

In addition, table 3 shows the net debt relief for third-generation swaps alongside the amounts dedicated to environmental projects. More recent third-generation swaps present a mixed bag when considering the size of the debt relief compared to the amount invested into the environment.

Transactions such as Ecuador's 2023 swap saw debt relief amount to US$963 million, one of the largest D4NS deals. However, this translated to just US$450 million in environmental proceeds, with a large proportion of the debt relief being absorbed into the wider fiscal budget. In some of the deal such as the Barbados deals in 2022 and 2024 or The Bahamas 2023 deal the replacement of expensive debt with cheaper,

long-term borrowing frees up quite significant funds when considered against the overall net debt relief.

Figure 3: Proportion of first- and second-generation swaps by environmental efficacy



Source: Author's calculations. Figures may not sum to overall number due to data availability.

Table 2: Environmental proceeds of third generation D4NS

Country	Date Signed	Net Debt Relief (USD millions)	Environmental Proceeds (USD millions)	Environmental Project
Seychelles	Feb-16	1	7	Marine Conservation
Belize	Nov-21	189	23	Marine Conservation
Barbados	Sep-22	4	50	Marine Conservation
Ecuador	May-23	963	450	Marine Conservation
Gabon	Aug-23	7	125	Marine Conservation
El Salvador	Oct-24	31	352	Marine Conservation
The Bahamas	Nov-24	-3	124	Marine Conservation
Barbados	Dec-24	-4	165	Climate Resiliency

Source: Author's calculations.

5.5 Stylized Fact 5: Third-Generation D4NS Deliver Mixed Debt Relief Results

While third generation D4NS are increasingly popular amongst climate-vulnerable, indebted economies the latest wave of deals have offered mixed results in terms of delivering material debt relief to developing economies. As observed by Kaiser (2023), third generation D4NS are repurchased in secondary markets from sellers who are purely financially motivated. This stands in contrast to first- and second-generation deals, where the debt was often purchased from commercials banks at material discounts or even freely donated by financial institutions (Fresnillo, 2023).[†] However, as highlighted in table 3, the overall discount observed across third generation D4NS has varied significantly between transactions. Deals such as Belize's 2021 and Ecuador's 2023 transactions are notable given that the implied debt discount rate was 45 and 41 percent, respectively. For context, original first generation D4NS have occurred at an implied discount rate of 52 percent.

Meanwhile, in three instances, the Bahamas and both Barbados transactions, debt was repurchased at or even slightly above par value. Indeed, the overall merits of the Bahamas deal are particularly questionable (see Box 1 for details). Returning to figure 1, these latest deals that transact at or close to par value align strongly with the theoretical principle observed by Kaiser (2023), in that these operations are more aligned with 'debt-for-nature buybacks' rather than D4NS that provide a material reduction in overall debt burdens.

Table 3: Third Generation D4NS

Country	Date Signed	Face Value of Debt Repurchased (USD millions)	Repurchase Amount (USD millions)	Implied Debt Discount (%)
Seychelles	Feb-16	22	15	30%
Belize	Nov-21	553	304	45%
Barbados	Sep-22	150	151	0%
Ecuador	May-23	1,628	665	41%
Gabon	Aug-23	507	442	13%
El Salvador	Oct-24	1,031	1,000	4%
The Bahamas	Nov-24	297	300	0%
Barbados	Dec-24	293	297	0%

Source: Author’s calculations.

[†] For example, Madagascar's 1994 D4NS was funded via a US$1.3 million debt donation by Deutsche Bank (Moye and Paddack, 2003).

Box 1: Bahamas Debt-for-Nature Swap (November, 2024)

In the latest generation of D4NS, looks can be deceiving, especially when large debt volumes are involved. In November 2024, The Bahamas concluded a long-anticipated US$300 million debt-for-nature swap that diverted over US$120 million into marine conservation efforts.

The Bahamas secured a US$300 million loan from Standard Chartered, with the Inter-American Development Bank (IADB) providing a US$200 million partial credit guarantee. An additional US$70 million was backed by a collateralized guarantee from Builders Vision, a philanthropic institution, while Axa contributed US$30 million in insurance (TNC, 2024). These external guarantees and insurance enabled The Bahamas to issue 15-year debt at a 4.7 percent interest rate. For comparison, a Bahamian government U.S. dollar Eurobond maturing in 2028 - similar in tenor to the newly issued debt - had averaged 9.6 percent over the previous 12 months.

The lower borrowing rate reduces the government's debt servicing expenses by an estimated US$8 million per year for the next 15 years, freeing up US$124 million in fiscal resources. The proceeds are set to be invested in strengthening the protection and management of the large marine area surrounding The Bahamas, as well as in developing protection plans for coral reefs, seagrass meadows, and mangrove forests in Bahamian waters.

While there is some merit in the debt management office replacing short-term expensive debt with long-term cheaper debt, the fiscal efficacy of the deal is somewhat muted. The swap terms allowed The Bahamas to repurchase US$218 million of its foreign-denominated debt for US$216 million, an effective debt discount of just 1 percent. A further US$81 million was used to pay down a pre-existing bank loan.

The relatively small amount of funds being released for environmental causes, combined with no material reduction in the overall debt burden of the Bahamian government, all on a gross-of-fees basis, raises questions about the efficacy of this deal.

6. Summary and Policy Recommendations

D4NS are inherently complex financial transactions. Indeed, perfectly aligning deals so that large amounts of debt are purchased at material discounts to face value and ensuring a large proportion of the proceeds are directed into environmental objects is akin to threading the eye of a needle.

This paper develops a new framework to assess the fiscal, environmental, and debt dynamics of D4NS. Applying this framework to a novel database of 169 transactions across 45 countries, it finds that while D4NS have evolved significantly over time, most deals fall short of achieving all three core objectives. First-generation swaps offered strong environmental outcomes but involved relatively small debt volumes and were often dependent on the presence of a domestic debt crisis to unlock deep discounts. Second-generation swaps were larger but frequently ‘leaky’, with a significant share of proceeds failing to reach environmental initiatives. Third-generation swaps have reintroduced D4NS at scale, but their effectiveness in delivering debt relief has often been muted due to high repurchase prices and limited creditor concessions.

Enhancing the effectiveness of D4NS requires capturing the deep discounts seen in earlier iterations while scaling up to the larger debt volumes featured in recent deals. One of the major obstacles to achieving this is the prolonged negotiation timeline of D4NS deals, which often prevents stakeholders from capitalizing on temporary market dislocations in the secondary bond market (Green Climate Fund, 2024). The slow pace of negotiations means that by the time a deal is finalized, the window of opportunity for purchasing distressed debt at deep discounts has often passed.

To overcome this challenge, a more forward-looking approach would involve establishing a dedicated 'D4NS distressed debt fund', managed by financial professionals with a clear investment mandate. This fund would be authorized to purchase the bonds of a pre-approved set of Global South economies when their prices fall below specific thresholds in secondary markets. By preemptively acquiring debt at steep discounts, the fund would enhance the effectiveness of D4NS deals by securing debt relief at lower costs before formal agreements have been conducted. This proactive approach would ensure that market dislocations are not missed and that D4NS mechanisms have the flexibility to maximize debt relief. If a D4NS deal ultimately fails to materialize, the fund could recycle the acquired debt back into investment markets, potentially generating returns that could be reinvested in the debt of other eligible countries where a D4NS agreement is more feasible. In addition, to expand the subset of available opportunities the fund could be given the scope to explore domestic debt deals rather than just limiting the experience to foreign-denominated debt.

Beyond its financial role, the fund would serve as a central coordinating body to align debt relief efforts with environmental initiatives across a diverse range of NGOs. It could also be structured to accept philanthropic contributions from commercial banks and creditors, mirroring the approach seen in first-generation D4NS. Furthermore, if structured correctly, it could also attract external capital from investors and other

financial institutions that could bolster its size and presence in international markets, increasing the size of the debt involved and its end environmental impact.

By integrating financial agility with structured conservation efforts, this approach could mark the evolution of a fourth generation of D4NS, one that effectively threads the needle between financial innovation, rapid market response, and environmental impact. This next generation of swaps would be better positioned to capitalize on market conditions, provide larger-scale debt relief, and deliver meaningful conservation outcomes at a speed and scale previously unattainable.

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Appendix: Bilateral Debt Swap Assumptions

In the case of second-generation debt-for-nature swaps, which were structured as bilateral government-to-government agreements, the underlying lending terms, including borrowing costs and maturity structures, are not consistently disclosed in official documentation. To calculate the implied repurchase rates for these swaps, this paper draws on a wide range of sources, including World Bank debt statistics, Paris Club agreements, and individual country case studies.

Because most bilateral agreements did not specify explicit buyback prices, the repurchase amounts are inferred from the concessional interest rates and maturity extensions characteristic of U.S. and other creditor restructurings during the late 1980s and 1990s. As the accompanying table illustrates, concessional rescheduling's typically refinanced official development assistance (ODA) claims at interest rates in the 1–3 percent range under Toronto, London, and Houston terms, and as low as 0.5–2.5 percent under Naples terms, compared with prevailing market rates of 5–7 percent or higher (World Bank, 1995). At the same time, maturities were extended substantially, with 14–25 year repayment schedules under Toronto and London terms, 20 years under Houston terms, and up to 40 years for ODA claims under Naples terms (Paris Club, 1988; Paris Club, 2025).

For the purposes of this database, these concessional arrangements are translated into present-value terms. In practice, bilateral debt converted through second-generation swaps was commonly refinanced at rates equivalent to roughly 2–4 percent, about half the market cost for comparable sovereign borrowers, and with maturities extended by 10–12 years beyond original terms (Clark, 1991; Sheikh, 2010). Applying standard present-value calculations, these concessions imply an effective discount to face value in the range of 35–40 percent, which forms the baseline assumption for estimating the fiscal relief generated by second-generation swaps in this study.

Table A: Indicative Terms for Second Generation D4NS

Term & Period	Applicability	Interest Rate	Repayment Term
Classic terms (pre-1980s)	Standard, all countries	Market rates (often 5–7% or higher)	≤ 10 years
Toronto (1988–1991)	Poorest countries	Market (non-ODA); concessional for ODA (1-3% range)	14–25 years
London (1991–1994)	Low-income	Market (non-ODA); concessional for ODA (1-3% range)	14–25 years
Naples (~1994–1995)	Highly indebted	Market (non-ODA); concessional for ODA (0.5-2.5% range)	40 yrs (ODA)
Houston (1990)	Highly indebted	Market (non-ODA); concessional for ODA (1-3% range)	15 yrs (non-ODA); 20 yrs (ODA)
Lyon (late 1990s)	HIPC-eligible poor	Deeper concessional terms	-

Source: Author's calculations using indicative figures on Paris Club and World Bank case studies.