

“Debt-for-nature or climate swaps in public finance management”

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DEBT-FOR-NATURE OR CLIMATE SWAPS IN PUBLIC FINANCE MANAGEMENT

Abstract

Considering climate change and growing ecological threats, achieving climate neutrality requires close attention from the state and the involvement of new tools, including those of the so-called green financing. This paper aims to determine the feasibility of combining the tasks of reducing the debt burden and expanding investments in environmental programs in Ukraine, using innovative tools for public finance management, such as debt-for-nature and debt-for-climate swaps. It substantiated the necessity of coordinating debt-for-environment investment programs within the framework of Ukraine's National Recovery Plan and initiatives implemented in Ukraine with the active participation of the World Bank Group. The advantages of this approach are ensuring clear interaction with international financial institutions and expanding the practice of greening public management.

Based on statistical data for 2009–2022, the results demonstrate the growth of negative debt dynamics and characterize limited financing environmental restoration in Ukraine. Relying on international practices, the study conducted a comparative analysis to identify the most significant characteristics of the new debt green conversion instruments as well as the advantages and limitations of their use in Ukraine. The paper offers scenarios for implementing the concept of debt-for-nature exchange in the conditions of Ukraine. It shows the result of the formation of a new debt payment profile. These findings can raise state authorities' awareness of making proper decisions regarding debt policy and public finance management.

Keywords

public finance management, state debt, debt-for-nature swaps (DFN swaps), debt-for-climate swaps (DFC swaps), Ukraine

JEL Classification

H61, Q56, O13

INTRODUCTION

In 2022, the proportion of countries with a high risk of debt distress reached 60%. Excessive debt burden limits funding for programs to restore damaged ecosystems and create a green and safe environment. Many heavily indebted countries are caught in a vicious circle. Under these conditions, it becomes increasingly difficult to service debt, make climate and environmental investments, and access to capital markets for debtor countries is limited.

Is it possible to transform bad debts into investments to restore a clean and safe environment in the face of a growing debt burden and increased environmental threats? The UNDP Signals Spotlight 2023 report lists the use of debt swaps such as debt-for-nature swaps (DFN swaps) and debt-for-climate swaps (DFC swaps) as a hot topic for discussion at the global level (UNDP, 2023). These instruments are still niche in the debt capital markets; however, 20 countries are already considering debt repayments in exchange for environmental and climate investments.

To eliminate the consequences of the full-scale war and the terrible destruction that Ukraine has suffered, the issue of additional sources for funding measures to restore damaged ecosystems and ecological infrastructure is being updated. It should be noted that the ecosystem of Ukraine, where more than 70,000 biological species live, covers 35% of Europe's biodiversity. In this regard, it is necessary to determine the possibility of using new green debt conversion tools such as debt-for-nature swaps (DFN swaps) and debt-for-climate swaps (DFC swaps).

International practice shows significant differences in the use of debt swaps in different countries. Therefore, it is requisite to conduct a comparative analysis of these tools to determine the advantages and limitations more accurately and assess the possibility of their use in Ukraine in the context of post-war reconstruction. Combining the objectives of reducing the debt burden and expanding investments in nature requires a clearer understanding of the form and terms of a debt swap. Thus, one of the most important tasks is determining approaches to state debt restructuring and forming a new profile of debt repayments when using DFN and DFC swaps in Ukraine. Particular attention should be paid to the consistency between debt-for-environment investment swap programs under Ukraine's National Recovery Plan and WBG initiatives implemented in Ukraine with the active participation of the World Bank Group.

1. LITERATURE REVIEW

The Paris Agreement has intensified the discussion about the need to strengthen the global response to the threat of climate change (UN, 2015; Council of the European Union, 2021). The EIB and other multilateral development banks have launched the first joint Climate Adaptation Plan (EIB, 2021), which consists of three parts: rapid financing to mitigate climate change risks; tightening requirements for information disclosure in the implementation of climate projects; and support for the least developed countries. However, "pervasive market failures" are hampering the agenda, requiring developing and delivering a wider range of financial products (Losenno, 2022).

After Ukraine signed the Paris Agreement in 2016 (UN, 2015), the goal was to reduce greenhouse gas emissions by 2030 to 35% compared to 1990 and achieve carbon neutrality no later than 2060 (CMU, 2017; Naumenkova et al., 2022).

The search for funding sources for measures to create a clean and safe environment in Ukraine becomes especially relevant in the context of eliminating the consequences of a full-scale war (National Recovery Council, 2022; MEPNR, n.d.). However, the amount of funds for this task is increasing.

The report, presented by the Ukrainian delegation at the Bonn Climate Change Conference in June 2023, notes that during the year of full-scale war

in Ukraine, more than 119 million tons of greenhouse gases polluted the environment, which is almost the same as Belgium's emissions per year. The amounts given consider both direct emissions from hostilities and fires caused by them (CMU, 2023). The approximate amount of damage caused to the environment by the explosion of the dam of the Kakhovka hydroelectric power station in the Kherson region is UAH 146.4 billion. As of July 4, 2023, the volume of water decreased by 14.775 billion cubic km, and the area of flooded forests is 63.45 thousand hectares (Ministry of Environmental Protection and Natural Resources, 2023).

The growing debt burden in Ukraine significantly limits the state's ability to finance programs to restore damaged ecosystems. Information on the deterioration of credit ratings of Ukraine's debt obligations (Ministry of Finance of Ukraine, 2023) points to limited access to global capital markets and an inevitable increase in the cost of debt servicing.

The need to find options to alleviate Ukraine's debt burden to other governments and commercial creditors was reflected in the H.R. 7081 "Ukraine Comprehensive Debt Payment Relief Act of 2022" bill (2022). Zhuravka et al. (2019, 2021) draw attention to the volatile debt dynamics in Ukraine and propose government debt forecasting models. Bogdan and Lomakovych (2021) note the increased risks of financialization and cross-border capital flows in an environment of high dependence on external debt.

Climate change and the depletion of natural resources reduce productive capacity and lead to the inability to withstand collective threats. With growing climate and environmental threats, the search for new green finance tools for heavily indebted countries continues. Brears (2023), Cassimon et al. (2011), Hansen (1989), and Greiner and Lankester (2007) explored the characteristics of various debt-for-nature or climate-investment swap models.

The concept of “debt swapping for nature investment” is not new. Debt swaps have been used since the 1980s. The initiator of this concept was the well-known American biologist, “godfather of biodiversity,” Thomas E. Lovejoy, who proposed buying foreign debt of debtor countries on the secondary market at a discount (Lovejoy, 1984). After being converted into local currency, the funds were used to purchase biologically sensitive land in the debtor country to protect the environment and conserve biodiversity. In the 1980s, activities were intensified to create environmental funds to protect natural resources. In the 1990s, this concept was actively implemented as part of the “Enterprises for North and South America” initiative (Potier, 1991; Sheikh, 2018) in rainforest conservation programs (Sarkar & Ebbs, 1992).

The first pilot project for using DFC swaps involved four countries with a high level of climate impact: Guinea-Bissau, Mauritania, Cape Verde, and Senegal (Steele & Patel, 2020). In January 2023, Cape Verde announced a first-of-its-kind Debt-For-Climate Swaps Agreement with Portugal as the main creditor (Kelly et al., 2023), following the completion of a pilot project.

As the most powerful non-Paris Club bilateral lender, the attention of China to the use of these innovative tools in the context of its growing role in the system of global governance that is consistent with environmental norms is increasing significantly (Chen, 2019; Nedopil Wang, 2020; Refinitiv, 2020). Yu and Nedopil Wang (2021) and Swanson et al. (2022) revealed the features of China’s participation in the debt restructuring mechanism of developing countries. They analyzed the features of using debt swaps in Belt and Road Initiative (BRI) projects. So far, Ukraine’s participation in BRI projects is limited under the current conditions.

Experts estimate the market for DFN swaps and DFC swaps at USD 800 billion, predicting increased competition between banks in the ESG debt-swap market (White, 2023a). Conclusions are drawn on the advantages of DFC swaps in terms of expanding the budget and fiscal space compared to other forms of green financing (Chamon et al., 2022).

Programs to restore a clean and safe environment are part of an ambitious national action plan – Ukraine’s National Recovery Plan (National Recovery Council, 2022; World Bank, 2023b) and are the focus of the Government of Ukraine. Financing the recovery of Ukraine’s economy takes place with the active participation of the World Bank using a package of initiatives through Ukraine’s Relief, Recovery, Reconstruction and Reform Trust Fund (URTF) (World Bank, 2022, 2023b).

This paper aims to determine the feasibility of combining the tasks of reducing the debt burden and expanding investments in nature in Ukraine, using innovative tools for greening of public finance management, namely debt-for-nature swaps (DFN swaps) and debt-for-climate swaps (DFC swaps).

2. METHODS

This study primarily proceeded from the conceptual approaches to assessing effective public management: the sustainable development of a country depends on the ability to generate GDP without depleting natural resources.

The main steps of the research process:

1. Estimating the macroeconomic dynamics of balanced development, in particular, the growth rate of the value of natural capital compared to GDP per capita growth.
2. Analyzing state debt dynamics and debt burden in Ukraine, based on the processing of statistical data from the National Bank of Ukraine, the Ministry of Finance of Ukraine, and the State Statistics Service of Ukraine.
3. Selecting the options to alleviate state debt burden to other governments and commer-

cial creditors as a part of Ukraine's National Recovery Plan.

4. Determining the possibility of swapping and selecting the most relevant green debt conversion tools (debt-for-nature swaps; debt-for-climate swaps).
5. Debt restructuring and forming a new profile of debt repayments.

The value of natural capital is estimated by the value of a country's natural resources. According to the World Bank methodology, natural capital includes an assessment of renewable capital (agricultural land, forests, protected areas, fisheries). Non-renewable natural capital includes fossil fuel energy (oil, gas, hard and soft coal) and minerals (gold, silver, iron ore, nickel, bauxite, copper, lead, phosphate, tin, and zinc). The monetary valuation of natural capital is based on the balance sheet approach following the standards of SNA (The System of National Accounts) and SEEA (The System of Environmental-Economic Accounting) (World Bank, 2021).

Debt swapping is a form of exchanging an existing debt agreement for a new one that involves "writing off" or "discounting" the value of the original debt. The write-off may be in the form of debt forgiveness. Discounting the cost can be carried out in the form of:

- changing the currency of settlements to minimize currency risks;
- using reduced interest rates;
- purchasing debt by another party in the secondary markets at a lower price for refinancing.

Given the high inflation risks and the significant amount of donor assistance already received, an acceptable form of debt restructuring for Ukraine in green exchange agreements is to reduce the interest rate.

The amount of debt for "green exchange" is determined depending on the opportunities to minimize the gap (SED-FER):

$$\text{Convertible debt} = \left(\frac{\text{State external debt} - \text{Foreign exchange reserves}}{\text{Foreign exchange reserves}} \right) \cdot k_{cd}, \% \quad (1)$$

$$k_{cd} = 10\%; 25\%; 50\%; 75\%.$$

Calculations were made at an interval of 10 years ($n = 10$), interest payments and debt repayment quarterly ($m = p = 4$).

$$\begin{aligned} (\text{SED} - \text{FER}) \cdot k_{cd} &= P_q \cdot a_{m,p}^{n,i} = \\ &= P_q \cdot \frac{1 - (1 + j/m)^{-mn}}{j \left[(1 + j/m)^{m/p} - 1 \right]}, \end{aligned} \quad (2)$$

where *SED* – state external debt, *FER* – foreign exchange reserves, k_{cd} – debt conversion ratio ($k_{cd} = 10\%; 25\%; 50\%; 75\%$), P_q – stable quarterly payout (principal repayment + interest expenses).

Stable quarterly payouts (P_q) are calculated as follows:

$$P_q = \frac{(\text{SED} - \text{FER}) \cdot k_{cd}}{\frac{1 - \left(1 + \frac{j}{4}\right)^{-40}}{j}}. \quad (3)$$

The calculation of the minimum amount of quarterly payouts (P_q) under various scenarios was carried out using a financial model built using Excel (What-if-Analysis; Excel Formula: PMT function; NPV).

3. RESULTS AND DISCUSSION

The value of natural capital is estimated by the value of renewable and nonrenewable natural resources. Thus, for 1995–2018, the cost of Ukraine's natural resources decreased by almost 28% (Table 1), including renewable natural resources by 29% and nonrenewable by 27%.

Unfortunately, for the period 1998–2019, negative macro dynamics took place in Ukraine: the growth of specific GDP amounted to 205%, while the specific cost of natural capital decreased (–17.2%) (Figure 1).

Source: World Bank (2023a).

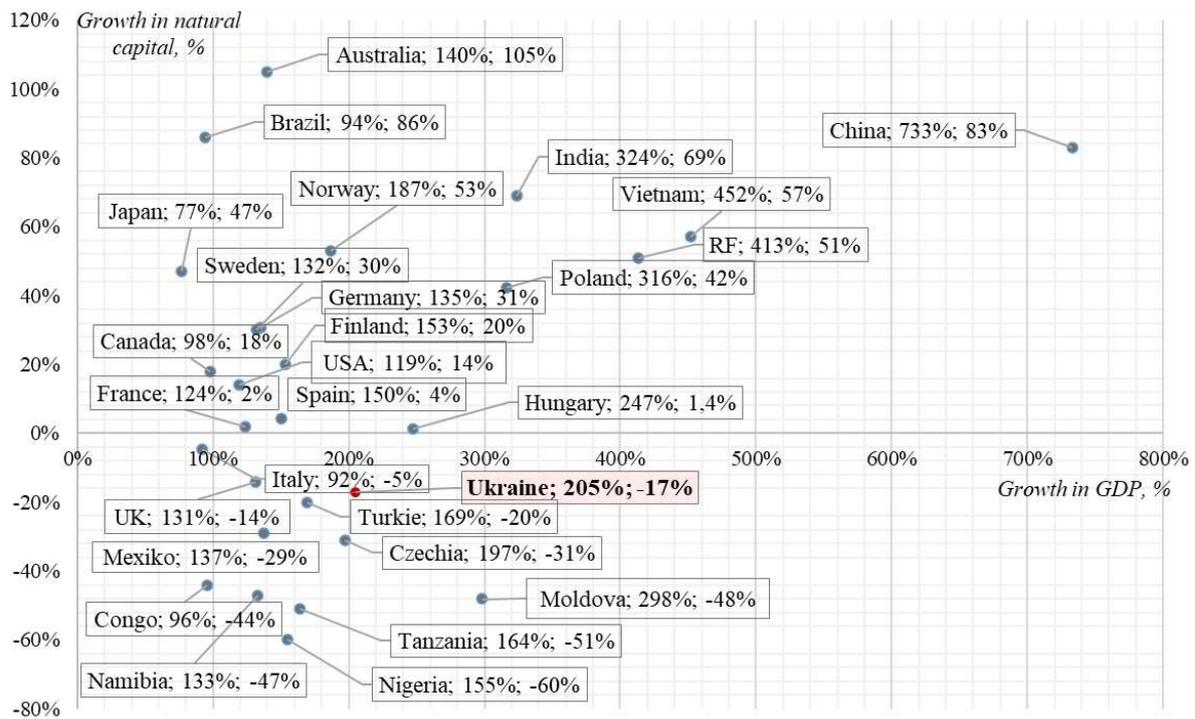


Figure 1. Growth in natural capital per capita and GDP per capita (%), 1995–2018

Table 1. Natural capital of Ukraine (in millions USD)*

Source: World Bank (2021).

Renewable and nonrenewable natural resources	1995	2000	2005	2010	2015	2018
Natural capital	405 318	218 306	285 623	380 070	359 134	290 727
Forests, timber	5 355	6 265	8 232	8 210	8 960	10 537
Forests, ecosystem services	19 748	20 747	24 881	20 611	22 204	18 664
Fisheries	0	0	837	599	398	233
Protected areas	10 235	6 329	7 181	7 514	9 373	9 347
Cropland	203 860	91 941	103 312	107 606	136 186	144 349
Pastureland	62 869	54 226	51 321	39 550	33 645	31 854
Fossil fuel energy	64 206	35 360	81 925	111 725	90 965	54 419
Minerals	39 044	3 438	7 935	84 256	57 403	21 324

Note: * In constant 2018 USD, using a country-specific GDP deflator.

Significant funds are needed to finance measures to restore natural capital and eliminate the consequences of a full-scale war. However, the state’s ability to finance large-scale environmental programs is extremely limited. The analysis of debt statistics testifies to the rapid deterioration of the debt situation in Ukraine.

State and state-guaranteed debt relative to GDP increased from 33.9% to 69.4% over the period 2009–2022 (Figure 2).

It should be noted that the state debt arises as a result of financial borrowing by the state, and the state-guaranteed debt arises as a result of guarantees accepted by the state for the obligations of third parties.

There is a rapid increase in Ukraine’s gross external debt to GDP, which at the end of 2022 amounted to 82.2%, and at the end of the 1st quarter of 2023 reached 90.2%. A significant part of the gross external debt of Ukraine is the state external debt.

Source: Ministry of Finance of Ukraine (2023a, 2023b).

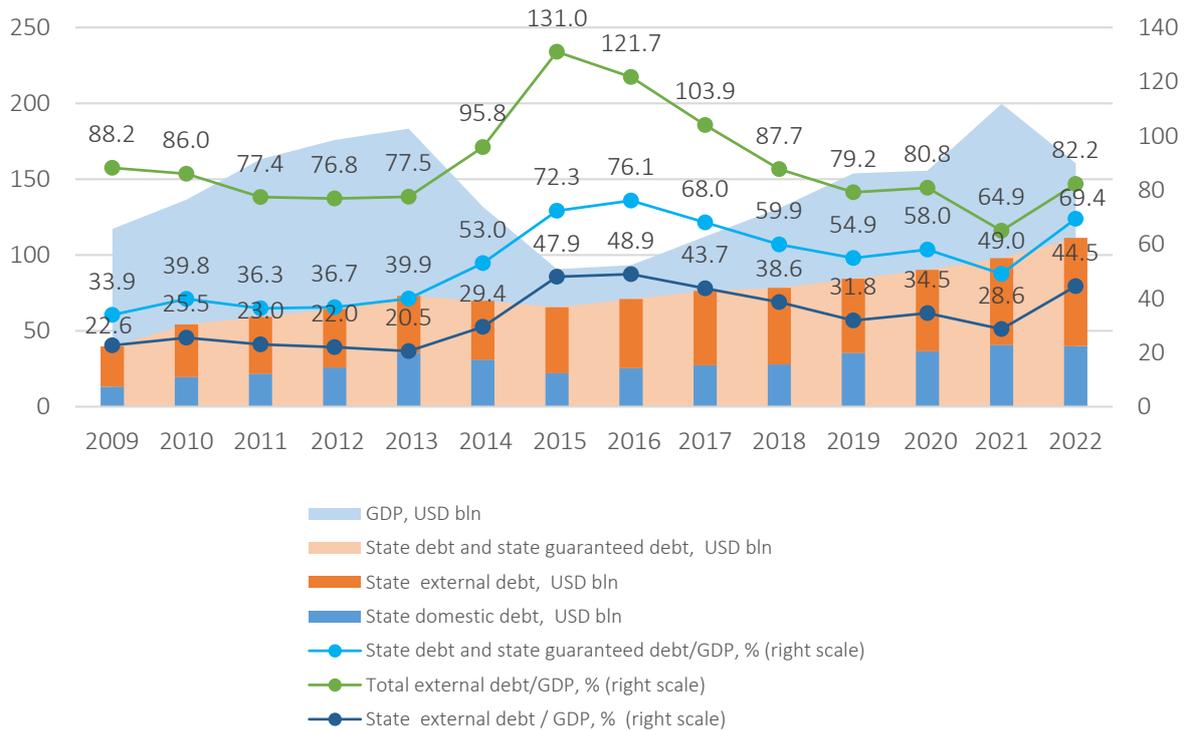


Figure 2. GDP and state debt dynamics in Ukraine in 2017–2022

Thus, in 2009–2022, the external state debt increased from USD 26.5 to USD 71.4 billion. As of May 31, 2023, the state external debt increased to USD 76.7 billion, or 1.6 times as compared to the data at the end of 2009. In the structure of external state debt, Ukraine’s debt to international financial organizations occupies the largest share.

The dynamics of the external state debt concerning the export of goods is extremely negative.

Thus, in 2022, the current value of external state debt increased to almost 1.6 of the value of commodity exports (Figure 3). This characterizes the growing uncertainty of the state’s ability to service the growing debt.

Also noteworthy is the analysis of the dynamics of the state external debt compared to the dynamics of foreign exchange reserves (abbreviated as forex reserves) (Figure 3). Thus, at the end of 2009, the

Table 2. Ukraine’s sovereign credit ratings

Source: Ministry of Finance of Ukraine (2023).

Rating agency	Foreign currency rating		Local currency rating		National scale rating on the country	Outlook	Assignment date/Confirmation date		
	Long-term debt	Short-term debt	Long-term debt	Short-term debt					
Standard and Poor’s (S&P)	CCC	↓	C	CCC+	C	uaBB	Negative	↓	Apr 6, 2023
Fitch Ratings (Fitch)	CC		C	CCC-	C				Jun 23, 2023
Moody’s Investors Service (Moody’s)	Ca	↓	–	Ca	↓	–	Negative		Feb 10, 2023
Rating and Investment Information, Inc. (R&I)	CCC	↓					Review for downgrade		Jul 27, 2022

Source: Ministry of Finance of Ukraine (n.d.a, n.d.b), NBU (2023), SSC of Ukraine (n.d.).

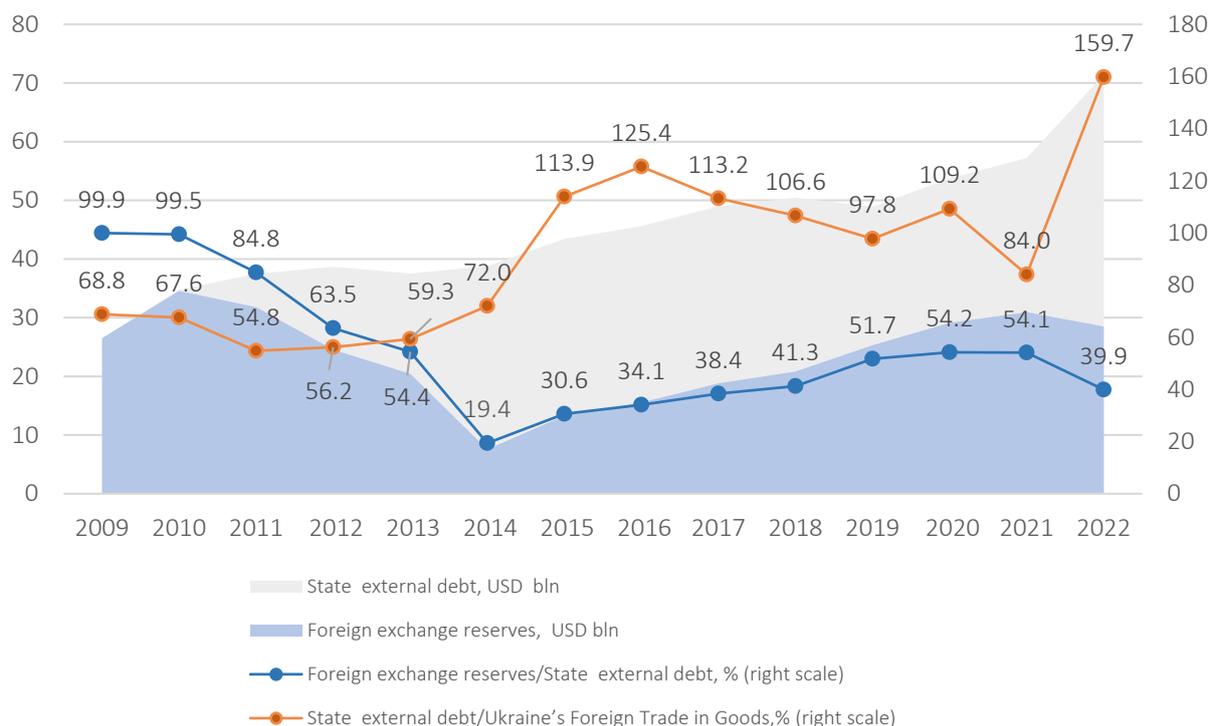


Figure 3. State external debt, foreign exchange reserves, and foreign trade in goods dynamics in Ukraine in 2017–2022

ratio of forex reserves to the state external debt was 99.9%, and at the end of 2022 – only 39.9%. An increase in the gap between the state's external debt and foreign exchange reserves negatively affects the state's rating to foreign investors, weakening the financial ability to protect Ukraine from external shocks and restricting access to the global capital market (Table 2).

Given Ukraine's limited ability to finance environmental protection, what benefits can the country gain from using green debt swaps? A comparative table was compiled to display the main characteristics of these tools and understand the potential effect of their use in Ukraine (Table 3).

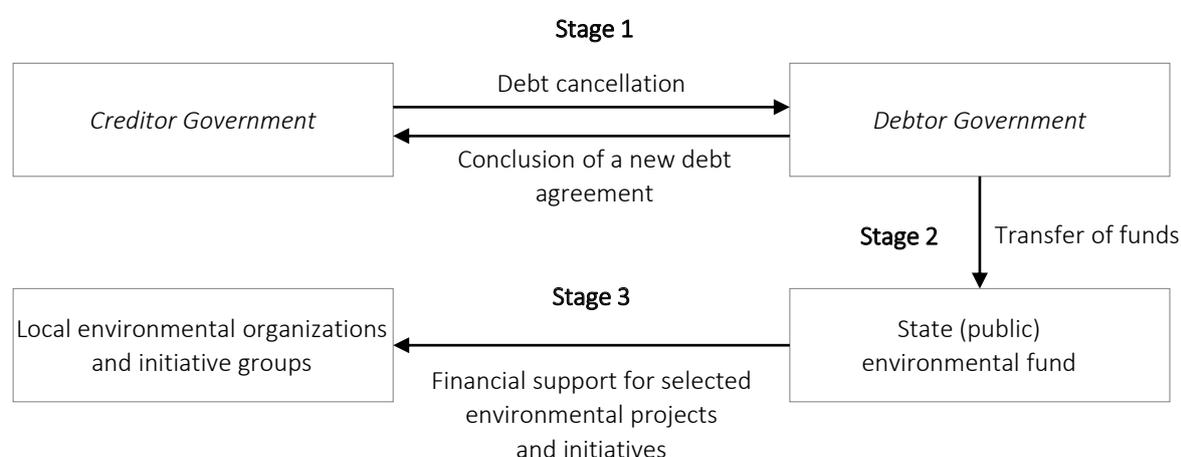
Characterizing these instruments, it should be noted that bilateral debt-for-nature initiatives are based on bilateral agreements between the governments of the debtor country and the creditor country and provide for the cancellation or partial repayment of debt by the creditor in exchange for the obligation of the debtor to invest in nature conservation (Figure 4).

A feature of bilateral agreements is that they are concluded between the government of the debtor country and the creditor country and provide for the financing of environmental activities through the state/public environmental fund. These forms of debt swaps are designed to accumulate a relatively small amount of funds for local use, mainly to finance local environmental projects or those previously funded (e.g., projects to eliminate the consequences of hurricanes, floods, coastal zone resource management, etc.), grant support for environmental initiatives and environmental organizations. Their use in the conditions of Ukrainian practice is possible at the level of individual territories and the implementation of socially significant environmental initiatives at the local level, primarily to solve the problems of conservation/restoration of biodiversity.

In modern conditions, tripartite agreements using DFN and DFC swaps have become widespread. A feature of such agreements is the accumulation of funds with the participation of an international non-governmental organization (NGO). The Nature Conservancy and Conservation

Table 3. Key characteristics of green debt swaps and their potential impact

Key characteristics	Effect: yes (+), no (-)		
	Bilateral Debt-for-Nature Initiatives	Debt-for-Nature Swaps	Debt-for-Climate Swaps
Termination of the previous or conclusion of a new debt agreement	+	+	+
Significant reduction in a country's debt burden	-	-	-
Greater fiscal space and greater flexibility for government decisions on spending sequencing	-	+/-	+
Conversion of outstanding debt into national currency	+	+	+
Obtaining additional sources of financing for environmental protection measures and initiatives	+	+	+
Debt swap based on bilateral agreements	+	-	-
Debt swap based on multilateral agreements	-	+	+
Fundraising with multilateral creditors	-	+	+
Participation in the schemes of an international non-governmental organization	-	+	+
Creating an SPV for Debt-Swap Transactions	-	-	+
Establishment of a donor trust	-	+	+
Use of financial products of International Development Finance Institutions (DFIs)	-	-	+
Financing of individual projects	+	-	-
Financing of national programs	-	+	+
Risks of inflation and devaluation of the national currency	+	+	+
Ability to use WBG financial instruments to manage project finance risks	-	-	+
Ability to use tools for structuring transactions and scaling financial flows	-	+/-	+
The need to comply with environmental and social standards (ESSs), environmental audit	+	+	+
Third-party monitoring, verification of compliance with agreed KPIs	-	+	+
Presence of requirements (political, economic) from the creditor	+	+	+
Growing threat to national sovereignty	-	+/-	+
Possibility of technology transfer and creation of closed technological chains	-	-	+/-
Creation of additional jobs and stimulation of employment in the debtor country	-	+	+

**Figure 4.** Illustrative example of bilateral debt-for-nature initiatives

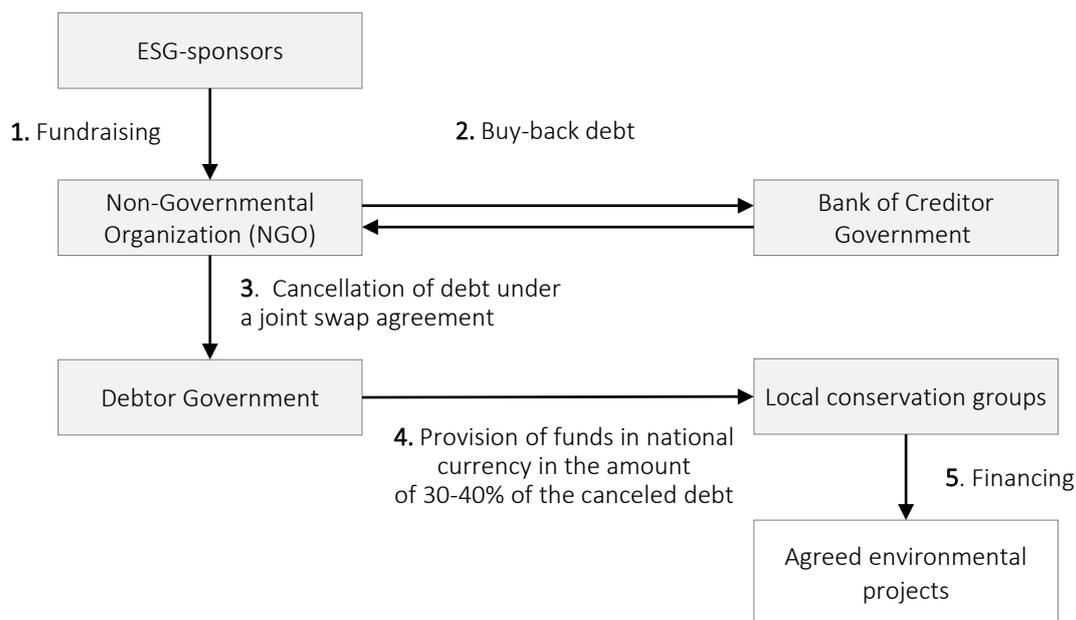


Figure 5. Illustrative example of a three-party debt-for-nature swap agreement

International were the first NGOs to enter such exchange agreements. The purchase of debt from creditors takes place on the secondary market in hard currency at a discount. An NGO, per a joint agreement with the government, writes off the debt in exchange for the government’s obligation to transfer a certain amount for implementing environmental protection measures (Figure 5).

The mechanism of debt-for-climate swaps is more complex, which is similar to debt-for-nature swaps but does not exclude the possibility of scaling cash flows with an expanding pool of potential investors. This type of agreement involves an NGO, creditors, and the government of the debtor country. DFN swaps allow agreements to be structured to achieve larger climate and environmental goals, such as energy decarbonization, climate change adaptation investments, etc. An NGO receives funds from multilateral creditors and ESG investors. The accumulated funds are transferred to a special purpose vehicle (SPV) to finance agreed projects and debt-swap transactions.

The expansion of scaling with the involvement of a wider range of investors is based on financial engineering tools. After receiving a loan from an SPV, the government of the debtor country directs these funds to repay part of the debt in foreign currency. Forms of debt restructuring can be different. In managing financial flows, funds

received from non-governmental international organizations and donors are returned to the SPV (Figure 6).

It should be noted that the structured forms of financing based on financial engineering are widely used in various models with a “return-risk” profile under the requirements of a particular type of investor. Thus, to expand the range of potential investors and clarify the terms of issue (reverse inquiry), the use of structured notes (CLSN, IRLSN) of credit default swaps (CDS) is likely. However, the crisis in the securitized mortgage-backed securities market testifies to the already formed “modus operandi” and possible negative economic consequences and risks of using structured products.

Macro-financial instability increases volatility in the alternative finance market, increasing risk premiums and stimulating the use of additional instruments to ensure the expected return of potential investors. In Ukraine, structured instruments have certain limitations, create additional operational risks, and complicate the control of financial flows.

The study believes that debt-for-investment swaps for green recovery should be part of Ukraine’s National Recovery Plan. The advantages of this approach are:

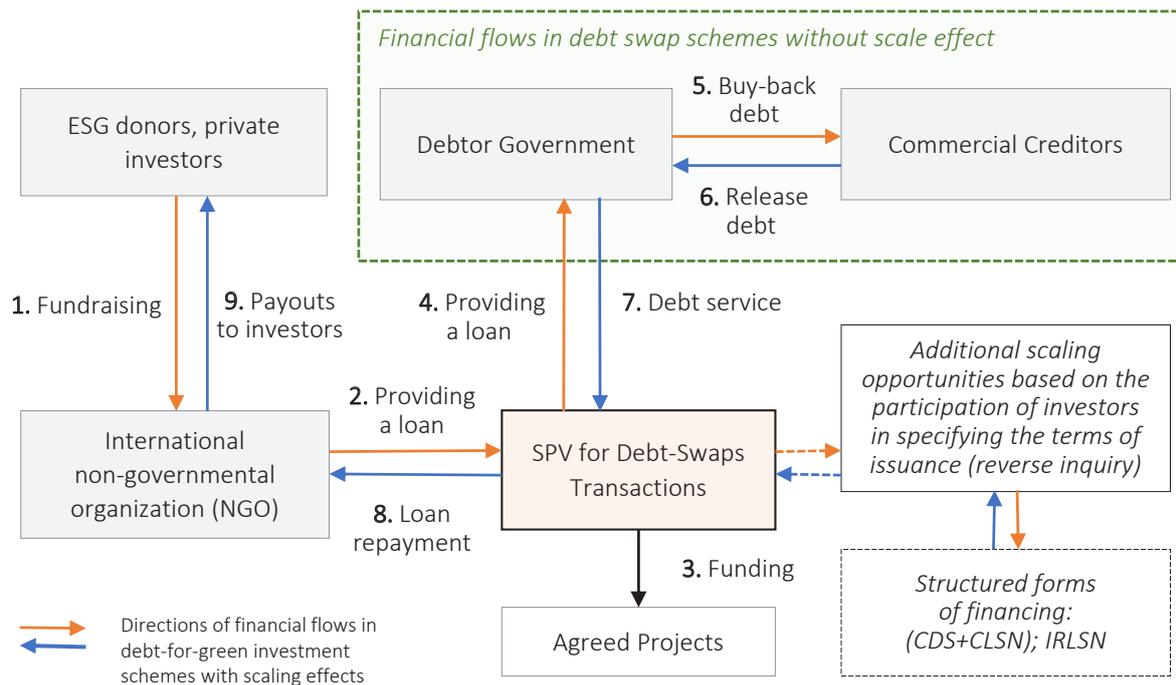
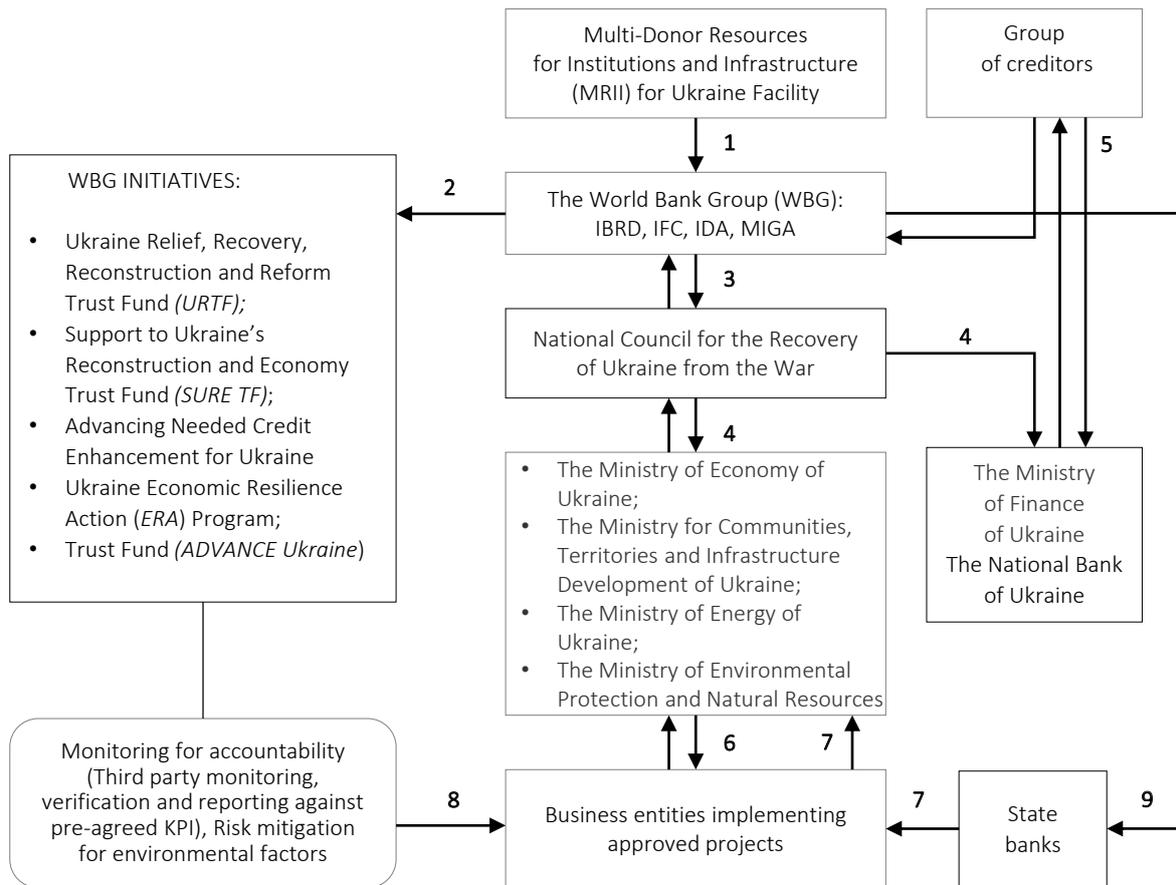


Figure 6. Illustration of the movement of financial flows when using debt-for-climate swaps

- diversification of sources of donor assistance following the goals and focus of national programs;
 - ensuring clear interaction with international financial institutions (WBG, IMF);
 - restructuring part of the external state debt in exchange for Ukraine's obligation to allocate a certain amount of funds for environmental restoration in accordance with the direction of national programs;
 - conducting independent monitoring and organizing reporting to control the implementation of agreed projects and the achievement of planned KPIs;
 - the possibility of using the guarantee instruments of the World Bank Group institutions (IBRD; IFC, MIGA, IDA) by domestic banks involved in financing environmental and climate projects;
 - expanding the practice of greening state finance management with the possibility of applying the experience gained in other sectors of the economy (energy, agriculture, etc.).
- The planned amount of project financing according to Ukraine's National Recovery Plan within the strategic imperative: "Re-build clean and safe environment" is minimal and amounts to about USD 20 billion by 2032, which is only 2.7% of total project funding across all National Recovery Plan programs.
- Therefore, the paper considered options for restructuring part of the external debt in exchange for a commitment to invest in nature. The restructuring aims to reduce the cost of debt repayments based on applying a lower interest rate.
- The results justified the approach of adjusting the discount rate by the country risk premium, aimed at reducing excessive volatility in risk-return models in financial transactions. Thus, the country's (Ukraine) risk premium as of January 1, 2022 amounted to 6.43%, and as of January 1, 2023, its value reached 17.26% (Figure 8).
- Table 4 presents calculations of Ukraine's debt profile under various scenarios. Thus, as of December 31, 2022, the state external debt (SED) of Ukraine is USD 71.3990 billion, foreign exchange reserves (FER) – USD 28.4945 billion. So, according to var-



Note: 1. Accumulation of funds from donor countries and private investors to restore Ukraine. 2-3. Formation of a multi-donor trust to implement World Bank initiatives under the national programs of Ukraine's National Recovery Plan. 4. Approval of a plan to repay part of the debt in exchange for the commitment to implement environmental and climate measures under Ukraine's National Recovery Plan. 5. Restructuring/writing off part of the debt and agreeing to new obligations of the state. 6. Coordination of target indicators, competitive selection of projects to achieve KPIs. 7. Funding of the approved projects. 8. Independent environmental and financial monitoring. 9. Use of WBG financial instruments by banking institutions to manage project finance risks.

Figure 7. The restructuring part of the external state debt in exchange for a commitment to invest in nature as a part of Ukraine's National Recovery Plan

Source: Damodaran (2022).

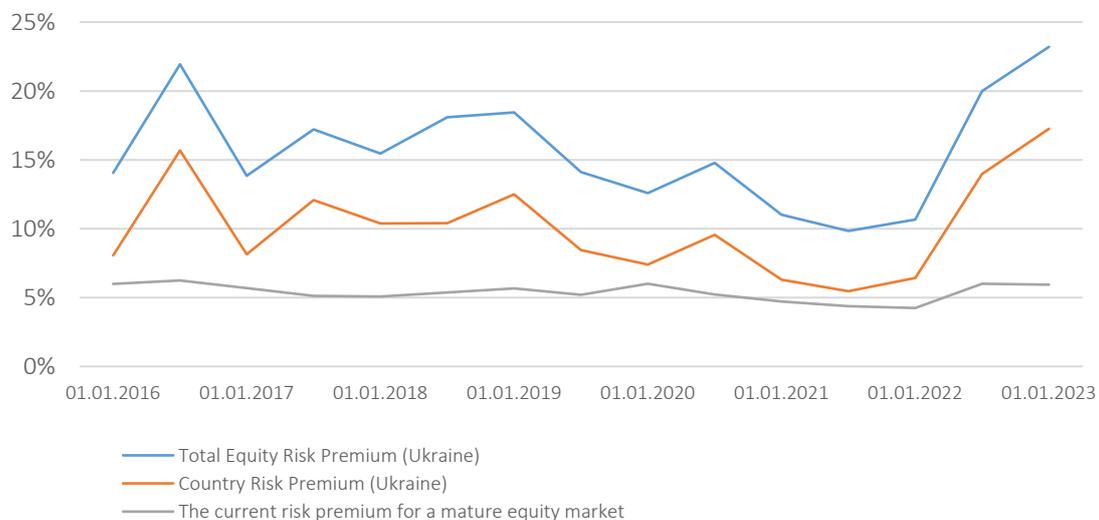


Figure 8. Country risk premium and total equity risk premium for Ukraine in 2014–2023

Table 4. Debt profile

The share of state external debt subject to restructuring, k_{cd}	Payments depending on scenario conditions, USD mln			
	Stable quarterly payout (P_q)	Loan amount = (State external debt – Foreign exchange reserves) * k_{cd}	Total interest expenses	Total payout
1. Total expected risk premium: 5.94%				
The risk premium for a mature equity market: 5.94%, Country risk premium (i_c) – not applicable under debt restructuring terms				
10%	143.025	4 290.454	1 430.548	5721.002
25%	357.563	10 726.135	3 576.371	14 302.506
50%	715.125	21 452.270	7 152.741	28 605.011
75%	1 072.688	32 178.405	10 729.112	42 907.517
2. Total expected risk premium: 23.20%				
The risk premium for a mature equity market: 5.94%, Country risk premium (Ukraine): 17.26%.				
10%	278.021	4 290.454	6 830.389	11 120.843
25%	695.053	10 726.135	17075.973	27 802.108
50%	1 390.105	21 452.270	34 151.946	55 604.216
75%	2 085.158	32 178.405	51 227.920	83 406.325

ious options, the amount of debt converted into green investments is: 4.290; 10.726; 21.452; 32.178 (USD bln).

The study next considers the option with $k_{cd} = 50\%$, which implies debt restructuring in the amount of USD 21.452 billion, which is 30% of Ukraine's external state debt as of December 31, 2022.

Debt restructuring terms are proposed with a new contract at a reduced rate of 5.94%, in line with the current risk premium for a mature equity market as of January 1, 2023:

- Total expected risk premium: 5.94%;
- Country risk premium (Ukraine): 17.26%;
- Total equity risk premium (Ukraine): $5.94 + 17.26 = 23.20\%$.

Therefore, lowering the discount rate by the amount of the country risk premium leads to a significant reduction in debt service costs.

The result of the green debt conversion should be the formation of a new profile of debt repayments and a partial reduction in the debt burden in exchange for financing activities to restore the environment on an ongoing basis. If Loan amount = Convertible debt = 21.452 billion USD, then investments in creating a clean and safe environment over 10 years can be increased from 20 to 41.452 billion USD. Under these conditions, total

government spending commitments decrease: $55.604 - 28.605 - 21.452 = 5.547$ billion USD.

It is worth emphasizing that the state's desire to reduce total costs should not be achieved by refusing to fulfill obligations regarding investments in nature. Thus, in the example above, debt restructuring without additional environmental obligations saves $55.604 - 28.605 = 26.999$ billion USD.

For Ukraine, it may be more effective to solve debt restructuring problems separately and finance rehabilitation and nature restoration. First, there is a need for a large-scale restructuring to reduce the debt burden and then investments in nature. However, the debt burden is increasing, and financing conservation or achieving climate neutrality in the face of chronic budget deficits is becoming increasingly difficult.

Given the increase in debt dependence and the economic crisis in Ukraine, the use of debt swaps will not significantly affect the expansion of fiscal space. At the same time, these new instruments can be used in Ukraine to finance specific environmental or climate projects and initiatives. It is advisable to use foreign experience to create so-called conservation and climate funds at the expense of internal and external ESG investors. To protect against "greenwashing," it is advisable to strengthen control over financial flows and expand the list of key risk indicators (KRI) for assessing risk factors

in the implementation of payment transactions (Mishchenko et al., 2022).

Agreements on the exchange of debt for investments in nature are based on a preliminary analysis of the economic and political situation in the country and provide for the fulfillment of certain requirements of the creditor country. This form of interaction, as evidenced by international practice, is possible in the presence of long-term strategic interests and ties between countries.

The lender puts specific criteria for countries applying for financial assistance. For example, the political criteria for candidate countries for financial assistance include the following: the existence of a democratically elected government in the country; a ban on supporting terrorism; cooperation with the USA in the field of drug control; observance of human rights. The economic criteria are as follows: obtaining a loan from The International Bank for Reconstruction and Development (IBRD) or The International Development Association (IDA) for structural or sectoral restructuring; agreement with the IMF; implementation of investment reforms in the country, as evidenced by the conclusion of a bilateral agreement with the United States and progress in the implementation of the open investment regime (Sheikh, 2018).

However, for small open economies, external borrowing is often accompanied not only by economic obligations to service and repay debts, but also by certain political conditions, which complicates the work of the government in managing external debt (Mishchenko et al., 2019).

It should be noted that green debt swaps are not without their drawbacks. In particular, using these tools does not always contribute to simultaneously achieving the dual goals of nature conservation and debt relief (Georgieva et al., 2022). In addition, there are risks of greenwashing in the ESG debt swap market (White, 2023a, 2023b).

Moreover, increasing funding for nature should not lead to a financial crisis or limit spending on other development priorities. Therefore, the use of debt swaps cannot be based on the adjustment and reduction of funding for other programs of Ukraine's National Recovery Plan. On the other hand, donor grants and concessional loans from development banks for Ukraine cannot last forever and meet the growing needs for financing nature in full. At the same time, new types of swaps do not exclude the possibility of using climate grants, concessional lending, or concessions in heavily indebted countries.

CONCLUSION

This paper aims to determine the feasibility of transforming part of the public debt into investments to create a clean and safe environment using new debt conversion instruments, such as debt-for-nature swaps and debt-for-climate swaps.

The analysis of debt statistics data for the period 2009–2022 demonstrated a critical increase in the debt burden in Ukraine, which significantly limits the state's ability to finance measures to create a clean and safe environment and restore ecosystems affected by the consequences of a full-scale war.

The study characterizes innovative forms of environmental financing based on exchanging part of the state's external debt for obligations to invest in environmental programs and achieve climate neutrality. A comparative analysis of the main instruments of "green debt conversion" was carried out – bilateral debt-for-nature initiatives, debt-for-nature swaps, and debt-for-climate swaps.

The findings present scenarios for the implementation of the concept of debt-for-nature exchange in the conditions of Ukraine based on the reduction in the cost of debt payments and the formation of a new debt profile. The results show the formation of a new debt payment profile, which reflects a partial reduction in the debt burden in exchange for financing activities for environmental restoration on an ongoing basis.

The study results lead to the conclusion that the use of debt swaps should occur within the framework of Ukraine's National Recovery Plan. The state should use additional internal sources of fund accumulation to implement the DFN Swaps Agreement. The study also identified issues and limitations in the use of DFN swaps and DFC swaps in Ukraine.

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REFERENCES

- Bogdan, T., & Lomakovych, V. (2021). Financialization of the global economy: Macroeconomic implications and policy challenges for Ukraine. *Investment Management and Financial Innovations*, 18(1), 151-164. [https://doi.org/10.21511/imfi.18\(1\).2021.13](https://doi.org/10.21511/imfi.18(1).2021.13)
- Brears, R. C. (2023). Debt-for-nature swaps. In R. C. Brears (Ed.), *Financing Water Security and Green Growth* (pp. 73-88). Oxford Academic. <https://doi.org/10.1093/oso/9780192847843.003.0006>
- Cabinet of Ministers of Ukraine (CMU). (2017). *Pro skhvalennia Enerhetychnoi stratehii Ukrainy na period do 2035 roku “Bezpeka, enerhoefektyvnist, konkurento-spromozhnist” [On approval of the Energy Strategy of Ukraine for the period up to 2035 “Security, energy efficiency, competitive-*
- Cabinet of Ministers of Ukraine (CMU). (2023). *Mindovkillia: Vazhlyvi rishennya dlya Ukrainyina Bonnskij konferencyi zi zmini klimatu [Ministry of Environmental Protection and Natural Resources: Important decisions for Ukraine at the Bonn Climate Change Conference]*. (In Ukrainian). Retrieved from <https://www.kmu.gov.ua/news/mindovkillia-vazhlyvi-rishennia-dlia-ukrainy-na-bonnski-konferentsii-zi-zminy-klimatu>
- Cassimon, D., Prowse, M., & Essers, D. (2011). The pitfalls and potential of debt-for-nature swaps: A US-Indonesian case study. *Global Environmental Change*, 21(1), 93-102. <https://doi.org/10.1016/j.gloenvcha.2010.10.001>
- Chamon, M., Klok, E., Thakoor, V., & Zettelmeyer, J. (2022). *Debt-for-climate swaps: Analysis, design, and implementation* (WP/2022/162). International Monetary Fund. Retrieved from <https://www.imf.org/en/Publications/WP/Issues/2022/08/11/Debt-for-Climate-Swaps-Analysis-Design-and-Implementation-522184>
- Chen, N. (2019, September 18). *Green leadership – Belt & Road initiative*. Refinitiv. Retrieved from <https://www.refinitiv.com/perspectives/future-of-investing-trading/green-leadership-belt-road-initiative/>
- Council of the European Union. (2021). *Fit for 55 Package*. Brussels. Retrieved from <https://data.consilium.europa.eu/doc/document/ST-13977-2021-INIT/en/pdf>

9. Damodaran, A. (2022). *Country risk: Determinants, measures and implications*. NYU Stern. <http://dx.doi.org/10.2139/ssrn.4161010>
10. European Investment Bank (EIB). (2021). *The EIB Climate Adaptation Plan: Supporting the EU Adaptation Strategy to build resilience to climate change*. Retrieved from https://www.eib.org/attachments/publications/the_eib_climate_adaptation_plan_en.pdf
11. Georgieva, K., Chamon, M., & Thakoor, V. (2022, December 14). *Swapping debt for climate or nature pledges can help fund resilience*. International Monetary Fund. Retrieved from <https://www.imf.org/en/Blogs/Articles/2022/12/14/swapping-debt-for-climate-or-nature-pledges-can-help-fund-resilience>
12. Greiner, R., & Lankester, A. (2007). Supporting on-farm biodiversity conservation through debt-for-conservation swaps: Concept and critique. *Land Use Policy*, 24(2), 458-471. <https://doi.org/10.1016/j.landusepol.2006.07.001>
13. Hansen, S. (1989). Debt for nature swaps – Overview and discussion of key issues. *Ecological Economics*, 1(1), 77-93. [https://doi.org/10.1016/0921-8009\(89\)90025-6](https://doi.org/10.1016/0921-8009(89)90025-6)
14. Kelly, L., Ducros, A., & Steele, P. (2023). *Redesigning debt swaps for a more sustainable future* (IIED Briefing). International Institute for Environment and Development. Retrieved from <https://www.iied.org/2137Iied>
15. Losenno, C. (2022, November 12). *Delivering on adaptation*. European Investment Bank. Retrieved from <https://www.eib.org/en/stories/adaptation-finance-multilateral-development-banks>
16. Lovejoy, T. (1984, October 4). *Aid Debtor Nations' Ecology*. The New York Times. <https://www.nytimes.com/1984/10/04/opinion/aid-debtor-nations-ecology.html>
17. Ministry of Environmental Protection and Natural Resources (MEPNR). (n.d.). *EkoZagroza [EcoThreat]*. (In Ukrainian). Retrieved from <https://ecozagroza.gov.ua/>
18. Ministry of Finance of Ukraine. (2023). *Credit Ratings 2023*. Retrieved from https://mof.gov.ua/en/credit_ratings_2019-345
19. Ministry of Finance of Ukraine. (n.d.a). *Debt policy*. Retrieved from <https://mof.gov.ua/en/borgova-politika>
20. Ministry of Finance of Ukraine. (n.d.b). *Derzhavnij borg ta garantovaniy derzhavoyu borg [State debt and state guaranteed debt]*. (In Ukrainian). Retrieved from <https://mof.gov.ua/uk/derzhavnij-borg-ta-garantovaniy-derzhavju-borg>
21. Mishchenko, S. Naumenkova, S., Mishchenko, V., Ivanov, V., & Lysenko, R. (2019). Growing discoordination between monetary and fiscal policies in Ukraine. *Banks and Bank Systems*, 14(2), 40-49. [http://dx.doi.org/10.21511/bbs.14\(2\).2019.04](http://dx.doi.org/10.21511/bbs.14(2).2019.04)
22. Mishchenko, V., Naumenkova, S., Grytsenko, A., & Mishchenko, S. (2022). Operational risk management of using electronic and mobile money. *Banks and Bank Systems*, 17(3), 142-157. [http://dx.doi.org/10.21511/bbs.17\(3\).2022.12](http://dx.doi.org/10.21511/bbs.17(3).2022.12)
23. National Bank of Ukraine (NBU). (2023). *Zovnishnij borg Ukrayini na kinec I kvartalu 2023 roku [Ukraine's external debt at the end of Q1 2023]*. (In Ukrainian). Retrieved from https://bank.gov.ua/files/ES/ExDebt_q.pdf
24. National Recovery Council. (2022). *Ukraine's National Recovery Plan*. Retrieved from <https://recovery.gov.ua/en>
25. Naumenkova, S., Mishchenko, V., & Mishchenko, S. (2022). Key energy indicators for sustainable development goals in Ukraine. *Problems and Perspectives in Management*, 20(1), 379-395. [http://dx.doi.org/10.21511/ppm.20\(1\).2022.31](http://dx.doi.org/10.21511/ppm.20(1).2022.31)
26. Nedopil Wang, C. (2020). *Investments in the Chinese Belt and Road Initiative (BRI) in the first half of 2020 during the Covid-19 pandemic*. Green BRI Center and International Institute of Green Finance. <https://doi.org/10.13140/RG.2.2.14360.21766>
27. Potier, M. (1991). Debt-for-nature swaps. *Land Use Policy*, 8(3), 211-213. [https://doi.org/10.1016/0264-8377\(91\)90034-G](https://doi.org/10.1016/0264-8377(91)90034-G)
28. Refinitiv. (2020). *BRI connect: An initiative in numbers* (5th ed.). Retrieved from https://www.refinitiv.com/content/dam/marketing/en_us/documents/reports/belt-and-road-initiative-in-numbers-issue-5.pdf
29. Sarkar, A., & Ebbs, K. (1992). A possible solution to tropical troubles? Debt-for-nature swaps. *Futures*, 24(7), 653-668. [https://doi.org/10.1016/0016-3287\(92\)90074-P](https://doi.org/10.1016/0016-3287(92)90074-P)
30. Sheikh, P. (2018). *Debt-for-Nature Initiatives and the Tropical Forest Conservation Act: Status and implementation*. Congressional Research Service, RL31286. Retrieved from <https://crsreports.congress.gov/product/pdf/RL/RL31286>
31. SSC of Ukraine. (n.d.). *Statystyka [Statistics]*. (In Ukrainian). Retrieved from <https://ukrstat.gov.ua/>
32. Steele, P., & Patel, S. (2020). *Tackling the triple crisis. Using debt swaps to address debt, climate and nature loss post-COVID-19* (Issue Paper). London: IIED. Retrieved from <https://www.iied.org/sites/default/files/pdfs/2022-10/16674IIED.pdf>
33. Swanson, E., Niu, R., Zhu, L., Nedopil Wang, C., & Yue, M. (2022). *Debt for nature swap. A green finance tool for dealing with overseas sovereign debt*. Paulson Institute and Green Finance and Development Center, Fudan University. Retrieved from https://greenfdc.org/wp-content/uploads/2023/01/GFC-2022_China-Debt-for-Nature-Swap-Report_EN.pdf
34. Ukraine Comprehensive Debt Payment Relief Act of 2022, H.R. bill, 7081, 117th Congress. (2022). <https://www.congress.gov/bill/117th-congress/house-bill/7081>
35. UNDP. (2023). *UNDP Signals Spotlight 2023*. Retrieved from <https://www.undp.org/future-development/signals-spotlight>

36. United Nations (UN). (2015). *Paris Agreement*. Retrieved from https://unfccc.int/sites/default/files/english_paris_agreement.pdf
37. White, N. (2023a, January 23). *Barclays sees real greenwashing risk in ESG debt-swap market*. Bloomberg. Retrieved from <https://www.bloomberg.com/news/articles/2023-01-23/barclays-sees-real-risk-of-greenwashing-in-esg-debt-swap-market?leadSource=uverify%20wall&sref=T4>
38. White, N. (2023b, January 11). *Wall Street's new ESG money-maker promises nature conservation – With a catch*. Bloomberg. Retrieved from <https://www.bloomberg.com/news/articles/2023-01-12/bankers-bet-millions-on-sovereign-debt-deals-tied-to-green-goals>
39. World Bank. (2021). *The changing wealth of nations 2021: Managing assets for the future*. <https://doi.org/10.1596/978-1-4648-1590-4>
40. World Bank. (2022). *New multi-donor trust fund established to channel donor support to Ukraine*. Retrieved from <https://www.worldbank.org/en/news/press-release/2022/12/16/new-multi-donor-trust-fund-established-to-channel-donor-support-to-ukraine>
41. World Bank. (2023a). *Responsible use of natural resources: Essential for sustainable growth*. Retrieved from <https://datatopics.worldbank.org/sdgatlas/goal-12-responsible-consumption-and-production/>
42. World Bank. (2023b). *Ukraine relief, recovery, reconstruction and reform trust fund (URTF)*. Retrieved from <https://www.worldbank.org/en/programs/urtf>
43. Yue, M., & Nedopil Wang, C. (2021). *Debt-for-nature swaps: A triple-win solution for debt sustainability and biodiversity finance in the Belt and Road initiative (BRI)?* IIGF Green BRI Center. <https://doi.org/10.13140/RG.2.2.29143.19368>
44. Zhuravka, F., Filatova, H., & Aiyedogbon, J. (2019). Government debt forecasting based on the Arima model. *Public and Municipal Finance*, 8(1), 120-127. [https://doi.org/10.21511/pmf.08\(1\).2019.11](https://doi.org/10.21511/pmf.08(1).2019.11)
45. Zhuravka, F., Filatova, H., Šuleř, P., & Wołowiec, T. (2021). State debt assessment and forecasting: Time series analysis. *Investment Management and Financial Innovations*, 18(1), 65-75. [https://doi.org/10.21511/imfi.18\(1\).2021.06](https://doi.org/10.21511/imfi.18(1).2021.06)