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PROMOTING A PANDEMIC RECOVERY:
EVIDENCE TO SUPPORT MANAGING THE GROWING DEBT CRISIS PROJECT

SUSTAINABLE, INCLUSIVE AND ENVIRONMENTALLY RESPONSIVE DEBT IN UGANDA: IMPLICATION OF COVID 19

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ABOUT RED SUR

The South American Network on Applied Economics (Red Sudamericana de Economía Aplicada, Red Sur), is a policy-oriented research network integrated by public and private universities and centers of knowledge production in the region. It conducts research in the areas of economic development, productivity and innovation, natural resources, inclusive growth, employment, integration, trade and value chains.

Red Sur is interested in promoting regional socio-economic analysis for policy discussion to respond to the challenges of development. The ultimate goal is to generate useful knowledge to address the policy priorities facing the challenge of inclusive and sustainable growth in the region. On this basis, Red Sur promotes, coordinates and develops research projects from an independent perspective and based on rigorous methodologies in coordination with national, regional and international entities.

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SUSTAINABLE, INCLUSIVE AND ENVIRONMENTALLY RESPONSIVE DEBT IN UGANDA: IMPLICATION OF COVID 19

Working Paper of the Project "*Promoting a pandemic recovery: evidence to support managing the growing debt crisis*" (IDRC - Red Sur N° 109742-001)

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Red Sur led the project "Promoting a pandemic recovery: evidence to support managing the growing debt crisis", aimed at restructuring public debt for socio-economic recovery and sustainability in Africa and Latin America and mobilized seven research centres from both regions.

The project was led by Fernando Lorenzo (Centro de Investigaciones Económicas, CINVE/Red Sur). The academic direction of the project and the process of elaboration of this document was carried out by Red Sur Regional Technical Coordination team, composed of Andrés López (IIEP-UBA-CONICET/Red Sur), Ramiro Albrieu (Red Sur), Luis Miguel Galindo (Universidad Nacional Autónoma de México, UNAM) and Álvaro Ons (CINVE/Red Sur).

The researchers and centres by country that made up the project's research consortium in Latin America were: the ARU Foundation of Bolivia, under the leadership of researchers Omar Velasco, Wilson Jiménez, Josué Cortez and Diego Peñaranda. The study in Honduras was led by Luis Miguel Galindo (UNAM), Gerson Urtecho and Sergio Sánchez. The study in Paraguay was conducted by Centro de Análisis y Difusión de la Economía Paraguaya (CADEP), under the leadership of Belén Servín, Juan Cresta, Fernando Masi, Fernando Ovando and Dionisio Borda.

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The series of publications resulting from the project includes the following titles that are published as Red Sur Working Papers and Policy Briefs, available at www.redsudamericana.org:

Number	Title	Authors/Institution
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Working Paper No 5/2023	Estudio País: Construyendo un Futuro Sostenible en Bolivia (in Spanish)	Omar Velasco, Wilson Jiménez, Josué Cortez and Diego Peñaranda (Fundación ARU)

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Working Paper No 6/2023	Estudio País: Construyendo un Futuro Sostenible en Honduras (in Spanish)	Gerson Urtecho, Sergio Sánchez and Luis Miguel Galindo (UNAM)
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Working Paper No 11/2023	Sustainable, Inclusive and Environmentally Responsive Debt in Uganda: Implication of COVID 19	Economic Policy Research Centre (EPRC)
Working Paper No 12/2023	Profile of Ethiopian Debt and Its Institutional Challenges: An Exploratory Analysis	Getnet Alemu and Alemayehu Geda (Addis Ababa University/AAU)
Working Paper No 13/2023	Fundamental and Proximate Drivers of Public Debt in Ethiopia	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
Working Paper No 14/2023	A Two-Edged Sword: The Impact of Public Debt on Economic Growth: The Case of Ethiopia	Addis Yimer, African Child Policy Forum (ACPF) and Department of Economics Addis Ababa University (AAU) and Alemayehu Geda, Addis Ababa University (AAU)

CONTENT

EXECUTIVE SUMMARY

Background

Uganda's debt has been rising since 2010 when the country changed its focus from poverty reduction to development. This paradigm shift saw a frontloading of infrastructure projects to address deficits in the road and energy sectors. This trend has continued with disbursements from the multilateral and bilateral creditors to finance COVID-19 mitigating measures.

Indeed, COVID-19 has re-emphasised the importance of debt management. Uganda's debt stock has increased significantly to 47 percent of Gross Domestic Product (GDP) in 2020/2021 from 41 percent in 2019/20. This debt is mostly non-concessional, with an average weighted interest rate of 14 percent, no grace period, and primarily less than 10 years of maturity. This implies high debt service costs, which may crowd out many drivers of economic growth. There are also concerns about the social implications of the growing debt, especially on the vulnerable groups such as women and youth – whom may disproportionately bear the consequence of reduced expenditure and debt-servicing.

Moreover, Uganda has experienced a shift from traditional creditors, for example, Paris Club creditors, to new bilateral creditors such as China, India and Gulf States (United Arabs Emirates, Qatar, and the Kingdom of Saudi Arabia among others). There is a scope for more information on the size, structure, and terms of debt from the latter group.

In addition, Uganda's debt challenges have a climate change dimension. Yet, the country has not implemented PES (Payment of Ecosystem Services) and PPP (Polluter Pays Principle). Although, some debt-funded projects such as roads and energy projects contribute to a considerable proportion of greenhouse gas emissions.

Objectives

The study triangulates simulations from a Computable General Equilibrium (CGE) and multiplier model with document reviews and perceptions of Key Informant interviews (KIIs) and Focus Group Discussions (FGDs) to address the objectives of the study. The main objective of this study is first, examine the stock, flow and usage of Uganda's debt and the consequences of the emergence of COVID-19 on institutions in the context of promoting transparency, accountability, and participation of youth, women and marginalised groups in the management of debt; second, examine the consequence of new sovereign and private lenders, such as China and commercial banks; and lastly, the study evaluates the impact of debt on environmental degradation and the broader concept of climate change.

Findings

a) Uganda's debt is largely driven by the shift of development focus from spending on social services to infrastructure. However, COVID-19 has partly contributed to the upsurge in debt. The upsurge in debt has, however, not been matched with capacity in institutions that improve accountability, transparency, and inclusivity;

b) There is also an upsurge of debt from new creditors such as China and private commercial banks. However, there is scope to improve transparency and participation in debt restructuring initiatives by the new creditors;

c) The outcomes of the upsurge of debt have also been marked by improvements in indicators of economic growth and development such as tax effort, trade, poverty reduction and employment creation. The improvement in the indicators is stronger if the debt is concessional. However, this positive relationship is not inclusive, as women are left behind; and

d) Debt is increasingly responsible for the usage of firewood and charcoal at household level and petroleum and diesel at production level, which could be partly driving the increase in climate change.

In this regard, the study recommends:

a) Capacity development of Uganda's fiscal institutions to ensure accountability, transparency, and inclusivity in debt management;
b) Reforming Uganda's debt legal framework to reduce debt vulnerabilities and litigation risks from new creditors should be considered;
c) Obtain the right balance between concessional debt, grants and commercial debt;
d) Convince emerging and private creditors to participate in debt participatory frameworks to improve debt transparency and accountability;
e) Design counterfactual monetary policy measures, like using reserves to stabilize the exchange rate and ringfence external borrowing for infrastructure projects that boost productivity and reduce transaction costs across all sectors of the economy;
f) The adoption of policies that can increase the participation of the female gender in the infrastructure construction sector and deal with other factors that may contribute to the non-participation of females such as access to education, ownership of resources and access to information among others; and
g) Use a carbon tax to promote the adoption of clean energy sources for households and implement policies that reduce debt-induced emissions from the use of energy carriers by productive sectors.

LIST OF ACRONYMS

Acronym	**Translation**
APRM	African Peer Review Mechanism
BoU	Bank of Uganda
CGE	Computable General Equilibrium
CGE	Computable General Equilibrium
CH4	Methane
CO2	Carbon Dioxide
Co2 Eq	Carbon Dioxide Equivalent
COVID-19 C	Coronavirus Disease 2019
CRAs	Credit Rating Agencies
EAC	East Africa Community
EAMU	East Africa Monetary Union
ESG	Environmental, Social, and Governance
FDI	Foreign Direct Investments

FGDs	Focus Group Discussions
FY	Financial Year
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GHG	Greenhouse Gas
GWP	Global Warming Potential
HIPC	Heavily Indebted Poor Country
hm3	hectometres
IMF	International Monetary Fund
IMF	International Monetary Fund
KII	Key Informant interviews
MDRI	Multilateral Debt Relief Initiative
MMED	Ministry of Energy and Mineral Development
MMT	Million Metric Tonnes
MMT CO2 Eq	Metric Tonne of Carbon Dioxide Equivalent
MoFPED	Ministry of Finance, Planning and Economic Development
MoWE	Ministry of Water and Environment
MSMEs	Micro Small and Medium-sized Enterprises
N2O	Nitrous Oxide
NDP	National Development Plan
NWSC	National Water and Sewerage Corporation
PAYE	Pay As You Earn
PEAP	Poverty Eradication Action Plan
PES	Payment of Ecosystem Services
PPA	Policy Performance Actions (PPA)
PPP	Polluter Pays Principle
PPPs	Public Private Partnerships
SAM	Social Accounting Matrix
SPS	Sanitary and Phytosanitary
tCo2e	Tonne of Carbon Dioxide Equivalent
UBoS	Uganda Bureau of Statistics
UDN	Uganda Debt Network
UGX	Uganda Shillings
UN	United Nations
USD	United States Dollars
VAT	Value Added Tax

CONTENTS

1. INTRODUCTION

The COVID-19-driven economic shocks call for a review and comparison of ongoing with past responses for better policy outcomes. Matters of debt acquisition, structure, usage and sustainability have increasingly come to the fore following COVID-19 that triggered an economic disruption that has persisted longer than predicted. COVID-19 has induced expenditures beyond what would otherwise be required (IMF, 2020). Besides, implications on low-income countries with limited room for policy support and slower vaccine rollout for some countries (such as Uganda) raise fresh concerns about a vaccine powered recovery and economic resilience. Experiences from past global recession and economic crises, such as the international financial crisis of 2008, the Asian crises of 1997 and the African debt crises that culminated into two rounds of debt forgiveness, namely the Heavily Indebted Poor Country (HIPC) in 1998 and the Multilateral Debt Relief Initiative (MDRI) in 2000, demand a review of current conditions to draw parallels and differences for relevant policy implications (UDN, 2015).

The rise in debt is also, partly, a result of re-emergence of the 5 year development planning. Uganda's debt has been rising since 2010 when the country changed its focus from poverty reduction to development. This paradigm shift saw a frontloading of infrastructure projects to address deficits in the road and energy sectors (Lakuma & Lwanga, 2017). For example, domestic debt through the issuance of fiscal bonds in 2015/16 grew by 6.1 percent of GDP from zero at the beginning of 2013/14 (UDN, 2015). This was almost 20 percent of the entire debt stock in just three years and from only one source of debt (Ibid). This trend has continued with disbursements from the multilateral and bilateral creditors to finance COVID-19 mitigating measures (BoU 2021). Uganda's public debt stock increased by 18.6 percent between June 2020 and January 2021, mainly due to external debt (ibid). This is unprecedented; the pandemic has exacerbated the risks associated with fast-rising public debt accumulation.

Moreover, public debt is projected to increase even further in the medium term, which implies high debt service costs in the coming years. Public debt is likely to rise to support efforts geared towards closing pre-existing and emerging infrastructure gaps in the road and the oil and gas sectors, respectively. In nominal terms, public debt was projected to increase to 49.9 percent of GDP by the end of June 2021, peaking at 54.1 percent in 2022/23 (MoFPED, 2021). This is mostly non-concessional debt, with an average weighted interest rate of 14 percent, no grace period, and primarily less than 10 years of maturity (ibid).

Debt repayment crowds out expenditure on other critical sectors. Current debt trends in Uganda resemble the late 1990s when local and international efforts led to debt forgiveness and cancellations when the country was faced with significant debt service costs. In 2023, debt service (amortization and interest) stood at 35 percent of total government spending when total spending on human capital development programme (education, health and social development) is estimated at 18.2 percent (MoFPED, 2023). On the one hand, public concern has persisted on the cost of keeping up with the pace of debt. For example, in 2015, the government planned to buy back Bujagali dam to cut back on exorbitant energy tariff charged by the private developer (UDN, 2015). On the other hand, there are concerns on the social implications of the growing debt, especially on the vulnerable social groups such as women and the youth – that they will disproportionately bear the burden of increasing debt. The government has primarily managed domestic debt through restructuring duration, increasing the principal and interest due. For example, in the 2023/24 budget the authorities restructured the duration of 16 percent (8,358 billion) of total budget resources (MoFPED, 2023). The limited possibility of future forgiveness calls for capacity building that enables the government to manage debt over time, including gradually reducing debt stock before it reaches critical proportions.

Even more significantly, Uganda's debt challenges have a climate change dimension. The country has adopted but not implemented a carbon price, yet some roads and energy projects contribute to a considerable proportion of greenhouse gas emissions. Therefore, a focus on the role of both public and private capital in addressing climate change by financing sustainable infrastructure is vital. Uganda's infrastructure challenges require a sustained capital expenditure of about more than

USD 1.4 billion per year over the next decade (Ranganathan & Foster, 2012). Uganda already spends nearly USD 1 billion per year on infrastructure, equivalent to about 10 percent of GDP (Mawejje & Munyambonera, 2017). Unless the new infrastructure is sustainable, Uganda mayay lock itself into a high carbon pathway saddled in debt.

The high cost of private credit may disproportionately affect marginalised groups. The yields on the Government of Uganda's bonds remain low—due to massive monetary policy easing (BoU, 2021). The subdued economic outlook primarily due to the COVID-19 crisis has not reduced the overall cost of private credit (ibid). Indeed, lending rates remain high, subduing private sector credit. Without credit, micro small and medium-sized enterprises (MSMEs), which women mostly own, face bankruptcies, especially in the hard-pressed accommodation, education, and food and entertainment sectors. This will affect livelihoods, exacerbate inequalities, and reverse the gains in poverty reduction and inequity improvements. More so among women and girls who earn less, save less, hold insecure jobs or live close to poverty (UN, 2020)

Therefore, this study contributes to the discourse on debt management for improved and sustained economic development. Specifically, this paper sought to, first, examine the stock, flow and usage of Uganda's debt and the consequences of the emergence of COVID-19 on institutions in the context of promoting transparency, accountability, and participation of youth, women and marginalised groups in the management of debt; second, examine the consequence of new sovereign and private lenders, such as China and commercial banks; and lastly, the study evaluates the impact of debt on environmental degradation and the broader concept of climate change.

The rest of the paper is structured as follows: Section 2 outlines the methodology. Section 3 presents the findings of the study on the existing capabilities of institutions in context of debt; the consequences of the new debt market, inclusivity and participatory frameworks; the impacts of debt on macroeconomic variables, trade, tax, interest groups and poverty; and source of climate change and fiscal tools for mitigating debt impacts. Section 4 provides the conclusions and policy recommendations.

2 METHODOLOGY

This paper employed mixed methods composed of document review, computable general equilibrium model and interviews with key informants and focus groups. First, a critical review of past and present debt policy frameworks addressing transparency, accountability, usage, structure, acquisition, and debt sustainability in Uganda was undertaken. Second, the paper calibrated a Computable General Equilibrium (CGE) and a Multiplier model to discern the different economic sectors and demographic groups responses to debt shocks. The comprehensive CGE and the Multiplier model methodologies are documented in a background paper by Asiimwe *et al.* (2023). Lastly, the paper utilised Key Informant Interviews (KIIs) with policymakers and Focus Group Discussions (FGDs) with project-affected communities to complement the information from quantitative analysis. These methodologies are summarised below.

2.1 DOCUMENT REVIEWS

Documents were reviewed to understand and identify interview candidates conversant with the Uganda's debt ecosystems. This review provided a basis for a better understanding of the processes of debt acquisition, structure, usage, sustainability, accountability and transparency for both domestic and foreign sovereign debt; mapping of Uganda's debt ecosystem by documenting past and current debt policy frameworks; documenting of stakeholder participation in policy making during debt restructuring; generating of evidence on public participation and effective citizen engagement; and identifying key stakeholders for conducting KIIs and FGDs. The document review also provided a basis for establishing a framework to identify strengths, weaknesses, opportunities, and threats affecting Uganda's debt ecosystem.

The policy documents reviewed include Uganda's debt sustainability reports. Other document reviewed are Public Debt Management Framework; Medium Term Debt Management Strategy; Debt Sustainability Framework; Public Finance Management Act; Poverty Eradication Action Plan (PEAP); Structural Adjustment Facility Policy Framework Papers; Uganda's long-term development strategies

(Vision 2040 and NDP I, II and III); Annual Auditor General's report; and Uganda Debt Network reports among others. In addition, published debt research papers, legislations, guidelines, monitoring, and audit reports were reviewed.

2.2 COMPUTABLE GENERAL EQUILIBRIUM MODEL AND MULTIPLIER MODEL

First, the CGE model blocks were developed following the four quadrants specified by Sadoulet & de Janvry (1995). These quadrants include demand for commodities, production for the domestic market, production for the export market, and the balance of payment (see Appendix 1).

Second, the paper incorporates carbon dioxide emissions from the intermediate use of energy goods in the CGE model. It follows that the carbon price is an instrument that captures the external costs of greenhouse gas (GHG) emissions usually levied on the carbon content of fuels. Therefore, the paper defines carbon pricing as an explicit price of GHG emissions per tonne of carbon dioxide equivalent (tCo2e) from a given energy source (see Table A1, A2 and A3). Following the World Bank (2016), this paper chose a carbon price of USD 3/tCO2e, equivalent to Ugx 10,500/tCO2e assuming the base year exchange rate of UGX 3,500 per US dollar was used. The paper assumes that energy products are used as intermediate goods by industries, final consumption by households and none is exported. It follows that total carbon tax revenues are determined by multiplying the carbon price by the emissions from intermediate use and final household consumption minus anything associated with exports (for details, see Appendix 2).

Third, the modelling of debt-financed public investments focussed mainly on the energy and road infrastructure. This followed the approach presented by Bwire *et al.* (2016); Gurara *et al.* (2017), and IMF (2015) (see Appendix 3).

Fourth, the multiplier model is used to simulate the impact of debt on household outcomes. The pathway of the impacts is through Leontief coefficients proposed by Pyatt & Round (2006), Llop (2005) and Bandara & Kelegama (2008). The model computes the number of people under the poverty line per category of households; then uses the structural multipliers and poverty elasticity to simulate the impact of debt on household incomes (see Appendix 4). The paper used the 2016/17 Social Accounting Matrix (SAM) for Uganda as the main baseline primary (Tran *et al.* 2020). The structure of the Input-Output framework in the SAM is illustrated on Table A4 in Appendix 5.

Lastly, data on emissions were obtained from the 2017 Ministry of Water and Environment national emission inventory. Data on volumes of biomass energy goods were from MEMD (2016), and those of petroleum products (fossil fuels) were from the UBoS (2021).[1] [2] The SAM was obtained from MoFPED (2022), and data on government borrowing was compiled from various Background to the Budget documents and the National Budget Framework Papers documents from Uganda.

2.3 KEY INFORMANT INTERVIEWS AND FOCUS GROUP DISCUSSIONS

To fill up information gaps that could not be captured quantitatively, the study conducted Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). The sample of KIIs respondents was selected as follows: The first step utilised the Uganda's Public Investment Plan (PIP) to construct the sampling frame by identifying all debt-funded projects in the financial years 2020/21 and 2021/22. The sampling frame was stratified into two categories: The first strata was composed of livelihood enhancement and environmental sustainability projects. While the second strata, was composed of the four regions (Central, Eastern, Northern, and Western) in Uganda. A purposive sample of projects was selected from the stratified sample. Effort was made to ensure that at least one projects was selected in each of the four regions. In this case, projects that had multiple implementation regions, were more likely to be picked than those that were not. This is because such projects offered comparability and variation across regions, implementers, and beneficiaries. This exercise yielded nine (9) projects (Table A5 in Appendix 6).

The second step involved identifying of the Ministries, Department and Agencies (MDAs) in-charge of implementing each of the nine (9) sampled project and listing of relevant project staff. The project staff included project coordinators and site engineers, among others. For each of

[1] MEMD (2016), Table 1.9: Biomass Demand 2016

[2] UBOS (2021), Table 3.3.2: Annual sales of selected petroleum products in million litres, 2016-2020

the sampled nine projects, the research team conducted one KII with the lead person and an FGD (with representation from local leadership, women, men, youth, and elderly) at the project implementation sites in the different regions. The KIIs and the FGDs were guided by a prepared unstructured questionnaire.

3. FINDINGS

This section presents result from triangulation of information from desk reviews, CGE modelling, KIIs and FGDs. In particular, the section discusses Uganda's recent experience with debt accumulation, distribution, and management. The section also discusses the concept of "new" debt in the context of Uganda as represented by increasing influence of new lenders such as China and commercial banks. Most importantly, the section also analyses debt use and the consequence that it has on accountability, inclusivity and transparency. In addition, debt use is also viewed in the context of its impacts on macroeconomic aggregates, policies, households and special interest groups. The section concludes by discussing the varied impacts debt has on climate change.

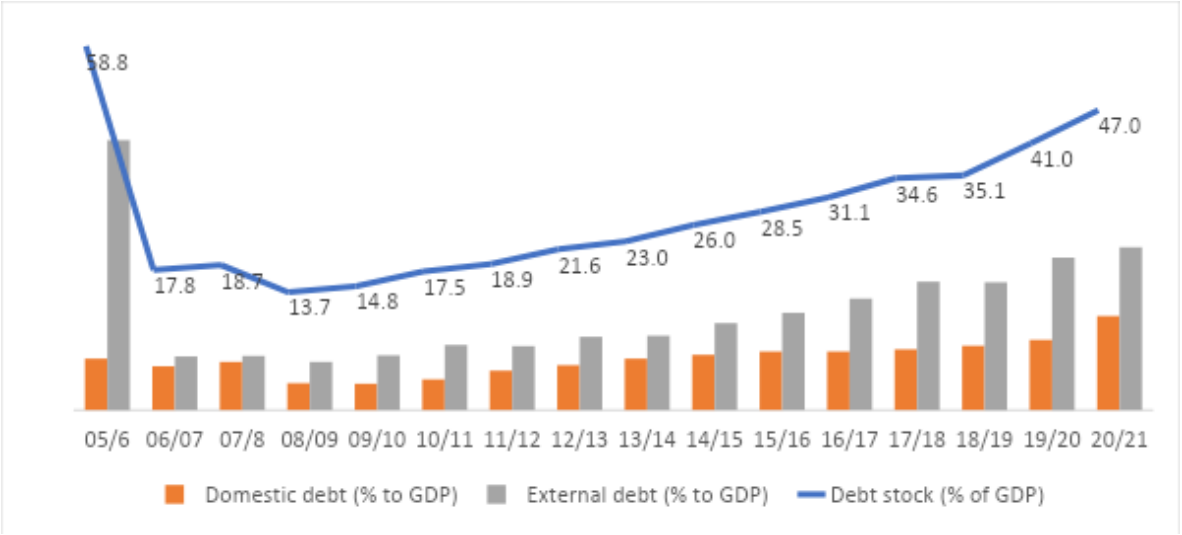
3.1. UGANDA'S DEBT ACQUISITION, STRUCTURE AND SOURCE

This subsection examines the historical stock and flow of Uganda's domestic and foreign debt; the consequences of the emergence of COVID-19 on macroeconomic aggregates; and institutions required to provide transparency and accountability in the acquisition and usage of debt. The section also provides a detailed discussion of the emergence and the consequence of new sovereign lenders, such as China and commercial banks, on structure, acquisition, usage, and institutions required to manage debt.

3.1.1 Structure of domestic and external debt

Uganda's debt structure and acquisition patterns have evolved in tandem with the country's development agenda. The country has shifted focus from social spending to infrastructure development, particularly in the road and energy sectors. Indeed, the end of the Poverty Eradication Action Plan (1990-1997) and the rise of the National Development Plan (NDP) phase (2010 to date) has seen a more than double rise in public debt. Figure 1 reveals that before COVID 19 (between 2010/11 and 2018/19), Uganda's public debt to GDP doubled from 17.5 to 35.1 percent, largely buoyed by projects to address infrastructure deficits in the road and energy sectors.

Figure 1: Evolution of Uganda's public debt

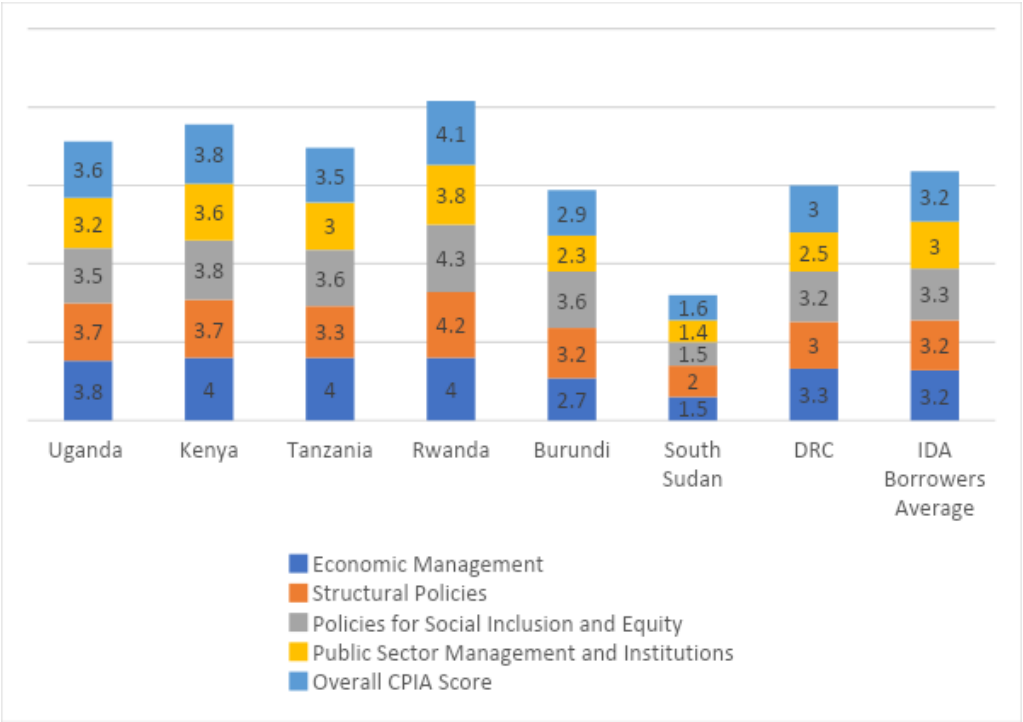


Source: Author's construction based on MoFPED database.

Uganda is at the risk of debt distress. Figure 1 suggests that Uganda's public debt stock has risen to 47 percent of GDP in 2020/21 from 17.5 percent in 2010/11, which is 3 percentage point from 50 percent. The 50 percent threshold is the IMF/World Bank debt sustainability threshold for low income countries (IMF, 2023); and the ceiling benchmark for the East Africa Monetary Union (EAMU) convergence criteria (EAC, 2013). Close to 6 percentage point of this rise is partially attributed to COVID-19 (from 2019/20 to 2020/21). The large public debt to GDP ratio suggests that Uganda has limited space to absorb shocks. As such, a re-occurrence of an extreme economic shock, akin to COVID 19, may lead the country into high risk of debt distress.

The recent increase in Uganda's debt stock has, however, not been matched by efforts and initiatives to improve the performance of institutions that promote accountability, transparency and inclusivity. Figure 2 suggests that Uganda is lagging behind Kenya, Tanzania and Rwanda regarding deepening the quality of institutions that support economic management and implementing policies for social inclusion and equity. In addition, Kenya and Rwanda outperform Uganda regarding institution that support public sector management.

Figure 2: Performance in country policy and institutional assessment for selected countries



Source: Country Policy and Institutional Assessment (CPIA) Africa 2022 report.

Consequently, Uganda has a scope for improvement in economic management. Specifically, in strengthening institutions that conduct monetary and exchange rate policy; fiscal policy; and debt policy and management. Also, policies for social inclusion and equity such as gender equality, equity of public resource use, building human resources, social protection and labour could enhance the qualitative aspect of interventions in the country. In addition, the enhancement of the capacity of public sector management would be prudent in enhancing property rights and rule-based governance, quality of budgetary and financial management, efficiency of revenue mobilisation, quality of public administration, accountability, and reduction of corruption in the public sector. Regarding the above gaps, a key informant reported as below;

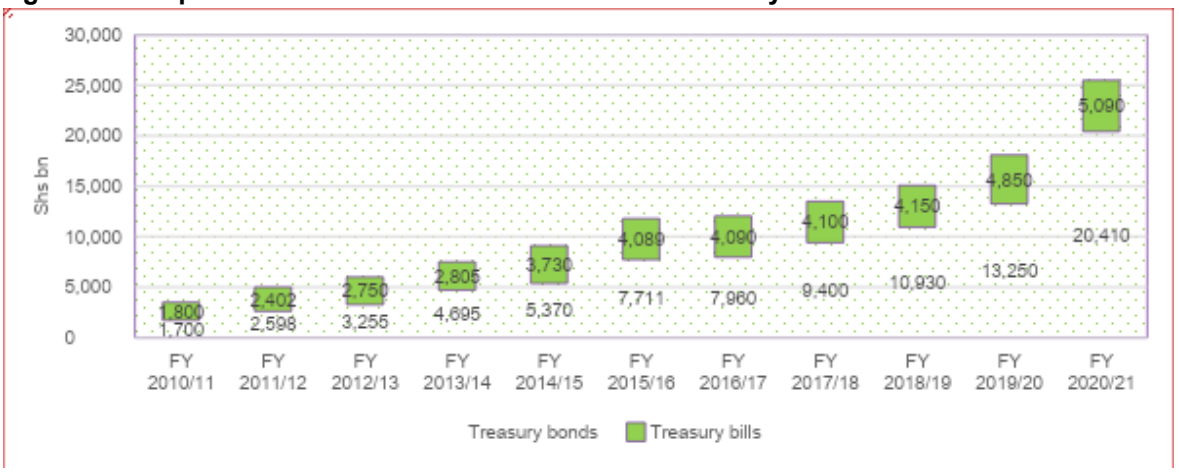
> *While the budget scores so well in terms of transparency, it is still weak considering actual impacts on the issues of credibility. Increasing supplementary budgets and domestic arrears erode the credibility of the budget. This is one of the most critical areas that needs improvement.*

There are also perceptions that corruption is rife, and that some of the policies are just on paper and when it comes to actual work something else is implemented. This creates a lot of uncertainty about what exactly happens in the country and that erodes credibility compared to countries like Rwanda, where policies are implemented to the dot. Debt projects are rarely implemented as envisaged on paper. The policy framework is very fragile. (KII, December 05, 2022)

In addition, there is a scope for improving Uganda's efficiency in implementing debt financed projects. In this regard, KIIs suggested that Uganda's increasing inability to access concessional loans from multilateral lenders such as the World Bank is partly because of the poor absorptive capacity of borrowed funds. Indeed, a key informant stated that in 2022, Uganda could not access USD 600 million in concessional funding from the World Bank's IDA arm due to the slow implementation of existing projects caused by various public investment management challenges.

In relation to composition of debt, the COVID-19 pandemic outbreak was matched with a fast accumulation of domestic borrowing. Domestic debt increased from 15,080 billion in 1018/19 to 18,100 billion in 2019/20 (Figure 3). The composition of domestic debt has also changed. The largest portion of domestic debt comprises longer term instruments, treasury bonds. The share of bonds has increased from 49 percent in FY 2010/11 to 80 percent in FY 2020/21 (Figure 3). The increase in the share of longer dated instruments (treasury bonds) in public domestic debt over the years is consistent with Government's decision to issue more long-term debt. Increasing the maturity of domestic debt reduces the refinancing risk associated with the portfolio and smoothens the redemption / repayment profile.

Figure 3: Composition of domestic debt – Bonds and treasury bills



Source: Author's construction based on MoFPED database

However, domestic debt is used mainly to finance consumptive activities. Domestic debt is used to pay for budget deficits and to address revenue shortfalls that may curtail recurrent expenditures such as salaries, supplies and rent. While MoFPED (2023) suggest that budget deficits have largely been kept at about 6 percent, Uganda faces increased fiscal pressure from sudden revenue drop due to an economic slowdown and new expenditure pressures related to COVID-19.

Consequently, Uganda has reprioritised the budget. Seven (7) sectors, namely, agriculture, health, education, trade and industry, social development, works and energy (Lakuma et al. 2022) have been identified for budget prioritisation. These sectors are key in addressing household and firm production and productivity, providing jobs, reducing the health impacts of coronavirus, supporting poverty reduction efforts, promoting exports and enhancing economic growth (ibid).

Although, leakages in the expenditure system has affected budget credibility, which has hindered potential concessional lenders. As earlier mentioned, Uganda's access to World Bank's budget support instruments has been curtailed by diminishing fiscal discipline and the credibility of public institutions. Indeed, a key informant reported as below.

The World Bank used to offer budget support operations in years between 2001 and 2011 and then Uganda's institutional framework started developing holes. In this regard, there were financial scandals in government institutions namely the Office of the Prime Minister and the Ministry of Public Service. It showed that the institutions are not as credible as they should be for budget support operation, reducing the Bank's use of this instrument in Uganda. The World Bank tried to bring this product back a few times in 2016 and 2018 without success. This is because availing of this financing instrument requires agreement between the World Bank and its other multilateral partners who are not confident about the transparency of Uganda's public institutions. (KII, December 05, 2022).

Typically, countries in moderate debt distress, such as Uganda, may access concessional financing from multilateral lenders by implementing Policy Performance Actions (PPA); debt management, fiscal sustainability, and public investment management.[3] These reforms ensure the country returns to the low risk of debt distress classification. Uganda has agreed to undertake reforms such as limiting new borrowing, VAT law reform in 2022/23 and adopting a legal framework for public investments in Uganda.

As for external debt, even though the share of debt from multilateral creditors remains the largest, the share by bilateral lenders and new creditors is increasingly becoming significant. The percentage of debt by multilateral lenders reduced from 88 percent in 2011/12 to 63 percent in 2020/21 (Figure 4 Panel (a)). However, it should be noted that China's increasing dominance has been slowed by COVID-19. Figure 4 Panel (b) suggest that the largest share (38 percent) of external loan disbursements to Uganda was from China in 2017/18. However, IDA (35 percent) has overtaken China (16 percent) in explaining the largest share of external loan disbursements in 2021/22 (Figure 4 Panel (c)). Nevertheless, China remained the largest source of debt among bilateral lenders in 2020/21 estimated at 21 percent (MoFPED, 2022a). Despite China's increasing role as a source of debt to Uganda, China remains less debt-transparent compared to the multilateral creditors i.e., the World Bank and IMF (Mills, 2019).

While the size and timing of Chinese loans appear in the press, little information is known about the loans' terms and condition. The independent (2019) suggests that China requires Uganda to allow it to supply most inputs to its many infrastructure projects and to open an escrow account in Beijing and deposits money as a guarantee. In addition, Langford and Asiimwe (2014) reported that the bulk of China's debt to Uganda is semi-concessional and is tied to certain infrastructure projects. As such there was no competitive public procurement or independent evaluation of the projects; it is, therefore, not possible to determine the true financing cost and degree of concessionallity of such projects. Indeed, comparing the loan terms for Chinese loans against that of multilateral creditors, a key informant reported the following:

In terms of borrowing, there is not any institution that has better lending terms as World Bank. First, any new loan obtained from the Bank does not have interest, second it has a grace period of 12 years and third, it is payable over 50 years. That is basically more of a grant. Even other multilateral creditors, such as IMF would not provide lending terms as good as that. China has also tried to make some adjustments in their lending terms, specifically in the grace periods, to be closer to non-concessional borrowing terms. However, such adjustment are not sufficient and some of them might have hidden conditions. For instance, Zambia's assets were attached as collateral for debt, although we have not seen that in Uganda. (KII, December 05, 2022).

However, the clamour for Chinese loans has partly been driven by stringent terms and conditions imposed by alternatives provided by multi-lateral lenders. Indeed, a key informant reported that World Bank lending comes with strict conditionalities sometimes requiring initial commitment by borrower countries to spend a significant amount of the disbursed debt on priorities that may not be in the borrower's development agenda such as catering to refugees. Conversely, China does not restrict areas to which its lending could be expended. However, the World Bank has

[3]https://www.finance.go.ug/sites/default/files/Publications/DEBT%20SUSTAINABILITY%20ANALYSIS%20REPORT%20FY%202021-22.pdf

noted that additional grant is provided for projects that address critical issues that refugees and environmental preservation.

Concentration of Chinese loan on infrastructure, partly contributes to lack of transparency. Reisen (2014) reported that because China's lending is concentrated in infrastructure development (i.e., for resource extraction, telecommunications, and transport), lending is based on a barter system. In this system, funds are not directly lent to the recipient country, but rather Chinese government mandates a Chinese construction company (that usually receives support credit from China's Exim Bank) to undertake the construction work after the approval of the recipient country. Then, in exchange for the infrastructure provision, the borrowing government gives to a Chinese company operating in the field of natural resources (mostly oil or minerals), the right to mine natural resources through acquisition of equity stakes in a national oil company or through acquiring licenses for production. Mihalyi *et al* (2020) reported that resource-backed loans are more likely to exacerbate debt distress for resource-rich poor countries than slow it. This is because such loans have opaque contractual terms and are usually contracted by state owned enterprises that neither publish audited financial statements nor provide the data to national debt offices.

In addition to the above shortfalls, Chinese construction firms have in some instances exploited loopholes in the borrower country laws, and weaknesses in monitoring and institutional frameworks to cause environmental degradation during implementation of infrastructure projects backed by Chinese debt. For instance, during the construction of a road project in central Uganda, key informants reported the following about QingChong International Construction Corporation (QICO) in Uganda;[4]

> *During the implementation of the "Rehabilitation of Masaka Town roads (7.3Kms)" project. QICO excavated murram soil for road works from the hilltop, leading to the creation of large ball pits, which were never filled. This distorted the natural flow of water from the hill resulting in serious flooding and the destruction of peoples' property downhill. The poor management of ball pits has destroyed other surrounding community roads by creating very large galleys, making the roads impassable. More so, the contractor has for long-time operated ball pits without an environmental certificate from National Environmental Management Authority (NEMA). While the city environmental officer approved two soil-damping sites, QICO, has continued to damp construction soil in wetlands. The largest victim of this wetland is the Nakayiba wetland. In addition, the construction of the road caused a lot of dust that was not adequately controlled, destroying people's businesses and health. The contractor used to water the road only once in a bid to save money--- this was not adequate*

Considering the above, indebted countries to enter bilateral deliberative mechanisms to ensure full transparency and accountability on debt by China─ through their companies. This could alleviate vulnerabilities associated with Chinese resource-backed debt. These bilateral engagements would clarify the debt source and hence terms and conditions from bilateral lenders. Indeed, a key informant reported that while Uganda has acquired debt from China ─ specifically from the China Exim bank, it is sometimes difficult to distinguish whether it is bilateral or from private commercial banks.

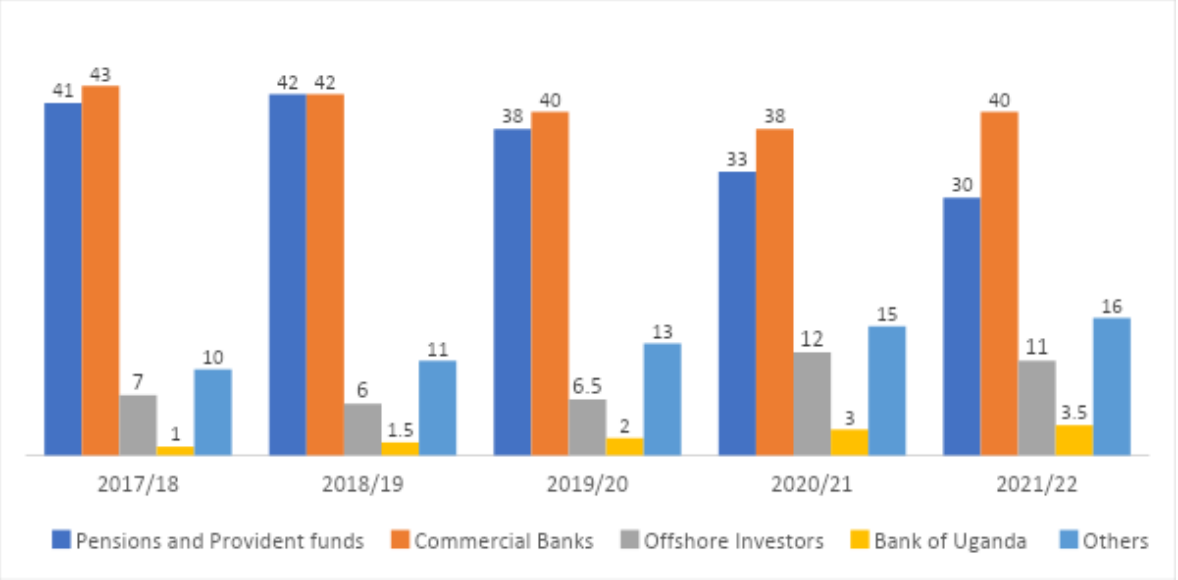
> *Uganda needs to build institutions that promote debt transparency, to make sure that the country does not incur debt that it cannot openly discuss the terms and conditions. Actualising this requires amending the legal framework to categorically indicate that if a source of debt cannot be published then it cannot be sovereign debt. However, many times you hear (sic) that the terms cannot be released because the legal agreement with the creditor has not been allowed. Hence, there is a need to adjust our legal framework to be able to counter such incidences.*

[4] Name changed

3.1.2 The role of new creditors in specific contexts of debt distress in Uganda

The emergence of the COVID-19 pandemic saw an increased penetration of offshore private creditors and increased domestic private commercial borrowing by Government. Indeed, between (2018/19 -2021/22), following the outbreak of the COVID-19 pandemic, the share of offshore investors in Uganda's debt portfolio, almost doubled from 7 percent in 2018/19 to 11 percent in 2021/22 (Figure 5). Considering domestic debt, commercial banks continued to hold the largest share of domestic public debt– at 40.1 percent by the end June 2022. These were followed by pension and provident funds at 29.8 percent, down from 33.7 percent the year before. Offshore investors flocked to the Ugandan market in FY2020/21, nearly doubling their share of domestic debt to 11.6 percent (Figure 5). While this might signal increased confidence in Uganda's economic management, both external and domestic private commercial debt is expensive and is typically availed at a higher cost than concessional multilateral/bilateral debt.

Figure 5: Uganda's debt by holder, %



Source: Author's construction based on MoFPED database.

However, the participation of private lenders should understood against a backdrop of a finite source of finite concessional/ semi concessional funding. In addition, private lenders plays a critical role in deepening the structure of domestic financial markets and accelerating the depth and structural efficiency of the domestic market, for a deep domestic financial market would curtail the externalisation of debt. Private lenders are also critical in identifying and incubating Public Private Partnerships (PPPs), which eases the pressure on government's balance sheet. In addition, commercial banks have varied roles to play such as financiers and advisors to the various financing options and actors identified in the 2022 public investment strategy.[5]

As financiers and advisers' private lenders offer many skills and experiences that is under appreciated in many domestic debt offices. For instance, private lenders bring in rigor in debt analysis as a way of keeping both lender and borrower honest with each other; a deep pool of investor base from across the global given their financial gateway status for investment flows into Africa; and a rich experience in crafting risk management solutions. A KII with a commercial bank reveals:

> Dialogue in truly understanding the Sovereign's needs. In many instances, this has resulted in very bespoke funding and risk management solutions in additional to continuously improving the tool kit available to our public debt managers. One such example is an interest rate protection framework that we executed that has protected GoU from exposure to the now very

[5] The 2022 public investment strategy identifies the traditional domestic/ bank financing, equity financing, FDI, Crowdfunding, Philanthropy, Climate finance, Islamic finance, etc as the financing options available to Uganda.

high dollar interest rates—almost more than 2% protection. We continue to engage, as a market, on other financing options such as infrastructure bonds to arrive at appropriate funding structures for the different development needs.

On Crises such as Covid: With approvals from Bank of Uganda, about of 40% (approximately UGX 7.2trillion) was restructured. More than 70% of this money has since paid off. As a bank, we then followed this intervention with initiatives such as the Enterprise restart fund where we have reached more than 260,000 Ugandans through the SACCOs fund. A key lesson for us drawing up on more partnerships at times like these.

On the Environmental, Social, and Governance (ESG) matters: The Uganda Bankers Association has embarked on a project that will put in place a framework for measurement tools, guidance on E&S risk appetite, organisational structures to embed the agenda, reporting tools and frameworks, etc all of which aimed to embedding ESG matters in our lending practices.

The rise of new creditors has re-emphasised the importance of Credit Rating Agencies (CRAs). Private creditors' investment decisions in the international capital markets are guided by credit ratings assessed by CRA with respect to credit worthiness of sovereign debt and their assessment of the default risk. In this regard, credit ratings and opinions by CRAs on the credit worthiness of sovereign debt and their assessment of the default risk can improve or reduce chances of access to international capital markets by African countries. Credit rating Agencies have an impact on the investment decisions of private creditors, specifically the Eurobond market. In the advent of COVID-19 pandemic, many African countries spent between one and seven percent of their Gross domestic product (GDP) on stimulus packages (United Nations, 2020a). As such many of these countries experienced a downgrade of their sovereign credit ratings. Since the outbreak of the COVID-19, 20 out of 32 African countries have been downgraded and/or given negative outlooks by either Fitch, Moody and Standard & Poor (United Nations, 2022). Specifically, Africa's downgrades (62 percent) are disproportionally higher than that of the global average of 31 percent (Fofack, 2021).

Private commercial creditors rely on CRAs to make lending decisions, as such the country risks downgrade owing to a biased credit rating by CRAs. A downgrade will likely increase Uganda's borrowing costs and the risk of debt overhang. Considering the increased risk of biased credit rating and credit downgrades by CRAs, key informants suggested the need for developing countries to establish their own domestic CRAs, while emphasising the credibility of those domestic CRA.

> *Whether CRAs are biased or not does not stop developing countries from coming up with their credit rating institutions to double check the authenticity of international rating agencies. When we use, for example, an African credit rating agency, when we look at the risks and frameworks (sic), we think the country should be going in this direction as opposed to what the international credit rating agency is proposing can be a very useful institutional framework to counter claims that international credit rating agencies are biased.*

Besides having an impact on the international bond market, downgrades by sovereign credit rating have a cascading effect on direct foreign investments. Specifically, in 2020, the downgrading of sovereign credit rating resulted in an 18 percent decline in foreign direct flows in African countries from USD 46 Billion in 2019 to USD 38 Billion in 2020 (United Nations, 2021b). The APRM (2019) reported that it takes an average of seven years for a downgraded developing country to regain its previous rating.

3.2. DEBT USAGE

This sub-section addresses the issue of the usage of debt and the outcomes of the usage on several pre-identified development indicators. This helps in the determination of whether debt acquisition is

having an impact on ordinary citizens. Channelling debt resources into productive projects such as infrastructure development yields positive returns, as opposed to dead weight debt.

3.2.1 Impact of debt on macroeconomic variables

Uganda's debt level, and the interest payments accrued to it, is a major source of capital outflow. The low domestic revenue collection levels relative to the expenditure needs has led to continuous borrowing, further worsening the debt level. Experience from various countries has shown mixed results from using borrowed resources on macroeconomic variables. On one hand, some studies such Loganathan, Sukemi, & Sanusi (2010) and Loganathan, Sukemi, & Sanusi (2010) show that unproductive debt is detrimental to economic growth and development. For example Kumar & Woo (2010); and Zouhaier & Fatma (2014) show that a 10 percent increase in external debt as a percentage of GNI decreases economic growth by 0.27 percentage points. On the other hand, Ebhotemhen (2020) found that prudent management of debt, as provided in Box 1, in Nigeria led to economic growth. Similarly, Baum et al (2013) concluded that there is a positive effect of public debt on economic growth in the short run, but the significance of this relationship diminishes when debt reaches beyond 67 percent of GDP.

Box 1: Debt Burden Thresholds and Benchmarks in the Debt Sustainability Framework

	Present Value of External Debt (%)		External Debt Service (%)		GDP
	GDP	Exports	Exports	Revenue	
Strong	50	240	21	23	70
Medium	40	180	15	18	55
Weak	30	140	10	14	30

Source: World Bank and IMF 2023

Yet, there is a positive relationship between Uganda's government borrowing and indicators of economic growth and development. Projection based on the CGE model presented in Table 1 shows that investments from debt resources boosts economic growth (real GDP), on average, by 2.5 percent per annum between FY 2022/23 and FY 2026/27. However, debt-driven real GDP growth gains reduce over time. For example, the annual real GDP growth is expected to reduce to less than a percent from FY 2026/27 to 2032/33.

Table 1: Percentage changes of macroeconomic economic variables

Simulation Period	Real GDP	Firm Income	Absorption	Household consumption	Real GFCF
2021/22	3.07	15.95	5.52	4.18	16.68
2022/23	2.64	13.70	4.81	3.61	14.62
2023/24	3.06	15.98	5.57	4.20	16.92
2024/25	2.35	12.19	4.34	3.23	13.29
2025/26	2.08	10.80	3.88	2.87	11.95
2026/27	0.62	3.14	1.17	0.85	3.69
2027/28	0.59	3.01	1.13	0.82	3.55
2028/29	0.56	2.88	1.09	0.78	3.42
2030/31	0.54	2.76	1.04	0.75	3.30
2031/32	0.51	2.64	1.00	0.72	3.18
2032/33	0.49	2.53	0.96	0.69	3.06

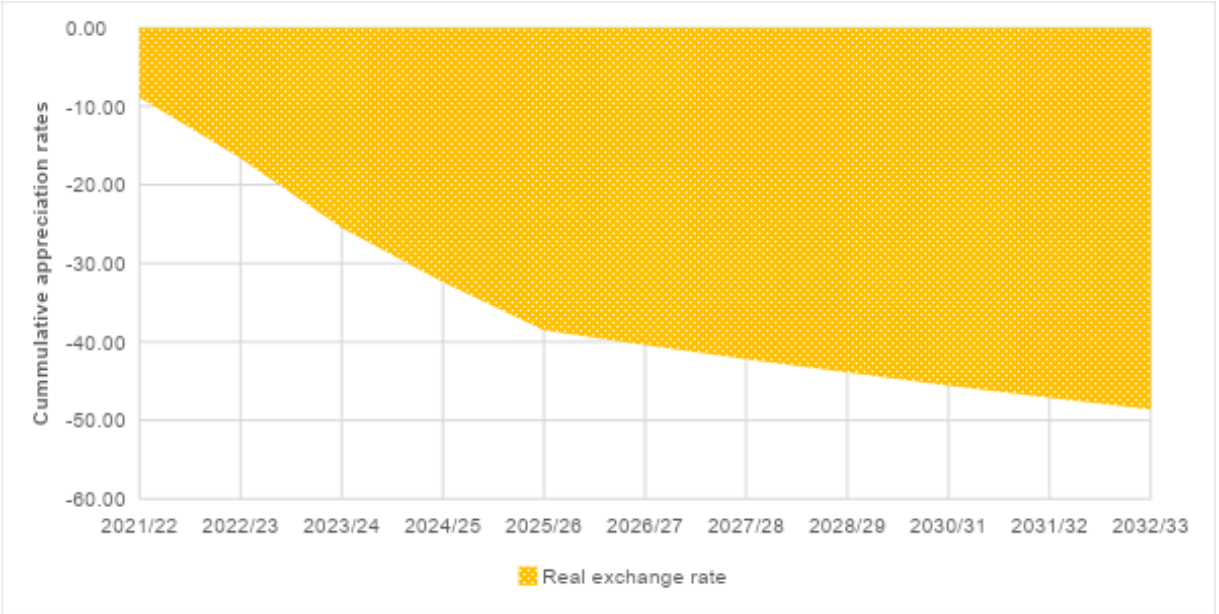
Source: Authors on Construction from Uganda's CGE model

More importantly, concessional loans are instrumental in explaining real GDP growth. Concessional loans are currently used to finance government projects like the construction of industrial parks, rehabilitation of district roads, construction of dams, and support for rural water supply, among others (see Figure A1 in the appendix for projections of concessional loans). These productive government expenditures boost the growth in Gross Fixed Capital Formation (GFCF). As a result, the study findings reveal that GFCF will grow, on average, by 14.6 percent between FY 2021/22 – FY 2025/26. In addition, Table 1 also shows that the increased economic activity boosts the profitability of firms, thus raising firms' income by an annual average of 13 percent between FY 2021/22 – FY 2025/26. This is because channelling of debt resources to expand infrastructure such as road construction increases accessibility to markets and reduces costs such as transportation, which increases the overall income margins of firms.

3.2.2 Impact of debt on trade policy

Interest payments accrued on external debt creates demand for foreign currencies leading to the depreciation of the domestic currency. Projections based on results presented in Figure 6 suggest that the real exchange rate will depreciate, on average, by 7.7 percent per annum between FY 2021/22 – FY 2025/26 and later 1.7 percent for the subsequent period ending FY 2032/33, holding other factors constant. According to the (MoFPED, 2022), the depreciation is attributed to the recently increasing debt levels that has driven debt service as a percentage of revenue to over 30 percent in FY2021/22 and is projected to further increase in FY 2022/23, due to heightened domestic interest rates as well as the increasing cost of external debt (ibid). This is evident in some country case studies such as Alam & Taib (2013) who found a positive relationship between external public debts with exchange rate depreciation. This means that the depreciation of the domestic currency is correlated with cheaper exports and expensive imports. Fewer imported goods in relation to the increasing exports improve the balance of payment.

Figure 6: Cumulative exchange rate depreciation resulting from debt



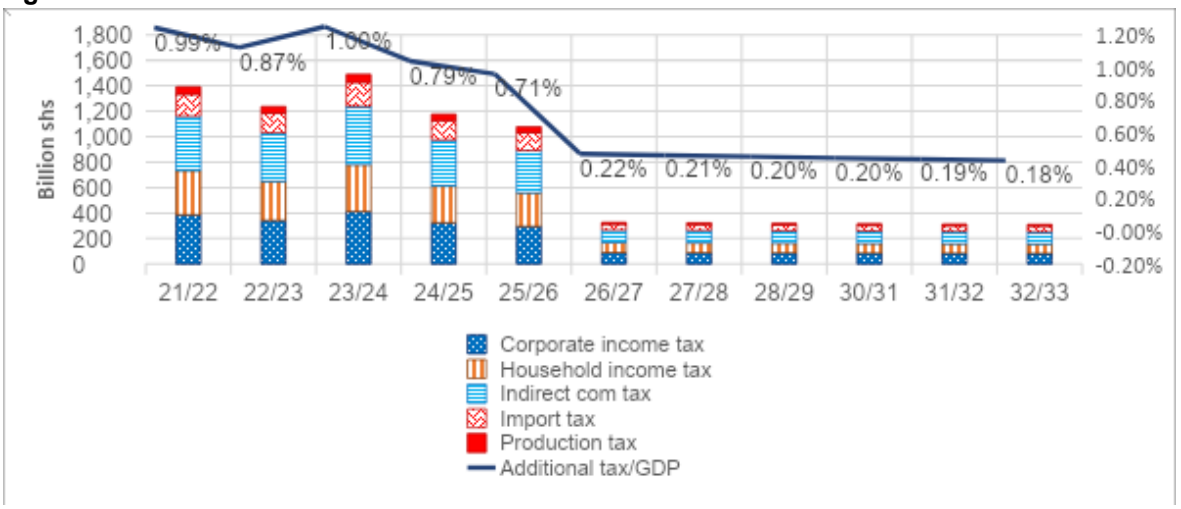
Source: Authors on Construction from Uganda's CGE model.

3.2.3 Impact of debt on tax collections

There is a positive impact of debt on tax collection and the results are stronger if the debt is concessional. This is because productive debt boosts government investments which leads to procurements of investment commodities and their production by the respective sectors, thus increasing the tax base and collections**.** The projections of concessional debt are estimated to induce additional tax collections approximately by 0.9 percentage points of GDP annually between FY 2021/22 – FY 2025/26 (Figure 7). Since new debt is programmed to reduce as oil sector becomes

commercial in FY 2024/25, tax collections from the investment of new debt also reduces to an average of 0.2 percent of GDP for the rest of the simulation period. The largest portion of the tax head is the indirect commodity tax. The indirect commodity tax takes largest share given that it is paid by all consumers of goods and services regardless of their income status and, therefore, it is hard to evade. It is then followed by corporate income tax, household income tax (PAYE); tariffs and production taxes (Figure 7).

Figure 7: Tax collections due to concessional loan disbursements

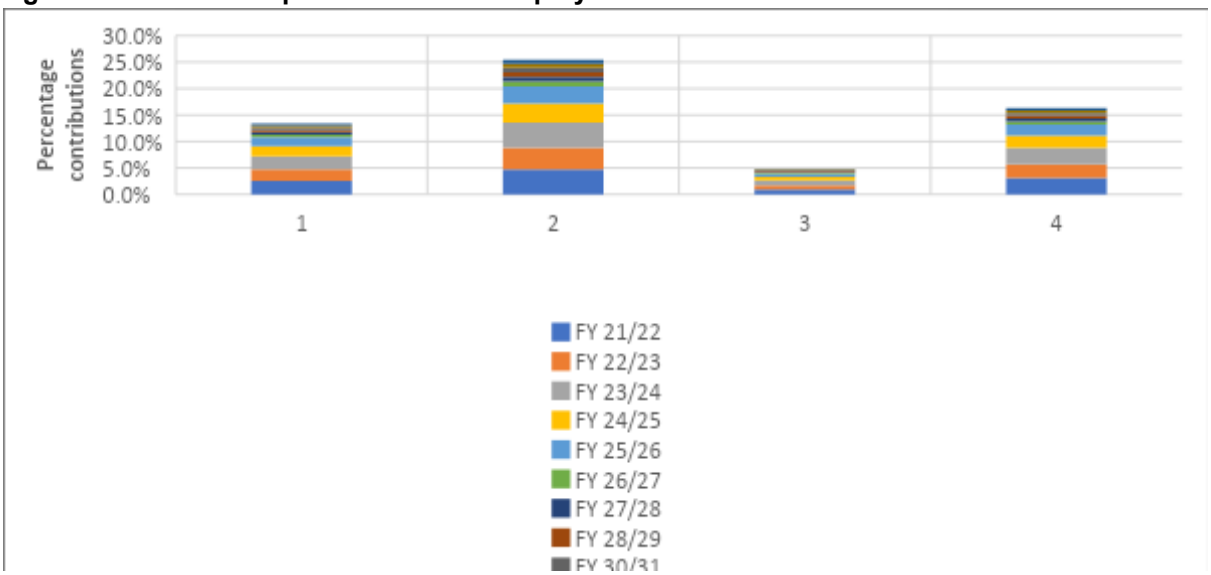


Source: Authors on Construction from Uganda's CGE model.

3.2.4 Gendered impact of debt on employment

Rural males dominate most debt driven jobs. The male gender and rural workers were found to dominate the new jobs created. This is because of the current structure of the economy where jobs in infrastructure development are largely dominated by men and are rural based. Figure 8 suggests that total employment increases by an annual average of 5.5 percent from FY 2021/22 to FY 2032/33. Of these increases in jobs, increases in rural jobs contribute 3.6 percentage points and urban jobs account for 1.9 percentage points. This shows that Uganda's debt disbursements especially for infrastructure developments creates more jobs for rural labour than urban labour. This is largely because of two reasons. First, the debt-financed infrastructure developments like hydropower projects, national roads and schools are geographically located more in rural areas. Secondly, in terms of the numbers of workers employed, debt-financed infrastructure investments employ mostly unskilled and semi-skilled labour which is largely located in rural areas. Nevertheless, increasing debt-financed infrastructural developments are shown to largely increase economic output which facilitates the creation of more jobs. The new jobs resulting from debt-financed infrastructural developments are distributive by location, from urban to rural and by gender, from males to females.

Figure 8: Gendered impacts of debt on employment



Source: Authors on Construction from Uganda's CGE model

In aggregate, males benefit more than their female counterparts regarding finding debt-driven jobs. A substantial portion of the new jobs created are accounted for by the male gender compared to the female counterparts. Of the 5.5 percent increase in employment, the males account for 3.8 percentage points and female 1.7 percentage points (Figure 8). This gender inequality in the labour market was identified in the third National Development Plan (NDP III) as one of the challenges to accelerating economic growth and development. However, the difference between males and females could be driven by many other factors such as access to education, ownership of resources and access to information among others.

3.2.5 Impacts of debt on poverty

Most debt-funded projects are capital intensive, which takes away jobs from host communities. Most debt funded projects are highly mechanised and require, for most of the activities, skilled labour. The local communities are, in most cases, unable to supply the required skilled manpower. Nevertheless, for purposes of inclusivity and poverty reduction through employment, some projects have ring-fenced casual labour positions for the communities within the project implementation area. Some of these positions include bush clearing, excavation of transmission channels and supply of food to the project workers. A key informant revealed that:

> *"… in the Strategic town water supply project, 85 jobs were created, of which 15 were technical while 70 were non-technical and these were executed by the local residents and this has boosted their earnings. Several other projects created jobs for the locals too. However, in some of the areas where debt-funded projects were implemented, concerns were raised on the amount of work done vis a vis the pay."*

As earlier mentioned, the nature of available jobs has led to gender differences in employment. Specifically, the nature of some project activities requires some level of physical strength to execute. Evidence from a FGD held with a local community at a road project implementation area indicated that:

> *"Only men got a few causal jobs of clearing bushes during surveying. Women in this community cannot manage such hard jobs. Even the next phase of construction is likely not to employ many women as this is a hard job (sic) which involves carrying heavy machinery, etc …"*

Nevertheless, debt funded projects have a positive spill-over effect at a macro level. Besides direct employment, some local community members have been able to establish shops within the project implementation areas, which has further bolstered trade and improved earnings. This is evident from earlier results presented on Table 1, which suggested that the increase in economic activities increases wage payments which boosts household consumptions by an annual average of 3.6 percent between FY 2021/22 – FY 2025/26, which later reduces to 0.8 percent as projected concessional loan disbursements reduce by two-thirds in the subsequent years.

There is a positive association between debt-financed infrastructural investments national poverty reduction. Simulations on Table 2 suggest that debt-financed infrastructural investments in FY 2021/22 would directly reduce national poverty by 0.61 percentage points. The number of poor people would reduce by 0.44 percent which is equivalent to approximately 227,179 Ugandans escaping poverty. The simulated reduction in poverty is stronger in Eastern Uganda (EU) mainly because the region hosts most of the poor population. These results are based on a CGE model assessment limited to impacts of fiscal resources borrowed and spent on infrastructure investments. The study used the allocations for FY 2021/22 budget. These are: UGX 4,145 billion for the transport sector and UGX 1,105 billion for the energy sector. However, the model's results notably paint only a positive picture regarding the impact of debt on poverty. This could be attributed to using only the FY 2021/22 budget allocations for the transport and energy sectors. In addition, and as earlier mentioned, high poverty areas tend to reduce poverty much faster than their counterparts that are not. In this case, given that eastern Uganda has high poverty indices it will tend to obtain high poverty reduction than other regions.

Table 2: Impact of infrastructural debt on household poverty

	CR-HHD	CU-HHD	ER-HHD	EU-HHD	NR-HHD	NU-HHD	WR-HHD	WU-HHD	ALL HHDS
	Percentage Household population distribution								
Population share	14.73	12.76	22.67	3.49	17.61	3.23	20.67	4.84	100
	Percentage change in people in poverty								
All sim	-2.27	-5.58	-2.54	-4.49	-2.18	-3.18	-3.86	-7.66	-0.44
	Percentage reduction in poverty rates (FGT0)								
All sim	0.28	0.26	0.94	1.18	0.78	0.43	0.48	0.53	0.61
	Number of people escaping poverty								
All sim	15,522	12,360	80,177	15,442	51,747	5,261	37,026	9,643	227,179

Source: Authors on Construction from Uganda's CGE model

1. CR= Central Region; CU= Central Uganda; ER= Eastern Region; EU= Eastern Uganda; NR= Northern Region; NU= Northern Uganda; WR = Western Region; and WU = Western Uganda
2. HHD = Households

In this case, and broadly, the impact of public debt on poverty depends on how the resources are managed and choice of project. Saungweme and Mufandaedza (2013) argue that using public resources to pay debt reduces the available resources to create job opportunities, enhance incomes, and hire new employees, among other activities. This exacerbates poverty levels. But obtaining external debt to finance employment creation mechanisms would eventually reduce poverty (Loko et al, 2003).

However, Uganda uses short-term debt to finance long-term infrastructure investments in the energy and road sector, resulting in a debt-asset mismatch problem. It is likely that debt will mature before sufficient returns are realized from the investments infrastructure, which take long to execute and yield results. Types and consequences of debt-asset mismatches in the context of Uganda are discussed in Box 2. Furthermore, the efficiency and effectiveness of debt have been undermined by limited value for money related to weak governance, lack of transparency and corruption (UDN, 2015). This calls for the inclusion of most stakeholders, especially civil society and

marginalised groups such as women, the youth and the rural population, in the discussion on debt acquisition, structure, usage and sustainability. The call for transparency is timely with respect to the fact that Uganda has experienced a significant shift from traditional creditors, for example, Paris Club creditors to new bilateral creditors such as China and India and states in the Middle East where there is scope for more information on the size, structure and terms of debt from the latter group.

Box 2: Uganda: Types and Consequences of Debt- Asset Mismatch

One of the plausible causes of defaulting by countries on payment of their debt is the possibility of having a debt-asset mismatch. This study took into consideration the different types of debt asset mismatches and what its likely effect on Uganda's debt. There are three categories of debt-asset mismatch.

1. Payment duration: A government borrowing short-term loans to finance activities that have long-term returns and vice vasa.

2. Interest rate: A government borrowing at one interest rate but plans to pay back at another interest rate.

3. Exchange rate: Here, a government acquires external debt in domestic currency of the lending country and must convert it into local currency at a prevailing exchange rate. At the time of repaying the debt, the government must reconvert from the local currency to the dollar, but the exchange rate is not the same as the former.

Source: Extract from a Key Informant Interview

The study collected data based on KII to understand whether there is a need to worry about the debt-asset mismatch and its effect on debt servicing in Uganda. A Key Informant respondent explained as follows.

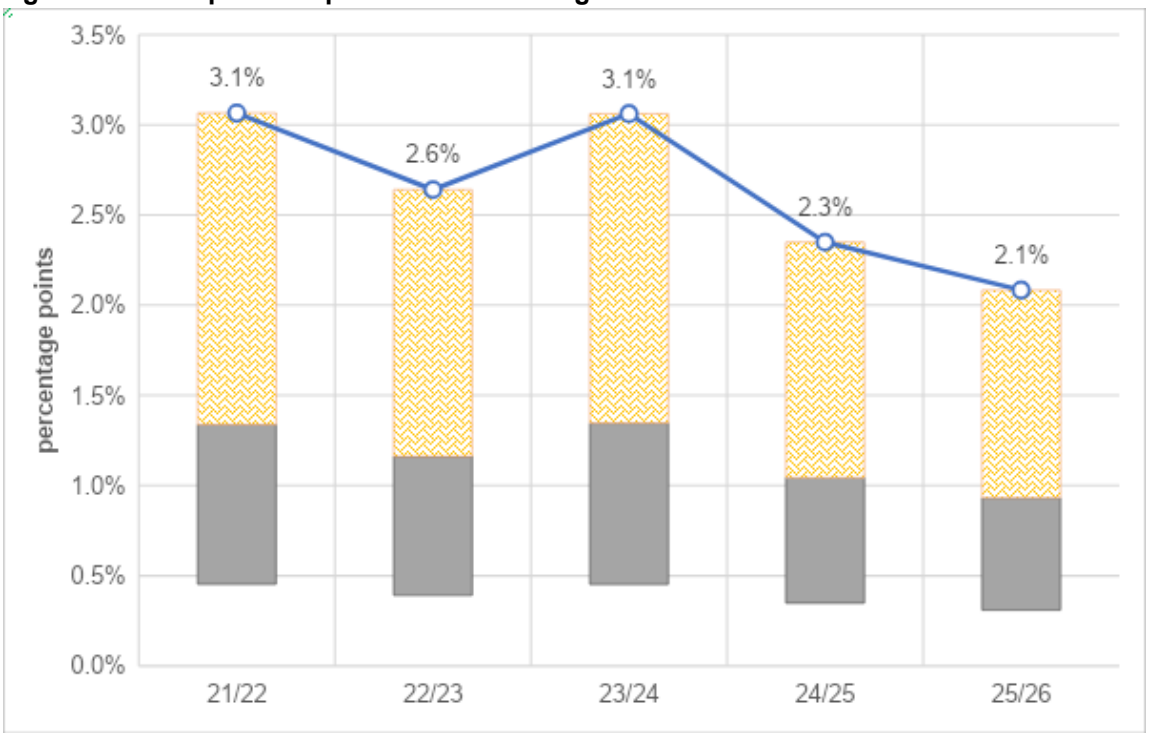
"…this is not something that I have seen as a major issue, it may require looking at the debt data for the country and maybe looking at each debt, and its deadlines and matching it to the return date. My understanding was probably related to debt reporting, that, maybe, the country has a different system of debt reporting and then another one has a different system of this reporting; I would say that is not necessarily the case because the World Bank and the International Monetary Fund have been using the same kind of debt reporting system and United Nation Conference on Trade And Development (UNCTAD) which is a common sort of framework that is used by countries so that we avoid this kind of having different approaches to debt. So, if there are any differences, it is probably an issue of capacity and having needed to build different capacities so that you can be able to report it well. But as far as the framework is concerned, it is the same not just for the World Bank but by UNCTAD. …"

From the KII response, a conclusion can be drawn that many countries, including Uganda, are following an internationally guided system that is synchronised with the domestic economy's system to prevent the emergency of debt-asset mismatch.

3.2.6 Sectoral impacts of debt induced economic growth

The service sector is the most efficient in producing debt-driven growth. This is because of the services associated to infrastructure developments such as transport services, banking and insurance, consultancies such as feasibility studies, negotiations for the right of way and other services related to construction. Of the average annual growth of 2.6 percentage points; the service sector would contribute 1.5 percentage points. This is followed by the industry sector which contributes 0.8 percentage points. Industry hosts the construction sector, mining and quarrying (sand and gravels) and iron and steel which are key inputs to infrastructural developments. The agricultural sector is the least beneficiary because the sector does not have strong direct linkages to debt-financed infrastructural developments. Agriculture is affected by indirect linkages resulting from increased incomes of households and the production of other sectors. The results are shown in Figure 9.

Figure 9: Decomposed impacts on economic growth



Source: Authors on Construction from Uganda's CGE model

3.3. DEBT AND CLIMATE CHANGE

In this section, the study assesses the impact of public borrowing on climate change, using greenhouse gases and wastewater release to the environment as the proxies for climate change. The three Greenhouse gases (GHG) used in the analysis (carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O)) are converted into Carbon dioxide equivalent using the Global Warming Potential (GWP) conversion factors. The results focus on anthropogenic emissions that result from government borrowing which stimulates economic activity like the construction of public infrastructure and other production activities because of increased demand for intermediate goods.

This section also decomposes GHG emissions into two: the consumption and the production perspectives. While the former involves assessing all GHGs emitted as a result of consumption and waste generation (especially from the urban population); the latter assesses GHG emissions from energy-intensive production that is not served by electricity.[6] This section also assesses the impact of debt on the sources of fresh water through the release of wastewater into the environment.

3.3.1 Impact on emissions of greenhouse gasses (GHG)

The twin rise in public debt and environmental degradation raises policy questions. This is likely to cast doubt on Uganda's ability to meet the Paris agreement for climate change and ensuring sustainable development. As earlier mentioned, debt-related fiscal policies can have short and long-term conflicting environmental effects. For example, Boly *et al.* (2022) estimated that a percentage increase in public debt ratio could result into an increase in cumulative carbon dioxide per capita, in developing countries, in the long run. These GHG emissions have contributed to climate change, which has impacts on the economy. However, debt acquired to support adaption and mitigation actions such as resettlement of people from floods and landslides, managing locusts, tree planting and wildlife management among others could be useful in mitigating climate change.

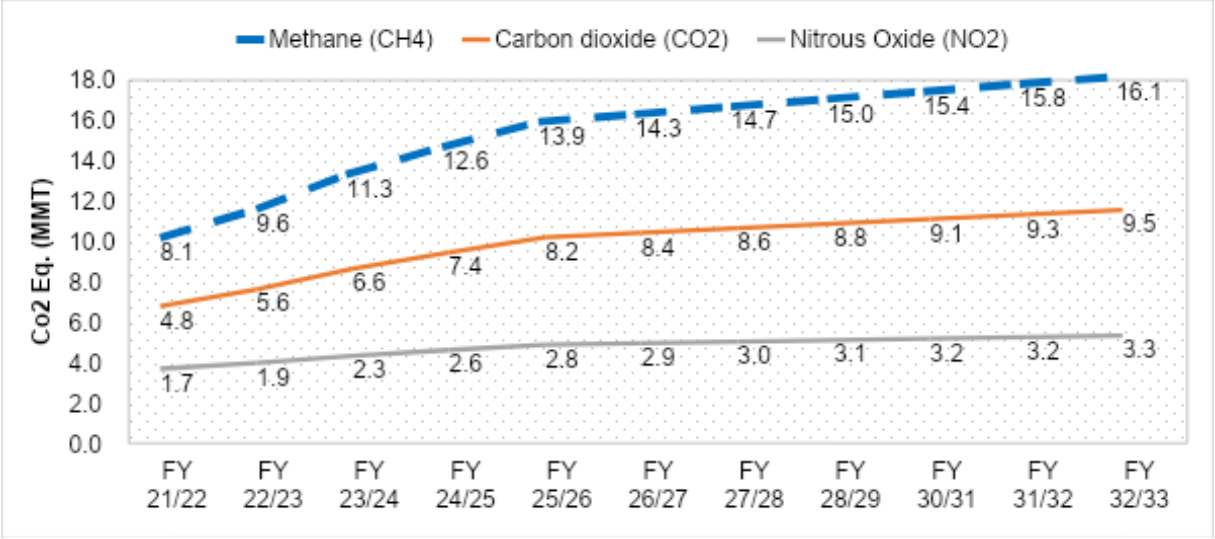
[6] The production perspective argues that cities in low and middle-income nations with heavy industry or fossil-fuelled power stations are more likely to have very high carbon emission.

Climate change is increasing in debt . Between FY 2021/22 and FY 2025/26 anthropogenic emissions increased annually by an average of 2.8 MMT of carbon dioxide equivalent (CO2 Eq.) associated to emissions from debt-funded activities. The results reveal that additional anthropogenic emissions from debt financed projects will reduce to an annual average of 0.7 MMT CO2 Eq. in FY 2026/27 as debt disbursements reduces, partially due to the prospects of commercial production of Oil in 2025. These findings corroborate those of Boly *et al.* (2022) who confirmed a negative impact of debt on the environment as mentioned earlier. The increase in such emissions could be attributed to, both, the inputs used in activities such as road construction (Marzouk *et al.* 2017) and the cutting down of vegetation cover during project implementation as indicated by participants in the KIIs and FGDs that;

> *"Some vegetation was cut during the process of constructing the water plant, even though the project was meant to extend safe drinking water closer to the communities. However, there are plans of replanting some trees after the project implementation"*

Methane and Carbon emissions will continue to dominate the types of emission prevalent in Uganda. A disaggregation by GHG reveals that emissions are dominated by Methane (CH4) followed by Carbon dioxide (CO2) and lastly Nitrous Oxide (NO2). By FY 2032/33 emissions from debt would amount to 29.0 MMT of CO2 Eq. of which Methane accounts for 16.1 MMT; Carbon dioxide (CO2) about 9.5 MMT; and Nitrous Oxide about 3.3 MMT as shown in Figure 10. The predicted domination of Methane and carbon dioxide gases in the near future could be attributed to the expected kick off of commercial oil production in 2025 as oil and natural gas systems are among the major sources of the two gases. It is reported that resource-rich countries like Ghana, registered an increase in carbon dioxide emissions, both, during the kick-off of natural resource extraction and in the post-oil production in commercial quantities (Alhassan and Kwakwa 2023).

Figure 10: Impact on anthropogenic emissions (MMT CO2 Eq.)



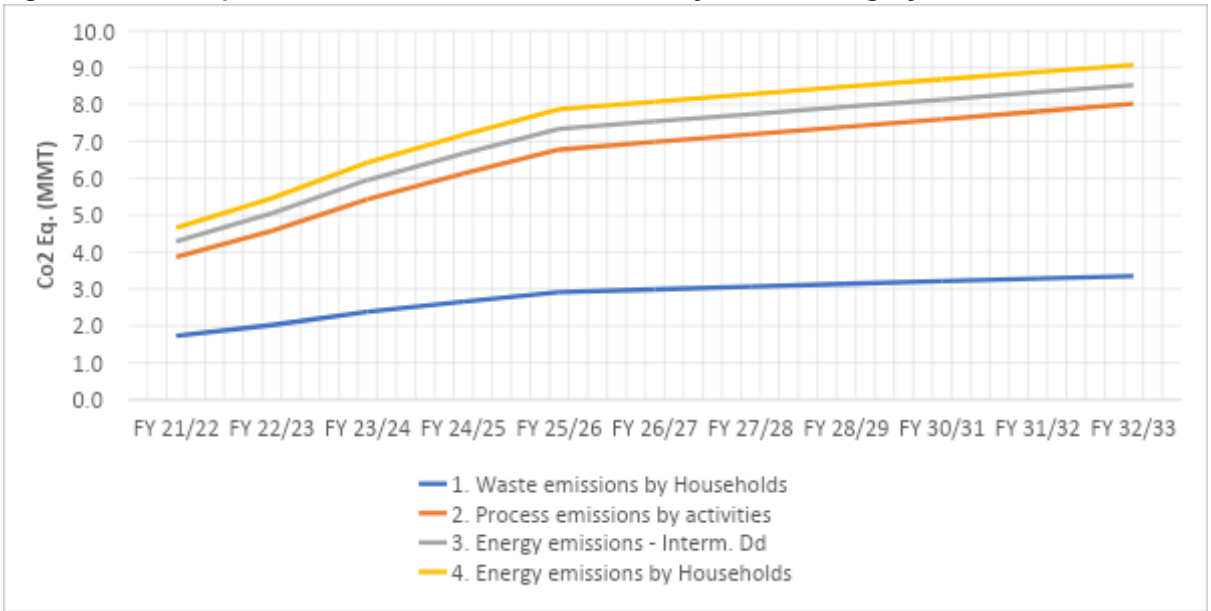
Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

3.3.2 Decomposition of debt-induced emission by source

A decomposition of debt-induced emissions in Uganda shows that consumption as the largest source of pollution. Consumption is dominated by the emissions from energy carriers consumed by households (31.3 percent of total debt-induced emissions). These energy carriers include charcoal, firewood, petrol, diesel, and kerosene. These results are not surprising given the high percentage of households using charcoal and firewood for cooking in Uganda's urban and rural areas, respectively. The second largest emission source category is the emissions from energy carriers used by productive sectors as intermediate inputs. This accounts for 29.4 percent of debt-induced emissions.

The third largest is the process emissions from productive sectors (27.7 percent) and lastly waste emissions from households (11.6 percent), as shown in Figure 11.

Figure 11: Decomposition of debt-induced emissions by source category

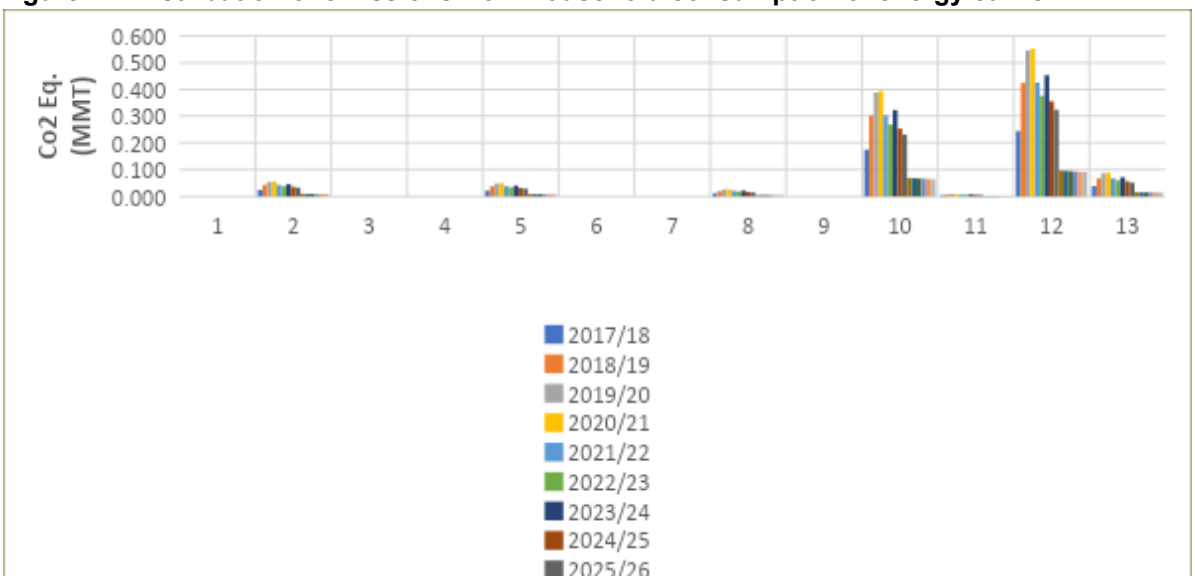


Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

3.3.3 Decomposition of emissions from the use of energy carriers and process emissions by households and productive sectors

The use of firewood and charcoal is the most dominant energy carrier at the consumption level. The dominant energy carrier at household level are firewood (58.3 percent) and charcoal (41.6 percent). The rest of the energy carrier emissions from diesel, petrol, and kerosene account for about 0.05 percent as shown in Figure 12. In terms of Greenhouse gas (GHG) emissions at household level, Methane accounts for about 80.5 percent followed by Carbon dioxide (11.2 percent) and Nitrous Oxide (8.3 percent) as shown in Box A1 panel (a) (b) and (c) in the appendix. Box A1 panel (c) shows that Methane is largely coming from the use of firewood and charcoal as a source of cooking energy, and these are considered carbon neutral.

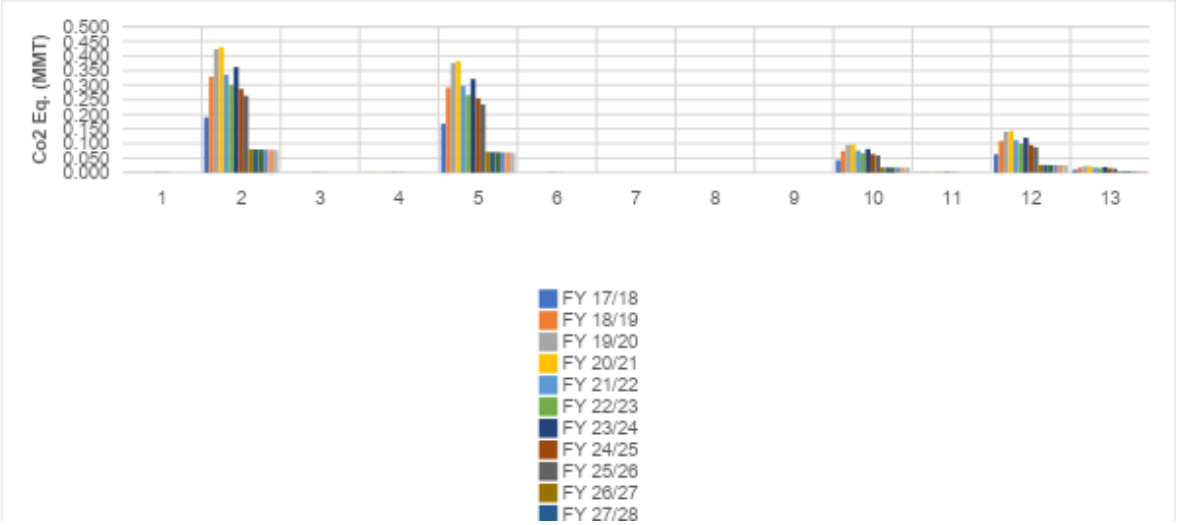
Figure 12: Distribution of emissions from household consumption of energy carrier



Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

Productive sectors use energy carriers such as Diesel, Petrol, Kerosene, Charcoal and Firewood to generate energy. The process of using these energy carriers produces emissions that accumulate to 8.5 MMT CO2 Eq. Of this, diesel accounts for 40.1 percent, followed by petrol (35.5 percent), firewood (15.3 percent) and lastly charcoal (9.1 percent) as shown in Figure 13. These findings were expected as diesel is the main fossil fuel used in Uganda's industrial activities.[7] Carbon dioxide dominates emissions from energy carriers used by productive sectors, accounting for 75.2 percent (Box A1 panel a in the appendix); followed by Methane (22.4 percent) and Nitrous Oxide (2.5 percent). Notably, carbon dioxide is largely from Diesel and Petrol (Box A1, panel b) whereas Methane is from Charcoal and Firewood (Box A1, panel c).

Figure 13: Distribution of emissions from productive sectors consumption of energy carrier



Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

3.3.4. Impact on water use and wastewater release to the environment

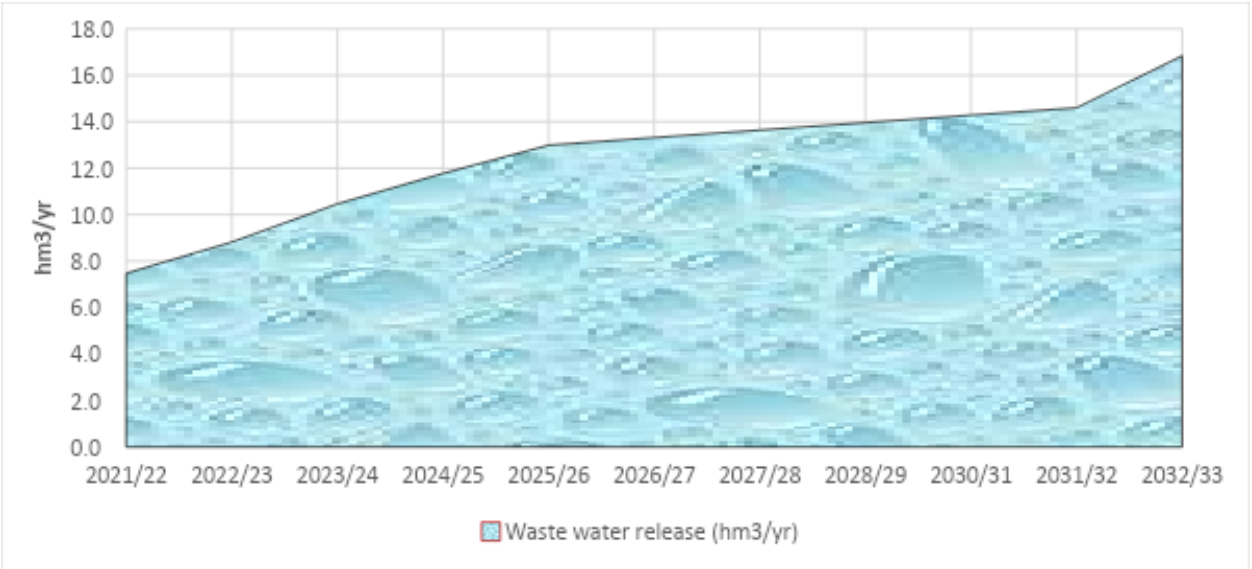
Some debt-funded projects may not only contribute to changes in weather patterns globally; but also the safety of water and aquatic life, locally, in the project implementation areas. Some of the debt-funded project activities such as construction involve the reclamation of swamps, the cutting down of natural vegetation, and the diversion of natural waterbodies like rivers. The release of wastewater to the environment, which surpasses assimilative capacity, may distort the quality of the environmental resources and also contaminates environmental products like fish, water for domestic use and the general ecosystems. For instance, the deposits of heavy metals in the environment affects the quality of agricultural products and any other product that uses environmental resources like soft drinks and beverages. In addition, distortion of the ecosystem affects the carbon balance in the atmosphere which leads to changes in temperatures and climate change disaster. Furthermore, the effects on the productivity of aquaculture could, in turn, affect exports of fish and fish products as well as soft drinks.

In addition, debt-financed infrastructural developments were found to have negative effects on water released to the environment. The production process involves the running of machinery and the transformation of intermediate products into final products which results into plenty of wastes which are directly channelled into fresh water sources like lakes and rivers. In addition, economic agents like households, government and firms release wastewater to the environment and most of this is through government utility institutions like the National Water and Sewerage Corporation (NWSC).

[7] https://www.oecd.org/tax/tax-policy/taxing-energy-use-uganda.pdf

Moreover, concessional debt increases the likelihood of wastewater emission to the community. Figure 14 suggests that concessional debt is expected to cumulatively increase wastewater emission from 7.5 cubic hectometres (hm3) in FY 2021/22 to 16.8 hm3 by FY 2032/33. Expectedly, the release of wastewater is largely dominated by the industry sector, followed by the service sector. This amounts to an annual additional loss of freshwater equivalent to 1.0 hm3 per year as shown in Figure 14. The release of this wastewater poses a risk to the sustainability of the ecosystems and reduces agricultural productivity as well as affecting exports; through reducing the quality below the thresholds of the Sanitary and Phytosanitary (SPS) requirements in the international markets. Such cases include deposits of heavy metals and other compounds that affect the quality of all products that depend on the environment. Figure 14 shows the cumulative wastewater released (or to be released) to the environment between FY 2021/22 and FY 2032/33.

Figure 14: Impact of debt on waste water release (hm3/year)

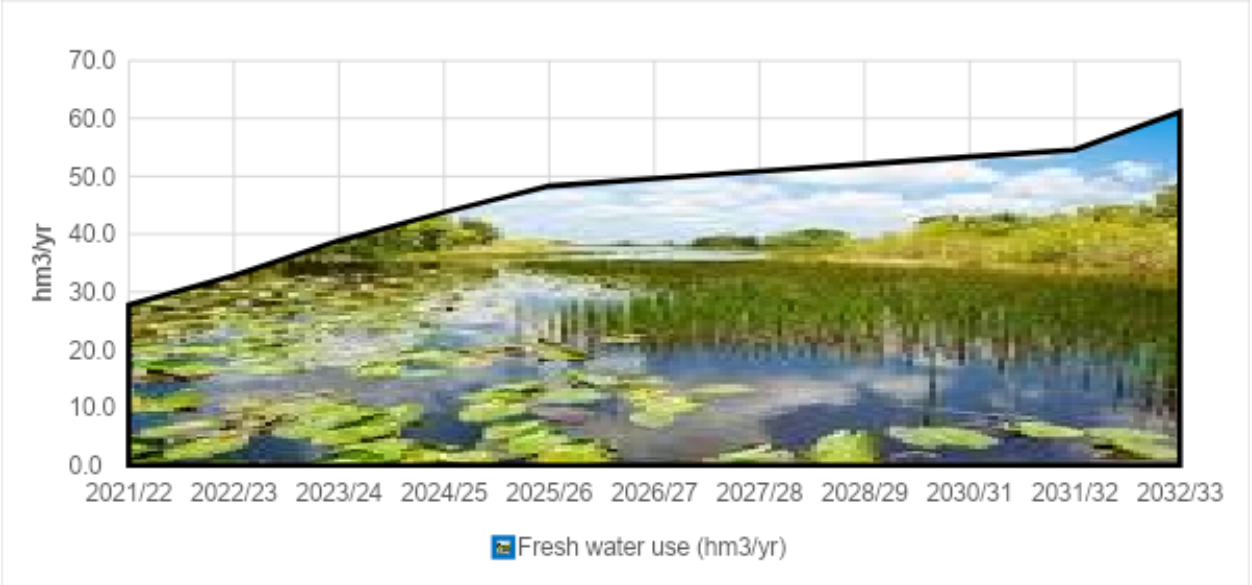


Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

Conversely, debt increases the likelihood of accessing water among marginalised communities. Figure 15 suggests that debt has a positive effect on the volume of clean freshwater used in the country. This is possibly because debt-financed infrastructure projects increase economic output which requires more water for use in the production process. The results show concessional debt for Uganda would require about 61 cubic hectometres (hm3) of fresh water for a period between FY 2021/22 to FY 2032/33. This amounts to an annual additional use of freshwater equivalent to 3.5 hm3 per year as shown in Figure 15. Additionally, the positive impact of debt on freshwater use could be attributed to the fact that some of the debt-funded projects are water and sanitation projects with the main aim of extending fresh water to the communities as revealed by the qualitative survey. Respondents from the communities where water-extension projects have been implemented reported that such projects have increased access to fresh and clean water by areas which initially were suffering from water shortages. Specifically, the area chairperson in one of the visited communities indicated that;

> *"Before the implementation of the water project, his area was facing severe water shortages to the point that, he and the members he leads were bathing once or twice a week. The pattern has changed since the project was implemented, and water was extended closer to the people through Public Stand Posts (PSPs) which were constructed in different homesteads and people can access clean water cheaply. However, the people in charge of the PSPs tend to over-price the water (Ugx 100 per litre instead of the recommended Ugx 50 per litre) and this has also been a challenge as some members of the community can still not afford the water".*

Figure 15: Impact of debt on the use of freshwater (hm3/year)

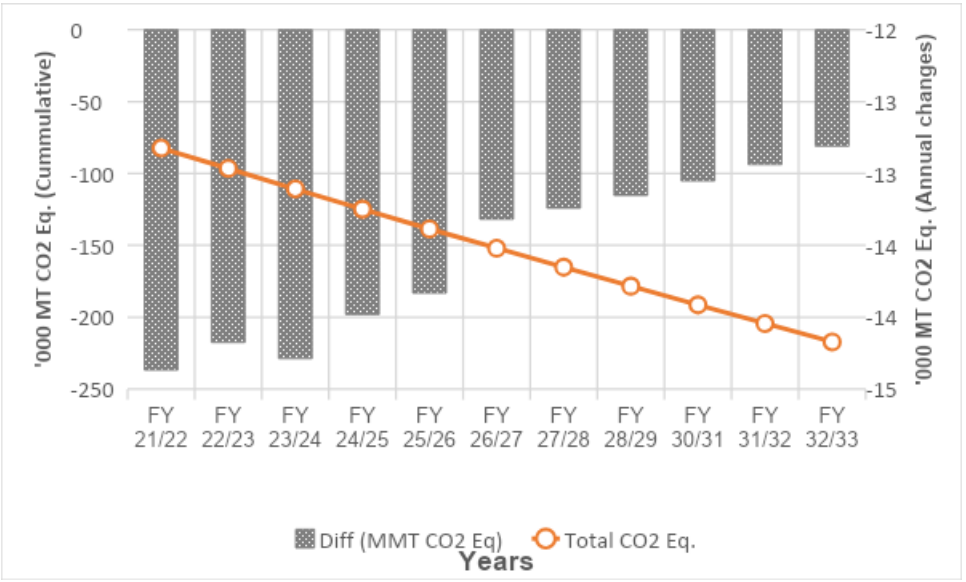


Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

3.3.5 Impact of a carbon tax on emissions

Carbon tax and carbon trading may contribute to climate change mitigation. Carbon tax and carbon trading is envisaged to contribute to making green energy like hydroelectricity relatively cheaper, thus encouraging its adoption. Figure 16 uses a carbon tax rate of 20 percent and assess the behavioural changes of decisions of economic agents in terms of energy sources and emissions. The results suggest that a 20 percent carbon tax on energy carriers would reduce emissions by an annual average of 13,560 MT CO2 equivalent between FY 2021/22 and FY 2032/33. Cumulatively, this would result in 217,153 MT CO2 equivalent by FY 2032/33. This implies that carbon tax would be one of the effective ways of reducing carbon emissions.

Figure 16: Emissions reduction due to carbon tax ('000 MT CO2 Eq.)



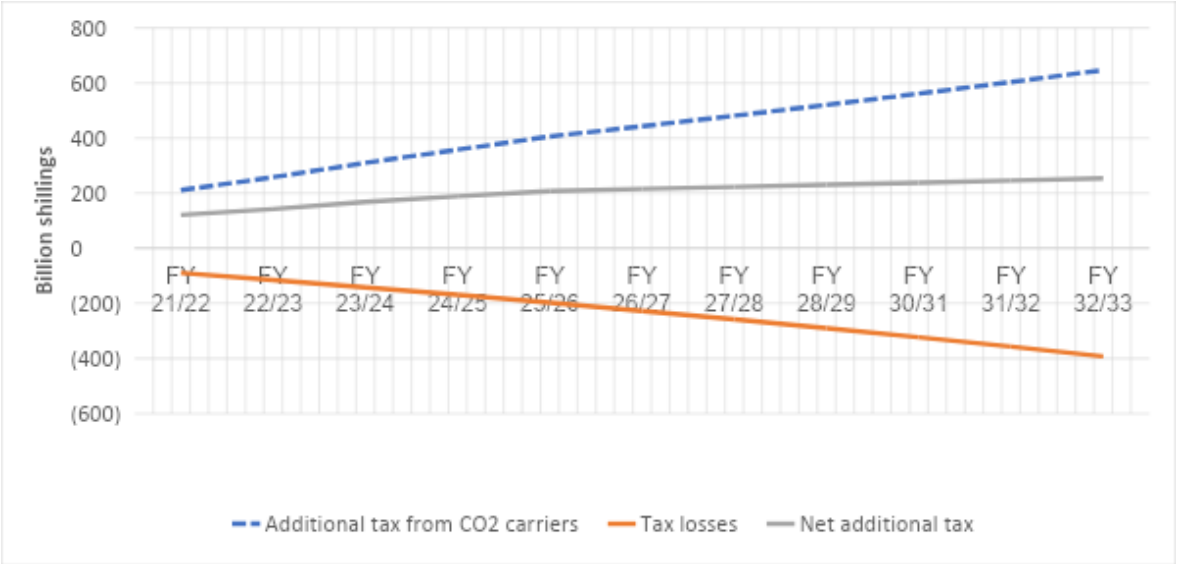
Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

3.3.6 Impact of Carbon tax policy on tax collections

Besides reducing the amount of carbon emissions, a carbon tax could raise significant tax revenues. It is estimated that the government will generate additional taxes, on average, UGX 436 billion annually during the FY 2021/22 – FY 2032/33 period with imposition of a carbon tax (Figure 17). However, carbon tax on commodities that have carbon footprints like fossil fuels and biomass could have an impact on energy consumption, as those energy types are also used for cooking, transportation, running industries and domestic use.

Therefore, the imposition of a carbon tax could increase the cost of production due to inelastic transition from carbon carriers to green energy sources. This would force some sectors to reduce their output, causing tax losses of about UGX 233 billion, resulting into a net tax collection of about UGX 203 billion annually (FY 2021/22 – FY 2032/33) from carbon tax as illustrated in Figure 17.

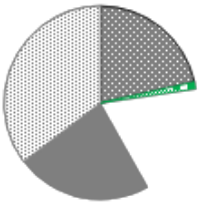
Figure 17: Tax collections from carbon tax, Ugx Bn.



Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

A carbon tax also calls for redesign of Uganda's fiscal regime, which calls for capacity building. Traditionally, the carbon tax has always been imposed on the importation of old cars in form of environmental levy. Yet, the predicted net annual tax gains (UGX 203 billion) from carbon tax are largely from tax on Firewood (35 percent), Charcoal (23 percent), Diesel (22 percent), Petrol (19 percent) and Kerosene (1 percent) (Figure 18). This has implications on the design of Uganda's policy regarding emissions.

Figure 18: Distribution of carbon tax by carbon carrier



Source: Authors own construction using results from the CGE model using data from Ministry of Water and Environment

4. Conclusions and Recommendations

Using mixed methods this study discerns the management, environmental and development outcomes of Uganda's debt in context of COVID-19. In doing this the study aimed at identifying capacity gaps in fiscal institutions and tools required to manage the pre-existing and emerging challenges posed by size and structure of debt.

Uganda's debt is largely driven by the shift of development focus from spending on social services to infrastructure. This fact, notwithstanding, the recent surge in debt has been driven partly by COVID-19 that has necessitated budget reprioritisation to address economic slowdown and provide interventions for mitigating the impact of the pandemic. The upsurge in debt has, however, not been matched by institutions that improve accountability, transparency and inclusivity.

There is also an upsurge of debt from new creditors such as China and private commercial banks. This has increased the relevance of credit rating agencies as providers of information to facilitate risk assessment of a potential line of credit. However, these new creditors have been reluctant to participate in debt restructuring initiatives.

The outcomes of upsurge of debt have, also, been marked by improvement in indicators of economic growth and development such as tax effort, trade, poverty reduction and employment. The improvement in the indicators is stronger if the debt is concessional. However, this positive relationship is not inclusive as women are left behind.

Debt is increasing the use of firewood, charcoal, diesel and petroleum, which may contribute to climate change. Consumption of charcoal and firewood by households; and petrol, diesel and kerosene by are the leading debt-induced pollutants in Uganda. In addition, debt-financed infrastructural developments were found to have an increasing negative effect on water released to the environment.

In this regard the study recommends:

a) Capacity development of Uganda's fiscal institutions to ensure accountability, transparency, and inclusivity in debt management.
b) Reforming Uganda's debt legal framework to reduce debt vulnerabilities and litigation risks from new creditors should be considered. This calls for an exhaustive mapping of a desired, but pragmatic legal, regulatory and tax framework for competitive financial markets. This should be founded on a structured and consistent dialogue with the government, lenders, and stakeholders in Uganda's sustainable growth.
c) Obtain the right balance between concessional debt, grants and commercial debt. While the preference should be for concessional debt, there is a need to recognise this source is finite and there is need to explore other alternative financing sources.
d) Leveraging of Uganda's relationship with China and other emerging creditors to convince private creditors to participate in debt participatory frameworks to improve debt transparency and accountability.
e) To manage appreciation pressures of debt, acquisition of productive debt cannot be over-emphasized. In addition, the adoption of both long term and short-term measures is imperative. In the short term, the government needs to design counterfactual monetary policy measures, like using reserves to stabilize the exchange rate. In the long-term, the government needs to ringfence external borrowing for infrastructure projects that boost productivity and reduce transaction costs across all sectors of the economy. These include, (a) construction of transport infrastructure to improve access to markets, (b) increase access to affordable and reliable electricity to reduce costs of production and support the transition of labour from low-productivity agriculture to high productivity industrial sector; and (c) invest in agro-processing to strengthen the backward and forward linkages between agriculture and industry sectors.[8]

[8] This is key to boost agricultural productivity; since World Bank (2022) shows that a third of the labour force is trapped in the agriculture sector producing a quarter of GDP. These short-term and long-term measures would quench the effects of debt on the realisation of the outcomes of Uganda's trade policy.

f) The adoption of policies that can increase the participation of the female gender in the infrastructure construction sector. Such policies, include sensitisation of the public against traditions that ringfence certain job categories for the male gender. Such sensitisation should encourage both the female and male gender to equally participate in all job opportunities among all productive economic activities. These polices will aid Uganda in the achievement of SDG 5 that calls for gender equality and empowerment of women and girls. In addition, there is a need to deal with other factors that may contribute to the non-participation of females such as access to education, ownership of resources and access to information among others.
g) Reduce climate impacts by promoting the adoption of clean energy sources for cooking among households by increasing access to affordable electricity, energy saving cooking stoves, biomass energy, improved cooking tools like pressure-cookers especially among rural households and sensitisation of the sectors to adopt the cheap clean energy sources.
h) Implementing policies that reduce debt-induced emissions from the use of energy carriers by productive sectors should focus on substituting the carbon-printed energy carriers with clean and green energy sources and penalise those who prefer not to change technology through a carbon fee on energy carriers with carbon prints.
i) To reduce the quantity of wastewater release to the environment, the government needs to invest and increase coverage of the National Water and Sewerage Corporation (NWSC) to enable it to cover all sectors in terms of wastewater management. The investment should focus on treatment of wastewater and re-use of this water among productive sectors. In addition, the exploration of options of imposing a tax on wastewater released by each economic activity will reduce on the annual loss of fresh water and improve the quality of water released into the environment; thus, saving the ecosystem from deterioration.

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APPENDICES

Appendix 1: CGE Model

CGE model blocks were developed following the four quadrants specified by Sadoulet and de Janvry (1995). The first quadrant focuses on the demand for commodities. The second quadrant examines production for the domestic market; the third quadrant examines production for the export market and lastly, the fourth quadrant focuses on the balance of payment. These quadrants are demonstrated below.

I. ***Production function***

The production follows a Constant Elasticity of Substitution (CES) function to combine factors in the production process. To demonstrate a CES function, let q is a production function, a is the scale parameter, α is share parameter and;θ_0, θ_k, θ_l are efficiency parameters (neutral, capital saving and labour saving technologies); ρ Transformation of elasticity of substitution between capital and labour. The CES is demonstrated below.

$$q = a\theta_0\left[\alpha\left(\theta_k k\right)^{-\rho} + (1-\alpha)\left(\theta_l l\right)^{-\rho}\right]^{-1/\rho} \quad (1)$$

$\rho = \frac{1-\sigma}{\sigma}$ and $\sigma = \frac{1}{\rho+1}$; thus, $-1 < \rho < 0$ for $\sigma > 1$ and $0 <$ ρ for $\sigma < 1$

>0

The top of each activity production function is a combination of aggregate value-added, aggregate non-energy intermediates inputs, and energy inputs in a Leontief production framework demonstrated in Eq (2), (3), and (4). The next level of nesting, has total value-added modelled using a constant elasticity of substitution (CES) function of capital and composite labour, as shown in Equation 5. Individual labour categories also enter the production function at the lower level in a CES function.

$$VA_j = v_j XST_j \quad (2)$$

$$CI_j = io_j XST_j \quad (3)$$

$$ENG_j = ioegy_j XST_j \quad (4)$$

$$VA_j = B_{VA(j)}\left[\beta_{VA(j)}\, LDC_j^{-\rho_j} + (1-\beta_{VA(j)})\, KDC_j^{-\rho_j}\right]^{-\frac{1}{\rho_j}} \quad (5)$$

Where j is an index for industries, VA_j aggregate value-added, v_j the value-added Leontief coefficient, XST_j total aggregate output from industry j, CI_j aggregate non-energy intermediate consumption by industry j, and io_j the non-energy intermediate Leontief coefficients, ENG_j aggregate energy intermediate consumption by industry j, and $ioegy_j$ is the energy intermediate Leontief coefficients. In Eq (5), the Bs are scale parameters, βs share parameters, and ρs elasticity parameters. LDC_j and KDC_j refer to labor and capital demand, respectively.

All individual non-energy intermediate inputs are governed by a Leontief function, assuming fixed input coefficients. On the other hand, energy inputs apply a nested CES function. In Eq (6), total energy inputs combine both biomass and non-biomass energy inputs in a CES function, and in Eq (7), non-biomass energy input aggregates electricity and fossil fuel energy sources. At the lower nest, biomass, electricity, and fossil fuel energy sources are also governed by a CES function.

$$ENG_j = B_{INT(j)}\left[\beta_{INT(j)}\, BIOM_j^{-\rho_j} + (1 - \beta_{INT(j)})\; NONBIOM_j^{-\rho_j}\right]^{-\frac{1}{\rho_j}} \quad (6)$$

$$NONBIOM_j = B_{ELCFS(j)}\left[\beta_{ELCFS(j)}\, ELEC_j^{-\rho_j} + (1 - \beta_{ELCFS(j)})\; FOSSIL_j^{-\rho_j}\right]^{-\frac{1}{\rho_j}} \quad (7)$$

$BIOM$ and $NONBIOM$ refer to biomass and non-biomass energy sources, respectively, with their corresponding scale, share, and elasticity parameters. In Eq (7), $ELEC$ is electricity energy goods, while $FOSSIL$ is fossil fuel energy goods, including petrol, diesel, and kerosene. We assume a higher substitution of two between biomass and non-biomass. In contrast, the substitution is inelastic, set at 0.2 between electricity and fossil fuels, and for the individual biomass, electricity, and fossil fuels. However, perturbation is done on these parameters in the sensitivity analysis.

II. Consumption demand function

The paper uses the CES function to specify the consumer demand functions. In general terms, the basic objective of the theory of consumer behaviour is to explain how a rational consumer chooses what to consume when confronted with various prices and a limited income; with an objective to maximise utility. To demonstrate the utility function, let *q* be a vector of quantities of *n* commodities and *z* Individual characteristics. The utility and budget coefficients are shown in Eq (8).

$$u(q, z) \quad \text{and } p'q = y \quad (8)$$

The consumer's objective function is to maximize utility with respect to *q*, subject to the budget constraint is shown in Eq (9).

$$Max_{q,\lambda}\, u(q, z) + \lambda(y - p') \quad (9)$$

The solution to this maximisation problem is a set of *n* demand equations:

$$q_i = q_i(p, y, z), \quad i = 1, \ldots, n. \quad (10)$$

These *n* equations contain,

$$n \text{ income slopes } \frac{\partial q_i}{\partial y} \text{ or income elasticities } \eta_i = \frac{\partial q_i}{\partial y}\frac{y}{q_i}$$

$$n^2 \text{ income slopes } \frac{\partial q_i}{\partial p_j} \text{ or price elasticities } E_{ij} = \frac{\partial q_i}{\partial p_j}\frac{p_j}{q_i}$$

Linear Expenditure System (LES)

The Linear Expenditure System (LES) will be used for a consumption function. This is derived from the Stone-Geary utility function, which is pointwise separable. For demonstration, let c_i be the minimum subsistence consumption that cannot fall and b_i represent the marginal budget shares. The utility function is shown in Eq (11), and the demand functions derived from maximisation of this utility function under a budget constraint is the represented by the Linear Expenditure System (LES) in Eq (12).

$$u = \prod_{i=1}^{n}\left(q_i - c_i\right)^{b_i} \quad or \quad u = \sum_{i=1}^{n} b_i \ln ln\left(q_i - c_i\right) \qquad with\{0 < b_i < 1\; \sum_i b_i = 1\; q_i - c_i > 0 \quad (11)$$

$$p_i q_i = p_i c_i + b_i\left(y - \sum_j p_j c_j\right), \quad i = 1, \ldots, n. \qquad (12)$$

Since the impact needs to be attached to household welfare, the disaggregation of households will follow the approach discussed by Stone (1978). The detailed CGE model equations are shown in Appendix 3.

III. Incorporating carbon emissions from energy use in the CGE

The paper incorporates carbon dioxide emissions from the intermediate use of energy goods in the CGE model. We demonstrate this in Eq (13) where $ICO2O$ is total carbon dioxide emissions from the intermediate consumption of energy commodityIP; which is the carbon dioxide emissions coefficient of commodity $emcco2(ip)$; multiplied by intermediate consumption of that particular energy good ip in sector $DIO(ip, jap)$; divided by the base year conversions coefficient, $\frac{1}{convcoff(ip)}$.

$$ICO2O(IP) = \left[\sum_{jap=1}^{n} emcco2(ip) * \frac{1}{convcoff(ip)} * DIO(ip, jap)\right] \qquad (13)$$

IV. Modelling carbon tax in the CGE

The carbon price is an instrument that captures the external costs of greenhouse gas (GHG) emissions usually levied on the carbon content of fuels. We, therefore, defined carbon pricing to refer an explicit price of GHG emissions per tonne of carbon dioxide equivalent (tCo2e) from a given energy source. The range of carbon prices across the existing initiatives are broad, ranging from less than US$1/tCO2e to US$131/tCO2e (World Bank, 2016). According to the same source, over three-quarters of the covered emissions were priced below US$10/tCO2e. On this basis, we arbitrarily chose a carbon price of US$3/tCO2e. Carbon pricing is still an evolving process and is continually expanded to cover a wider range of GHG emissions sources. In this paper, carbon price covers energy sources including firewood, charcoal, petrol, diesel, and kerosene. In Uganda's context, US$3/tCO2e is equivalent to 10,500/tCO2e assuming using the base year exchange rate of UGX 3500 per US dollar.

The baseline carbon tax revenues from the energy good *ip*, is captured by the variable CARBONO (ip), which is estimated using Eq (14). All energy goods are consumed as intermediate inputs in the different activities and as final goods by households; none is exported. Therefore, total carbon tax revenues are determined by multiplying the carbon price $co2pxo$ by the emissions from intermediate use $\sum_{jap=1}^{n} DIO(ip, jap)$ and household final consumption $\sum_{jag=1}^{n} CO(ip, jag)$, minus any associated with exports. The $emcco2(ip)$, $emcch4(ip)$, $and\ emcn2o(ip)$ relate to carbon dioxide, methane, and nitrous oxide emissions coefficients expressed in carbon dioxide equivalent.

$$CARBONO(ip) = \{co2pxo * [emcco2(ip) + emcch4(ip) + emcn2o(ip)] * [\sum_{jap=1}^{n} DIO(ip, jap) + \sum_{jag=1}^{n} CO(ip, jag) - E$$

(14)

The carbon tax revenue is the used to calculate the tax rate per unit of energy consumed used in the simulations as follows.

$$cbtaxo(i) = CARBONO(ip)/\{(PLO(i) + \sum_{ij=1}^{n} PCO(ij) * tmrg(ij, i) * DDO(i) +$$

$$(eO * PWMO(i) + \sum_{ij=1}^{n} PCO(ij) * tmrg(ij,i)) * IMO(i) + TIMO(i)\};$$

Where $PLO(i)$ is the price of local product i (excluding all taxes on products), $PCO(i)$ the purchaser price of composite commodity i (including all taxes and margins), t$mrg(ij,i)$ the rate of margin ij applied to commodity i, $DDO(i)$ the domestic demand of local production of commodity i from industry j, eO the exchange rate, $PWMO(i)$ world price of imported product i expressed in foreign currency, $IMO(i)$ the quantity of product i imported, and $TIMO(i)$ the import duties on imported commodity i.
Note that set ip is only a subset of set i of all the commodities; hence, the above equation relates to commodities in set ip.

V. Modelling debt financed projects in the CGE

Modelling of debt will focus on financing the budget deficit for energy and road infrastructure gaps. The modelling of debt financed public investments focusses on the energy and road infrastructure. This follows and not limited to the approach presented by Bwire *et al.,* (2016); Gurara *et al.,* (2017) and IMF (2015).

Appendix 2: Simulation design and approximation of climate change

I. Simulation design for climate change

To assess the impact of debt to climate change and welfare we structure the simulation in two aspects. First, we limit debt to government borrowings for infrastructure developments. Secondly, we limit climate change emissions of greenhouse gases. Thus, the climate change module in this analysis is inclined to three of the six pollutants listed in the Kyoto protocol. The Kyoto Protocol is an international agreement that was signed to curb down emissions of atmospheric greenhouse gases (GHG)[9] which were threatening life on planet earth. The protocol was adopted in Kyoto – Japan in 1997, thus its name the '*Kyoto protocol*'. The six Kyoto greenhouse gasses include; carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), F-gases (hydrofluorocarbons and perfluorocarbons) and sulphur hexafluoride (SF6). Emissions of these GHGs lead to global warming and the related climate change effects. The mapping of human activities to the Kyoto gases is shown in Table A1 (Greenhouse gases) and Table A2 (Other pollutants).

Table A 1: The Kyoto Greenhouse Gases (GHG) and sources

No.	Kyoto GHG	Sources
1.	Carbon Dioxide (CO2)	Combustion of fossil fuels (Several) Reducing agents (Manufacture of metals) Gas power generation (Electricity, Oil and Gas Extraction)
2.	Methane (CH4)	Livestock, manure management (Agriculture) Landfills Production and use of fossil fuels and fuel wood (Several)
3.	Nitrous Oxide (N2O)	Fertilising (Agriculture), fertiliser production (Manufacture of Industrial chemicals) Road traffic (Road Transport)
4.	Perflourocarbons (PFCs)	Aluminium production (Manufacture of Metals)

[9] Greenhouse Gases (GHG) refer to gasses in the atmosphere that absorb and also releases heat which increases the temperature of the atmosphere higher than it would have been.

5.	Sulphur Hexafluoroides (SF6)	Magnesium production (Manufacture of Metals)
6.	Hydrofluorocarbons (HFCs)	Cooling fluids (Several)

Source: Authors on Construction

Table A 2: Other pollutants (acidifying gases and ozone precursors)

No.	Other pollutants	Sources
1.	Sulphur Dioxide (SO2)	Combustion (Several) Process emissions (Manufacture of Metals)
2.	Nitrogen Oxides (NOx)	Combustion (Several)
3.	Carbon Monoxide (CO)	Combustion (Several)
4.	Non-Methane Volatile Organic Compounds (NMVOCs)	Oil and gas-related activities Road traffic Solvents (Oil Refining, Road Transport, Households)
5.	Ammonia (NH3)	Road traffic (several) Fertilising (Agriculture)
6.	Suspended Particulates (PM2,5 and PM10)	Road traffic (Households, Agriculture, Road Transport) Fuel wood (Households)

Source: Authors on Construction

The analysis focuses on three of the Greenhouse Gases (GHG) and these are; carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) largely because of the nature of Uganda's activity carbon prints. For comparison purposes, we convert the one unit of measurement using the Global Warming Potential (GWP) conversion factors. Thus, GWP captures the amount of warming a gas can cause within 100 years in the atmosphere which is done in comparison with Carbon dioxide (CO2). We adopt the GWP conversion factors from the 4th Assessment Report of the International Panel on Climate Change (IPCC). For instance, Methane (CH_4) has GWP of 25 meaning that 1kg of CH_4 can cause 25 times the 100 years warming in comparison with 1kg of carbon dioxide (CO2). Thus, multiplying GWP impact conversion factor with the amount of gas gives the carbon dioxide equivalent (CO2e). The GWP conversion factor are shown in Table A3.

Table A 3: Global Warming Potential (GWP) conversion factor

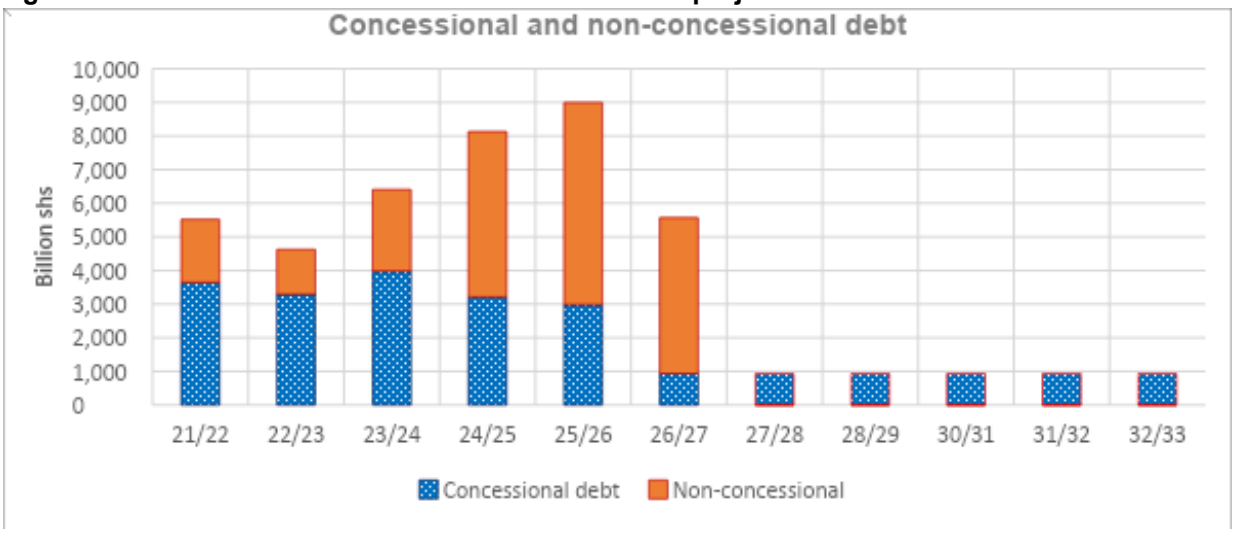
No.	Green House Gases	Chemical formula	100 year GWP (AR4)
1.	Carbon dioxide	C02	1
2.	Methane	CH_4	25
3.	Nitrous Oxide	N2O	298
4.	Sulphur hexafluoride	SF_6	22800
5.	Hydrofluorocarbon-23	CHF_3	14800
6.	Hydrofluorocarbon-32	CH_2F_2	675
7.	Perfluoromethane	CF_4	7390
8.	Perfluoroethane	C_2F_6	12200
9.	Perfluorocyclobutane	c-C_4F_8	10300
10.	Perfluoropentane	C_5F_{12}	13300
11.	Perfluorohexane	C_6F_{14}	9300

Source: Authors on Construction

Appendix 3: Simulation design for debt

Regarding debt, the simulation focuses on government external borrowing. In FY 2021/22, government borrowed about Ugx 5.5 trillion both concessional and non-concessional loans. This is projected to increase to Ugx 9 trillion in FY 2025/26. In the simulation, we use the concessional loans projections depicted in the Background to the Budget Report (MOFPED, 2022a). The projections for the Ministry of Finance, Planning and Economic development are for FY 2021/22 – FY 2026/27. For the concessional loans, we maintain the final year's projections for the period extending to FY 2032/33. The debt projections are shown in Figure A1.

Figure A 1: Concessional and non-concessional loans projections



Source: Source: Authors on Construction using the Background to the budget

Appendix 4: The multiplier model

The multiplier model is based on the Leontief coefficients proposed by Pyatt and Round (2006), Llop (2005) and Bandara and Kelegama (2008). Let X_{ij} be output for sector *j,* a_{ij} are Leontief coefficients and $(I - A)^{-1}$ is the multiplier matrix. Thus, we derive$(I - A)X = F \rightarrow X = (I - A)^{-1}F$.

To simulate the impact on poverty using the multiplier model we follow the decomposition of multipliers proposed by Pyatt and Round (2006). First, compute the number of people under the poverty line per category of households; then we use the structural multipliers and poverty elasticity (εˆ) to changes in household incomes as demonstrated in Eq (15) to Eq (17). Then, Eq (18) is for ensuring consistency in the data generation process.

$$\frac{dQ_i}{Q_i} = \left(1 + \left|\varepsilon_i\right|\right)\frac{dn_i}{n_i}\hat{d}_i M_{I,P} dz_p \quad (15)$$

$$\hat{\sigma}g(q) = \hat{\sigma}\left(I + \left|\hat{\varepsilon}\right|\right)g(n) - \left(\hat{\sigma}\hat{\mu}M_{I,P}\hat{z}_p\right)g\left(z_p\right) \quad (16)$$

$$M_{I,P} = M_{3(I,I)}M_{2(I,P)}M_{1(P,P)} \quad (17)$$

$$M = \left(M_3 - I\right)M_2M_1 + \left(M_2 - I\right)M_1 + \left(M_1 - I\right) + I \quad (18)$$

Where; $\hat{\mu} = \frac{\left|\varepsilon_i\right|}{y_i}$ and $\hat{\sigma} = \frac{Q_i}{Q}$

$\frac{dQ_i}{Q_i}$ is the change in the number of people below the poverty line due to the policy shocks in the infrastructural sector and $\hat{\sigma}$ is the proportion of total poverty that is attributed to households in a socio-economic group *i.* The detailed derivation of the multiplier model is shown in user guide.

Appendix 5: SAM Structure

Table A 4: The SAM Structure

Income columns			**Goods and services**	**Production Activities**	**Factors**		**Resident institutions**			**Savings-Investments**	**Rest of the world**		**Total**
					Labour	**Capital**	**Households**	**Firms**	**Government**				
			(1)	**(2)**	**(3)**		**(4)**			**(5)**	**(6)**		
Goods and services	**(1)**		Trade/ transp. margins	Intermediate consumption			Final (HH) consumption		Final gov't consumption	Investment and variation of stocks	Exports		Demand of goods
Production Activities	**(2)**		Domestic production						Subsidies to production				Inflow of activities
Factors	**(3)**	**Labour**		Wages and salaries							Labour income from ROW		Labour income
		Capital		Payment for the use of capital									Capital income

Resident institutions	**(4)**	**Households**			Wages and salaries		Intra-household transfers	Distributed profits /dividends	Transfers to households		Transfers from ROW to HH		Household income
		Firms				Payment for the use of capital					Transfers from ROW to firms		Firm income
		Government	Taxes on goods and services	Taxes on activity			Direct taxes/ Social Security	Taxes	Transfers within gov't	Budget deficit	Transfers from ROW to gov't		Gov't income
Savings - Investments	**(5)**		Decrease of stocks	Depreciation of capital			Savings of Households	Savings of Firms	Budget surplus		Deficit bal. of payment		Financial resources
Rest of the world	**(6)**		Imports		Remuneration of external labour		Transfers to ROW from HH	Transfers to ROW from firms	Transfers to the ROW from gov't	Surplus bal. of payment			Outlays of ROW

	Total	Supply of goods and services	Domestic production	Payment for labour	Payment for capital use	Household expenditure	Use of firm earnings	Public expenditure	Total investment	Payments of ROW

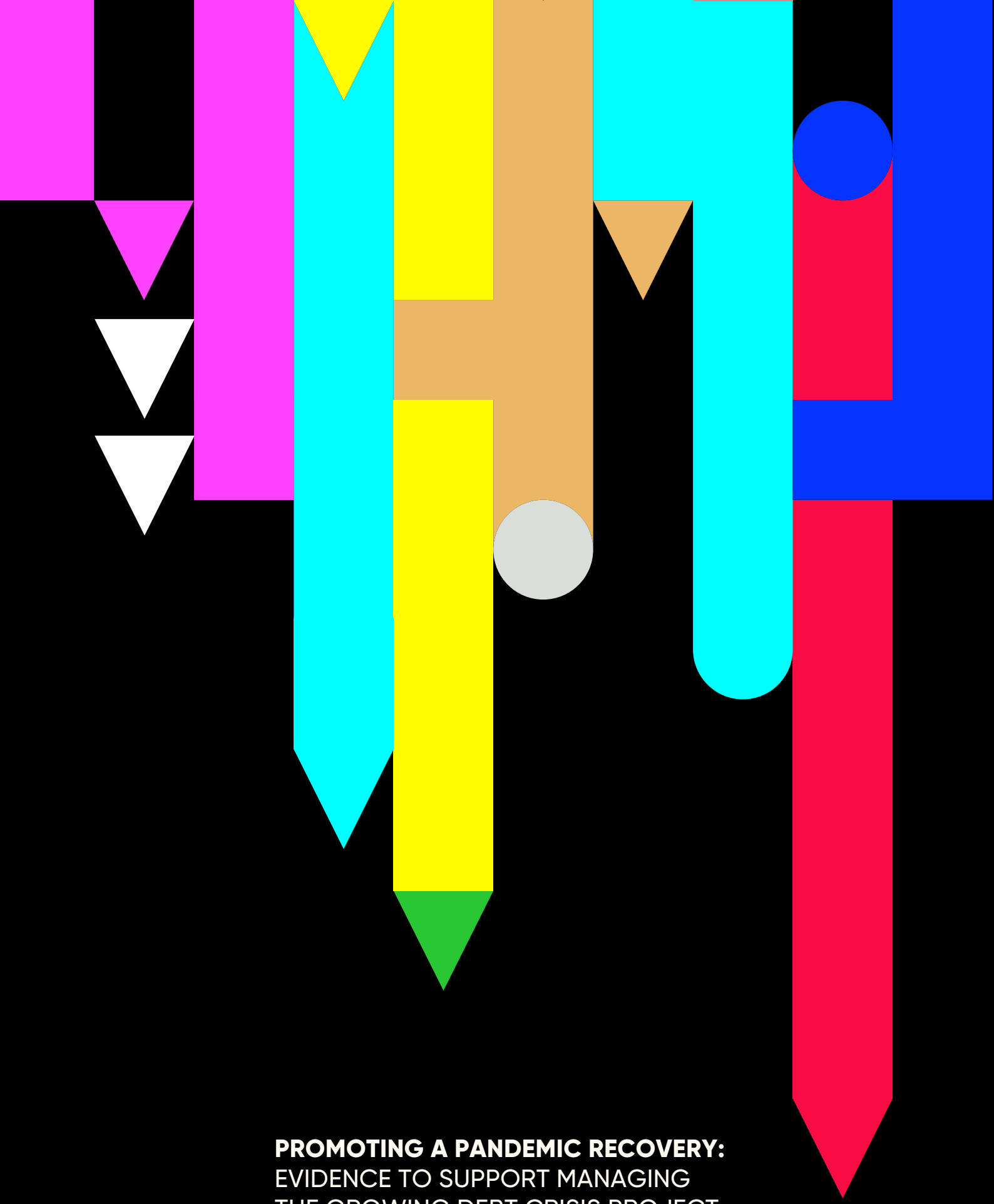
Source: Authors on Construction

Appendix 6

Table A 5: List of respondents visited for KIIs and FGDs

Project	**Implementation Region(s) visited**
Farm income enhancement and forestry conservation	Eastern, Northern and Western
Water & sanitation development facility- Central—Phase II	Central
Strategic town's water supply & sanitation project	Eastern and Western
Integrated water resources management and development project	Eastern
Rehabilitation of district roads project	Central, Western, Northern and Eastern
Rural Development and food security in Northern Uganda Under the project for the restoration of livelihoods in Northern Uganda	Northern
Rehabilitation and upgrading of the urban road project	Central and Eastern
Rehabilitation of Masaka Town Roads (7.3km) Support To Rural Water Supply and Sanitation Project	Central (specifically, Masaka town)
Support to rural water supply and sanitation project	Central, Western and Northern

Source: Authors on Construction



PROMOTING A PANDEMIC RECOVERY:
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THE GROWING DEBT CRISIS PROJECT