Adjusted Macroeconomic Indicators – 2020 Edition

UGANDA

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Macroeconomic Policy Department

Ministry of Finance Planning & Economic Development

ABOUT THIS REPORT

This report is an updated version of the 2019 report that presented the adjusted macroeconomic indicators for Uganda. It provides new indicator values for 2020 (see Section 4) and an updated set of policy recommendations based on those values (Section 5 and Section 6). Much of the content and structure of the report remains the same. However, it is important to note that the methodology from the previous report has also changed slightly hence the new results are not directly comparable with the previous results.

This work is part of a global partnership aimed at promoting sustainable development by incorporating natural resources into national accounting processes.[1] Adjusting these macroeconomic indicators gives a more holistic understanding of macroeconomic developments because they factor in a wider range of capital. This means we can understand whether growth has come at the expense of depleting resources, or whether resource extraction has been invested in other types of capital.

The analysis enhanced World Bank estimates by incorporating Ugandan data where it was appropriate to do so. The analysis recalculated adjusted net savings (ANS) and adjusted net national income (ANNI). No change was made to the World Bank's estimates for comprehensive wealth.

There are six main sections in this report.

- **Introduction** – presents a background to the development of the Ugandan Natural Capital Accounting (NCA) framework and its relationship with the Ugandan National Development Plan (NDP).
- **Macroeconomic indicators** – describes the relevant adjusted macroeconomic indicators and wealth measures used by the statistical analysis and includes an overview of the concept of comprehensive wealth in the context of Uganda.
- **Method** – presents the variables, data sources and the methodology used to do the analysis.
- **Latest results** – the results from this year's analysis.
- **Policy implications** – a set of implications and recommendations for policy decision-making based on the analysis.
- **Recommendations and next steps** – this section concludes and lays out the future work plan for the team while also summarising the economic goals and actions that would contribute to increasing the country's wealth.

[1] See: https://www.wavespartnership.org/

IN SUMMARY

Results

- Uganda's ANS in 2018 as share of gross national income (GNI) was 16.7 percent, down from 19.3 percent of GNI in 2017, reflecting an absolute decline of 8.5 percentage points concurring with a 6 percentage points GNI growth.
- The biggest negative impact on ANS in 2018 comes from the increased consumption of fixed capital (CFC), followed by declines in gross national savings (GNS) and education spending, and increased pollution damages.
- ANNI decreased by 0.3 percent as a share of GNI, from 92.1 percent in 2017 to 91.9 percent in 2018. This was as a result of increased CFC.
- CFC increased by 10.8 percent from a value of US$ 2,049 million in 2017 to US$ 2,270 million in 2018.
- Education expenditure has been declining since a peak in 2016, from 5.7 percent of GNI in 2016 to 4.7 percent of GNI in 2018, reflecting also absolute spending declines of 0.5 and 6.4 percent in 2017 and 2018, respectively.
- Net forest depletion has increased significantly since 2012. The growth in 2018 was 5.3 percent.
- Overall pollution damage increased by 7.7 percent in 2018 but remains stable as a share of GNI.

Recommendations

The recommendations from this report can be summarized into three broad areas of focus:

1. Increase domestic saving and the stock of physical capital
2. Increase human capital and its productivity
3. Reduce emissions and deliberately increase vegetation and forest cover.

The **three** recommendations will help in reducing all the components that apply negatively to NNI and NNS thus leading to positive ANNI and ANS. A positive ANNI and ANS will suggest that the country's wealth is not as a result of the depletion of physical, human or natural capital, and open pathways towards more sustainable economic development.

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ABBREVIATIONS

ANNI	**Adjusted net national income**
ANS	Adjusted net savings
BoU	Bank of Uganda
CFC	Consumption of fixed capital
CWON	Changing Wealth of Nations
DAS	Depletion adjusted savings
ESA	Education Satellite Accounts
FAO	Food and Agriculture Organisation of the United Nations
FRA	Forest Resources Assessment
GDP	Gross domestic product
GNI	Gross national income
GNS	Gross national savings
MoFPED	Ministry of Finance, Planning and Economic Development
NCA	Natural capital accounting
NDP	National Development Plan
NFA	National Forest Authority
NNI	Net national income
SBI	Sustainable Budget Index
SEEA	System of Economic Environmental Accounts
SNA	System of National Accounts
UBOS	Uganda Bureau of Statistics
WAVES	Wealth Accounting and Valuation of Ecosystem Services

1. INTRODUCTION

1.1. Background

The Natural Capital Accounting (NCA) framework being developed in Uganda reflects recent developments and global trends in broadening the measurement framework for economic activity. Traditional measures of economic activity, such as gross domestic product (GDP) and the conventional national accounting framework measures, do not take into account some of the broader impacts of that activity, such as the consumption of natural resources, pollution and environmental degradation. A further gap in traditional economic accounting measures is the lack of a comprehensive measure of a country's wealth, or a balance sheet, to accompany the income measures. As a parallel, to assess a company's financial status and sustainability it is necessary to consider both its income statement and its balance sheet, or assets and liabilities. The same applies to countries. A measure of wealth can help to identify whether a country's income is being generated sustainably or is dependent upon the depletion of assets.

An important initiative to address these shortcomings is the System of Economic-Environmental Accounts (SEEA), developed under the auspices of the United Nations Statistical Division. The SEEA Central Framework was published in 2012.[2] The SEEA follows the principles of the System of National Accounts (SNA) that underpins the calculation of GDP and other related measures of economic activity. The SEEA is consistent with the SNA (and therefore follows the appropriate statistical principles). However, it also incorporates a broader range of activities (costs and benefits) in the calculation of two key macroeconomic indicators:

1. Adjusted net national income (ANNI), and
2. Adjusted net savings (ANS).

While developing the SEEA, the World Bank was also engaged in a related project, the Changing Wealth of Nations (CWON). This made use of the adjusted macroeconomic indicators in the SEEA but extended it to include measurements of different types of assets. The CWON project therefore began to present measures of comprehensive wealth, a form of national balance sheet, to accompany the (adjusted) income accounts. The components of comprehensive wealth include, besides the usual measures of produced capital stock and (net) financial assets, a range of natural capital assets, both renewable and non-renewable, and human capital. This enabled tracking of levels of national wealth, and whether national income is being generated sustainably from the perspective of preserving national wealth.

The CWON project and its related publications[3] and databases[4] now includes information on ANS, ANNI and the components of comprehensive wealth. All of these are intended to assist in identifying whether a country's GDP is being generated in a sustainable manner, and whether the pattern of growth is sustainable. In particular, it addresses whether national income is being generated by the depletion of natural resources, and if so, are other types of capital being increased to compensate for this.

These measures of adjusted national income and wealth play an integral role in the related Wealth Accounting and Valuation of Ecosystem Services (WAVES) project, a broad-based

[2] United Nations. 2014.
[3] Lange et al. 2011; World Bank. 2006; World Bank. 2011.
[4] The Adjusted Macroeconomic Indicators tools can be found in the World Bank's data catalogue.
ANS: https://datacatalog.worldbank.org/dataset/adjusted-net-savings
Comprehensive wealth: https://datacatalog.worldbank.org/dataset/wealth-accounting

initiative co-ordinated by the World Bank.[5] The WAVES project includes the preparation of a number of different types of accounts for participating countries. These may include accounts for water, energy, land, forests, wetlands, fisheries, minerals and other elements of natural capital or ecosystem services, alongside adjusted macroeconomic and wealth accounts. Uganda is now undertaking an NCA exercise covering a range of accounts, including land, forest and wetland accounts, as well as macroeconomic and overall wealth accounts. The exercise is being facilitated by World Bank group under the WAVES program.

This report presents the results of the adjusted macroeconomic indicators for Uganda and identifies policy issues that need to be considered during government planning and budgeting. The empirical results use a mixture of data for Uganda generated from local sources and, where there are gaps, data from the World Bank ANS database.

NCA for Uganda is intended to be an ongoing exercise. Many of the indicators need to be calculated and updated annually and should be presented alongside other measures of economic activity so that they can guide both long term and medium-term plans and budgets. Given that resource-based industrialisation plays a central role in the third National Development Plan (NDP III), NCA measures will be central to monitoring the implementation and impact of the strategy. Furthermore, development of some of the desired indicators is incomplete, as data sources will need to be identified and developed, so that new components of national wealth, such as oil and gas resources, can be incorporated.

1.2. Links to National Development Plans (NPAs)

Uganda's development planning is encapsulated in the Comprehensive National Development Planning Framework that was developed in 2007. To realize the 30-year vision aspirations, five-year medium-term NDPs are formulated highlighting development priorities. Out of the expected six NDPs to be implemented by 2040, two have been implemented, NDP I and NDP II (which ended during FY2019/20).

Implementation of NDP III for FY2020/21 to FY2024/25 started in July 2020. NDP III aims at enhancing household incomes and improving the quality of life of the population by holistically focusing on resource-led industrialization for export-led growth.

The theme of NDP III is '*Sustainable Industrialization for Inclusive Growth, Employment and Sustainable Wealth creation*'. However, the currently available metrics of performance of the economy do not adequately cater for sustainability, since they do not account for welfare changes or externalities. In addition, GDP growth measurements do not consider the impact on the stock of wealth of the economy. For instance, NDP III's focus on resource-led industrialization will involve depletion of non-renewable resources like oil, iron ore and phosphates. This means that an increase in GDP could result from depletion of these non-renewable resources. Similarly, with renewable resources, unless interventions to ensure sustainability are undertaken (reducing depletion to match natural regeneration), renewable resources may be exhausted.

SEEA broadens the measure of key macroeconomic indicators. It takes into account the depletion of natural resources, accumulation or depletion of human capital and impacts of economic activity on the environment. The SEEA adjusted macroeconomic indicators ANNI and ANS address key sustainability issues which are at the core of NDP III's focus. The adjusted macroeconomic

[5] See: https://www.wavespartnership.org/

indicators will provide a reliable source of information for planning and policymaking as far as sustainability issues are concerned.

Uganda is now regarded as a resource rich country[6] after the discovery of oil in the Albertine region. Various projects and programs are underway to prepare for the extraction of the oil. There will be a need to take precautionary measures when the oil revenues begin to flow, because the key fiscal and macroeconomic aggregates may be subject to high volatility that will be difficult to forecast, raising sustainability issues. These adjusted macroeconomic indicators will help determine if wealth creation is enough to offset the depletion of energy resources.

The ANS also takes into account the depletion of forests. These indicators will be key in tracking the progress towards the attainment of the increased forest cover target and will complement the already existing indicators in tracking the forest cover of the country.

[6] A resource rich country is one where the Government derives a significant proportion of revenues from mineral resources (can be through different channels) (25% +), resources exports account for a significant proportion of total export earnings and resources production accounts for a significant proportion of GDP.

2. ADJUSTED MACROECONOMIC INDICATORS

The main macroeconomic indicators developed under the SEEA project aim to broaden the range of economic activities and impacts that are captured. These measures are as follows:

ANNI: conventional measures of gross national income (GNI) are adjusted by deducting the value of depletion of assets, including produced capital (consumption of fixed capital (CFC)) and natural capital (both renewable and non-renewable).

ANS: conventional measures of gross national savings (GNS) are adjusted by adding the value of investment in human capital, deducting the value of depletion of assets (as above), and deducting the value of pollution damage.

The depletion of non-renewable natural capital (such as minerals and energy resources) is measured directly by the depletion component of production (extraction). For renewable natural capital (such as forests and fisheries), depletion is measured by the excess of production (extraction) over the natural rate of re-growth. In principle, the consumption of renewable natural capital is sustainable if it does not exceed the rate at which the resource regenerates.

The ANNI measure is intended to adjust conventional measures of national income to take account of depletion of assets. Conventional GDP or GNI measures – which are usually the basis for assessments of economic expansion – record gross income regardless of whether part of that "income" comes from the depletion of assets. ANNI is therefore a more accurate measure of sustainable income.

For the ANS calculation, the value of investment in human capital is added, as human capital is treated as part of the comprehensive wealth base of the economy. It is proxied by the value of recurrent spending on education by the public, and if possible, also the private, sectors[7].

The pollution damage incorporated in the ANS calculation has two components: (i) the value of CO_2 emissions, and (ii) the value of particulate ($PM^{2.5}$) emissions[8].

ANS is particularly useful as it is a more comprehensive measurement and is directly linked to the components of comprehensive wealth. A negative figure for ANS indicates that wealth is being depleted, and therefore that the pattern of economic activity is not sustainable.

ANNI and ANS figures are published annually by the World Bank. They are included in the World Development Indicators database, along with the various components used in the calculations. However, it is useful to compile the indicators using local data as it is often more representative and relevant than the World Bank estimates.

[7] Only recurrent spending is included, as the investment component is already included in the measure of produced capital stock. For reasons of data availability and consistency across countries, the World Bank ANS calculation uses only data on public (that is government) spending on education. Whereas we have made an attempt to also account for other sources of education expenditure.

[8] Full details of the methodology can be found in: Estimating the World Bank's Adjusted Net Saving: Methods and Data, 2018 (https://datacatalog.worldbank.org/dataset/adjusted-net-savings)

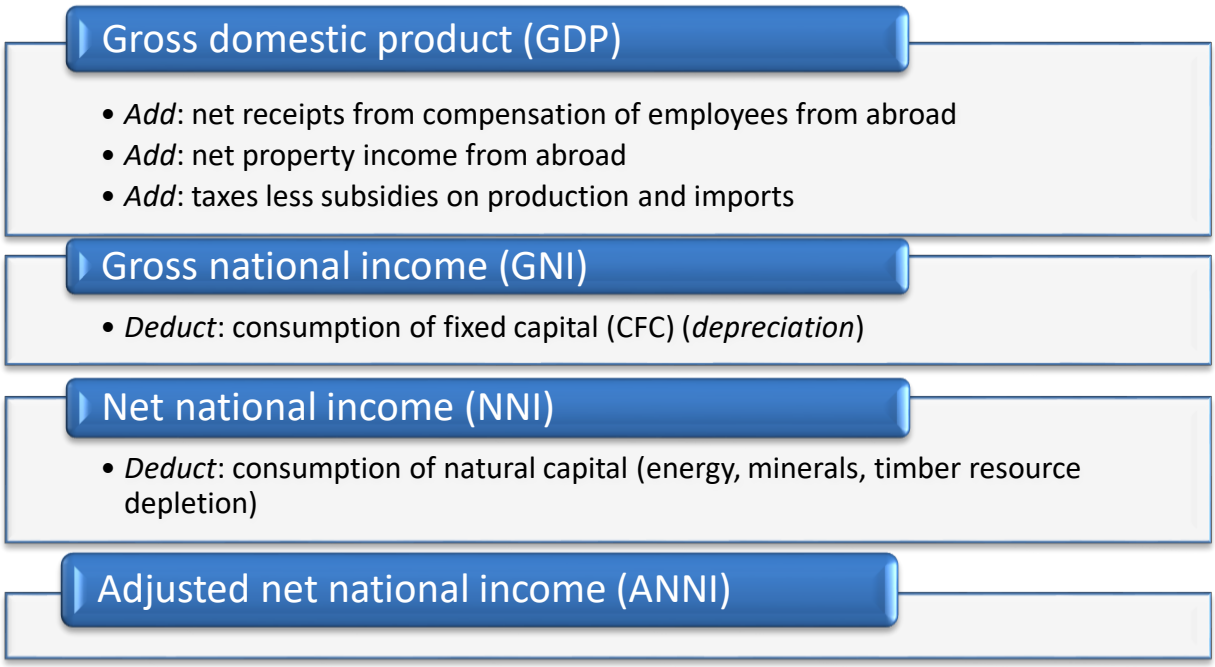
3. METHOD

Our work uses Ugandan data for some variables that are components of ANS and ANNI. These variables are calculated annually. There is good reason to replace some of the World Bank data with local sources. For example, a relatively high proportion of Uganda's education expenditure comes from non-government sources which is not captured in the World Bank methodology. Therefore, there is merit in including private as well as public sources of education spending. In addition, the World Bank uses the export price for timber products. However, this poorly reflects Uganda's internal market. Uganda is undergoing significant deforestation; hence domestic prices are more relevant. This exercise will also make it easier to calculate bespoke statistics in future, as more inputs are developed. This section will summarise what has been done and why, the issues encountered, and what improvements could be considered.

3.1. ANNI and ANS

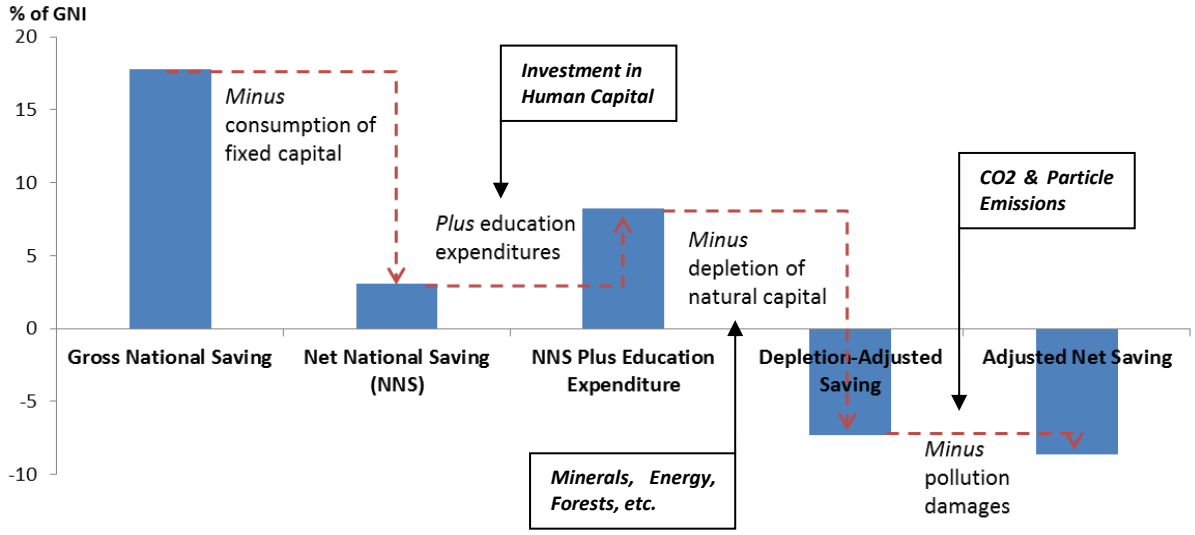
ANNI is GNI adjusted for depreciation and natural capital depletion. Figure 1 shows the process. This project has not replicated the calculation of GNI, as that is a well-defined process in the standard national accounts. Instead, GNI has been used as the starting point for calculating ANNI.

Figure 1: Calculation of ANNI from GDP



ANS is a more comprehensive measure of a country's inflows than GNS. Figure 2 shows the process. Essentially, various deductions and additions are made to GNS in order to provide a more accurate picture of overall income and expenditure in the economy. First, depreciation of fixed assets is deducted. Then education expenditure is added to reflect investment in human capital. Finally, natural capital depletion and pollution damages are deducted.

Figure 2: ANS Visualisation



ANS and ANNI have been recalculated for Uganda, using locally available data, and some assumptions for:

i) CFC

ii) Recurrent education expenditure, including non-government expenditure

iii) Net forest depletion, and

iv) CO_2 emissions from deforestation.

In the medium term, these metrics should be improved, and new data should be added when it becomes available.

3.2. Data Sources

As the original work was carried out by the World Bank, most of the data is from this source. Where an acceptable local alternative exists, it has replaced the World Bank data.

Table 1: Data Used in this Report

Variable	*Source*
GNI	World Bank
GNS	World Bank
Capital stock	UBoS
Capital depreciation rate	MoFPED
GDP deflators	UBoS
Exchange rate (Shs/US$)	UBOS
Education expenditure	UBOS and MoFPED
Timber production by type	UBOS
Charcoal and wood fuel prices	Estimated from Uganda National Charcoal Survey, 2015[9]
Poles and sawn timber prices	UBOS

[9] MEMD (Ministry of Energy and Mineral Development). 2015

Productive forest area	UBOS, Wood Asset and Forest Accounts
Energy depletion	World Bank
Mineral depletion	World Bank
Rental rate	World Bank
Annual commercial increment	World Bank
Baseline CO_2 damage	World Bank
Total forest area	World Bank[10]
CO_2 emissions per ha of deforestation	Estimated from Uganda's Forest Reference Emission Level report
Air pollution damage	World Bank

3.3. Methodology

3.3.1. NNS

NNS is GNS less CFC. The logic is that depreciation of assets is equivalent to dissaving. CFC numbers come from the macroeconomic modelling team within Ministry of Finance, Planning and Economic Development (MoFPED). They are based on a depreciation of 5 percent of the year's capital stock.

The World Bank data on which most of this modelling depends is in current US$ by calendar years. Therefore, the modelling has been done in current US$ in calendar years. CFC numbers are in real Ugandan Shillings per financial year, so they were first converted into nominal terms, then into US$ and finally to calendar years. CFC was then deducted from GNS to give NNS.

3.3.2. NNS + Education Expenditures

Recurrent education expenditure is then added to NNS. The logic here is that any expenditure on education is an investment in human capital, an asset of the country, and thus be counted positively. Only recurrent education expenditure is added, as any development expenditure (building schools for example) is already captured in fixed capital investment, which is already reflected in the GNS calculation. Furthermore, education expenditure includes spending by the public sector (government), the private sector (households) and development partners. This was considered important for Uganda, where a large proportion of education spending comes from outside government and is thus not captured in World Bank data.

Education spending data came from two sources. The Education Satellite Accounts (ESAs), compiled by Uganda Bureau of Statistics (UBOS), gave good information on the total education expenditure from all sources, including household, external and income generation. It also provided a breakdown of spending by recurrent and development components.

The ESAs were only compiled for the period 2008/09 to 2013/14. These were used to estimate the proportion of total spending that came from the government. Over the period it was 31.4 percent. We also estimated the proportion of total education spending that was recurrent. Over

[10] The data reported by the World Bank on total forest area is derived from the FAO Forest Resources Assessment (FRA), which is published every five years (most recently in 2015). The source of the Uganda data included in the FRA is from the NFA.

the period it was 83.5 percent. Using a log-log regression with a linear trend, we also estimated the elasticity of private education spending to government education spending over the recorded period. The estimated value of -0.1 suggest that a decrease in government education spending is partly compensated by an increase in private spending, the amount compensated being up to 30 percent of the initial decrease in spending, considering that private spending is more than two times larger than government expenditure.

Government data on education expenditure was raised to give an estimate for total expenditure. The available data on government education expenditure runs from 1997/98 to 2016/17. Using the ratios and elasticity estimated from the ESAs, the corresponding private spending was estimated as follows:

- Assuming away temporal trends in service provision shares in the Ugandan education sector (which were not visible in the satellite accounts), the estimated government share of 31.4 percent was inverted to a 318.7 percent uplift (with private spending 218.7 percent of government spending) estimating long-term total spending from government spending.
- To reflect the long-term nature of this assumption, the uplift was not applied to current period government spending, but to a 3-year moving average of government spending, taken over the current period, one period in the past and one period in the future.
- In addition, the short-term responsiveness of private spending to changes in government spending is modelled by allowing the estimated long-term private spending to adjust, with an elasticity of -0.1, to changes in government spending from the previous period.

Estimated total education spending in the current period is thus the sum of three components:

(1) Current period government spending.

(2) The general level of private spending – computed as a 218.7 percent mark-up over the 3-year moving average of government spending and including one past and one future spending period.

(3) The short-term private spending response to changes in government spending – calculated as the response of the level of private spending calculated in Step (2) to the percentage change in government spending from the previous period Step (1), using the estimated elasticity of -0.1.

Table 2 provides a numerical example.

Table 2. Example of Education Spending Calculation

Step	Time	t-1	t	t+1
(1)	Current GoU spending	3.4	**4.2**	5.6
	3-Year Moving Average [= (3.4 + 4.2 + 5.6) / 3]	…	4.4	…
(2)	Estimated private spending (218.7% uplift) [-4.4 * 2.187]	…	**9.62**	…
	Log-difference of GoU Spending from t-1 to t [= ln(4.2/3.4)]	…	0.21	…
(3)	Estimated short-term private response [=9.62 * 0.21 * - 0.1]	…	**-0.20**	…
	Estimated total spending = (1) + (2) + (3) [=4.2 + 9.62 – 0.20]	…	**13.62**	…

This estimate was then converted to calendar years and added to NNS to give NNS + Education Expenditure.

3.3.3. DAS

DAS are NNS + Education Expenditures less NNC depletion. The logic is that saving at the expense of depleting natural capital is discarded. Both renewable (forests) and non-renewable (energy and minerals) resources are included in the World Bank methodology, and so are also included here.

NNC depletion is the sum of net forest depletion, energy depletion and mineral depletion. Please refer to the annexes for more detail on these components.

NNC depletion was deducted from NNS + Education to give DAS.

3.3.4. ANS

ANS is DAS less pollution damages. The logic is that you are not truly saving if that saving comes with negative externalities. These externalities can be either global, in the case of greenhouse gas emissions, where citizens of every country bear the cost, or local, as in the case of air pollution, where the health of local citizens is negatively affected.

Pollution damages, under the World Bank methodology, are the combination of baseline CO_2 emissions and air pollution damage. Baseline CO_2 emissions are those from fossil fuel use and cement production. Our analysis also includes an estimate for CO_2 damages from deforestation, as it was clear from the net forest depletion calculations that deforestation is a significant factor in Uganda[11].

For baseline CO_2 damage and air pollution damage World Bank numbers were used. For deforestation CO_2 damages we produced our own estimate.

The Forest Reference Emission Level report[12] for Uganda gave us an estimate for the average annual CO_2 emissions from deforestation over the period 2000 to 2015. When we compared this against the change in total forest area reported by the World Bank over the same period, we were able to estimate an average CO_2 emission per ha per year, of 73.7 tCO_2e. We applied this emissions factor to the total forest area lost by year, calculated from the same World Bank numbers, to give CO_2 emissions per year. We then multiplied this by an estimated carbon price to give a monetary value.

The carbon price was inferred from World Bank data. The annual CO_2 damage value provided in the ANS dataset in US$ was divided by the CO_2 emissions estimates provided by World Bank Open Data, to give an implied annual damage cost of carbon emissions. This price increases over time.

Both CO_2 damage estimates and air pollution damages were combined to give total pollution damage. This was deducted from DAS to give ANS.

[11] Deforestation CO_2 emissions result from the burning of forest, which is not replaced. Although the burning of charcoal and woodfuel also releases CO_2, if this is replanted (resulting in no deforestation), then net CO_2 emissions from this source is zero as the growing stock absorbs CO_2.

[12] The *Proposed Forest Reference Emission Level for Uganda*, *February 2018*, is published by the Ministry of Water and Environment, and is available here: https://www.mwe.go.ug/sites/default/files/library/Final%20-%20Uganda%20Forest%20Reference%20Emission%20Level%20Document%20-February%202018.pdf

3.3.5. ANNI

ANNI was calculated from the starting point of GNI, as calculated by the World Bank. From this MoFPED's estimation of CFC was deducted, just as for NNS, yielding NNI. The same value for natural capital depletion was then deducted as was used for DAS to give ANNI.

4. LATEST RESULTS

The latest compilation of adjusted macroeconomic measures provides further insights into Uganda's adjusted net wealth status overall and its evolution since last year. It is important to note that the methodology used in this report differs from the previous report. As a result, the new results are not directly comparable with the previous results, and also some of the data from last year referred to in this section has changed.

For ease of use, we have listed the different adjusted macroeconomic measures in a Table of Contents below and provided an abbreviations list for the key terms in this section.

4.1. Adjusted Macroeconomic Measures – Table of Contents

4.2. Abbreviations

ANS	Adjusted net savings
ANNI	Adjusted net national income
CFC	Consumption of fixed capital
DAS	Depletion adjusted savings
GDP	Gross domestic product
GNI	Gross national income
GNS	Gross national savings
NNI	Net national income
NNS	Net national savings

4.3. Key Results

- Uganda's ANS in 2018 as share of gross national income (GNI) was 16.7 percent, down from 19.3 percent of GNI in 2017, reflecting an absolute decline of 8.5 percentage points concurring with a 6 percentage points GNI growth.
- The biggest negative impact on ANS in 2018 comes from the increased consumption of fixed capital (CFC), followed by declines in gross national savings (GNS) and education spending, and increased pollution damages.
- ANNI decreased by 0.3 percent as a share of GNI, from 92.1 percent in 2017 to 91.9 percent in 2018. This was as a result of increased CFC.
- CFC increased by 10.8 percent from a value of US$ 2,049 million in 2017 to US$ 2,270 million in 2018.
- Education expenditure has been declining since a peak in 2016, from 5.7 percent of GNI in 2016 to 4.7 percent of GNI in 2018, reflecting also absolute spending declines of 0.5 and 6.4 percent in 2017 and 2018, respectively.
- Net forest depletion has increased significantly since 2012. The growth in 2018 was 5.3 percent.
- Overall pollution damage increased by 7.7 percent in 2018 but remains stable as a share of GNI.

4.4. Adjusted Macroeconomic Measures – Latest Results

4.4.1. ANS

Uganda's ANS in 2018 as share of GNI was 16.7 percent, down from 19.3 percent of GNI in 2017. This translates to an absolute 8.5 percent decline (from US$ 5,795 million to US$ 5.304 million), while nominal GNI growth over the same period was 6 percent. See Figure 3, Figure 4 and Figure 5.

Figure 3: ANS Visualisation as a % of GNI, 2018

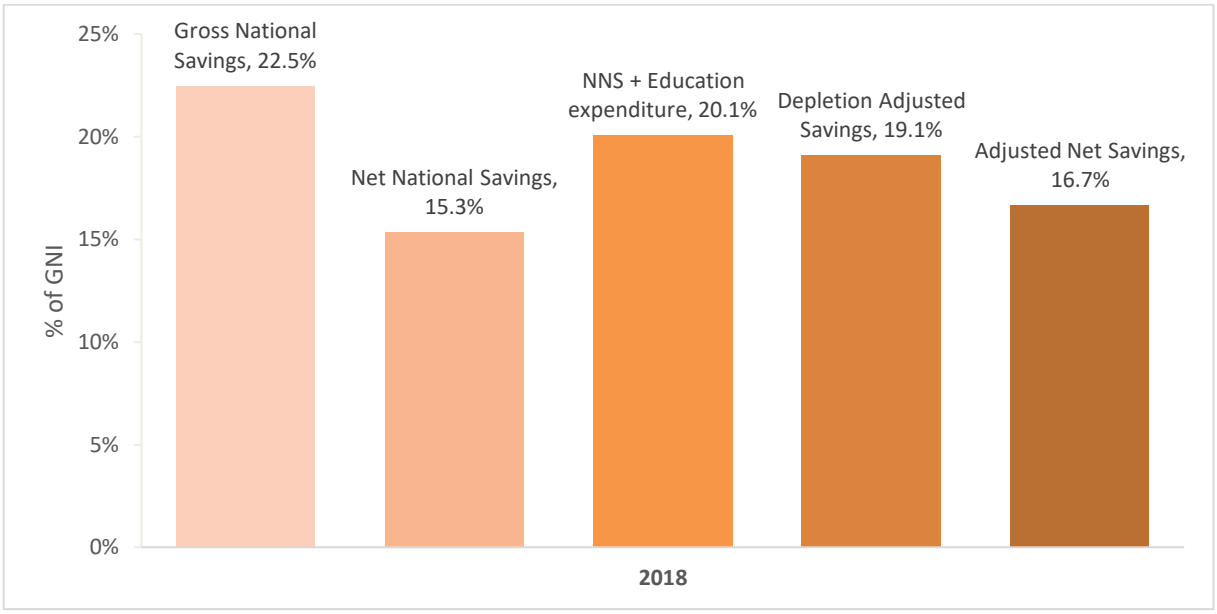


Figure 4: ANS Visualisation in Current US$, 2017-18

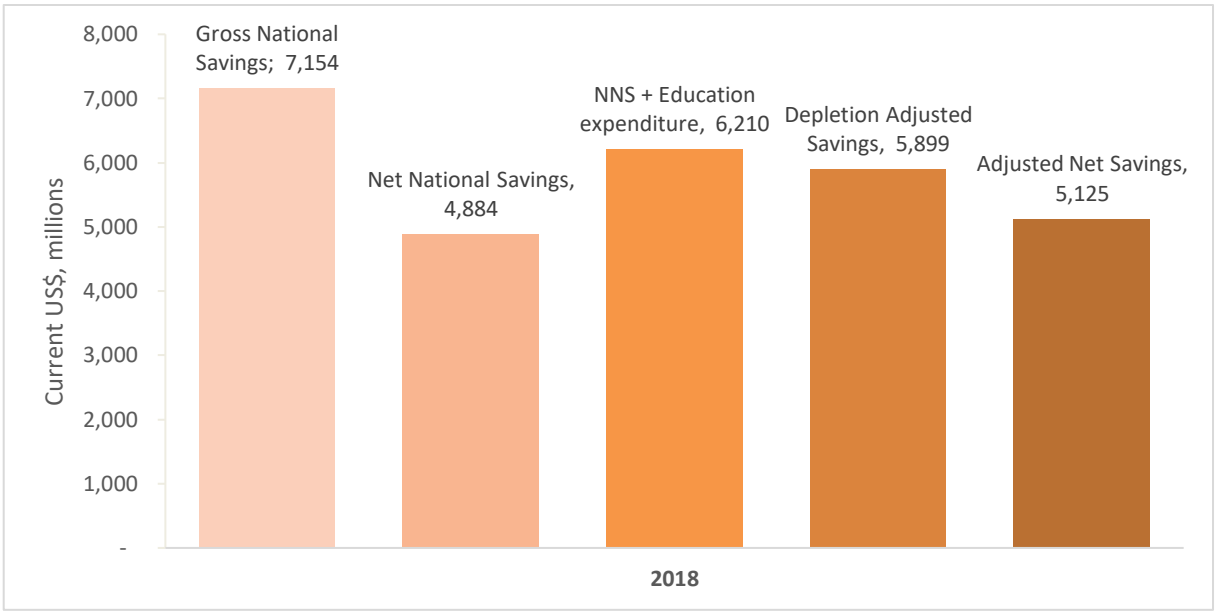
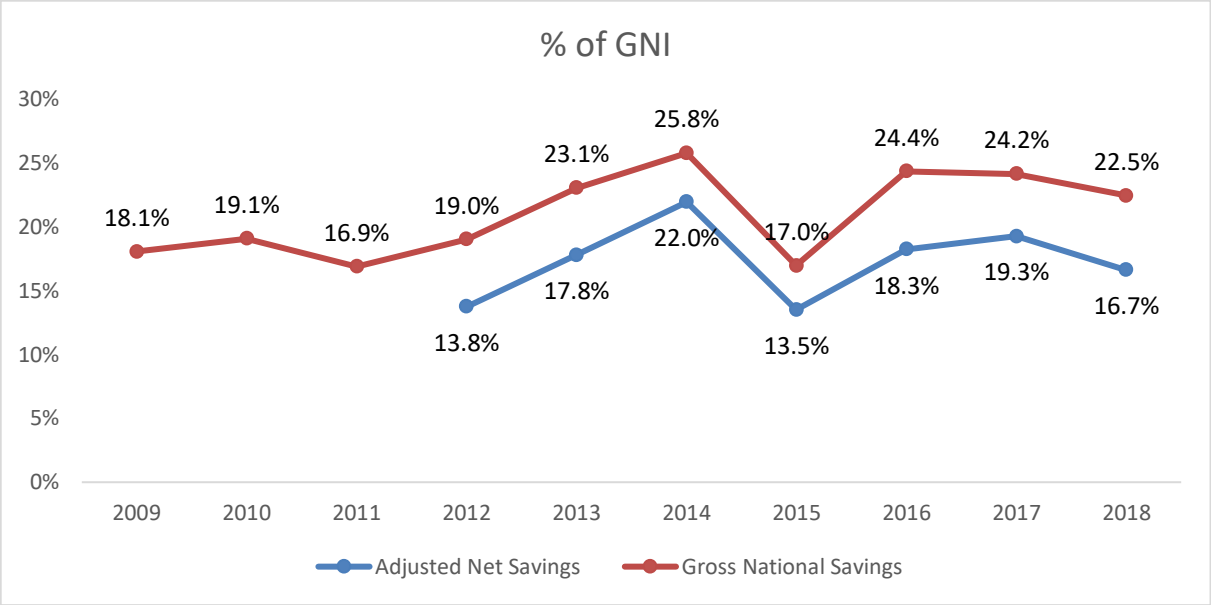


Figure 5: ANS and GNS as a % of GNI, 2009-18



A breakdown of ANS in current US$ from 2013 to 2018 is shown in Figure 6. The corresponding percentage change breakdown is shown in Figure 7 below.

Figure 6. ANS Breakdown in Current US$, 2013-18

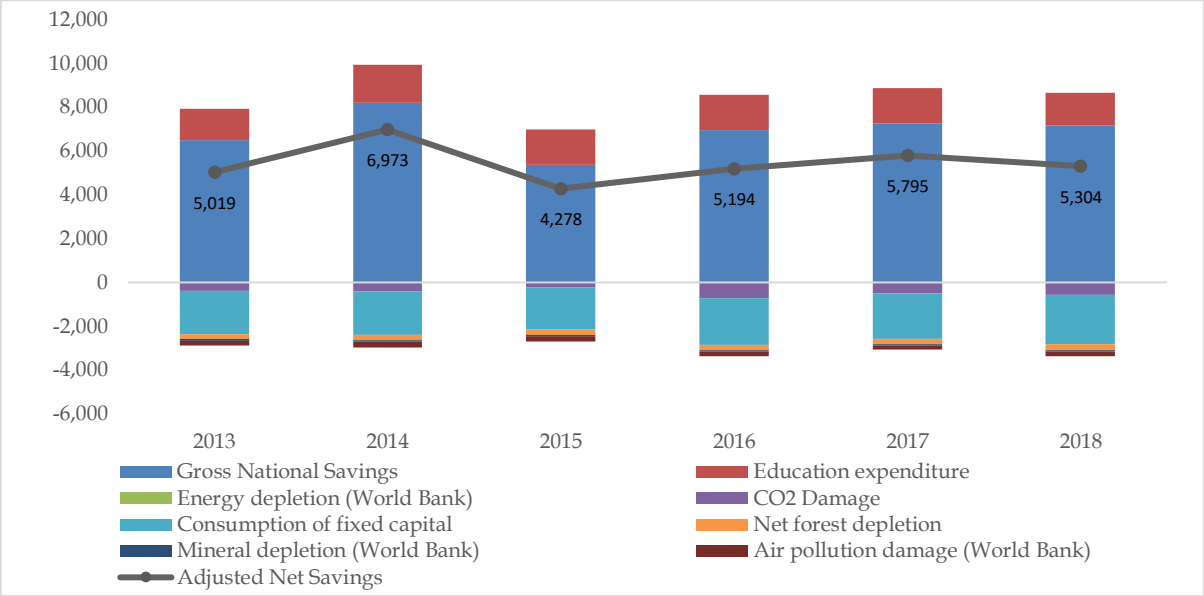
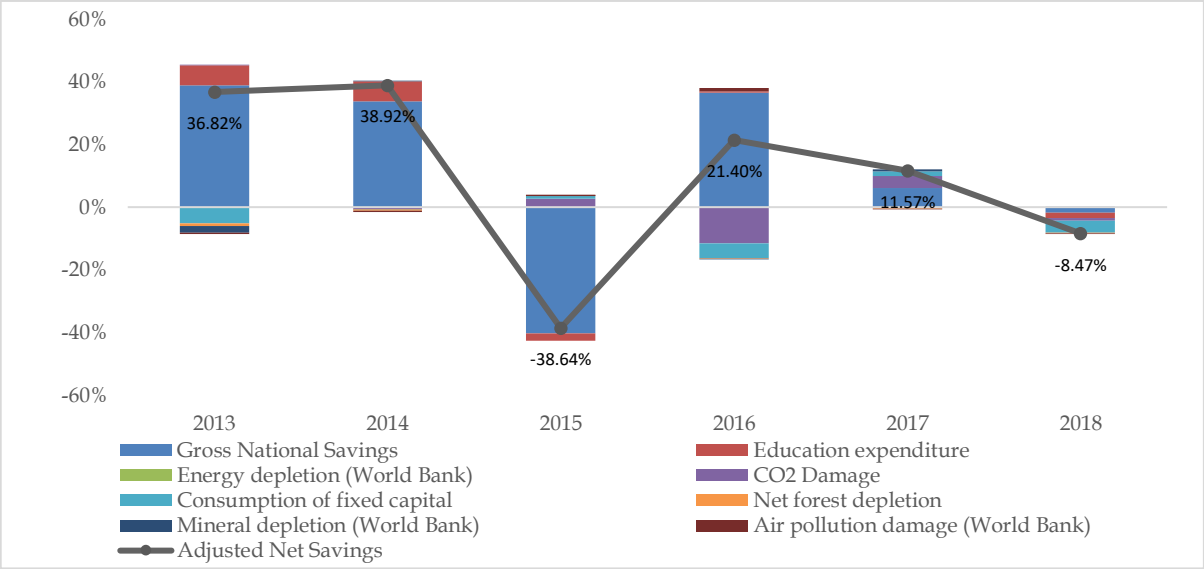


Figure 7. ANS Growth Rate Breakdown, 2013-18



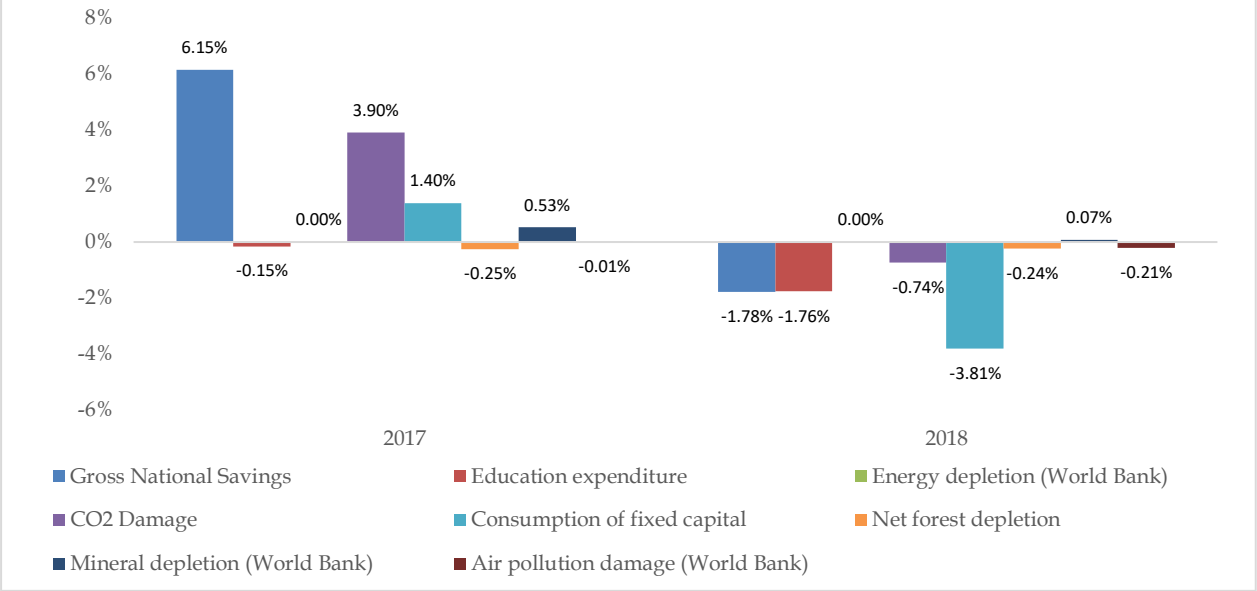
As mentioned above, ANS has declined by 8.5 percentage points from 2017 to 2018 (see Figure 7). This decline stands in stark contrast to the increase of 11.6 percentage points in the 2016-17 period. The decline during 2017 can be broken down as follows:

- 3.8 percent is accounted for by an increase in the CFC
- 1.8 percent is accounted for by a decline in GNS
- 1.8 percent is a result of a decrease in education spending
- 0.95 percent comes from increased pollution damages, and

- 0.17 percent comes from an increase in natural capital depletion (which can further be broken down into 0.24 percent coming from increased forest depletion, balanced by a 0.07 percent reduction in mineral depletion).

A magnified view of Figure 7 showing only the breakdown of ANS growth in 2017 and 2018 is provided by Figure 8.

Figure 8. ANS Growth Rate Breakdown, 2017-18



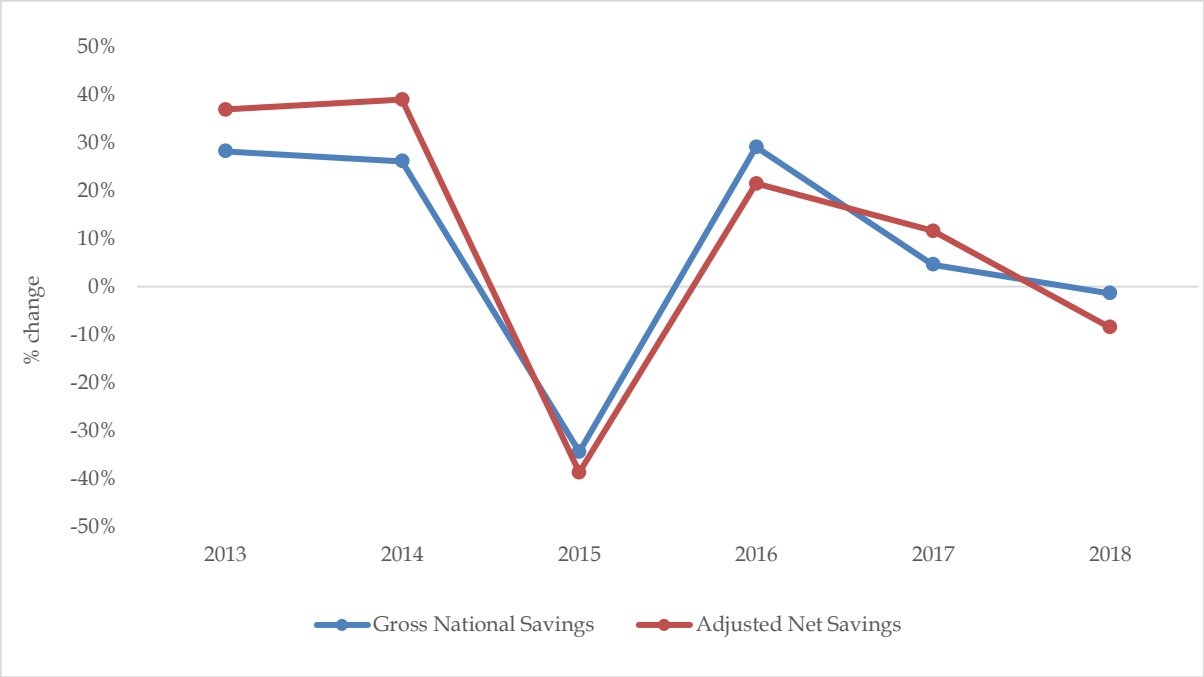
The biggest negative impact on 2018 comes from the increased CFC. It is even possible that this rate may be a low estimate[13] – whereas the same has reduced in 2017. Also notable are the reversal of growth rates of GNS and CO_2 Damage. CO_2 damage did improve in 2017 but worsened again in 2018.

Finally, education expenditure which remained stable from 2016 to 2017, was a lot lower in 2018, contributing significantly to the observed decline.

The trend reversal since 2017 can also be observed when comparing ANS growth to GNS growth, shown in Figure 9.

[13] The assumed rate for CFC of 5 percent of existing capital stock each year is low by international standards. Future research will aim to produce a more refined estimate, reflecting the expected service lives of different types of capital assets.

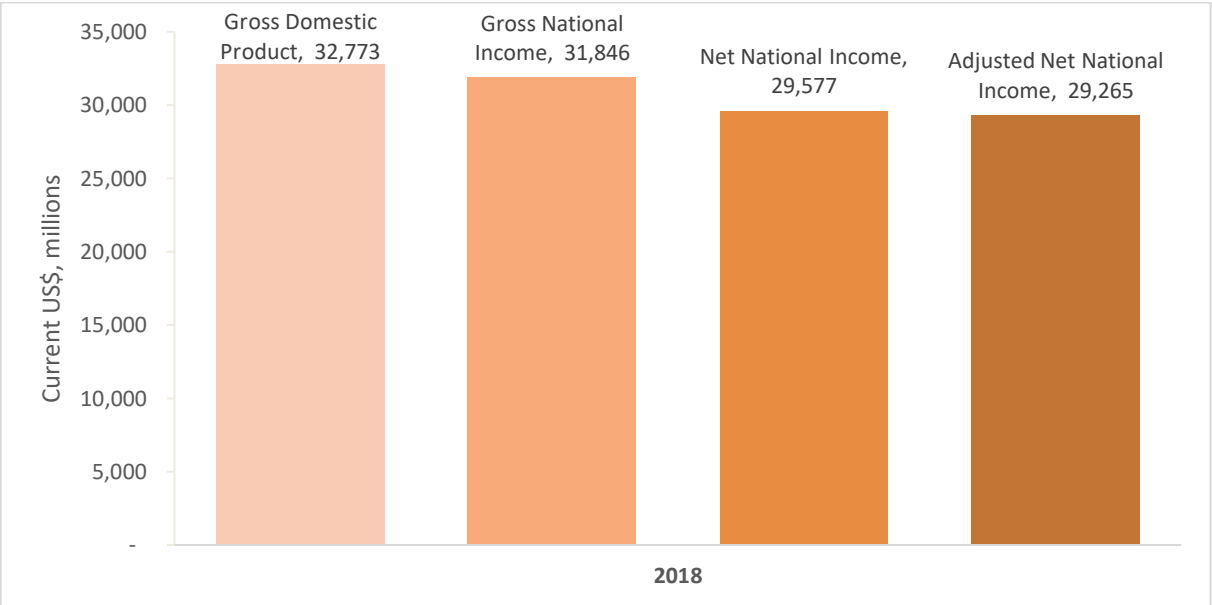
Figure 9. GNS and ANS Growth



4.4.2. ANNI

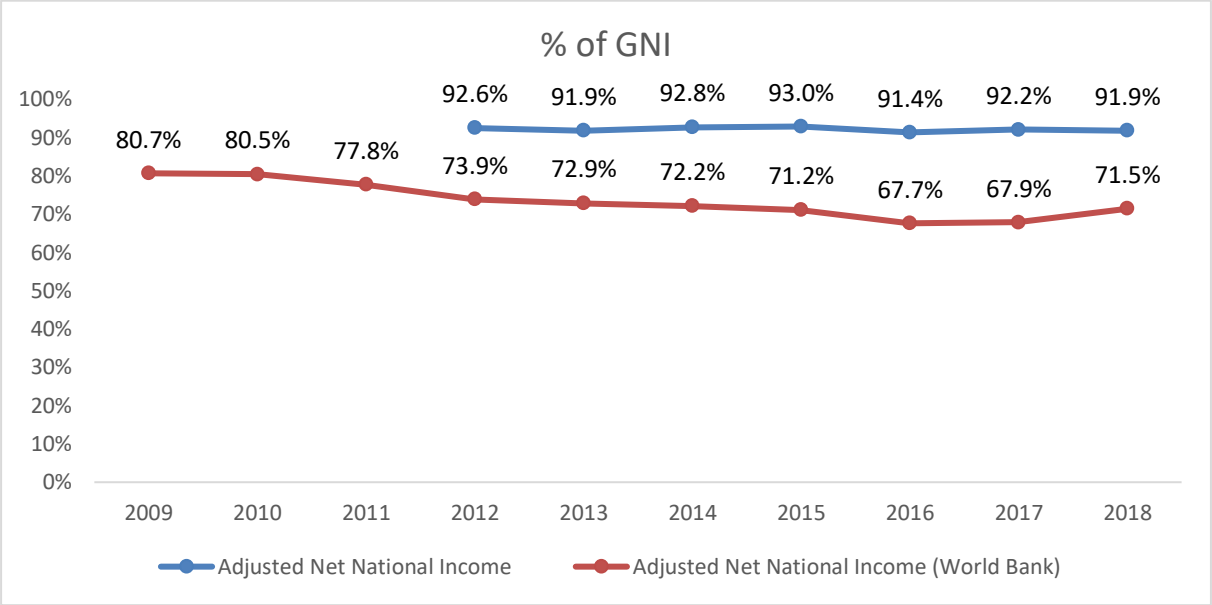
ANNI decreased by 0.3 percent as a share of GNI. However, this was with an absolute increase by 5.7 percent, from US$ 27,682 million in 2017 to US$ 29,265 million in 2018.

Figure 10. ANNI Visualisation in Current US, 2017-18



ANNI barely differs from NNI, due to the small values for NNC depletion. See Figure 11 and Figure 12. It has remained quite stable at 92 percent of GNI. The World Bank estimate is lower, due to their higher value of net natural capital depletion.

Figure 11. ANNI as a % of GNI, 2009-18



A breakdown of ANNI in current US$ from 2013 to 2018 is shown in Figure 12. The corresponding percentage change breakdown is shown in Figure 11 below.

Figure 12. ANNI Breakdown in Current US$, 2013-18

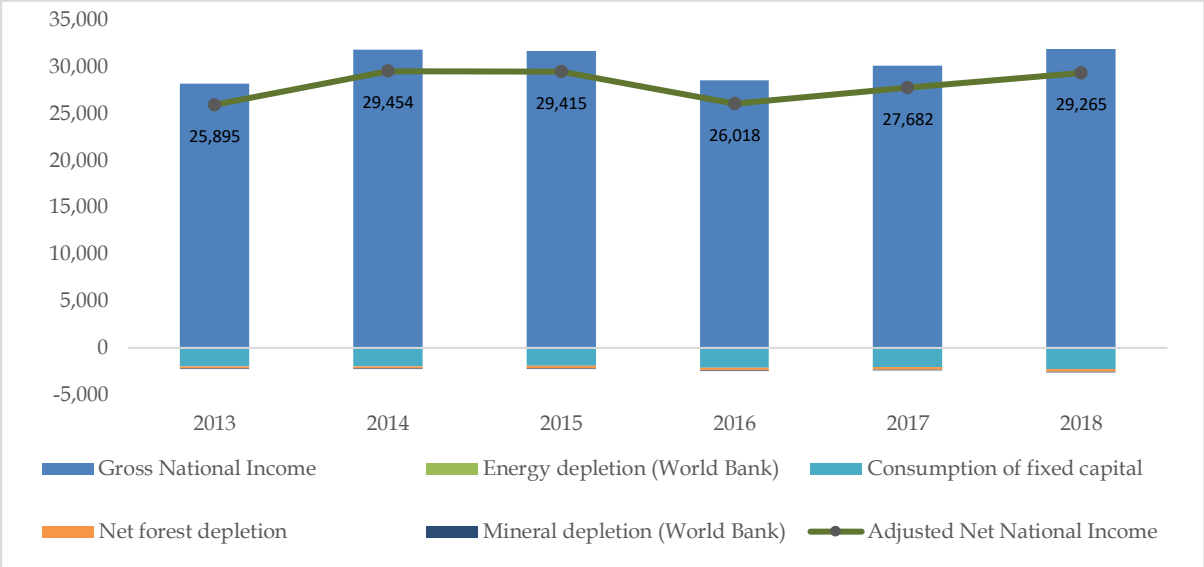
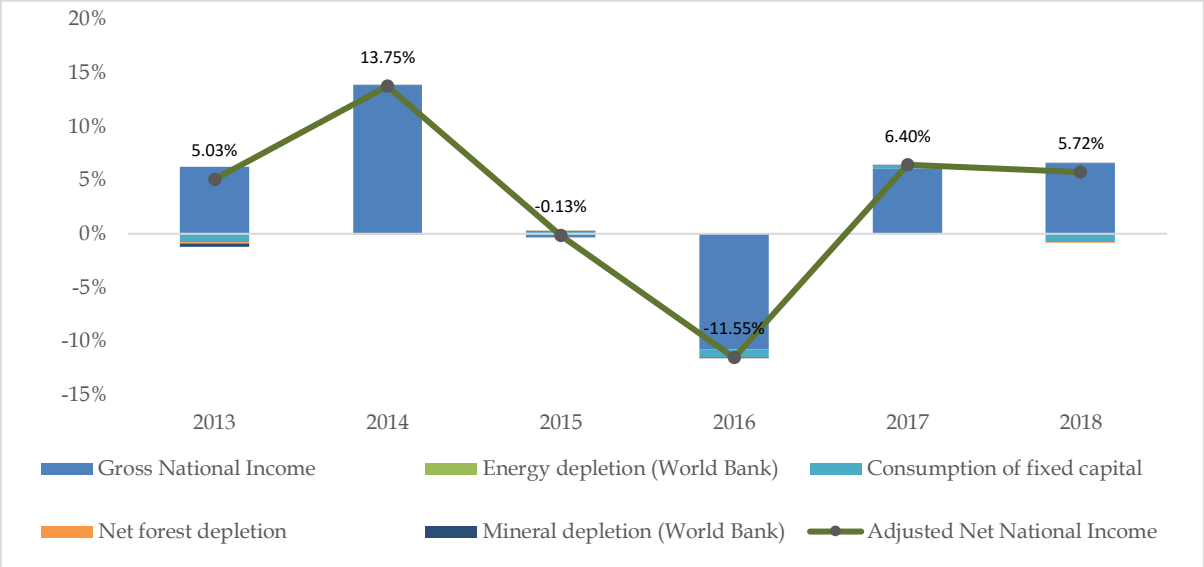


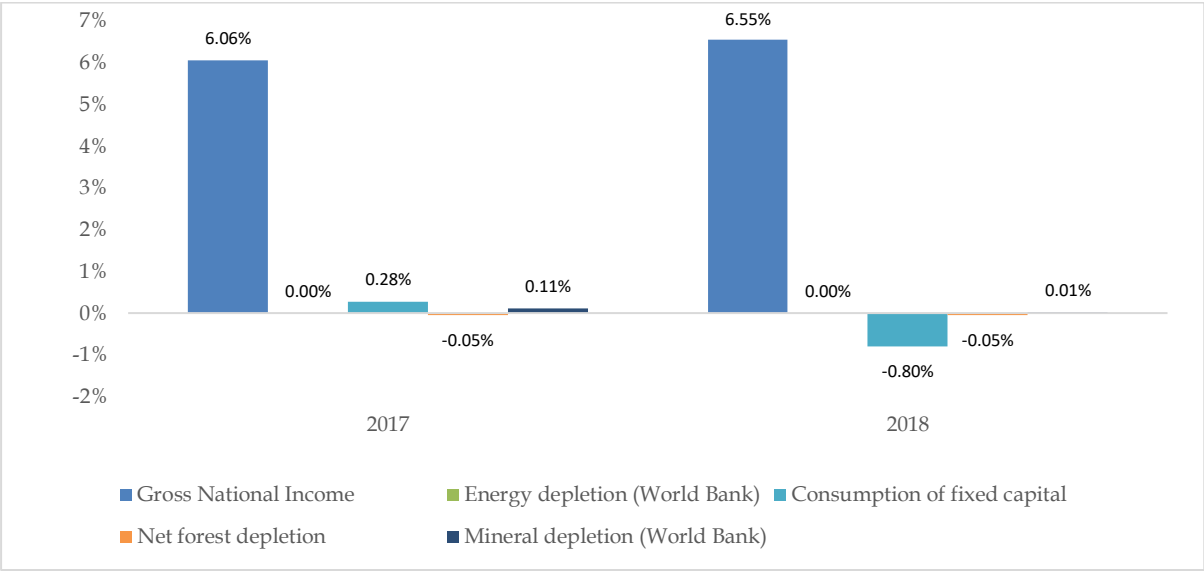
Figure 13. ANNI Growth Rate Breakdown, 2013-18



From the absolute 5.7 percent increase between 2017 and 2018, 6.6 percent is accounted for by the nominal GNI growth of 6 percent. Out of this, a further 0.8 percent is subtracted because of a higher CFC, and a small share of 0.03 percent is also subtracted to account for increased depletion of natural capital.

A magnified view of Figure 13 showing only the breakdown of ANNI growth in 2017 and 2018 is provided by Figure 14.

Figure 14. ANNI growth rate breakdown, 2017-18

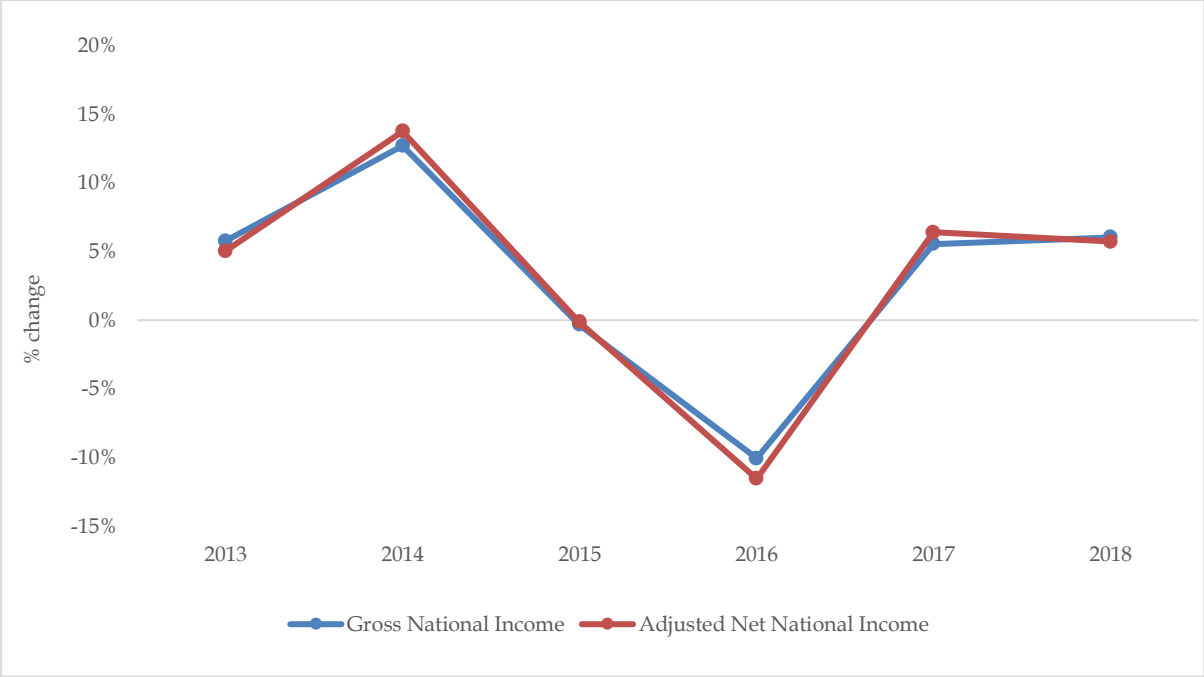


It is again evident that the biggest negative impact in 2018 comes from the increased CFC, accompanied by a slight deterioration in mineral depletion.

Uganda's overall high ANNI is a result of a low net natural capital depletion. This high ANNI (92 percent of GNI as shown in Figure 11) is mainly caused by cheap timber products, and a possible underestimate on the CFC.

The trend reversal since 2017 can again also be observed when comparing ANNI growth directly to GNI growth, shown in Figure 15.

Figure 15. GNI and ANNI Growth

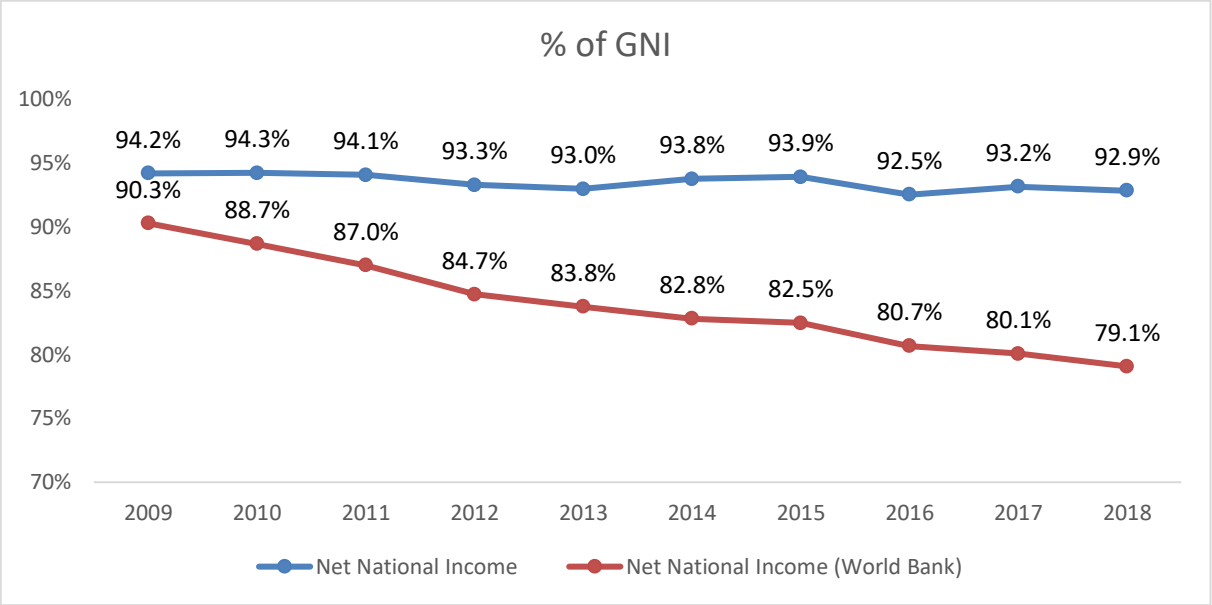


The following subsections investigate more closely the trends in the different components of ANS and ANNI and intermediate measures (such as NNS and NNI).

4.4.3. NNI

NNI is higher than the World Bank's estimate, reflecting differences in CFC assumptions. CFC may be a low estimate in the data used here. Its value has declined slightly as a share of GNI, from 93.2 percent in 2017 to 92.9 percent of GNI in 2018.

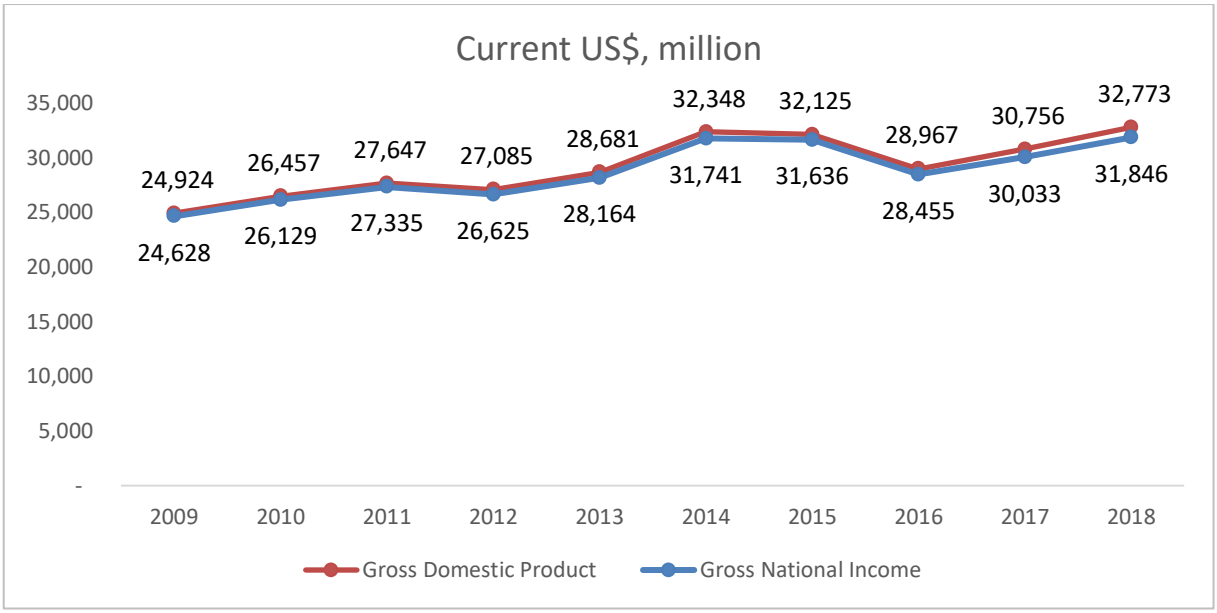
Figure 16. NNI as a % of GNI, 2009-18



4.4.4. GDP and GNI

GDP and GNI have been rising steadily since 2009. There were a number of minor dips and some of these changes were a result of a rebasing exercise that led to revised upwards figures in 2010 and 2014. In addition, the dip in 2016 may be related to the general election and exchange rate developments.

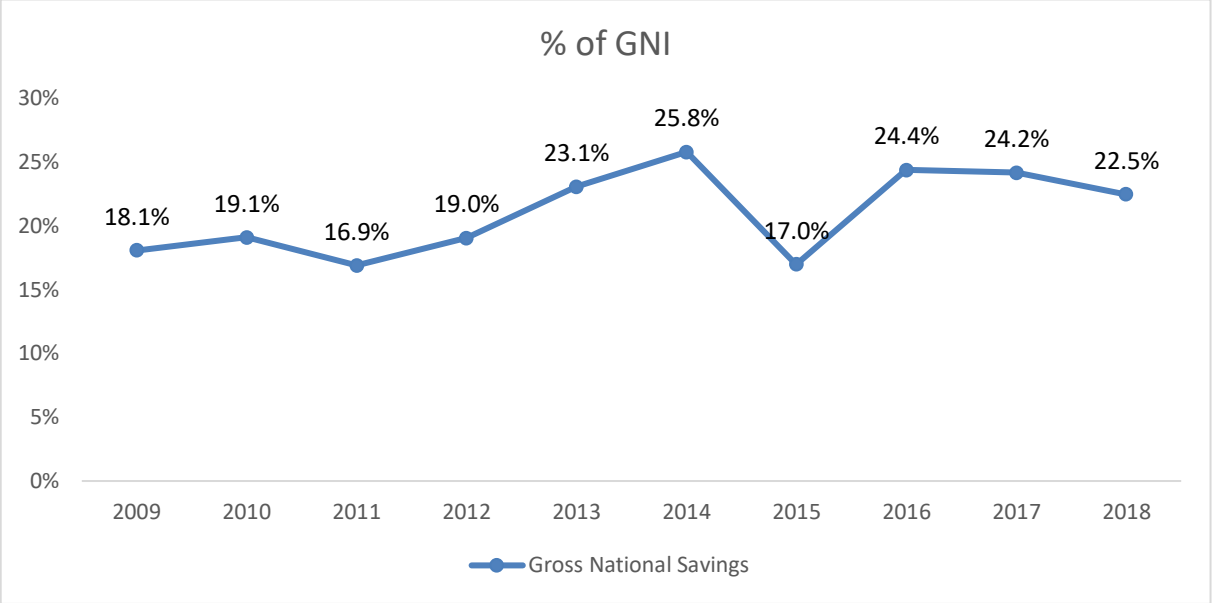
Figure 17. GDP and GNI, 2009-18



4.4.5. GNS

GNS have remained quite steady as a proportion of GNI, despite targets to increase them. GNS recorded a decrease of 1.4 percent, from US$ 7,257 million in 2017 to US$ 7,154 million in 2018. However, GNS is weighed down by budget deficits, which act as negative savings.

Figure 18. GNS as a % of GNI, 2009-18

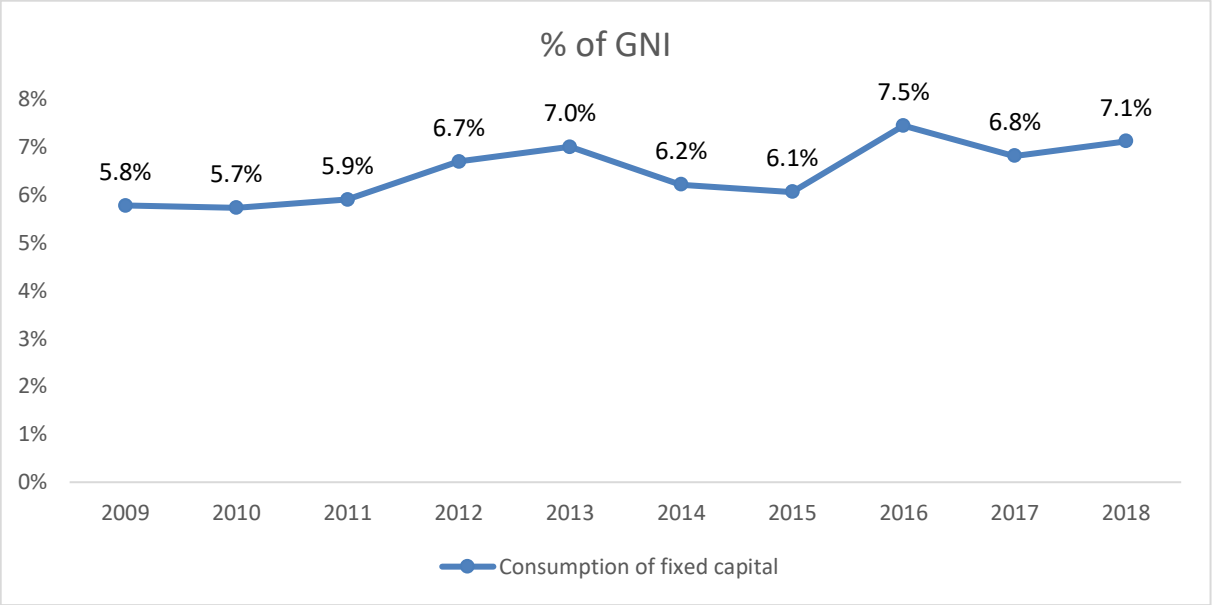


4.4.6. CFC

CFC increased by 10.8 percent from a value of US$ 2,049 million in 2017, which indicates a 0.3 percent increase relative to GNI.[14] MoFPED's data on CFC used in this report is a lot lower than the World Bank's estimate. In 2018, the MoFPED data provides an estimate of US$ 2,270 million (7.1 percent of GNI). The World Bank figures were notably higher at US$ 6.661 million (20.9 percent of GNI) (*not shown*).

[14] As a general rule, it would be expected that the ratio of CFC to GNI would rise over time in a country experiencing a high level of investment (and hence an increasing ratio of capital stock to GNI.

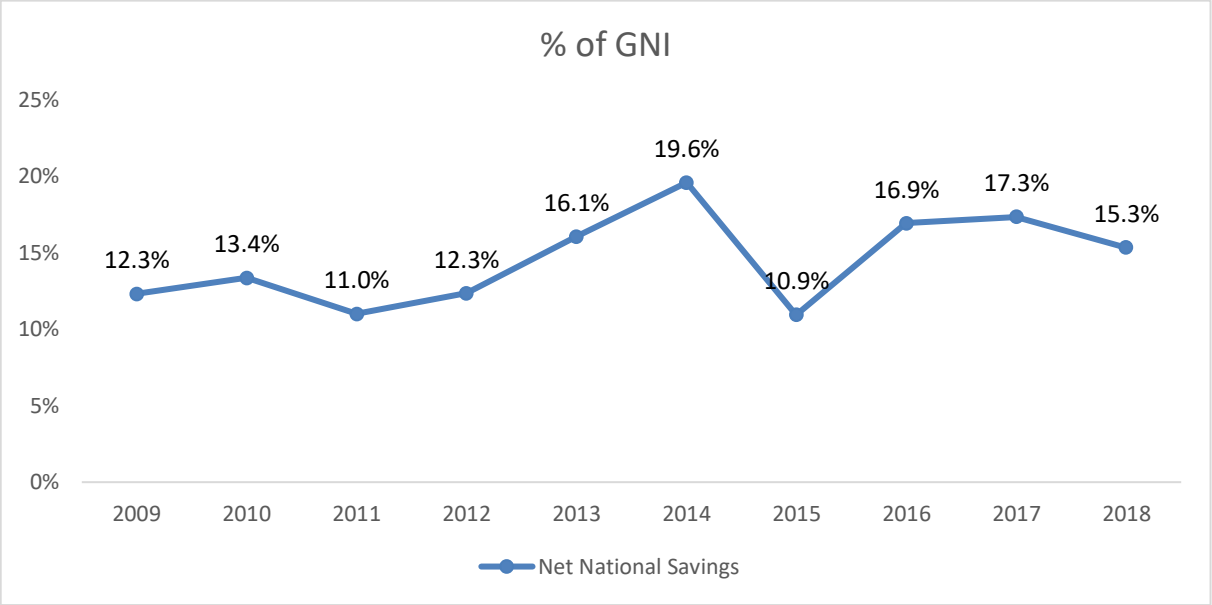
Figure 19. CFC as a % of GNI, 2009-18



4.4.7. NNS

NNS have declined as a percent of GNI since 2017. NNS was at 17.3 percent in 2017 and fell to a value of 15.3 percent of GNI in 2018. See Figure 20.

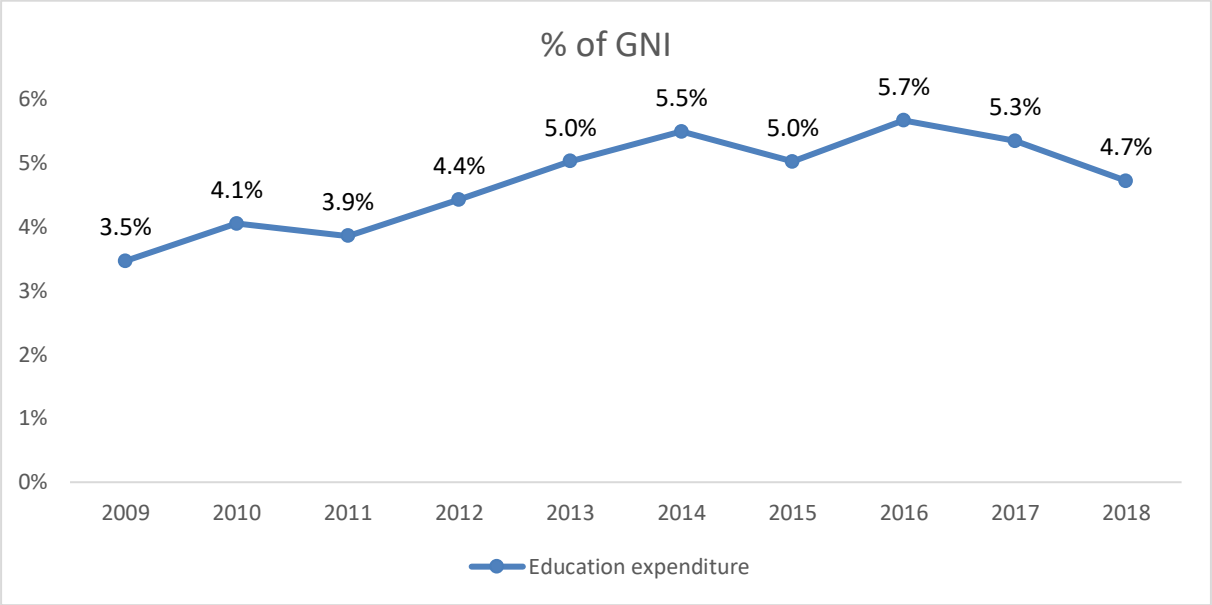
Figure 20. NNS as a % of GNI, 2009-18



4.4.8. Education Expenditure

Education expenditure has been declining since a peak in 2016. In 2018, expenditure was at 4.7 percent of GNI, down from 5.3 percent of GNI in 2017. This decline is accounted for by an absolute 6.4 percent decline in education expenditure from US$ 1,607 million in 2017 to US$ 1,505 million in 2018, in concurrence with a 6 percent nominal GNI growth.

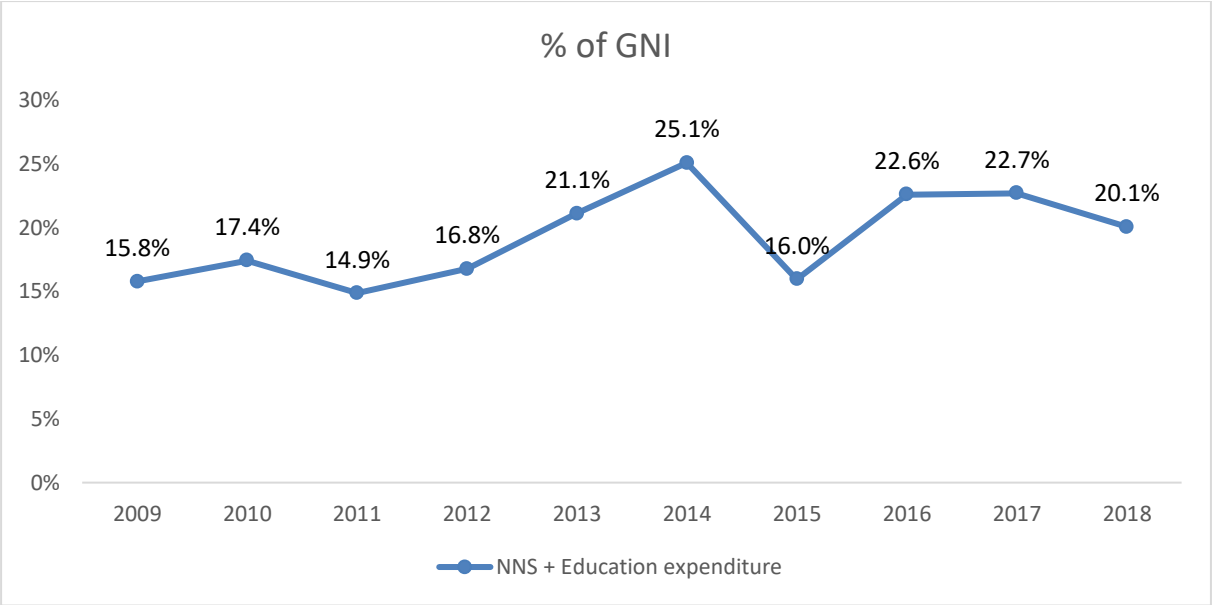
Figure 21: Education Expenditure as a % of GNI, 2009-18



4.4.9. NNS + Education Expenditure

Since 2017, NNS + education expenditure has dropped slightly to 20.1 percent. NNS + education expenditure peaked in 2014 at 25.1 percent and dropped to 16 percent in 2015. However, since 2016 it has levelled out again falling from 22.7 percent to 20.1 percent during 2017.

Figure 22: NNS + Education Expenditure as a % of GNI, 2009-18

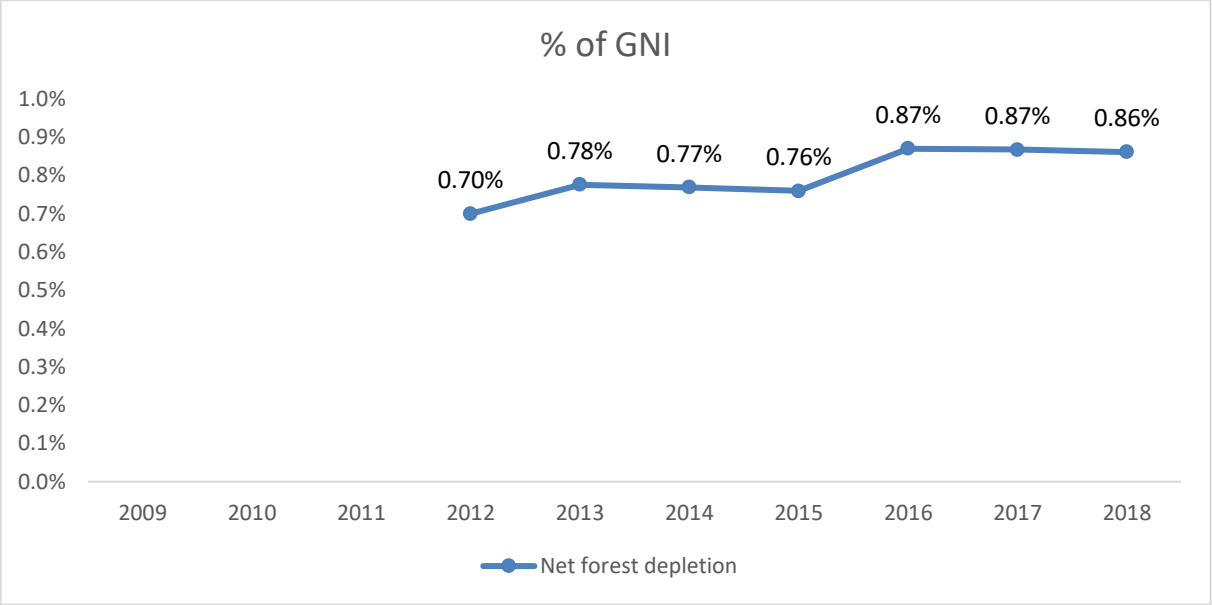


4.4.10. Net Forest Depletion

Net forest depletion has increased significantly since 2012. Net forest depletion increased from US$ 186 million in 2012 to US$ 274 million in 2018. And since 2017, it has increased by 5.3 percent,

up from a value of US$ 261 million. It has also increased slightly relative to GNI, as shown in Figure 23 below.

Figure 23: Net Forest Depletion as a % of GNI, 2009-18



4.4.11. Energy and Mineral Depletion

Energy and mineral depletion are currently at zero depletion, although from 2021 this will change dramatically. Uganda does not currently produce oil, gas or coal so, for now, we can assume zero depletion of energy assets for Uganda.[15] However, this will change shortly as oil and gas production comes on stream.[16] It is important that future estimates of ANS incorporate energy depletion.

Mineral depletion in Uganda is negligible – less than 0.02 percent of GNI in most years, and less than 0.1 percent of GNI in all years.

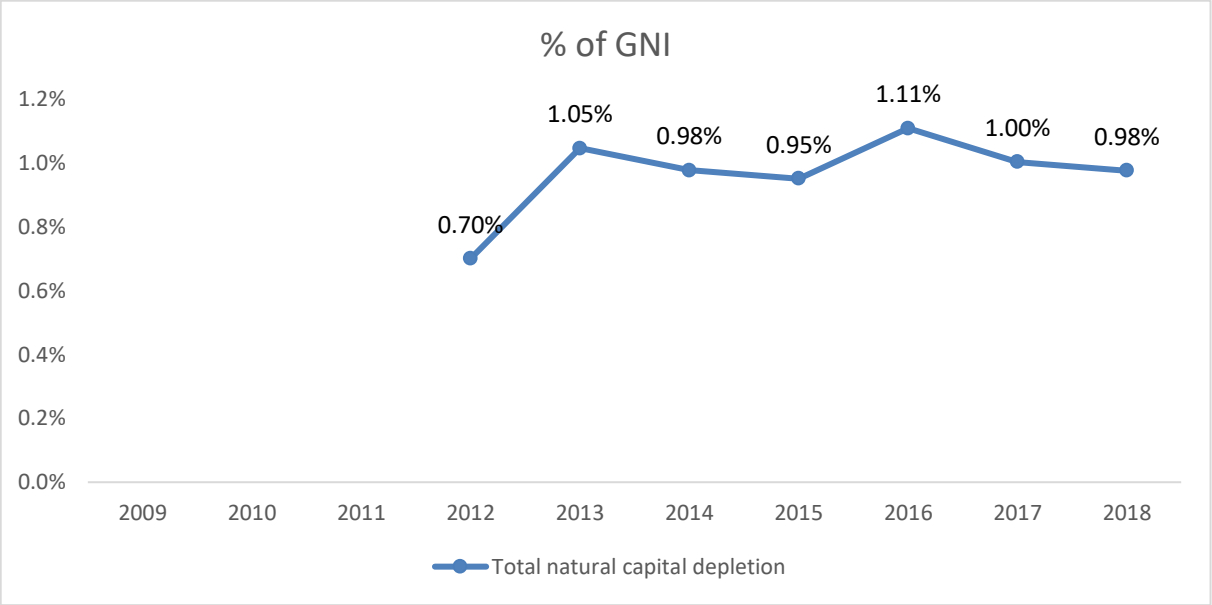
4.4.12. Total Natural Capital Depletion

As a result, total natural capital depletion mirrors net forest depletion almost exactly.

[15] The World Bank also reports zero depletion of energy assets for Uganda.

[16] See: https://www.africanews.com/2020/04/23/uganda-underlines-its-intention-to-become-a-major-oil-and-gas-player//

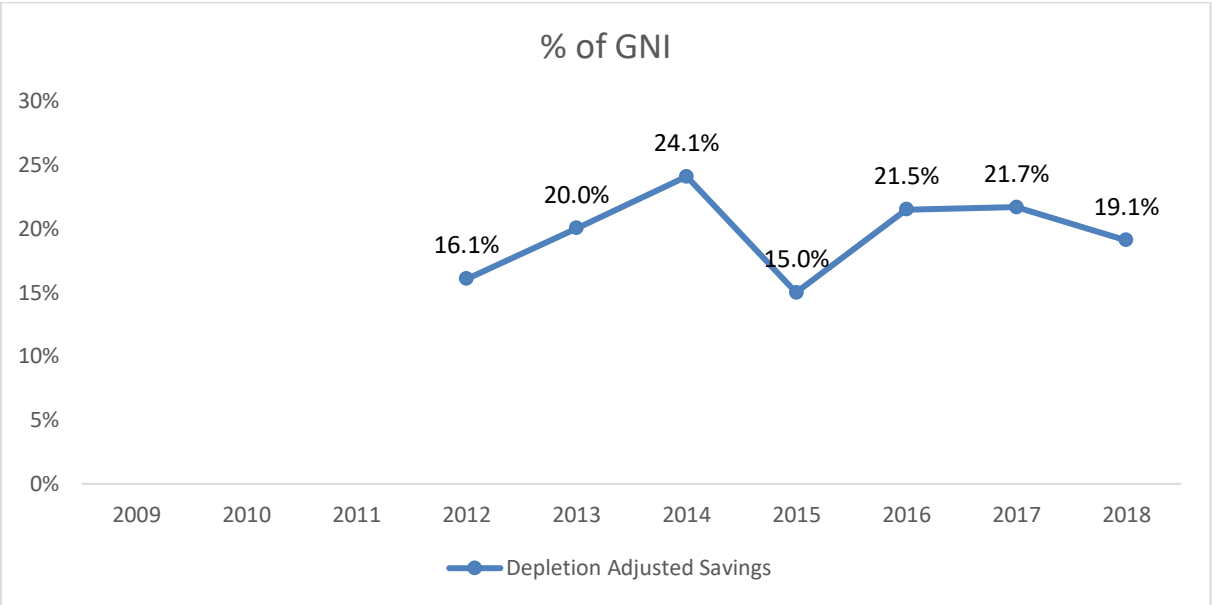
Figure 24: Total Natural Capital Depletion as a % of GNI, 2009-18



4.4.13. Depletion Adjusted Savings (DAS)

DAS remain positive for Uganda but have decreased slightly as a percentage of GNI. While DAS still remains positive for Uganda, since 2017 it has fallen slight from 21.7 percent in 2017 down to 19.1 percent in 2018.

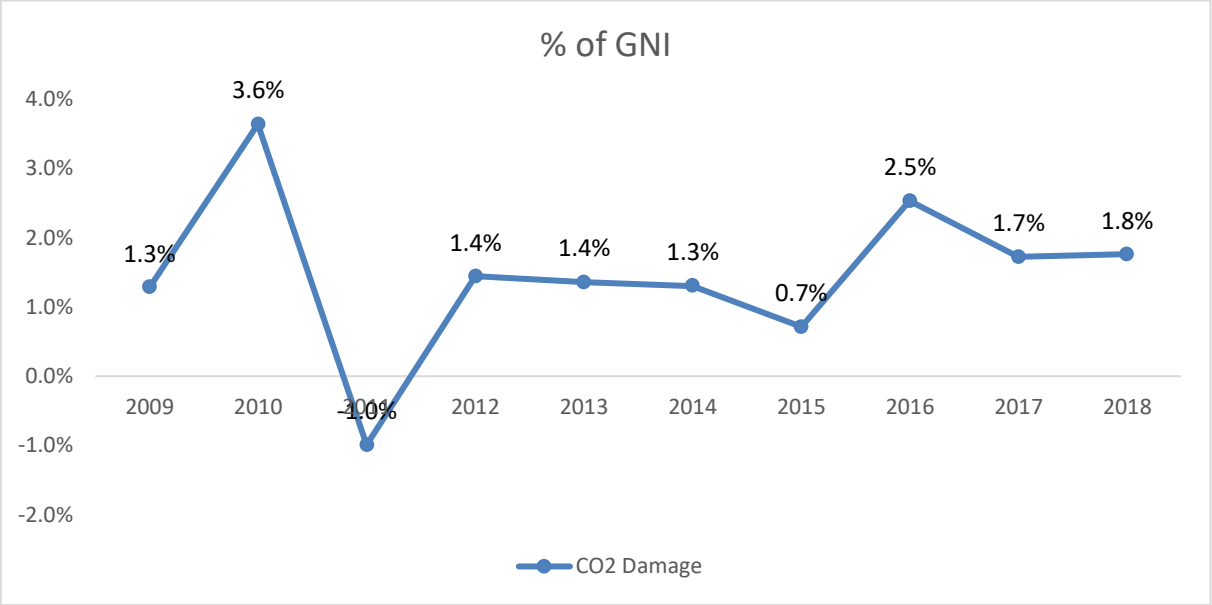
Figure 25: DAS as a % of GNI, 2009-18



4.4.14. CO_2 Damage

CO2 damage remained stable relative to GNI between 2017 and 2018. Between 2017 and 2018, CO_2 damage remained stable around 1.8 percent of GNI. However, in absolute terms it has increased by 8.3 percent over the same period.

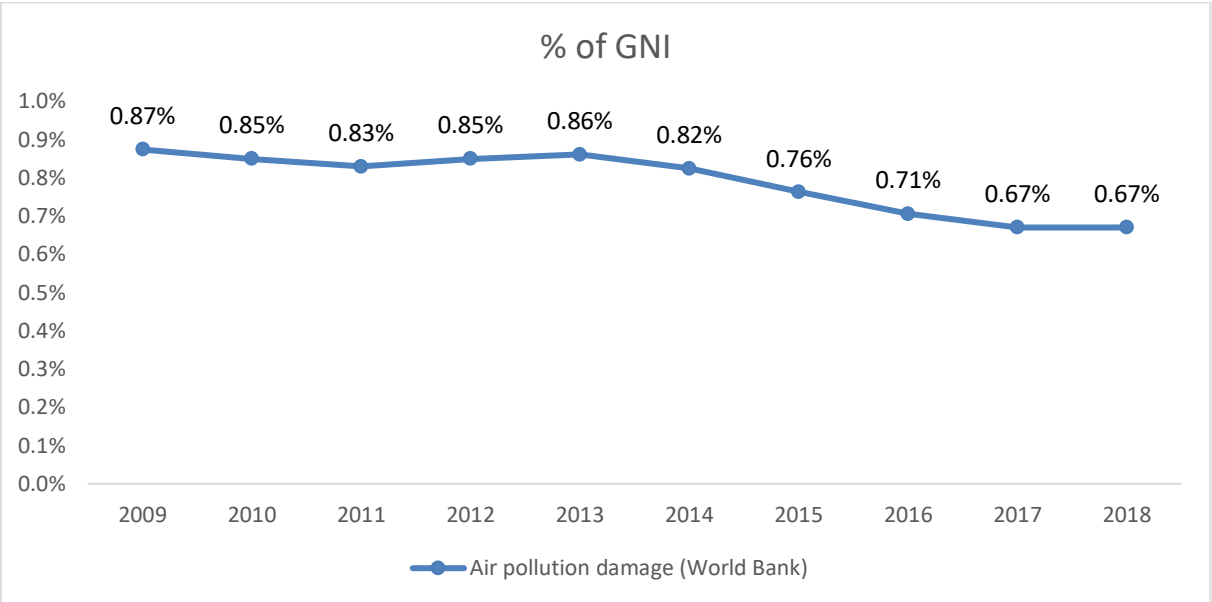
Figure 26: CO_2 Damage as a % of GNI, 2009-18



4.4.15. Air Pollution Damage

Air pollution damage continues to gradually fall as a percentage of GNI. Whilst rising in Uganda, it has fallen as a percentage of GNI and is now at 0.67 percent. It is slightly lower than CO_2 damage.

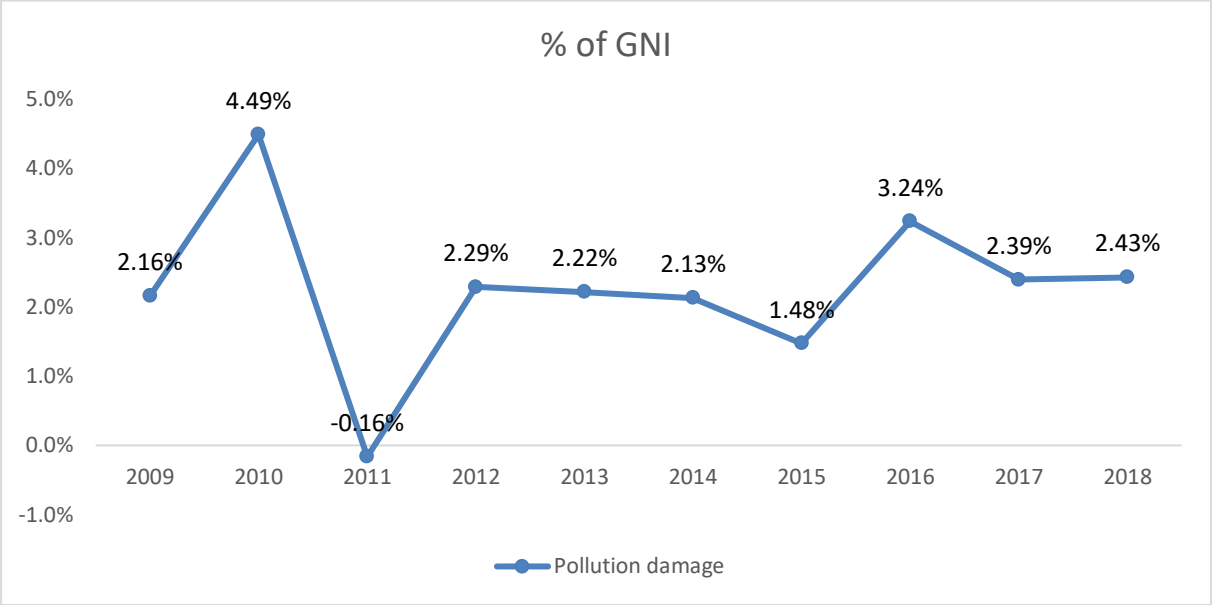
Figure 27: Air Pollution Damage as a % of GNI, 2009-18



4.4.16. Total Pollution Damage

Overall, pollution damage has been relatively stable as a share of GNI. However, in absolute terms, it increased by 7.7 percent between 2017 to 2018. In 2018, total pollution damage was estimated at 2.4 percent of GNI.

Figure 28: Total Pollution Damage as a % of GNI, 2009-18



4.5. Concluding Remarks

4.5.1. Key Message

The data and model suggest that Uganda has been dis-saving between 2017 and 2018 by:

- **decreasing GNS,**
- **consuming more fixed capital than GNI growth permitted,**
- **decreasing education spending both in absolute terms and relative to GNI, and**
- **increasing natural capital depletion and pollution damages.**

This result should inspire policymakers to rethink the current growth trajectory and search out for more sustainable alternatives for both physical, human and natural capital as well as regards the environment and its linkages with human health.[17]

4.5.2. Key Data

The data suggests that Uganda is not currently growing at the expense of running down its capital, since ANS is positive. However, the 8.5 percent decrease of ANS in absolute value and 2.6 percent decrease as percentage of GNI from 2017 to 2018 are notable and concerning.

A particular issue is the estimated 6.4 percent decrease in current education expenditure which negatively impacts on the value of Uganda's human capital. It amounts to a 0.62 percent change difference in the percentage share of education spending in GNI. In the model this is a result of a 12 percent decrease in absolute government spending and balanced by increased private spending. There was also an overall 3.2 percent increase in natural capital depletion (with a 5.3 percent increase in net forest depletion accounting for the bulk of this). In addition, the 7.7 percent increase in pollution damages, are concerning. Most of the decline in ANS is accounted for by a 10.8 percent increase in the CFC, which is also noteworthy.

[17] Human health is not yet considered in our model.

5. POLICY IMPLICATIONS

The government should continue to improve the implementation of policies aimed at increasing the national income as espoused in the NDP. To attain a sustainable growth path, it is important to target a growth rate in ANNI that is similar to GDP growth. Higher savings also facilitate higher levels of both physical and human capital and consequently higher levels investment in the economy. Consequently, productivity rises as does growth in the long run. Also, as the country is getting close to oil production, savings will be very important to keep the country's wealth balanced. As ANS is still positive, this implies that the country is accumulating assets and building up its wealth. However, the 8.5 percent drop since 2017 is a matter of concern.

Depreciation of fixed capital, reduced education spending, carbon dioxide emissions, air pollution and deforestation are all high leading to reduction in the income and savings, according to the adjusted sustainability measures presented here.

Suggested measures are thus to reduce the depreciation of fixed capital, increase education spending, and develop and enforce existing policies aimed at reducing the depletion of non-renewable resources like forests as well as promoting the sustainable extraction of non-renewable resources like oil and gas.

Specific measures for each of the ANS components:

- **Gross Savings**
  To increase real savings further, government should put in place more innovative strategies to promote savings in the economy, such as allowing interest payments to mobile money savers. Bank lending rates also remain high, averaging 20 percent. To increase access to affordable finance, it is also helpful to deepen and broaden formal savings and investment channels. In addition to these measures to increase private savings, the government should closely monitor and reduce its budget deficits and external borrowing, as well as aim to reduce its own domestic borrowing, which crowds out other borrowers.

- **Fixed Capital Stock**
  Management of existing fixed capital can be improved through routine maintenance of fixed assets like roads to reduce depreciation. The fixed capital stock can be increased through measures to improve the business and investment environment for firms. Several recent works and surveys have addressed these issues in depth. [18]

- **Education**
  The NDP III notes that industrialization requires a skilled, innovative and healthy labour force. Studies have shown that there is a significant gap between the requirements of industry and available skills. This requires a constant monitoring of education programs, curricula and policies. The current high level of private education service provision should also be evaluated in terms of adequacy and outcomes. Government education needs to be improved and made affordable to everyone (particularly secondary and tertiary education). All of these aspects call for an increase rather than a reduction in government education spending.

[18] For example the 2013 World Bank Enterprise Survey Country Highlights, and the 2019 CDA Policy Paper on Small and Medium-Sized Enterprises in Uganda.

- **Natural Assets**
  Increasing forest cover, which is decreasing at a very fast pace, should be a priority in light of the global and local ramifications. The government needs to make sure that policies are in place to ensure that the extraction of these renewable resources does not exceed renewal. The pace of deforestation should be reduced by improving enforcement of the existing policies as well as putting in place more stringent measures to reduce deforestation and promoting afforestation. The implementation of the following NDP III interventions will be critical if we are to increase the forest cover over the next 5 years. These interventions include: (a) promotion of rural and urban plantation development; (b) formulation of economic and social incentives for plantation forests; (c) scale-up of agroforestry as a climate smart agriculture practice; (d) establishment of dedicated fuel wood plantations necessary to contribute to achieving or exceeding net biomass surplus levels; and (e) improvement in the management of districts and private forests.

- **Oil and Mineral Assets**
  With the plan to extract oil and gas in the NDP III, as well as minerals including iron ore, gold and phosphates, there will be a considerable increase in the shares of these items in total wealth. Government will therefore have to take precautionary steps to ensure that these non-renewable resources are extracted in a sustainable manner so as to reduce the impact on the country's wealth accumulation. Additionally, to ensure that comprehensive wealth is not depleted, the extracted minerals and assets must be replaced by accumulation of human capital and produced capital.

- **Pollution**
  CO_2 emissions and air pollution are likely to increase further as the country embarks on exploitation of oil and gas, industrialization, urbanization and the continued rise in deforestation. Fiscal policy could play a role. For example, taxes on polluting sectors could compensate for, and discourage, negative externalities. Further government interventions to reduce pollution and carbon dioxide emissions in the general population, could include reducing the amount of plastic in the economy, which is often littered or burnt, and cutting back on the number of old cars or single-owned vehicles. Concrete measures could be to put a ban on plastic bags in favour of paper bags, put higher taxes and returnable deposits on plastic bottles (that is establish a recycling system), division and proper recycling of garbage, public awareness campaigns that encourage the use of own bottles and shopping bags, higher taxes on old cars, regular vehicle checks and pollution control, measures to encourage carsharing, and support for local transport systems in the city.

In conclusion we note that sustainable growth will require resource revenues to be spent on wealth enhancing development. This is well demonstrated in countries such as Norway and Botswana that have used revenue from their mineral resources to accumulate wealth.

Figure 29: Sustainable Budget Index

Sustainable Budget Index

The analysis in this report suggests a potential fiscal rule that could be incorporated into the formulation and execution of fiscal policy as Uganda steps up resource-based industrialization, and in particular the exploitation of oil and gas resources. One of the principles of mineral and energy resource taxation is that mineral and energy rents should be taxed at a high rate (close

to 100 percent)[19]. However, a sustainable fiscal policy needs to also include a rule for the expenditure of those mineral and energy fiscal revenues.

There are several potential rules that could be employed, one of which is the *Hotelling Rule*. This requires that all fiscal mineral revenues (derived from the depletion of an asset) are invested in other forms of capital. The simplest version requires that all mineral revenues are used to fund government development (capital) spending, for example, on public sector produced capital.

However, the comprehensive wealth approach takes a broader view of capital, and in particular includes human capital. The rule can therefore be broadened to include recurrent spending on education in the definition of public capital spending.

Any mineral or energy revenues that are not used to finance development spending or education spending should be saved (in other words, used to accumulate financial assets, which are also part of comprehensive wealth).

A version of this rule is in use in Botswana, termed the "Sustainable Budgeting Rule", and is monitored through the Sustainable Budget Index, defined as the ratio of government non-investment spending to recurrent fiscal revenues. A Sustainable Budget Index value of more than 1 means that non-investment spending is being financed in part from mineral (non-recurrent) revenues; a value of less than 1 means that mineral revenue is either being saved or spent on public investment, while recurrent spending is being financed from non-mineral (recurrent) sources, which is interpreted as being sustainable. Investment spending includes education spending for the purposes of this rule.

[19] The calculation of resource rents includes "normal" profit (including a reward for risk) as part of the cost of production. This allows the providers of capital to earn an adequate return, while the rent component of mineral and energy income is akin to "windfall" profit.

6. RECOMMENDATIONS AND NEXT STEPS

This year's report is a continuation of the analysis done on the adjusted macroeconomic indicators for Uganda. There will be many improvements that can be made in future years. However, it helps if guidance is given on the direction the analysis should take and how it should be managed. A few suggestions and guidance on the next steps are highlighted below.

6.1. High-level Indicator Goals

High-level indicator goals provide a guide to the impact these adjusted macroeconomic indicators are having on how we understand growth and development in Uganda. In addition, they offer a framework for monitoring and evaluation. These goals are listed below, along with a current update on progress.

Goal 1: The annual growth rate of ANNI should be at least as high as the growth rate of GNI. If not, it means that part of the growth in recorded national income is derived from the depletion of assets.

Current progress: This has roughly been the case since 2013. In 2017 ANNI growth was slightly higher than GNI growth. In 2018 the reverse was the case.

Goal 2: The rate of ANS should be maintained at a positive level and should increase over time.

Current progress: ANS is positive and has been for the duration of our estimates. It is fluctuating over time at around 17 percent of GNI or roughly US$ 5 billion. It does not seem to be increasing.

Goal 4: These indicators should be monitored and compiled annually.

Current progress: This report is the second of what will be an annual reporting exercise. The high-level indicator goals above will be included as part of the annual monitoring and evaluation process.

6.2. Recommended Areas of Focus

Last year's report made a series of broad policy recommendations that, if implemented, would increase the country's wealth. This year's policy implications are in line with these broad recommendations and emphasized as a response to the ANS deterioration observed since 2017. These recommendations can be summarized into three broad areas of focus:

4. Increase domestic saving and the stock of physical capital
5. Increase human capital and its productivity
6. Reduce emissions and deliberately increase vegetation and forest cover.

The **three** recommendations will help in reducing all the components that apply negatively to NNI and NNS thus leading to positive ANNI and ANS. A positive ANNI and ANS will suggest that the country's wealth is not as a result of the depletion of physical, human or natural capital, and open pathways towards more sustainable economic development.

6.3. Analytical Improvements

The team is committed to building on the experience to date to ensure that the framework, methodology and the resulting data is reviewed and improved. The areas they will focus on are:

- Updating the data sources annually and searching for improved data sources
- Building on the existing model. This will include:
    - Revisiting assumptions in particular in relation to wood and forestry resources and CO^2 emissions
    - Improving the data inputs for timber production and prices
    - Revisiting assumptions regarding private education spending
    - Producing outputs in real terms
    - Making comparisons with other countries.

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8. ANNEX I: NNC DEPLETION METHODS AND ASSUMPTIONS

This annex contains further information on the methodologies used for net forest depletion, energy depletion and mineral depletion.

8.1. Net Forest Depletion

The valuation of forest timber resources forms and important component of natural capital accounting in Uganda. We approach this from the perspective of NCA-related macroeconomic indicators and measurement of comprehensive wealth. Forest timber valuation is important for both of these:

- In the calculation of ANS, NNS are adjusted to account for (inter alia) the depletion of renewable and non-renewable natural capital, including forest timber resources.

- In the calculation of comprehensive wealth, natural capital includes the valuation of forest timber (as well as non-timber) capital.

The global ANS and CWON databases, produced by the World Bank, include the valuation of forest timber depletion and forest timber assets for Uganda. Many of the inputs used for these valuations are derived from global databases and regional values, for reasons of consistency of data sourcing, definitions and measurement across countries. However, it is often preferable to use domestic sources as far as possible, for a more accurate valuation. This note describes the process of producing domestic valuations for forest timber depletion in Uganda.

Net forest depletion, *D*, is calculated as:

$D = (Q-N).\pi$

where:

- *Q* is the volume of timber harvested, measured in cubic meters;
- *N* is the annual volume of natural growth in production-oriented forest;
  - $(Q - N)$ therefore represents overharvest
- π is the unit rent per cubic meter, calculated using export unit values and a constant regional rental rate

In the World Bank approach, timber is divided into three categories:

- Woodfuel
- Industrial roundwood (coniferous)
- Industrial roundwood (non-coniferous).

Production and rental values are derived from export unit values for each of the three categories. However, the use of export unit values may not be appropriate, when the vast majority of timber resources are sold domestically and are not exported or competing with imports. Production figures are obtained from the FAO Global Forest Resources Assessment, which are in

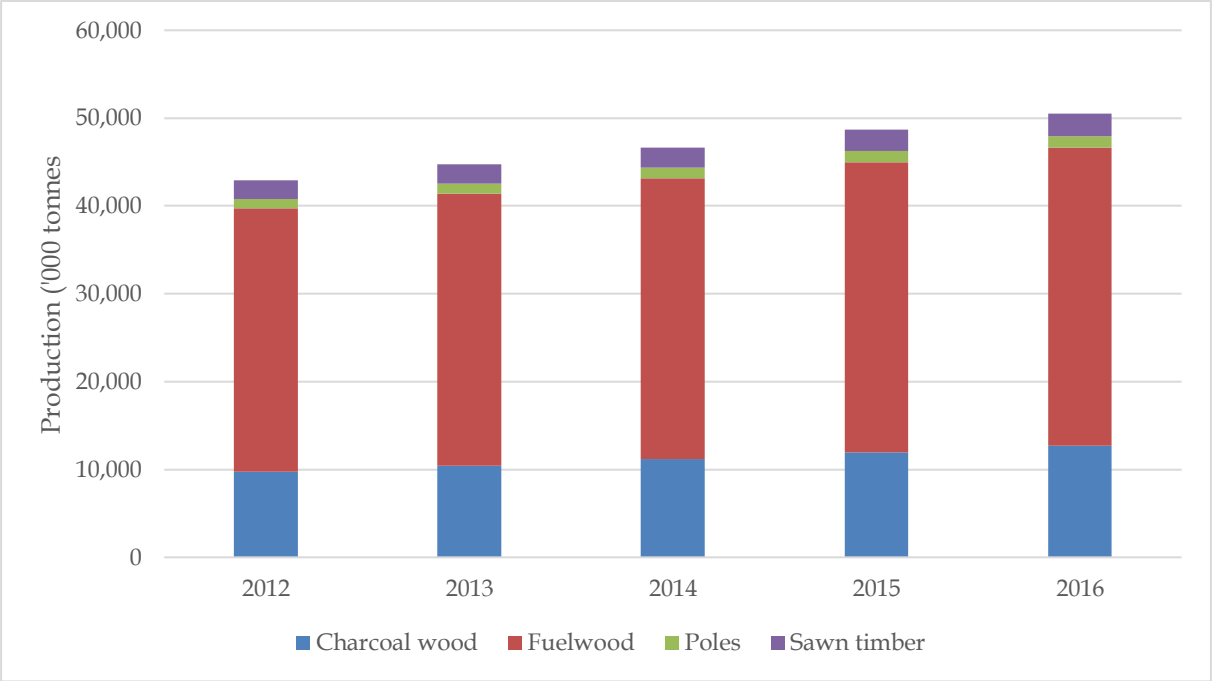
turn obtained from the NFA. The World Bank/FAO FRA data do not include the use of timber for producing charcoal.

Alternative data sources for timber production and valuation are available in Uganda. The starting point is Table 1.3 in the *UBOS Annual Statistical Abstract*,[20] which provides data on timber production (in '000 tonnes) and valuation (in UGX million) for several different categories of timber:

- Sawn wood
- Poles (construction, utility)
- Fuelwood (household, commercial, institutional)
- Wood for charcoal production

Production figures (volumes) for the different categories for the period 2012-16 are shown in Figure 30.

Figure 30: Production of Timber by Category ('000 tonnes)



Source: UBOS, 2019, Table 1.2 A,B

The FAO and World Bank data is presented slightly differently, in cubic metres rather than tons. The link between the two is the density of wood. By making assumptions of wood density for the different categories (default assumption is 720 kilogrammes per cubic metre), the volume of timber production can be estimated, and compared with the FAO and World Bank numbers.

There are, however, some concerns about the reliability of the Uganda data on timber production, which could be too high. The largest component of production is non-monetary domestic fuelwood consumption, for which data is subject to considerable uncertainty. The recorded production levels are extremely high relative to estimates of the standing stock of timber. For instance, the FAO FRA 2015 records total growing stock of 92 million cubic metres of

[20] UBOS. 2019.

timber stock on forest land, and 21 million cubic metres of timber stock on other woodland, making a total of 114 million cubic metres. With annual production estimated at 48,000 tons in 2016, or approximately 69,600 million cubic metres, the entire existing growing timber stock of Uganda would be depleted in less than two years. This is unlikely and suggests that either the growing stock is underestimated or the or the rate of production is overestimated (or both). The only other available data source on domestic fuelwood consumption, the 2016 National Charcoal Survey, has a consumption estimate that is less than half that of the UBOS data.

8.2. Fuelwood and Charcoal Wood Valuation

Unit valuations can also be obtained from the UBOS data, based on density assumptions and UGX/US$ exchange rates. The resulting valuations, and their comparison with the FAO/WB data, are shown in Table 3 below.

Table 3: Timber Valuations, US$/cubic metre

UBOS	2012	2013	2014	2015	2016
Charcoal wood	3.31	3.20	3.08	2.38	2.18
Fuelwood	3.41	3.28	3.21	2.52	2.36
Poles	62.22	71.90	76.03	65.02	59.00
Sawn timber	51.14	70.95	86.67	85.86	94.43
World Bank/FAO	2012	2013	2014	2015	2016
Wood Fuel	134.71	138.89	141.08	161.92	178.23
Industrial roundwood (C)	69.28	74.88	75.35	71.29	51.35
Industrial roundwood (NC)	391.09	384.82	391.18	389.70	350.30

Source: UBOS, FAOSTAT

The valuations based on UBOS production data are much lower than the FAO/WB data, particularly for fuelwood/charcoal. There is a marked downward trend in the (US$) values of wood for charcoal and fuelwood, which needs explanation.

Both sets of data show that the use of timber for fuelwood and charcoal is by far the main usage in Uganda. As a result, changes in the valuation are likely to have a dramatic impact on the valuations of net forest depletion and forest timber asset value. An alternative valuation can be derived from the information in the 2016 *Uganda National Charcoal Survey*.[21] This provides the following information that can be used to calculate the valuation:

Table 4: Calculation of Implied Value of Wood used for Charcoal Production

	Per Bag	Per Ton	Source of Information
Average weight of a bag of charcoal (Uganda) (kg)	61		Table 11-4

[21] MEMD (Ministry of Energy and Mineral Development). 2015.

Average farm-gate price for a bag of charcoal (UGX)	18,500	303,279	Para 13.1.2
Wood proportion of charcoal production costs	34%		Table 7-5
Wood input value (per bag of charcoal)	6,265	102,698	Calculated
Conversion factor (kiln efficiency)	18%	18%	TZ charcoal kiln study.
Wood input weight	0.34	5.56	Calculated
Wood density (t/m3)	0.72	0.72	Forest Research UK
Wood input volume (m3)	0.47	7.67	Calculated. NB PROFOR 2014 uses a conversion factor of 6
Wood input cost (UGX/m3)	13,395	13,395	Calculated
Exchange rate (UGX/US$)	3,420	3,420	BoU
Wood input cost (US$/m3)	3.92	3.92	Calculated

The calculated value of wood inputs to the charcoal value chain is US$ 3.92 per cubic metre, which is broadly consistent with, but somewhat higher than, the values derived from the UBOS data.

8.3. Energy and Mineral Depletion

For energy and mineral depletion, World Bank data was used, as we had no strong belief that these would be inaccurate (and are relatively small). These were added to our calculation of net forest depletion to give net natural capital depletion.

9. ANNEX II: ADJUSTED MACROECONOMIC INDICATOR RESULTS

Calendar Year (% of GNI)	2013	2014	2015	2016	2017	2018
GNS	23.07%	25.81%	16.99%	24.38%	24.16%	22.46%
CFC	7.01%	6.23%	6.07%	7.46%	6.82%	7.13%
NNS	16.06%	19.58%	10.92%	16.93%	17.34%	15.34%
Education expenditure	5.03%	5.50%	5.03%	5.67%	5.35%	4.72%
NNS + education expenditure	21.09%	25.08%	15.95%	22.60%	22.69%	20.06%
Net forest depletion	0.78%	0.77%	0.76%	0.87%	0.87%	0.86%
Energy depletion (World Bank)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mineral depletion (World Bank)	0.27%	0.21%	0.19%	0.24%	0.14%	0.12%
Total natural capital depletion	1.05%	0.98%	0.95%	1.11%	1.00%	0.98%
DAS	20.04%	24.10%	15.00%	21.49%	21.69%	19.08%
CO_2 damage	1.36%	1.31%	0.71%	2.53%	1.72%	1.76%
Air pollution damage (World Bank)	0.86%	0.82%	0.76%	0.71%	0.67%	0.67%
Pollution damage	2.22%	2.13%	1.48%	3.24%	2.39%	2.43%
ANS	17.82%	21.97%	13.52%	18.25%	19.29%	16.65%
NNI	92.99%	93.77%	93.93%	92.54%	93.18%	92.87%
ANNI	91.94%	92.80%	92.98%	91.43%	92.17%	91.90%

Calendar Year (Current US$, millions)	2013	2014	2015	2016	2017	2018
GDP	28,681	32,348	32,125	28,967	30,756	32,773
GNI	28,164	31,741	31,636	28,455	30,033	31,846
GNS	6,496	8,191	5,376	6,938	7,257	7,154
CFC	1,974	1,976	1,920	2,122	2,049	2,270
NNS	4,522	6,215	3,456	4,816	5,208	4,884
Education expenditure	1,417	1,745	1,590	1,615	1,607	1,505
NNS + Education expenditure	5,939	7,959	5,046	6,431	6,815	6,389
Net forest depletion	219	244	240	248	261	274
Energy depletion (World Bank)	0	0	0	0	0	0
Mineral depletion (World Bank)	76.36424	66.46961	60.86756	68.34707	40.90611	36.77846
Total natural capital depletion	295.0339	310.6123	301.3516	315.9347	301.5814	311.2252
DAS	5644.222	7648.868	4745.117	6115.101	6513.54	6077.861
CO_2 damage	382.5694	414.5727	225.4301	720.322	517.6253	560.744
Air pollution damage (World Bank)	242	262	241	201	201	213
Pollution damage	624.8981	676	467	921	719	774
ANS	5019.324	6972.758	4278.448	5194.014	5794.746	5303.801

NNI	26,190	29,765	29,716	26,334	27,984	29,577
ANNI	25,895	29,454	29,415	26,018	27,682	29,265

Financial Year (Current UGX, billions)	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
GDP	79,150	94,189	101,672	110,626	111,073	122,170
GNI	77,691	92,607	100,003	108,023	108,459	118,717
GNS	19,051	19,373	20,589	25,200	26,209	26,669
CFC	5,122	5,685	6,744	7,859	7,400	8,461
NNS	13,929	13,689	13,846	17,341	18,809	18,208
Education expenditure	4,101	4,849	5,342	5,566	5,802	5,609
NNS + Education expenditure	18,029	18,538	19,188	22,907	24,612	23,817
Net forest depletion	600	708	814	935	941	1,023
Energy depletion (World Bank)	0	0	0	0	0	0
Mineral depletion (World Bank)	185.178	185.1953	215.6629	185.4401	147.7267	137.1024
Total natural capital depletion	785.3938	892.8705	1029.344	1120.411	1089.119	1160.182
DAS	17244.06	17645	18158.43	21786.7	23522.75	22656.99
CO_2 damage	1033.763	904.8329	1597.735	2277.082	1869.332	2090.336
Air pollution damage (World Bank)	653	732	735	741	726	795
Pollution damage	1687.192	1,636	2,333	3,018	2,596	2,886
ANS	15556.87	16008.65	15825.87	18768.67	20926.92	19771.45
NNI	72,569	86,922	93,259	100,165	101,060	110,256
ANNI	71,783	86,029	92,230	99,044	99,971	109,096