I-WAVES
Training on Macroeconomic Indicators

Session 2: Building Adjusted National Income and Savings Accounts in Indonesia

WAVES

Wealth Accounting and the Valuation of Ecosystem Services
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Key Sustainability Issues

- **How much real income is generated in the economy each year?**
- **How is the available national income distributed between consumption and savings?**

These will be the two major components of this session:

- Calculation of adjusted net national income (ANNI)
- Calculation of adjusted net national savings (ANS)

ANNI and ANS

- Making use of Indonesian data for the calculation of adjusted net national income and adjusted national savings
- Supplemented by World Bank data where Indonesian data not available

ADJUSTED NET NATIONAL INCOME

Adjusted Net National Income (ANNI)

Gross Domestic Product (GDP)

- *Add*: net receipts from compensation of employees from abroad
- *Add*: net property income from abroad
- *Add*: taxes less subsidies on production & imports

Gross National Income (GNI)

- *Deduct*: consumption of fixed capital (depreciation)

Net National Income (NNI)

- *Deduct*: consumption of natural capital (energy, minerals, timber resource depletion)

Adjusted Net National Income (ANNI)

Adjusted NNI Indonesia

Making use of available Indonesian data to calculate adjusted national income

Required data sources and adjustments:

For NNI

- GDP
- Net primary income from abroad
- Net taxes and subsidies on production and imports with RoW
- Consumption of fixed capital

For ANNI

- Mineral depletion
- Energy depletion
- Forest depletion

ANNI – data sources & adjustments

Variable	Source
GDP	BPS national accounts
+ Net primary income from abroad (employee, property, investment)	BPS national accounts; UN Statistics Division, National Accounts Official Country Data, Table 1.3
+ Taxes and subsidies	National Accounts, UN Country Data
= GNI	
- Consumption of fixed capital	BPS; UN Statistics Division, National Accounts Official Country Data, Tables 1.3 & 4.1
= NNI	
- Depletion of minerals	World Bank
- Depletion of energy	World Bank
- Depletion of forest resources	World Bank
= ANNI	

Exercise

Calculation of ANNI:

- Calculate GNI, NNI and ANNI for Indonesia in current and constant prices (IDR), from 1998 to 2015
- Calculate the following ratios in each year (in either current or constant prices – the results will be the same)
  - **GNI to GDP**
  - **NNI to GNI**
  - **NNI to GDP**
- Calculate the average growth rates of real GNI, NNI and ANNI over the period as a whole

Data sources:

- BPS – national accounts (provided in spreadsheet)
- UN - CFC – (provided in spreadsheet)
- World Bank – depletion adjustments (adjusted savings) for minerals, energy, forest resources (World Bank World Development Indicators (WDI) Indonesia dataset)

Exercise

Hints:

- You will need to set up a new spreadsheet to do the calculations
- GDP data is provided in both in current and constant prices; use these two series to calculate the GDP deflator
- Net primary income from abroad and consumption of fixed capital is provided in current prices only; use the GDP deflator to calculate these in constant prices also
- You should do the GNI and NNI calculations in both current and constant prices
- Use World Bank data on depletion components (in % of GNI):
  - **Mineral depletion**
  - **Energy depletion**
  - **Forest depletion**
- As these are all provided in % of GNI, use these to calculate money values from the GNI figures you have calculated.
- You should then subtract these from NNI to get adjusted NNI (ANNI)
- You must calculate average growth rates for the series in constant prices

GDP to GNI

Variable	2015 values (IDR bn)	Avg. % of GDP 1998-2015
GDP	11,526,333	
Net primary income from abroad	-378,322	-4.1%
Taxes less subsidies	594,971	3.5%
GNI	11,148,011	

Over the period from 1998-2015, GNI varied between 92.4% and 101.9% of GDP, with an average of 97.1%. The gap is mainly due to outward remittances of profits from foreign investors, net of inward remittances from Indonesians outside of the country.

- GDP denotes the income generated by residents of Indonesia
- GNI denotes the income attributable to “citizens” of Indonesia (persons, firms and government) and is generally used as the comparator in SEEA calculations

GNI to ANNI

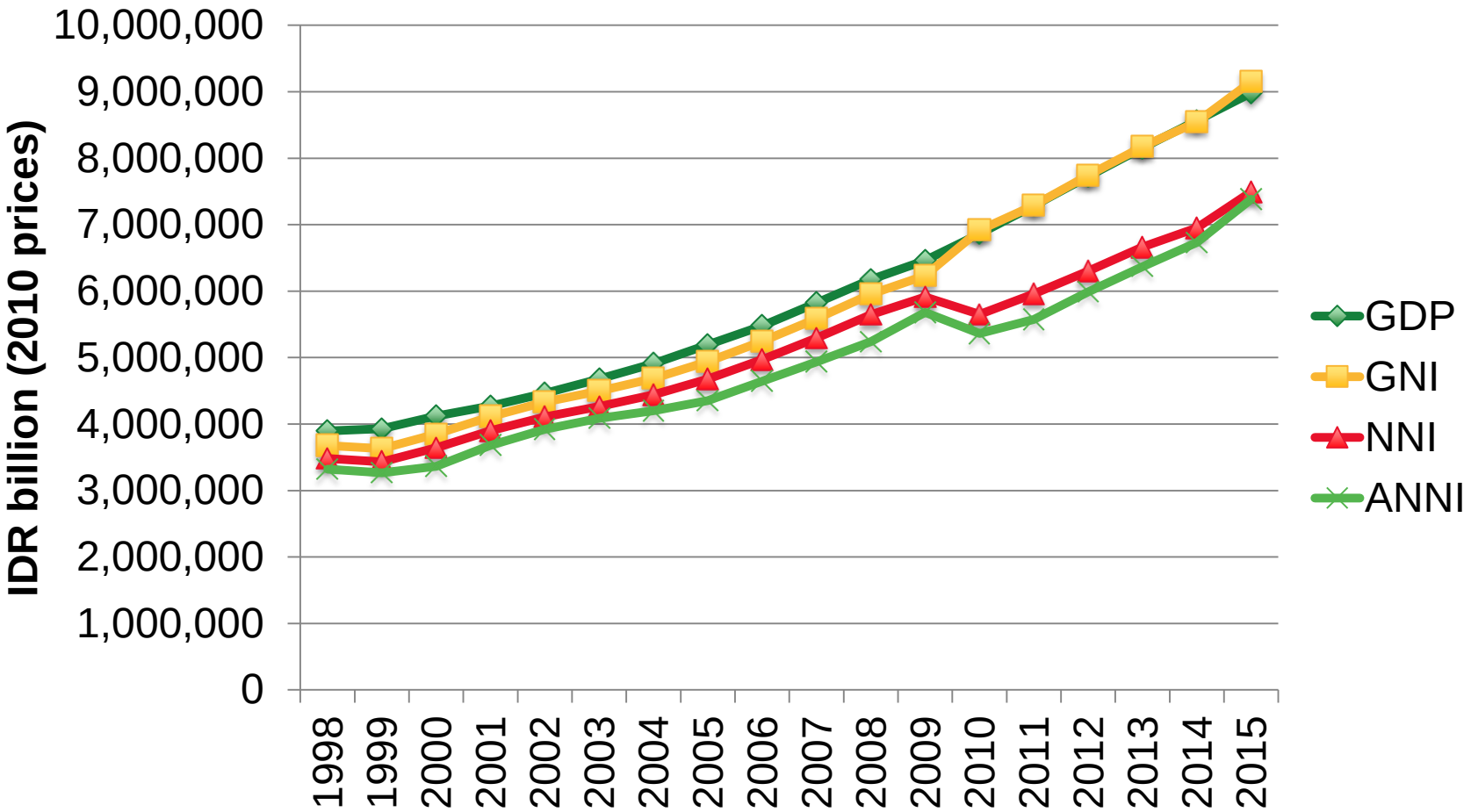
Variable	2015 values (IDR bn)	Avg. % of GNI 1998-2015
GNI	11,742,982	
Consumption of fixed capital (depreciation)	2,129,438	9.6%
Net national income	9,613,543	90.4%
Mineral depletion	36,736	1.1%
Energy depletion	93,926	3.7%
Net forest depletion	--	--
ANNI	9,475,908	85.6%
GDP deflator	128.3	
ANNI (real 2010 IDR)	7,384,613	

In moving from GDP to ANNI, the adjustments from the consumption of fixed capital (depreciation) and resource depletion are of similar magnitudes. Note, no data on forest depletion

Growth rates (real, simple average 1999-2015)

Variable	Growth rate
GDP	5.0%
GNI	5.5%
NN!	4.7%
ANNI	4.9%

Measures of National Income (real)



CALCULATING ADJUSTED NATIONAL SAVINGS (ANS) IN INDONESIA

Adjusted Net Saving

ANS =

Gross National Saving
- – Consumption of Fixed Capital
- + Investment in Human Capital
- – Depletion of Natural Capital
- – Pollution Damages

More inclusive measure of changes in a comprehensive set of capital assets that constitute a nation's wealth base, by accounting for physical capital, human capital, natural capital, and environmental degradation.

But beyond the SNA asset boundary

Calculation of Gross National Savings

Gross Domestic Product

- Plus: net primary income from abroad

Gross National Income

- Plus: net current transfers (secondary income) from abroad

= Gross National Disposable Income

- Deduct: household final consumption
- Deduct: government final consumption

= Gross National Savings

Calculation of Adjusted National Savings

Gross National Savings

- Deduct: consumption of fixed capital

= Net National Savings

- Add: expenditure on education (investment in human capital)
- Deduct: natural resource depletion (minerals, energy, forests etc.)
- Deduct: pollution damage (CO_2, particulate emissions)

= Adjusted Net Savings (Genuine National Savings)

- Monitoring changes in wealth each year

ANS – data sources & adjustments

Variable	Source
GNI	BPS national accounts/World Bank WDI
Net current transfers (secondary income) from abroad	BPS balance of payments
= GNDI	
Final consumption expenditure	BPS national accounts/World Bank WDI
= GNS	
Consumption of fixed capital	BPS national accounts/UN data
= NNS	
Depletion of minerals	World Bank WDI
Depletion of energy	World Bank WDI
Depletion of forest resources	World Bank WDI
Education expenditure	World Bank WDI
CO2 damage	World Bank WDI
Particulate emissions damage	World Bank WDI
= ANS	

World Bank methodology for pollution damage

CO2 damages

Air pollution damages

CO2 Damages

Value the economic cost of damages due to CO2 emissions

Stepping outside of SNA/SEEA boundaries, into more "experimental" estimates

CO2 Damages

Current World Bank guidance recommends a **social cost of carbon (SCC) of US$ 30 per tCO_2e emitted in 2015** (year 2014 prices) for the economic analysis of benefits from projects that reduce GHG. The SCC is the present value of the expected future damages to the world economy caused by an additional ton of carbon emitted into the atmosphere.

Under the polluter pays principle, global damages from CO2 emissions are charged to the emitting countries, with the assumption that countries suffering from the effects of climate change have a property right to a clean and healthy environment (Hamilton and Clemens 1999).

CO2 Damages

Data Requirements	Data Source (WB Methodology)
CO2 emissions (kt)	*World Development Indicators, World Bank* Source: Carbon Dioxide Information Analysis Center of the Oak Ridge National Laboratory, United States (CDIAC)
Social cost of carbon	World Bank (2014), adjusted by U.S. GDP Deflator (US$ 30 per tCO_2e emitted in 2015 (year 2014 prices))

CO2 Damages = CO2 emissions x social cost of CO2

- **Gap-filling**: Data on CO2 emissions are lagged by a couple of years, so the latest years are projected based on observed trends in the emissions intensity of economic activity (tons of CO2 emitted per unit of GDP)

Further work

- Appropriate social cost of carbon
- Distribution of CO2 damages? (contrast to polluter-pays-principle)

Air Pollution (PM) Damages

Value the economic cost of damages due to exposure to air pollution (PM2.5 and ozone)

Stepping outside of SNA/SEEA boundaries, into more "experimental" estimates

What is PM2.5?

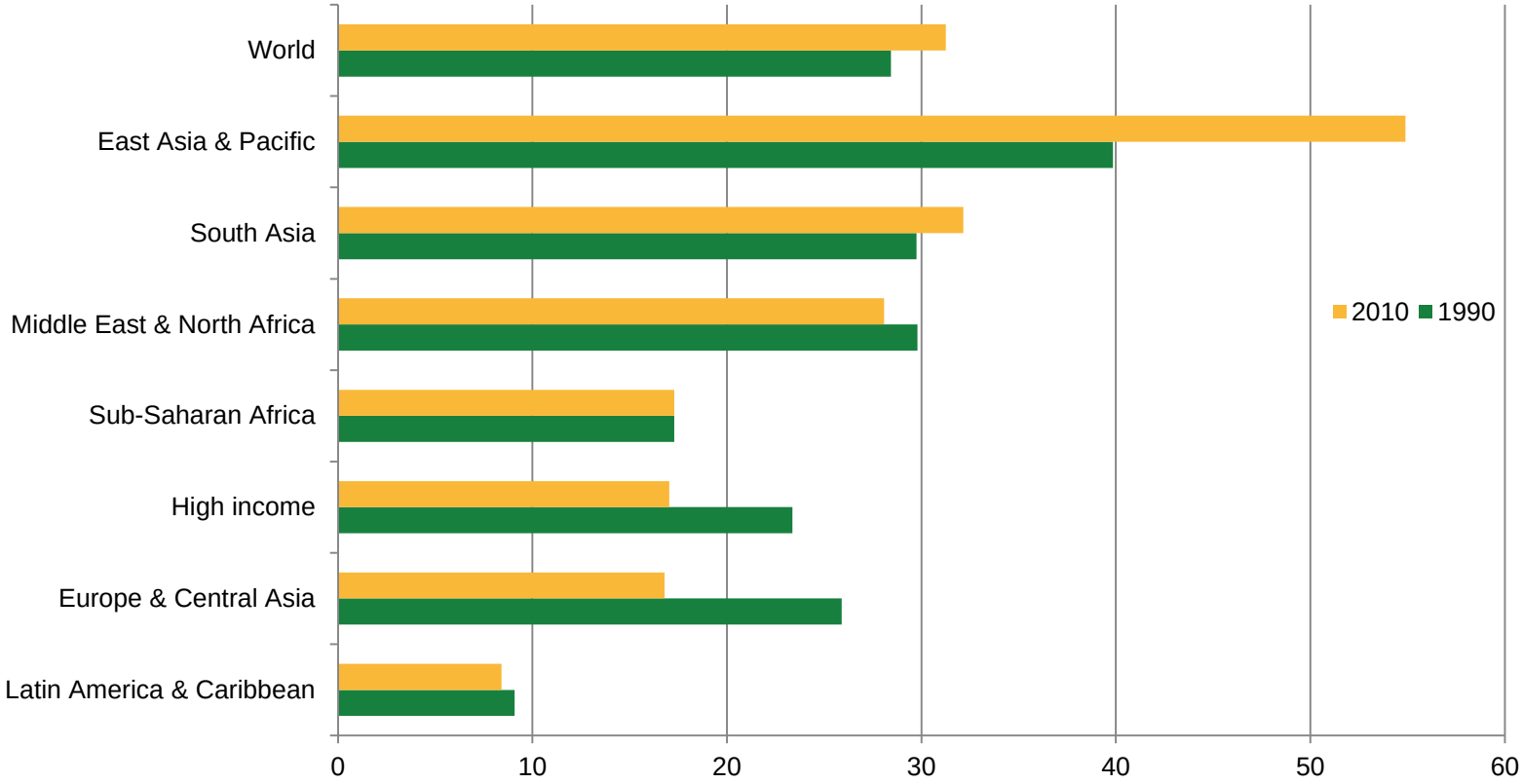
Particulate matter, or PM, is the term for particles found in the air.

- Particles less than 10 micrometers in diameter (PM10) pose a health concern because they can be inhaled into and accumulate in the respiratory system.
- Particles less than 2.5 micrometers in diameter (PM2.5) are referred to as "fine" particles and are believed to pose the greatest health risks.

The World Bank used to estimate and report exposure to PM10; we now report exposure to PM2.5, using data directly from the Global Burden of Disease study.

Exposure to PM2.5 Pollution, 1990-2010

Ambient $PM_{2.5}$ pollution, population-weighted exposure (micrograms per cubic meter)



Source: ***World Development Indicators 2015,*** **table 3**

- **WHO Air Quality Guideline is 10 microgram per cubic meter (annual average)**

Air Pollution (PM) Damages

Estimate the economic cost of damages due to exposure to PM2.5 and ozone

- **World Bank recently revised methodology**

  Rely directly on the results from the Global Burden of Disease project, which publishes **health impacts** from exposure to **ambient air pollution** and **household air pollution and ozone**

  - Premature mortality and years lived with disability (morbidity) from pollution exposure

Air Pollution (PM) Damages

Damage estimated as workers' lost productivity

- Working-age population (15-64) and children under 15
- Both premature deaths and morbidity (disability) are valued

Premature mortality: present value of lost future income, by age group

- I_0 is average wage income in the present year ($i = 0$)
- n is average life expectancy in working age for that particular age group
- g is the rate of annual growth in real income, assumed to be 2.5% for all countries and years
- r is the social discount rate, assumed to be 4% for all countries and years

Air Pollution (PM) Damages

Morbidity: reduced labor productivity due to non-fatal illnesses

$$D_0 = y_0 \cdot I_0$$

- y_0 are years lived with disability
- I_0 is average wage income

Exercise

Calculation of ANS

- Calculate NNS and ANS in current prices, and as a proportion of GNI, over 2005-2014
- What do these results tell you?
- What problems did you encounter, if any?

Data sources:

- As with ANNI calculation

Hints:

- This calculation only covers the period from 2005 to 2015 *due to data limitations)
- Some of the data needed is the same as in the earlier exercise
- You will need additional data from the World Bank dataset on education expenditure, CO2 damage, and particulate emissions damage

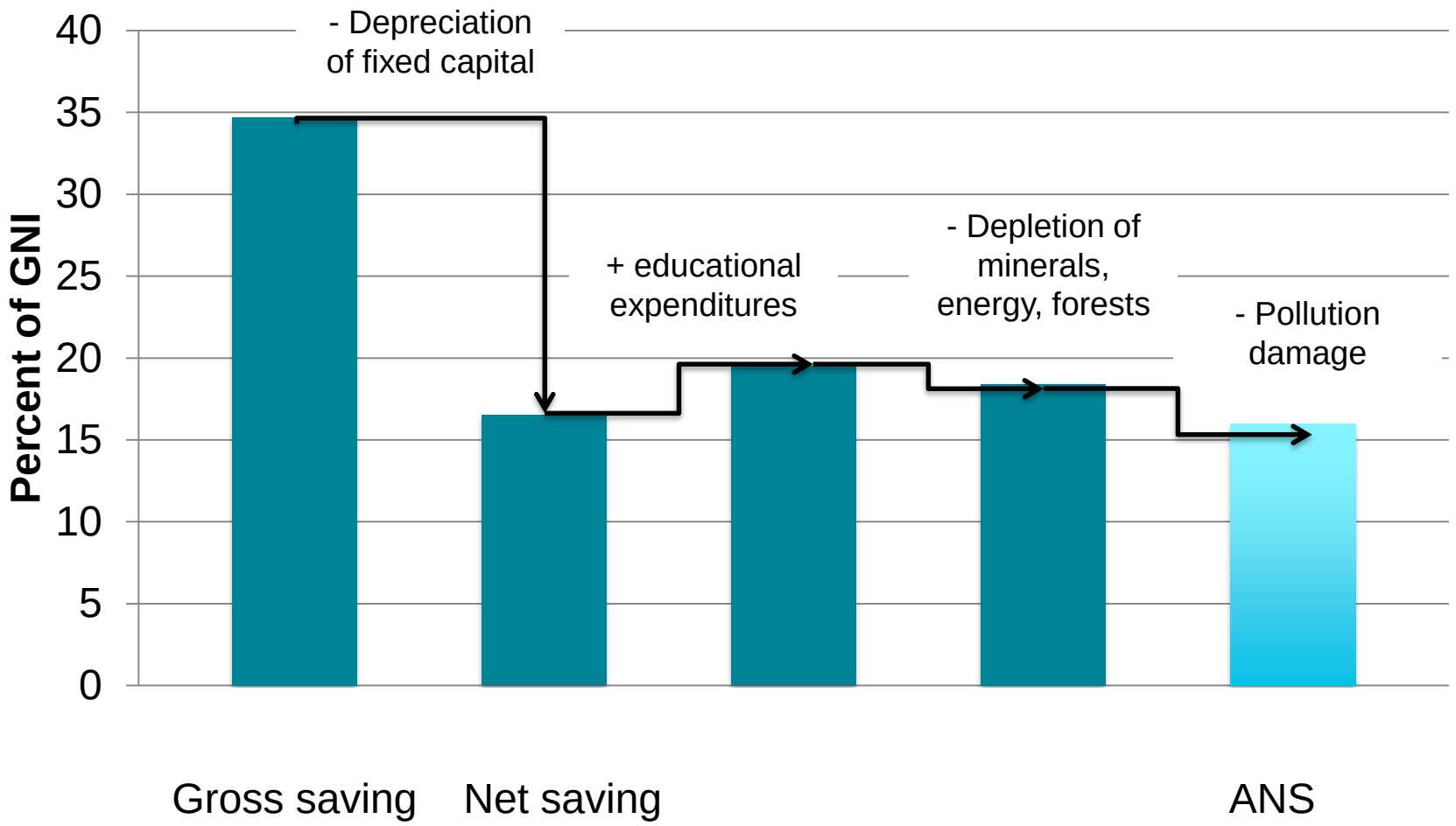
GNI to NNS (2015)

Variable	2015 values (IDR bn)
GNI	11,742,982
Net current transfers from abroad	73,755
GNDI	11,816,737
Final consumption	-7,745,630
GNS	4,071,107
Consumption of fixed capital	2,129,438
NNS	1,941,669

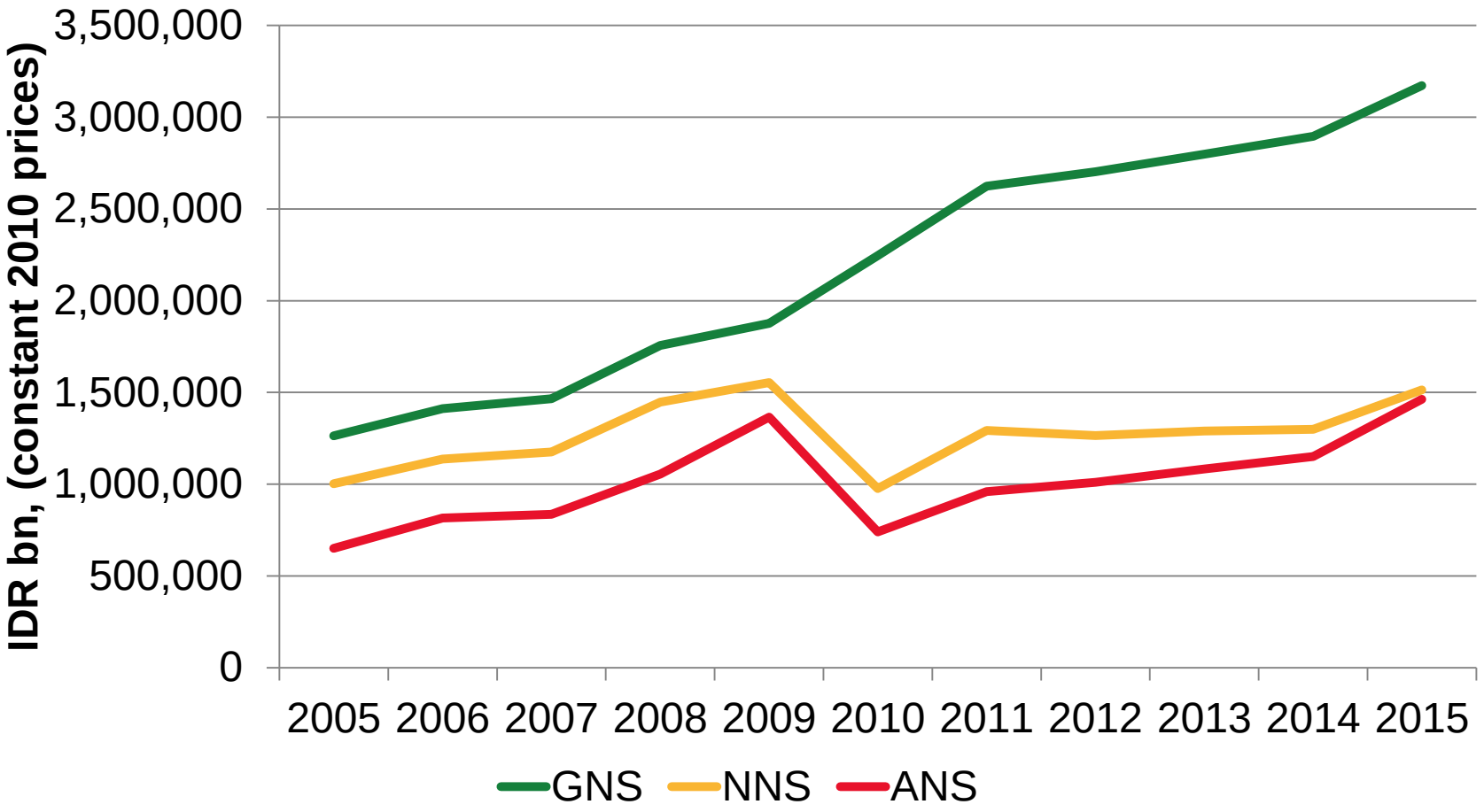
NNS to ANS (2015)

Variable	2015 values (IDR bn)
NNS	1,941,669
Education expenditure	*335,838*
Natural resource depletion (minerals, energy, forests)	*-130,662*
Pollution damage (CO2, PM2.5)	*-266,962*
Total adjustments	-61,687
ANS	1,876,584
ANS/GNI	16.0%

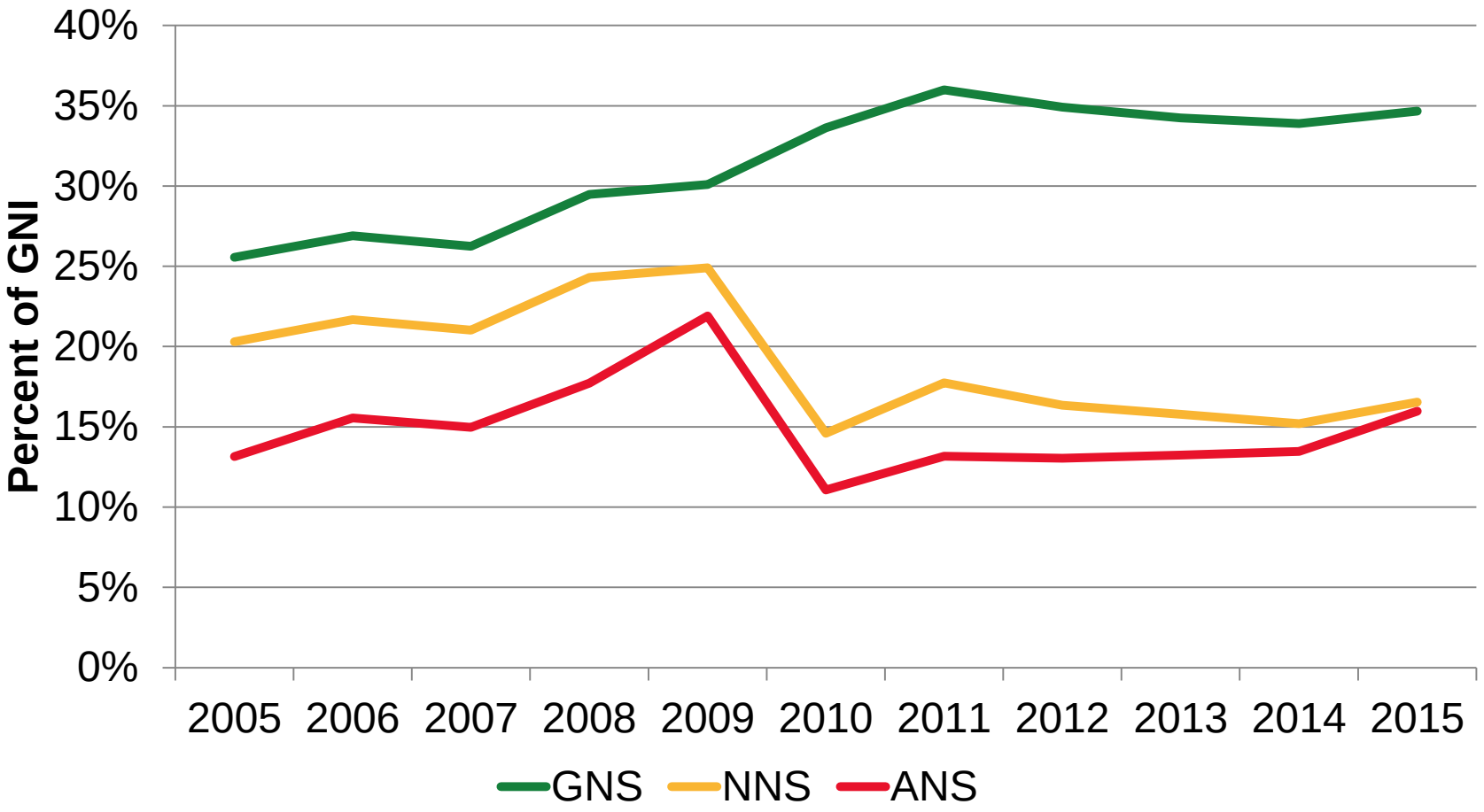
Adjusted net savings, Indonesia, 2015



GNS, NNS & ANS 2005-2015



GNS, NNS & ANS 1998-2014



Adjusted net savings: conclusions

- ANS is significantly lower than GNS, due to the consumption of fixed capital (depreciation), as well as the depletion of minerals and energy (no data for forests), and pollution damage.
- Investment in human capital has made a small contribution to boosting ANS
- Overall, ANS has remained positive, indicating that assets have been accumulated rather than depleted

What are savings used for?

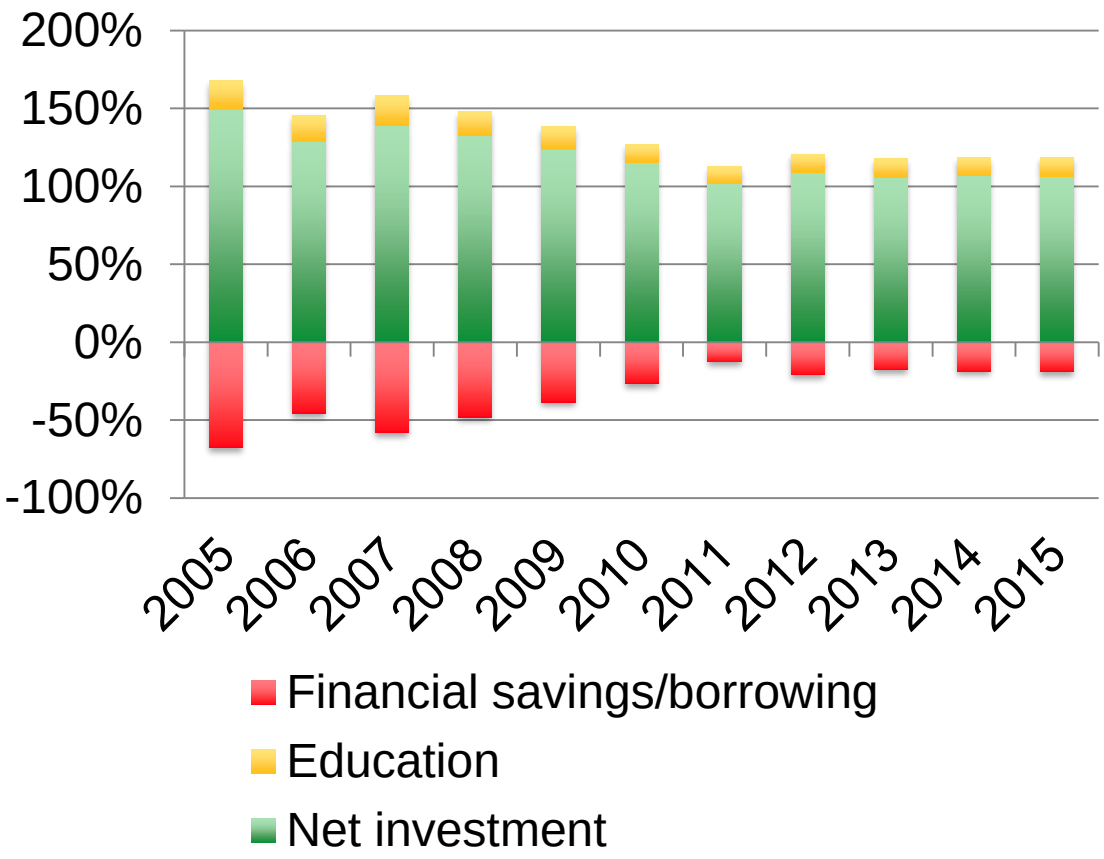
As discussed yesterday, savings can be used for:

Investment – in fixed capital or human capital

Accumulation of financial assets

What happens in Indonesia?

Application of savings (ANS) to investment (in fixed and human capital)



ANS is not large enough to finance net investment and education expenditure – hence national borrowing is necessary

Analysis of the application of ANS shows that as savings have risen, reliance on borrowing has fallen.

Recently, ANS has been nearly sufficient to cover investment in produced capital and human capital

Are there domestic alternatives to World Bank data?

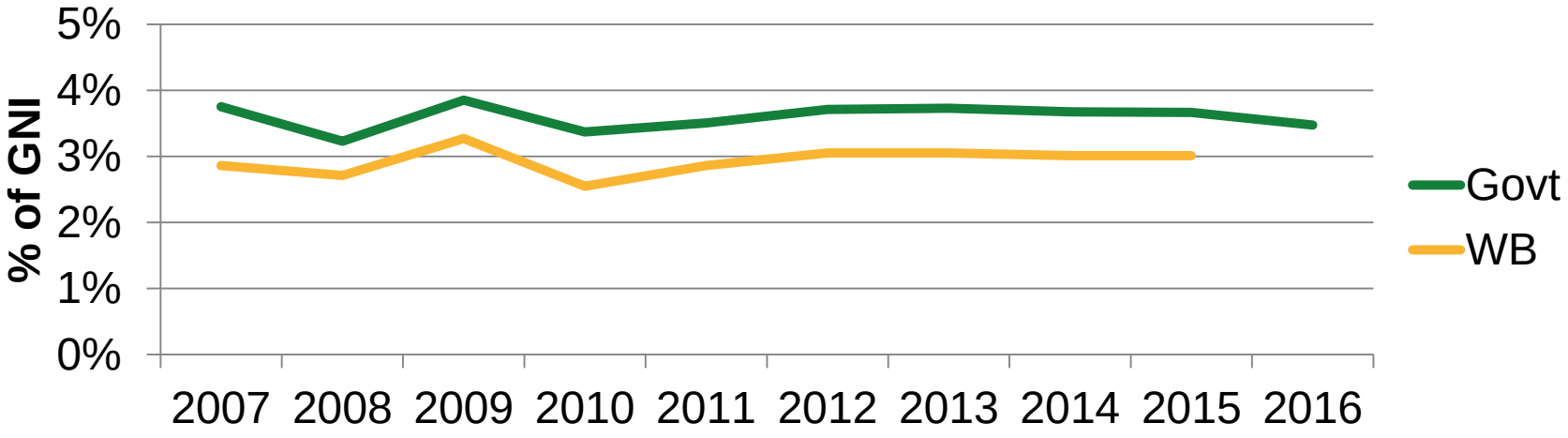
Education Data

In principle, WB and official data should be similar: WB uses official data as its source

Can compare WB and Govt data - In practice the figures are similar (EE/GNI)

WB figures are slightly lower than official figures, as they exclude education capital spending (included in produced capital)

Govt figures would have to be adjusted if used in the ANS calculation



Are there domestic alternatives to World Bank data? Additions to be made?

- Mineral depletion data
- Energy depletion data
- Pollution damages
- Forest depletion

END OF TOPIC 2