



Constructing Adjusted Net Saving

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Wealth Accounting and the Valuation of Ecosystem Services
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Adjusting National Accounts Aggregates

How can the costs of using up or damaging the environment be reflected in national accounts aggregates (e.g., GDP, GNI, Gross Saving)?

One measure that the World Bank calculates:

- **Adjusted Net Saving (ANS)**

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

Adjusted Net Saving

Interpretation, as measure of sustainability:

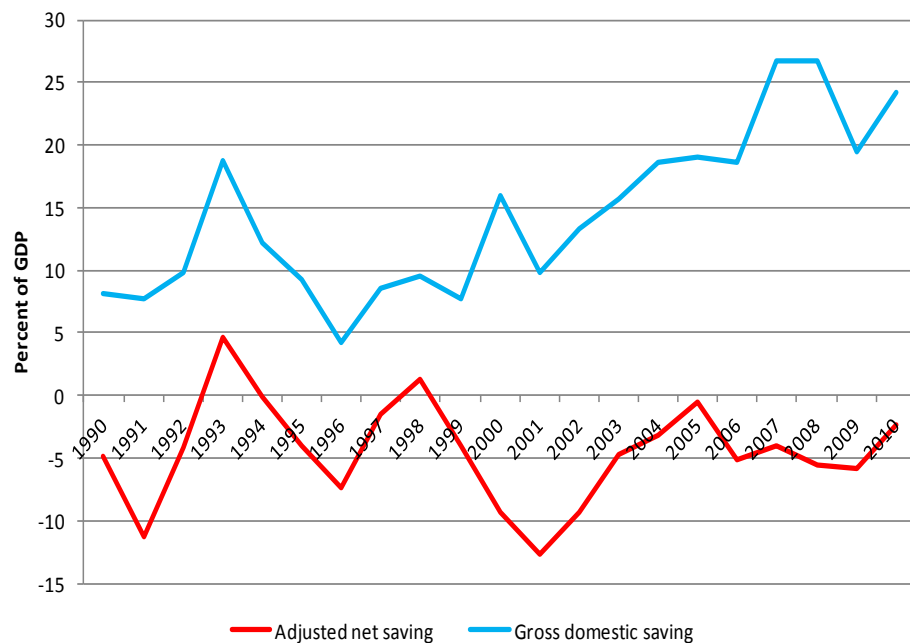
Positive ANS indicates an investment in the future—that a nation is accumulating the assets needed to build up its wealth and ensure its economic growth over the longer term

Years of negative ANS suggest that a country is running down its capital stock and is on an unsustainable growth path

Indicator of sustainability: Trends

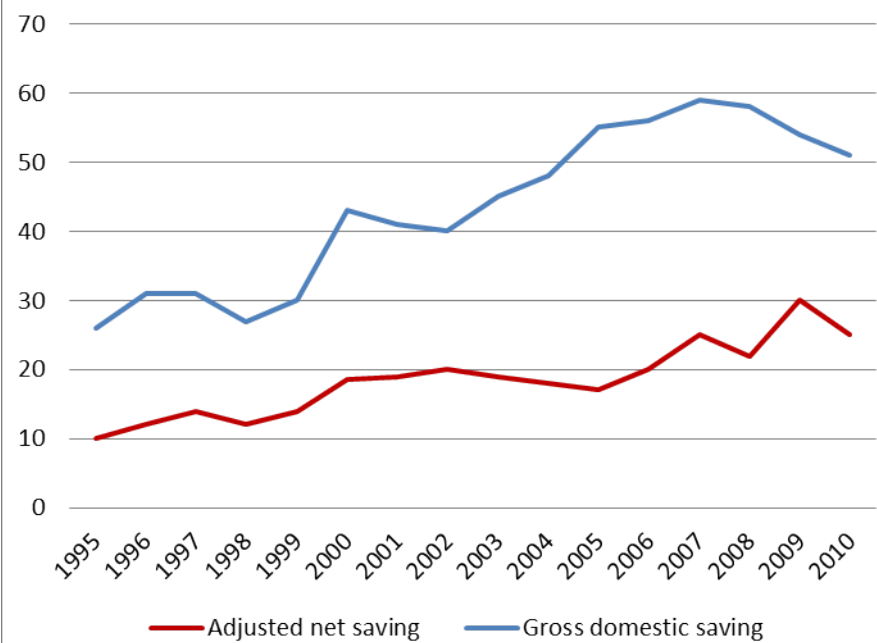
SUDAN, finding oil boosted gross saving, but not enough to offset depletion of oil... ANS is negative

Gross and adjusted net saving in Sudan



ALGERIA: Public + private savings more than offsets depletion. ANS is positive

Gross and Adjusted Net Saving, Algeria



Measuring Adjusted Net Saving

GROSS SAVING	Difference between GNI and public and private consumption plus net current transfers.	
CONSUMPTION OF FIXED CAPITAL	Replacement value of capital used up in the process of production.	
INVESTMENT IN HUMAN CAPITAL	Proxy: Education expenditures	
DEPLETION OF NATURAL CAPITAL	Subsoil Depletion (10 minerals, 4 energy resources)	Estimated directly
	Net Forest Depletion	Estimated directly
POLLUTION DAMAGES	CO2 emissions damages	Estimated directly
	Damages from exposure to PM2.5	Estimated directly
ADJUSTED NET SAVING	$\text{ANS} = \text{Gross Saving} - \text{Consumption of Fixed Capital} + \text{Investment in Human Capital} - \text{Depletion of Natural Capital} - \text{Pollution Damages}$	

Gross National Saving

Definition: Gross national savings are calculated as gross national income less total consumption, plus net transfers.

Note: We do not gap-fill missing data. So if a country does not have GNS for a given year, then we cannot calculate Adjusted Net Saving.

Data Requirements	Data Source
Gross National Saving	<i>World Development Indicators, WDI</i> http://data.worldbank.org/indicator/NY.GNS.ICTR.CD <i>Source: World Bank national accounts data, and OECD National Accounts data files.</i>

Gross National Saving: Philippines

Philippines: GNS data available for 1977-2013

Metadata from *WDI* for the Philippines:

- Source for GNI and net income from abroad is changed to national statistical office from central bank.
- April 2012 database update: National accounts data were revised for 1998 onward. Because intellectual property products are now reported as a part of gross fixed capital formation, gross domestic product (GDP) in current prices averaged 4 percent higher than previous estimates.

Consumption of Fixed Capital

Definition: Replacement value of capital used up in the process of production.

We already reviewed and calculated CFC when constructing ANNI; use the same data series.

Investment in Human Capital

Various approaches to measuring human capital

- Cost-based
- Income-based
- Other related indicators (e.g., educational attainment, outcomes)

In WB's ANS Framework, we use a proxy indicator:

Current public expenditure on education

Note: SNA treats education expenditure as consumption, but we count it as investment in human capital, therefore it is explicitly added in the measure of Adjusted Net Saving

Investment in Human Capital

Proxy indicator: Current public expenditure on education (% of GNI)

- Includes spending on: staff salaries, pensions and benefits; contracted or purchased services; other resources including books and teaching materials; welfare services; and other current expenditure, such as subsidies to students and households, furniture and minor equipment, minor repairs, fuel, telecommunications, travel, insurance and rents. It is expenditure on goods and services consumed within the current year and which may need to be renewed for subsequent year(s).

Data Requirements	Data Source
Current public expenditure on education	<i>United Nations Educational, Scientific, and Cultural Organization (UNESCO)</i>

Education Expenditures: Philippines

Data availability for Philippines: 1976-1988, 1995-1998, 2000-2009

Missing years are gap-filled by linear interpolation

[WB] Education Expenditures: Issues

Limitations in WB cost-based measure for investment in human capital:

- Does not include private education expenditures (e.g., households, private entities)
- Link between investment and education outcomes?

Explore this area further with the income-based approach to human capital

Depletion of Natural Capital

Depletion of Natural Capital includes:

Energy Depletion

Mineral Depletion

Net Forest Depletion

We already reviewed and calculated Depletion of Natural Capital when constructing ANNI; use the same data series.



CO2 Damages

Value the economic cost of damages due to CO2 emissions

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

CO2 Damages

Marginal damages from carbon pollution are derived from estimates by Fankhauser (1994) of global losses to crops, infrastructure, and human health incurred per ton of CO2 emitted over the 100 years each ton of CO2 will remain in the atmosphere. The present value of the flow of damages that extends into the future represents the social cost of carbon.

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)	<i>World Development Indicators, World Bank</i> Source: Carbon Dioxide Information Analysis Center of the Oak Ridge National Laboratory, United States (CDIAC)
Social cost of carbon	Fankhauser (1994), adjusted by U.S. GDP Deflator (approximately \$35 per ton of carbon in 2010)

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 PM_{2.5}

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.

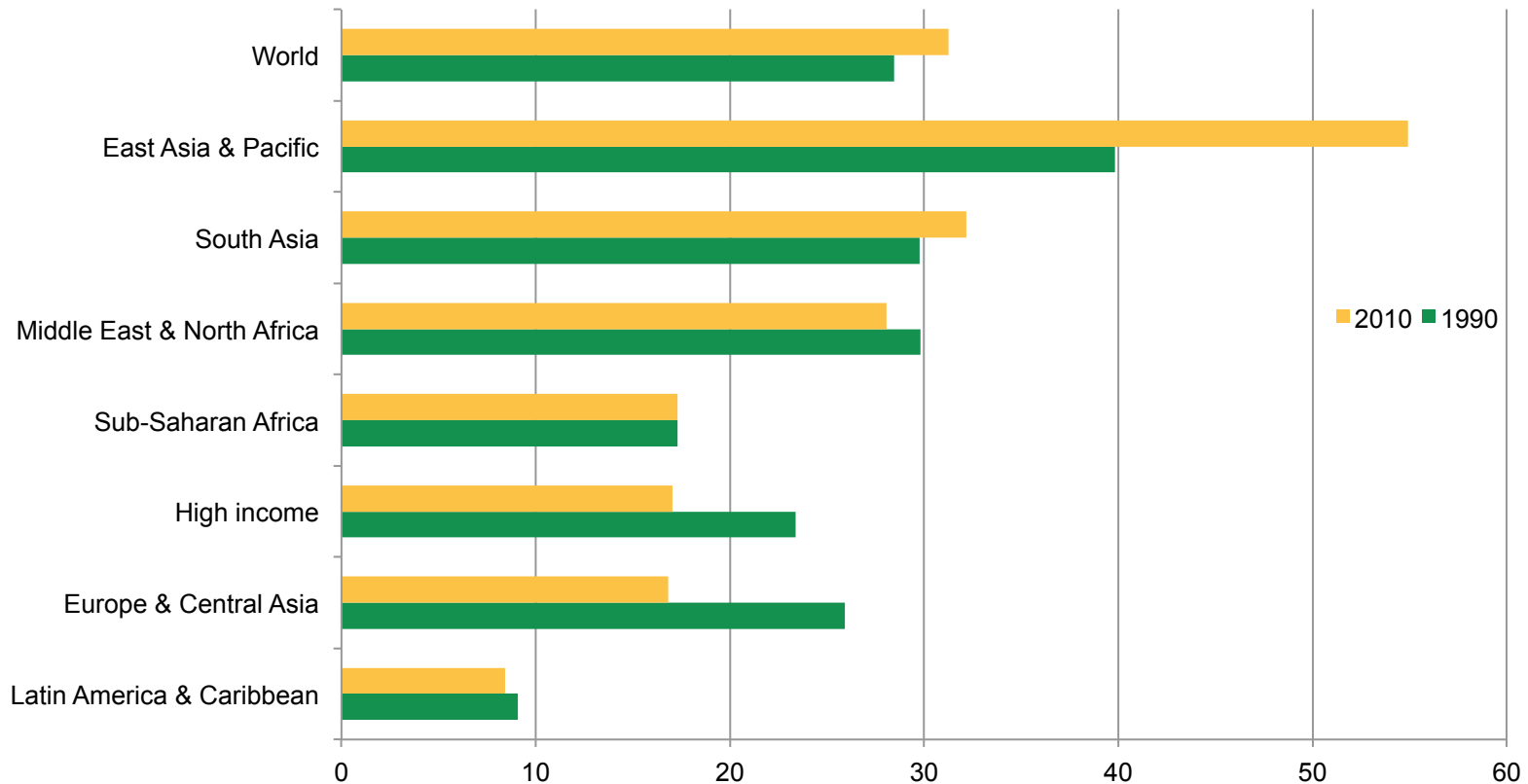
- Particles less than 10 micrometers in diameter (PM10) pose a health concern because they can be inhaled into and accumulate in the respiratory system.
- Particles less than 2.5 micrometers in diameter (PM2.5) are referred to as "fine" particles and are believed to pose the greatest health risks.

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 PM_{2.5} 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)**
- Philippines: 6.5 micrograms per m³ in 1990, 7 micrograms per m³ in 2010



Air Pollution (PM) Damages

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

- **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**

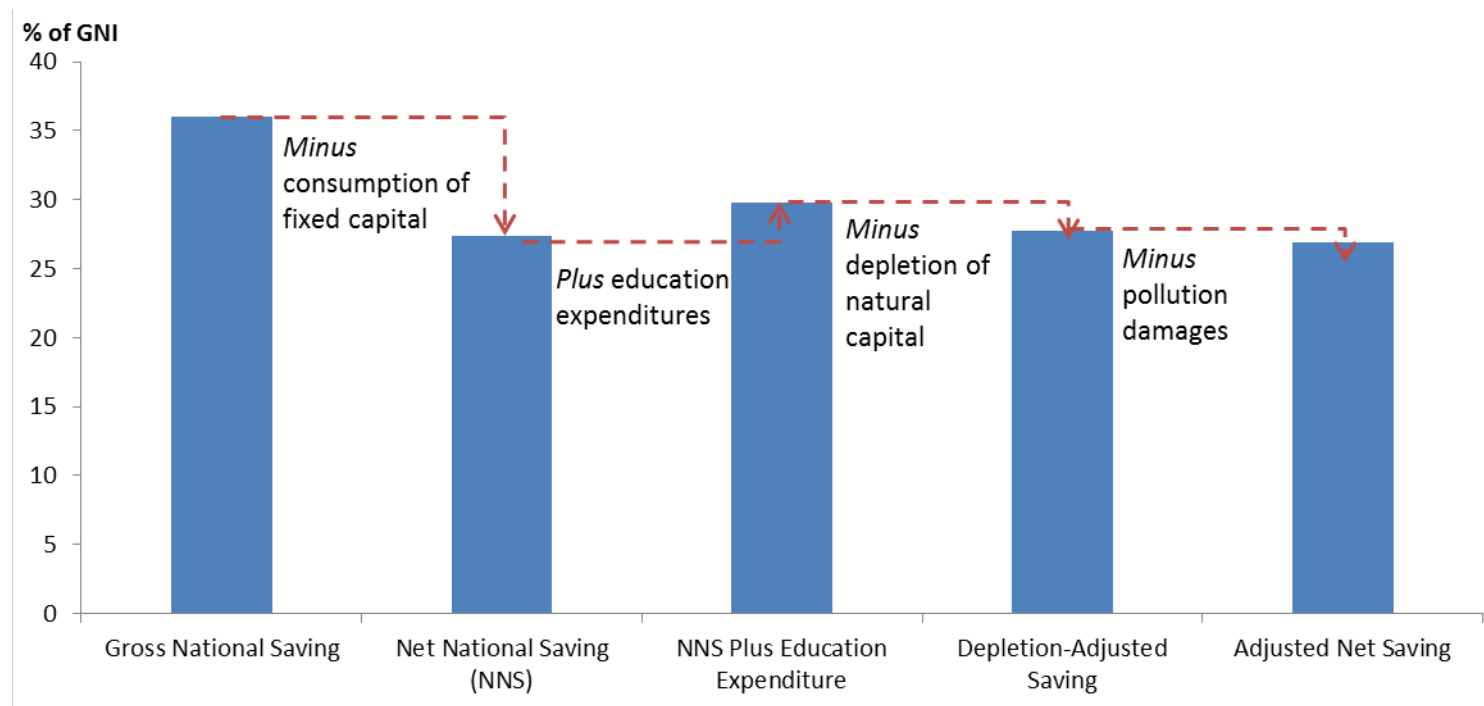
- Premature mortality and years lived with disability (morbidity) from pollution exposure
- Note: GBD 2013 (annual data from 1990-2013) soon to be published

Damage estimated as workers' lost productivity

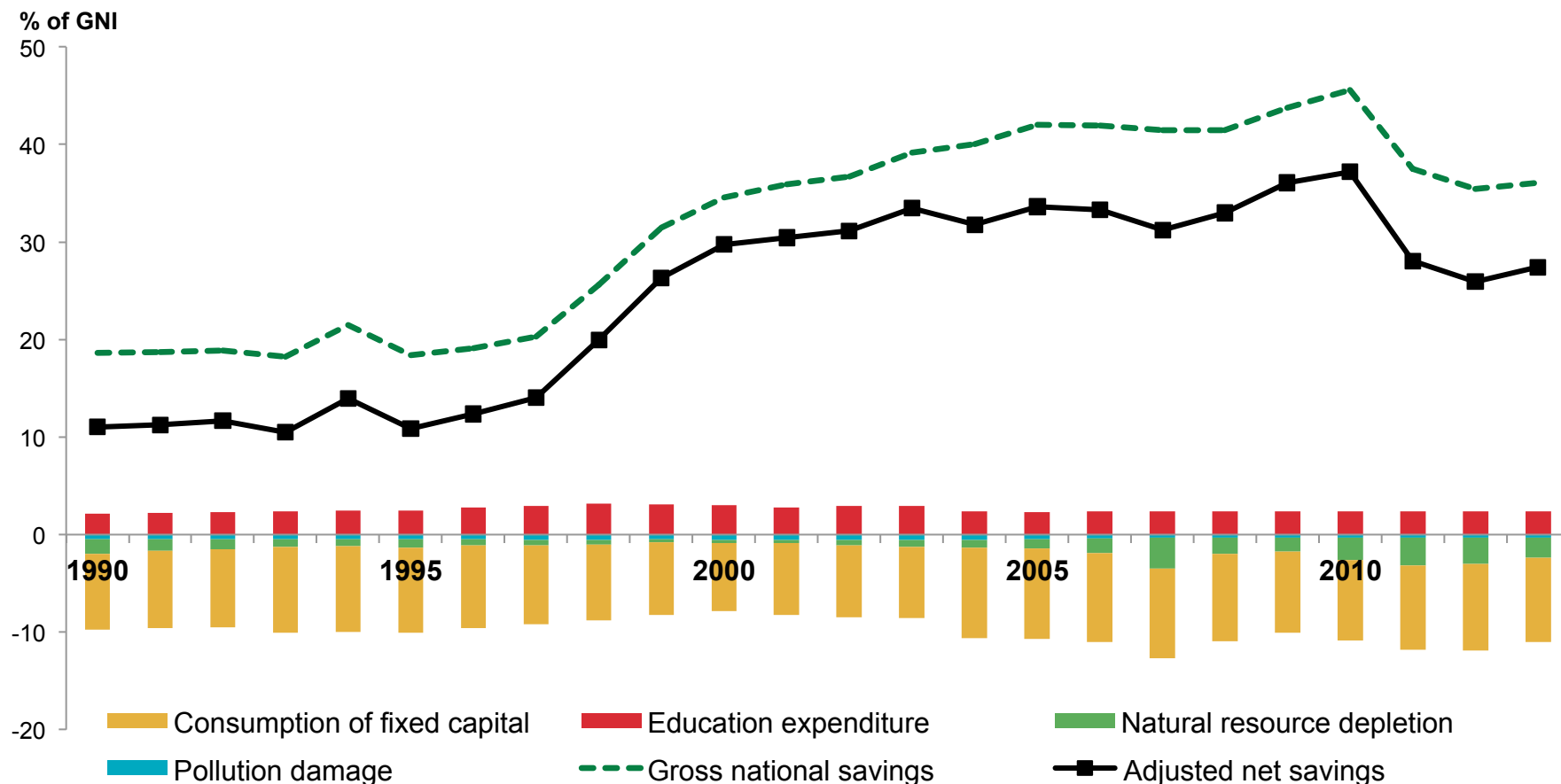
- Present value of future income for people (by age group), using average wage income, assumed earnings growth (2.5%), and a discount rate (4%)



WB Estimates for Philippines ANS (prelim)



WB Estimates for Philippines ANS (prelim)



Questions to Consider

- Within the Adjusted Net Saving framework, what other components could be included that are currently missing?

